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Disclaimer	This report is the final report including the results of all project tasks. The report is accompanied by a set of 28 country and 28 capital factsheets. All documents can be downloaded at: http://ec.europa.eu/environment/waste/index.htm This report has been prepared for the European Commission in accordance with the associated contract. It must be stressed that the views expressed in this report which are not otherwise assigned are those of the authors and are not necessarily shared by the European Commission. Please refer to this report as: <i>BiPRO/CRI 2015, Assessment of separate collection schemes in the 28 capitals of the EU, Final report, November 2015</i>	

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Glossary and abbreviations

ABBREVIATION	EXPLANATION
€	Euro
ACR+	Association of Cities and Regions for Recycling and sustainable Resource management
AT	Austria
BE BR	Belgium Brussel region
BE FL	Belgium Flanders
BE WA	Belgium Wallonia
BG	Bulgaria
BI-WEEKLY	Twice per week
CAP	Capita
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EEA	European Environment Agency
EL	Greece
EPR	Extended producer responsibility
ES	Spain
EU	European Union
FI	Finland
FR	France
GDP	Gross domestic product
HR	Croatia
HU	Hungary
ICLEI	Local Governments for Sustainability
IE	Ireland
IT	Italy
KG	Kilogram
LT	Lithuania

ABBREVIATION	EXPLANATION
LU	Luxemburg
LV	Latvia
MBT	Mechanical Biological Treatment
MRF	Materials Recovery Facility
MS	Member State
MSW	Municipal solid waste
MT	Malta
NGO	Non-governmental organisations
NIM	National Implementation Measures
NL	Netherlands
P&C	Paper and card
PAYT	Pay-as-you-throw
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
t	Tonnes
TFEU	Treaty of the European Union
UK EW	United Kingdom England and Wales
UK NI	United Kingdom Northern Ireland
UK SCO	United Kingdom Scotland
WEEE	Waste of Electrical and Electronic Equipment
WFD	Waste Framework Directive
WMP	Waste Management Plan
WP	Work package

Executive Summary

Separate collection of individual waste fractions is seen as a **pre-condition for fostering high quality recycling and high recycling rates**. Thus, Article 10(2) of the Waste Framework Directive (WFD) sets the general requirement of separate collection and obliges the Member States (MS) to set up separate collection systems for at least paper, metal, plastic and glass by 2015. Article 11 (1) sets the requirements for the European Member States to take measures to promote high-quality recycling through separate collection.

There is a wide variety of ways to collect different waste streams, and experience shows that practical implementation of the obligations differs significantly across 28 EU Member States (EU-28 MS).

The **objective of this project** is to **assess the separate collection schemes in the capital cities of the EU-28 MS**. The assessment focuses on the priority waste streams mentioned in Article 10 (2) and Article 11 (1) **metal, plastic, glass and paper, plus on bio-waste**. It includes an assessment of the legal framework for and the practical implementation of separate collection systems in the EU-28 MS, together with an in depth-analysis of systems applied in EU-28 capital cities. The study covers all separate collection systems that collect one or more of the five waste streams separately from residual waste/mixed municipal waste at source. This includes strict separation and co-mingled collection systems, door-to-door, bring-point collection and other systems.

What does the literature say?

Literature and case studies focusing on different aspects of separate collection in Europe clearly agree on the advantages of separate collection, even if opinions regarding the optimal design of collection systems differ. Key quotations are:

- Countries that have introduced **mandatory separate collection** of certain municipal waste fractions have high municipal waste recycling levels. MBT can contribute to or ensure the achievement of the targets in the Landfill Directive, but is not alone sufficient to achieve the 50 % recycling target.
- It is crucial to both extend the **technical infrastructure** as well as **inform and motivate the users** of the collection systems.
- The percentage of recyclable materials increases when municipalities introduce **door-to-door collection systems**. Door-to-door collection systems provide the highest recycling rates and the best quality of recyclables. Collection costs for such schemes are higher than alternatives, but collection rates and revenues are also usually higher, and the resultant rejection rates and treatment costs lower.
- **Bring systems** with drop-off containers often struggle to encourage the inhabitants to separate their waste and result in a larger percentage of impurities. However, bring systems are a reasonable solutions for certain fractions (e.g. glass).
- **Co-mingled collection of recyclables** is practice in several MS and tends to result in lower costs. Two-stream co-mingled collection (e.g. plastics and metals) is a reasonable way to reduce costs and maintain good material quality. Mixing several fractions together, however, can result in a

higher incidence of cross contamination, and the quality of recyclables tends to be lower and rejection rates higher.

- When **separate collection of biodegradables** was included in the door-to-door system, the overall sorting of dry recyclables (and other fractions) increased.
- **Civic amenity sites** have the potential to improve the overall recycling rate, on the condition that they are convenient to use (close-by and suitable opening hours) and that the number of sorted fractions is significant.
- The **trend in recycle markets** is likely to be towards requiring higher quality materials.

Which waste collection systems are used in the EU countries?

To collect recyclables and bio-waste, the systems applied in the EU-28 MS vary widely. The project investigated what collection systems are in place in the countries. This is not an easy task, as systems also vary at regional and even municipal level in most of the MS, as the choice and practical implementation of waste collection tends to be the responsibility of the municipality or district authorities.

To aid analysis, the applied systems (door-to-door collection, co-mingled door-to-door collection, bring points, civic amenity sites, deposit refund systems) have been categorised as primary systems (applied for the majority of inhabitants), secondary systems, and rare/very rare systems. The following overview focuses on the **primary collection systems applied** in the MS, i.e. the one to which most inhabitants are connected to. This means information is generalised and particularities of the systems are not included in the summary (see the national factsheets for more detailed information on national collection systems).

- **Door-to-door collection** in place in the MS vary from one bin – only collecting residual waste and relying on bring-point systems for recyclables and bio-waste – up to six separate bins/sacks (including the bin for residual waste).
- **Single-stream door-to-door collection** is performed for paper/cardboard and bio-waste in 14 MS, for glass in seven MS, for plastics in four MS and for metal in three MS.
- **Co-mingled door-to-door collection** is most common for metal and plastic together in one bin (seven MS). Five MS collect more than two fractions in one bin.
- The majority of countries apply **bring-point systems** for the collection of glass (18 MS, mostly separate for white and coloured glass). Ten MS collect paper/cardboard at bring points. Six MS primarily collect plastic at bring points - in five cases together with metal, but in Sweden in a separate container. Two MS collect metal separately at bring sites. Spain also collects bio-waste within the bring system.
- **Civic amenity sites** are used as additional collection systems, usually accepting the same fractions as collected in the bring containers (and additional fractions not included in Article 10 (2) and Article 11 (1)). For the Czech Republic, Latvia and Slovakia, civic amenity sites are the primary collection system for metal and bio-waste (SK only). In Poland, civic amenity sites are rare.

Table: Overview of collection systems in place in the 28 EU countries (primary systems only)

Collection type	Paper	Glass	Plastic	Metal	Bio-waste
Door-to-door (single fraction) 	AT, BE, BG, CY, DE, DK, FI, HU, IT, LU, LV, NL, SI, UK	BG, FI, LU, LV, NL, SI, MT	AT, LV, NL, DK	FI, NL, DK	AT, BE, CZ, DE, FI, EE, IT, HU, LU, NL, SI, SE, IE, UK
Co-mingled ...plastic + metal 			BE, BG, CY, DE, FR, IT, HU, LU, SI		
...3 fractions	RO, MT: paper, plastic, metal UK: plastic, metal, glass				
...all in one bin	EL, IE: paper, glass, plastic, metal				
Bring points 	CZ, EE, ES, FR, HR, LT, PT, PL, SE, SK	AT, BE, DK, CY, CZ, DE, EE, ES, FR, HR, IT, HU, LT, PT, PL, RO, SE, SK	SE	AT, EE, SE	ES
			ES, HR, LT, PT, PL (all plastic/metal in one container)		
Civic amenity sites 	Primary collection: CZ (metal waste), SK (metal and bio-waste), LV (metal) Addition collection of all waste streams: all countries PL: rare distribution of civic amenity sites				

As regards the **collected recyclables and bio-waste**, this means:

- **Paper/cardboard** is mainly collected within door-to-door systems (18 MS, four of them co-mingled with two or three other recyclable fractions); while ten MS rely mainly on bring-points.
- **Glass** is mainly collected within bring systems (18 MS); ten MS apply door-to-door systems for glass, of which three co-mingle glass with two or three other recyclable fraction.
- **Plastic** is collected within door-to-door systems in 18 countries, of which only four collect plastic as a separate fraction; all others apply co-mingling with one (metal), two or three other fractions. Six MS collect plastic (five together with metals) via bring-points. Four MS (CZ, FI, EE, SK) do not currently collect plastic separately from residual waste within main collection system, however this might be possible in civic amenity sites.
- **Metal** is collected within door-to-door systems by 17 MS. Three MS collect metal separately, nine collect metal together with plastic and further five MS co-mingle metal with additional fractions. For eight MS, bring points are the primary collection point for metal (five MS together with plastic in one container). Three MS collect metal only at civic amenities (CZ, LV, SK).
- **Bio-waste** including food waste is separately collected door-to-door in 13 MS, and a further two MS have door-to-door collection systems for garden waste only. Twelve MS do not collect bio-waste separately in their primary collection system.

How is the waste collected in the EU-28 capitals?

Waste generation in the 28 EU capital cities ranges from around 270 kg/cap (Dublin) up to 666 kg/cap (Luxembourg), with the average at 445 kg/cap. These differences can be partially explained by econometric factors (such as the household size, household expenditure or gross domestic product (GDP)) and other factors such as the number of tourists and daily commuters a city attracts. However, one key explanation is that each Member State includes different types/sources of waste in the statistical data on waste generation.

Cities (and local authorities) are generally responsible for collecting the household part of municipal solid waste. However, the data sources used for this project generally do not indicate the extent to which commercial waste is collected together with household waste. Only five cities (Budapest, Copenhagen, Dublin, Helsinki, and London) indicate the extent to which commercial waste is included in the generation data presented here.

There is also often a large difference between the average national waste generation and the generation in the capital. The data issues described above are equally applicable here. Additionally, differences can be caused by the household size (smaller in capitals) and GDP per capita (typically higher in capitals).

In general, it has been difficult to achieve comprehensive data coverage for the capital cities, particularly from a single source within each city: data for the generation and collection of waste for each city comes from multiple sources. This means that there is a recognised level of uncertainty about the data presented in this report.

Regarding the **collection schemes applied** in the cities: Altogether, 25 cities operate a door-to-door separate collection system, nine cities collection each fraction in a separate bin and 16 cities including co-mingled bins in their door-to-door collection infrastructure. 27 cities include bring sites for at least one material, while 23 cities have at least one civic amenity site in place.

Table: Overview of collection systems in place in the EU-28 capital cities

Capital city	Door-to-door separate 	Door-to-door co-mingled 	Bring points 	Civic amenity sites 
Amsterdam, Riga, Zagreb, Vilnius, Vienna, Copenhagen, Helsinki, Lisbon, Stockholm	X		X	X
Athens, Budapest, Dublin	X	X	X	
Berlin, Brussels, Ljubljana, London, City of Luxembourg, Madrid, Nicosia, Paris, Rome, Sofia, Tallinn, Valletta	X	X	X	X
Bratislava, Prague			X	X
Bucharest			X	
Warsaw	X	X		

Regarding the **yield of the separate collected materials**:

- On average, the **EU capitals separately collect 80 kg/cap** of paper/cardboard, plastic, glass, paper and bio-waste, and an average of 108 kg/cap once other fractions are included (e.g. bulky waste, WEEE,...).
- This means that, on average, only **19 %** of generated municipal waste is **collected separately** in EU-28 capitals: in other words, 80% of the waste still ends up in the residual waste bin.
- The highest collection rate is 189 kg/cap (Luxembourg) including all five fractions, while the lowest is 5 kg/cap (Zagreb). However, these absolute numbers are influenced by the level of waste generation. Ljubljana, Luxembourg, Rome, Stockholm, Tallinn and Vienna perform very well in terms of quantity collected, with annual amounts **exceeding 160 kg/cap for the five fractions**.
- Dublin, Helsinki, Ljubljana, Stockholm and Tallinn have the **highest separate collection capture rates** for the five fractions combined, measured as a percentage of the estimated generation of these fractions (based on national or city residual waste composition data, where available).
- The **separate collection of the five fractions** as percentage of total MSW generation in Dublin, Helsinki, Ljubljana, Stockholm and Tallinn is **more than 30 %**, while the collection of these fractions covers 55% of the MSW generated in Ljubljana (highest rate).

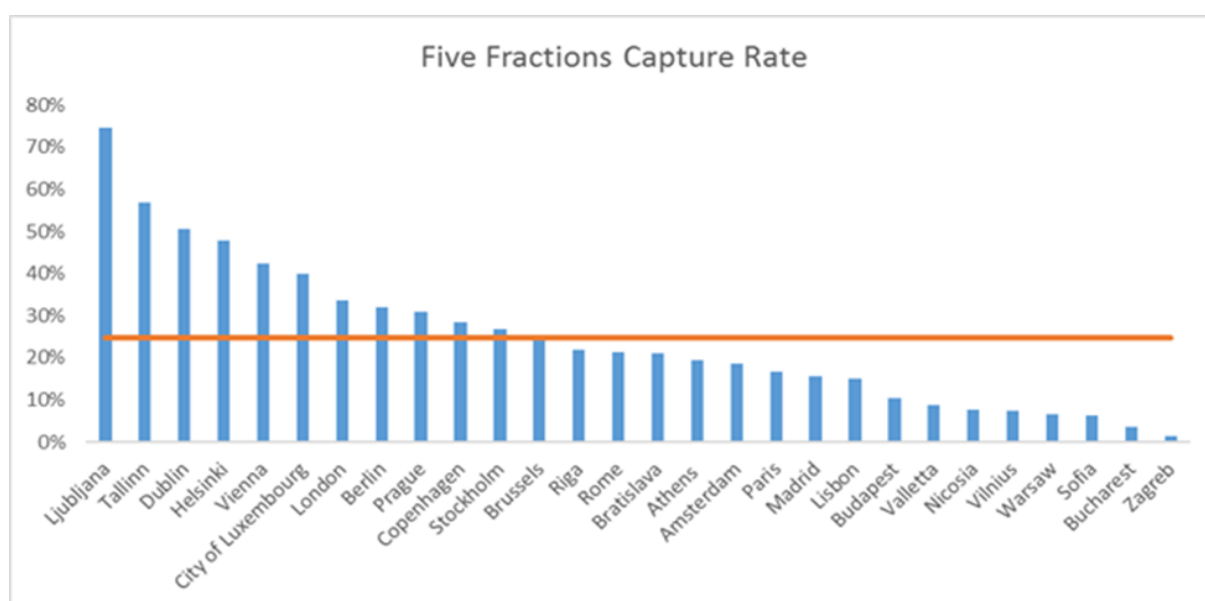


Figure: Combined capture rate for paper, metal, glass, plastic and bio-waste for EU-28 capitals

Regarding the **different fractions collected within the different systems**:

- **Door-to-door separate collection systems** collect on average 29 kg/cap of paper/cardboard (highest 58 kg/cap), 20 kg/cap of bio-waste (highest 73 kg/cap), 9 kg/cap of plastic, (highest 32 kg/cap), 6 kg/cap of glass (highest 25 kg/cap). Similar amounts can be achieved with co-mingled door-to-door collection systems: an average of 30 kg/cap of paper/cardboard, 6 kg/cap of plastic, 5 kg/cap of glass.

- A considerable amount of waste is collected within **bring-systems**. On average this accounts for 17 kg/cap of paper, 12 kg/cap of glass, 7 kg/cap of plastics and 2 kg/cap of metals.

The overview in the next table shows that:

- door-to-door collection systems are the dominant method for separately collecting paper: a similar amount is collected on average in **single and co-mingling collection**;
- the majority of glass is collected in **bring-points**;
- For plastics, a similar collection rate is achieved by single and co-mingling door-to-door collection and bring-points.

In total, 25 cities use civic amenity sites to collect at least one of the five fractions investigated in this study; the quantities collected via civic amenity sites are, however, lower than in the other systems.

Table: Overview of collection systems in place in the EU-28 capital cities

Collection type	Paper	Glass	Plastic	Metal	Bio-waste
Door-to-door (single fraction) 	29 kg/cap Highest: 58	6 kg/cap Highest: 25	9 kg/cap Highest: 32	1 kg/cap Highest: 1	20 kg/cap Highest: 73
Co-mingled plastic + metal 	30 kg/cap Highest: 53	5 kg/cap Highest: 12	6 kg/cap Highest: 12	3 kg/cap Highest: 4	
Bring points 	12 kg/cap Highest: 76	12 kg/cap Highest: 53	7 kg/cap Highest: 26	2 kg/cap Highest: 9	19 kg/cap Highest: 33
Civic amenity sites 	3 kg/cap	2 kg/cap	1 kg/cap	2 kg/cap	6 kg/cap

Regarding how **households pay for waste collection**:

- In **Pay As You Throw (PAYT) schemes**, households are charged according to the amount of waste they generate. Some of the PAYT schemes include a combination of flat rate fees or taxes (e.g. certain annual amount) and a variable element linked to container sizes (volume-based schemes), number of sacks (sack-based scheme), frequency of collection (frequency-based scheme) or the weight collected (weight-based scheme) or a combination of these elements. PAYT is usually applied to mixed residual waste, however it can also include bio- and garden waste or paper waste. The intention of such a system is that the separate collection of recyclable materials such as bio-waste, paper, glass, and metal is (partly or completely) cross-financed by a higher charge for residual waste. Usually, the collection of source-separated dry recyclables in a PAYT scheme is free

of charge for the consumer, and collection of these materials cross-financed by the fees on residual waste collection.

- MS not implementing PAYT schemes fund waste management by **flat rate charges** or **municipal taxes**.
- Out of the 17 cities where information on the type of charges for waste management is available, seven cities apply a form of **PAYT**. The applied PAYT schemes tend to be based on charges on residual waste (and in some cases separately collected door-to-door schemes for bio-waste) that are used to fund the separate collection of recyclables.
- Three additional cities apply a **combination of a fixed fee and PAYT**; a fixed fee may be a fixed price per household or bin, combined with additional costs considering bin size and/or collection frequency.
- The remaining seven capital cities apply **flat rates** on waste collection.

Table: Fixed or PAYT funding schemes for the collection schemes implemented by the 28 EU capital cities

	PAYT	Fixed fee + PAYT	Flat rate	N/A
	Berlin, Budapest, Dublin, Helsinki, Ljubljana, Tallinn, Vienna	Copenhagen, Stockholm, Warsaw	Amsterdam, Brussels, Lisbon, London, Luxembourg, Paris, Vilnius	Athens, Bratislava, Bucharest, Madrid, Nicosia, Prague, Riga, Rome, Sofia, Valetta, Zagreb
Average collection rate (separate collected/generated MSW quantities)	35 %	17 %	17 %	10 %

Although the effectiveness of the PAYT schemes varies, there is a correlation between **the type of charge applied and the collection rate: the cities applying PAYT perform on average much better than the rest. The worst performing cities base their funding on flat rates.**

Which cities are the best performers as regards separate collection?

One key objective of the study was to provide an overview of the performance of capital cities in separate collection. To satisfy this objective, key indicators on separate collection and applied collection schemes have been collected within a **headline scoreboard** (next page). This overview allows the identification of the cities with the best overall performance, meaning the cities that were among the top three performers for several indicators.

The cities that showed the best performance for at least three indicators are:

- **Ljubljana** is among top three performers **ten** times;
- **Helsinki** is among top three performers **seven** times;
- **Tallinn** is among top three performers **four** times;
- **Dublin** is among top three performers **four** times;
- **Vienna** is among top three performers **four** times.

Further, these cities have the **highest waste capture rates** for the combined five fractions measured as waste collected separately (in systems outside the residual waste bin) including all types of separate collection (door-to-door, bring-points and civic amenity sites).

Table: Headline scoreboard including results for 28 EU-Capitals

3 Best performers																			
	Indicators																		
	MSW generation kg/cap.	% of residual waste on total MSW	% of separate collection (all systems)	% of separate collection (only d2d)	Glass capture rate**	Paper capture rate**	Plastic capture rate**	Metal capture rate**	Plastic, metal and aggregated comingled capture rate**	Co-mingled collection y/n (fractions)	Bio-waste capture rate**	No. of glass bring points per 100 000 inhabitants	add. Fract.	Bio-waste collection kg/cap	Paper collection kg/cap	PAYT system established (y/n)	NATIONAL MSW reuse and recycling rate in % (EUROSTAT)		
City (Country)																			
Amsterdam	405,7	86,0%	12,4%	0,2%	58,4%	34,5%	2,5%	1,4%	2,2%	all fractions separately collected	4,0%	375	*	4,7	24,7	n	49,55		
Athens**	467,5	83,9%	16,1%	14,4%	39,4%	57,6%	15,8%	12,1%	14,9%	Plastic, Metal,Glass, Paper	0,2%	102	*	0,3	53,8	n	17,1		
Berlin	394,7	64,6%	27,4%	23,9%	53,9%	65,6%	20,0%	16,9%	19,1%	Plastic, Metal, Composite material	15,7%	177		21,7	50,3	y	64,5		
Bratislava	338,3	78,7%	14,2%	0,0%	58,0%	42,8%	43,4%	4,3%	31,4%	Plastic, Glass, Paper	3,4%	265	*	4,3	18,5	n	12,96		
Bucharest**	391,3	97,0%	2,9%	0,0%	10,7%	11,3%	12,4%	5,3%	11,0%	not available	0,0%	41	*	0,0	4,4	n	2,58		
Budapest **	424,2	93,7%	7,6%	5,9%	74,6%	13,3%	0,0%	0,0%	5,3%	Plastic, Metal	10,7%	24	*	12,4	11,2	y	25,37		
Brussels	406,7	74,9%	20,9%	15,8%	84,1%	34,5%	0,0%	0,0%	26,7%	Plastic, Metal, Composite material	8,4%	49		13,4	36,6	n	57,2		
Copenhagen**	398,0	67,4%	23,7%	11,4%	107,2%	35,7%	10,3%	18,0%	15,2%	all fractions separately collected	23,3%	405		37,2	32,1	y	45,21		
Dublin	270,8	59,0%	36,6%	29,1%	78,8%	60,8%	25,5%	23,2%	25,0%	Plastic, Metal, Paper (glass to limited extent)	47,1%	17	*	29,0	41,2	y	36,63		
Helsinki **	285,0	54,7%	38,6%	34,0%	25,7%	73,2%	0,0%	70,2%	10,8%	all fractions separately collected	42,7%	12	*	42,6	60,5	y	33,4		
Lisbon**	570,1	78,2%	11,5%	5,8%	59,8%	38,0%			25,9%	all fractions separately collected	0,2%	231	*	0,5	29,1	n	26,05		
Ljubljana	318,2	40,0%	55,4%	47,2%	87,5%	84,2%			66,7%	Plastic, Metal	72,5%	850	*	76,5	41,0	y	39,5		
London**	435,7	69,2%	25,4%	22,5%	57,1%	44,5%	15,9%	28,4%	19,7%	Plastic, Metal,Glass, Paper	27,3%	20	*	38,0	44,0	n	45,55		
Luxembourg**	666,0	56,4%	28,4%	11,1%	81,2%	60,9%			31,5%	Plastic, Metal, Composite material	21,6%	57	*	51,6	74,7	n	46,83		
Madrid**	328,8	87,9%	11,6%	5,2%	39,0%	12,8%			62,0%	not available	0,0%	163	*	0,0	10,0		27,21		
Nicosia**	656,2	93,9%	6,1%	4,9%	19,9%	11,3%			31,9%	Plastic, Metal, Composite material	0,0%	209		0,0	19,4	n	21,12		
Paris	489,4	80,6%	11,6%	10,3%	58,8%	17,7%	2,1%	2,5%	2,2%	Plastic, Metal, Composite material, Paper	2,3%	42	*	1,6	24,0	n	38,76		
Prague**	322,5	71,3%	14,3%	0,0%	36,1%	43,2%	24,2%	54,5%	25,1%	all fractions separately collected	12,9%	265	*	3,6	19,1	n	23,05		
Riga**	485,5	82,0%	18,3%	18,3%	10,6%	66,5%			47,0%	all fractions separately collected	0,0%	53	*	0,0	51,7	n	15,61		
Rome	612,9	70,9%	16,3%	6,5%	10,1%	14,0%			22,5%	Plastic/ metal ("light multi-material" fraction), plastic/metal/glass ("heavy multi-material" fraction)	32,0%	583	*	49,0	24,0	n	38,19		
Sofia**	348,3	93,8%	4,0%	0,0%	4,7%	4,1%	2,2%	0,0%	2,1%	Plastic, Metal,Glass	8,8%	13	*	10,5	1,5	n	25,22		
Stockholm**	504,4	70,7%	21,5%	3,1%	130,8%	22,8%	11,7%	36,6%	21,7%	all fractions separately collected	17,5%	29	*	28,5	34,9	y	47,62		
Tallinn	481,2	46,6%	47,2%	12,8%	85,3%	74,2%			37,9%	all fractions separately collected	33,8%	65	*	35,8	103,6	y	31,79		
Valletta **	591,3	84,0%	7,9%	5,0%	18,5%	3,6%			16,6%	Plastic, Metal, Paper	0,8%	201	*	2,5	3,9	n	12,22		
Vienna	556,7	64,8%	29,2%	0,0%	51,6%	58,9%	16,6%	41,0%	24,8%	all fractions separately collected	34,1%	165	*	60,6	73,0	y	59,2		
Vilnius	539,4	89,0%	5,5%	0,3%	10,9%	6,8%	4,1%	1,6%	3,8%	all fractions separately collected	8,7%	194	*	15,5	6,4	n	19,83		
Warsaw	370,3	80,1%	4,5%	4,5%	14,3%	3,6%	1,4%	1,1%	1,4%	Plastic, Metal, Paper	7,5%	0		8,9	1,7	y	19,43		
Zagreb	449,1	90,3%	1,0%	0,0%	6,3%	1,6%	0,2%	11,0%	0,6%	Plastic, Metal	0,2%	180	*	0,3	2,2	n	14,58		
Average	446,7	75%	19%	10%	49%	36%	11%	17%	22%		15,6%	184		19,6	32,1		32,01		
**only national waste composition data available to calculate capture rates																			

**only national waste composition data available to calculate capture rates

European Commission

Final Report

Assessment of separate collection schemes in the 28 capitals of the EU

How to do it right?

Examining the five best performing capital cities leads to some useful findings. Although the cities apply different collection schemes (strict separate collection/co-mingling approaches) and have experienced different rates of development (cities with long and constant improvements like Vienna versus cities with rapid improvements over the last 5-10 years like Ljubljana and Tallinn), it appears that there are some common traits:

- They have a PAYT system in place that is based on residual waste, and which cross-finances the collection of other separate collected fractions.
- The municipality and the producer responsibility schemes or free market mechanisms for recyclables are combined smartly and in a harmonized way.
- The fee system combined with the municipal regulations setting the minimum standard for collection are the primary success factor for the collection of bio-waste.
- The development of separate collection started with paper, then cardboard, glass and metal. The most challenging fraction to collect separately is bio-waste.
- Communication to households is very clear about what can and what cannot be placed in each bin. Interest should be cultivated in the general population about how waste is managed.

The study elaborated a set of recommendations addressing different levels of the decision making processes. **The key conclusion/recommendation of the project are:**

1. **Separate collection** of waste fractions leads to higher recycling levels, as the fractions collected separately are usually sent to recovery operations, in particular to recycling.
2. Involving the **private sector** in collection and treatment can help reduce costs and reduce the management burden. However, there is often a lack of transparency and information availability. There is also concern that budget surpluses might be kept within the private company and not re-directed to the municipality/household or connected to the fee system. If involving the private sector, minimum collection and treatment standards should be set and a robust reporting system for data on waste collection and treatment should be put in place.
3. **Door-to-door collection systems** result in the highest capture rates and yields of recyclables. Collection costs for such schemes might be higher; however, capture rates and revenues are also usually higher, and rejection rates and treatment costs lower.
4. **Strict separate collection** (one recyclable in one bin) usually leads to higher recycling rates. The quality of the collected material is better and rejection rate is lower. The co-mingled approach can work, but the collected material can only be sorted to produce clean fractions if there is very little unwanted contamination - reducing contamination/ "sorting mistakes" in the co-mingled bin is the largest challenge. The trend in recycle markets is likely to be towards requiring higher quality materials.
5. Implementation of **Pay As You Throw (PAYT)** for (residual) waste collection within the fee system is one of the main success factor for successful separate collection of waste fractions.

Deliverables and project schedule

The project ran from **14 November 2014** to **13 November 2015**. The following deliverables and meetings were required within the project:

Deliverable	Date	Status
1. Project start (signature of the contract)	14 November 2014	
2. Kick-off meeting (via telephone conference)	08 December 2014	
3. Inception report	19 December 2014	
4. Draft First Report (Draft deliverable for WP1 to WP3)	14 June 2015	
5. Final First Report (Final Deliverable for WP 1 to WP3)	14 July 2015	
6. Draft Second Report (Draft Deliverable for WP4)	14 October 2015	
7. Final Second Report (including all results)	13 November 2015	 This document

The following tasks/work packages have been completed within the project:

- Work Package (WP) 1 “**Legal implication of separate waste collection in the 28 EU Member States**”; including description of separate collection in EU-28 Member States;
- WP 2 “**Detailed description of existing separate waste collection systems in 28 capitals**”;
- WP 3 “**Setting up of a score board covering 28 EU Member States capitals as well as their overall territory as appropriate**”;
- WP 4 “**Proposal for action improving separate waste collection in Member States**”;
- WP 5 “**Overall management, quality control, coordination, communication and reporting**”.

1 Background and objectives

Proper legal implementation, application and practical enforcement of European Union (EU) waste legislation are key priorities of EU environmental policy, in order to comply with the obligation of the EU Commission to ensure and oversee the application of EU legislation according to the Treaty of the European Union (TFEU). Thereby it is recognised that EU waste policy aims to not only minimise environmental threats from waste and waste management, but also to improve waste management as an essential element in efforts to make Europe more resource efficient.

Separate collection of different waste streams is seen as a **pre-condition for fostering high quality recycling and high recycling rates**. It also requires public awareness on waste generation and prevention. Thus, Article 10(2) of the Waste Framework Directive (WFD) sets the **general requirement of separate collection** and obliges the Member States set up **separate collection systems for at least paper, metal, plastic and glass by 2015**. Article 11 (1) sets the requirements for the European Member States (MS) to take measures to promote high-quality recycling through separate collection.

Practice shows, that **practical implementation of the obligations is very different across the EU 28**. While some Member States have only recently started to implement separate collection systems, others have realised separate collection on a door-to-door¹ collection basis and go beyond the requirements of the WFD (e.g. obliging communities perform separate collection for bio-waste by 2015). Additionally, there is a wide variety of ways to collect the different waste streams using either strict separate collection systems (e.g. collection of paper or PET bottles only) or by collecting different fractions together in one bin – so called co-mingling collection (e.g. packaging metal, plastics and composite material together, or the collection of paper and packaging together).

EU studies show² that poorly developed separate collection systems are linked to low recycling rates and low performance with respect to the waste targets in EU waste legislation (besides those in the WFD e.g. the diversion of biodegradable waste from landfills under the Landfill Directive).

Therefore, it is the **objective of this project to assess the separate collection schemes in the 28 capitals** of the European Member states. The assessment focuses primarily on the priority waste streams mentioned in Article 10 (2) and Article 11 (1) metal, plastic, glass and paper, plus on bio-waste. It includes an assessment of legal implications and the practical implementation of separate collection systems in the EU-28 Member States and an in depth-analysis of systems applied in EU-28 capitals. The study covers all separate collection systems that collect one or more of the five waste streams separately from residual waste/mixed municipal waste at source. This includes strict separation and co-mingled collection systems, door-to-door, bring-point collection and other systems.

¹ The term **door-to-door collection** is used in this report as a system where waste bins/containers are usually collected in front of the houses/very close to resident houses. In this study, door-to-door collection means the same as kerbside collection (a term mostly used in UK literature). Even there might be a difference between door-to-door collection (e.g. in apartment houses in front of the apartments/houses) or the collection close to door (e.g. in back yards used by all inhabitants of an apartment house or at street close to houses), this difference is not made within this study.

² **EC 2014**: Commission staff working document „Ex-post evaluation of Five Waste Stream Directives („Fitness Check), 2.7.2014 (page 18) and also **BiPRO 2013**: Support to Member States in improving waste management based on assessment of Member State' performances, in particular in information included in the factsheets of ten low performing EU Member States available at: http://ec.europa.eu/environment/waste/framework/support_implementation.htm

2 General findings on separate collection retrieved from literature

The project team conducted a desk research

- a) to provide an **overview of available literature** focusing on different aspects of separate collection in Europe to improve the level of information available to the reader,
- b) to **highlight main findings on separate collection**, taking into account important findings as identified by other projects, and
- c) to create a **comprehensive information base** with a view to chapter 7 of this report (best practice models from literature) resp. chapter 8 of this report (recommendations).

2.1 Overview of available literature

The Table 2-1 below provides an overview of literature focusing on different aspects of separate collection in Europe, including a short description and indicating the geographical focus of the publication. Part A shows publicly available reports or studies whereas Part B lists scientific papers published in journals.

Table 2-1: Overview of available literature focusing on different aspects of separate collection in Europe

Author / Title	Short description / focus	Link
A. Reports/studies/statements		
[R4R 2014] Regions For Recycling (2014) / FINAL REPORT ON GOOD PRACTICES	- identification of effective initiatives that contributed to the increase of selective collection and recycling of material 40 good practices have been analysed and are described in factsheets - focus: different regions/cities in Europe	http://www.regions4recycling.eu/upload/public/Reports/Final-report-on-identified-Good-Practices.pdf
[ETC/SCP 2014] European Topic Centre on Sustainable Consumption and Production (2014) / The importance of regional and local policies on municipal solid waste management in Europe - exemplified by six regions in Italy, Poland and Spain (ETC/SCP Working Paper No 1/2014)	- report presents the outcomes of analyses of six regional studies of municipal solid waste management - explores the role of regional and local authorities in achieving good performance in MSW management, i.e. addressing separate collection - focus: six regions in Italy, Poland and Spain	http://scp.eionet.europa.eu/wp/wp2014_1
[EEA 2013] European Environment Agency (2013) / Managing municipal solid waste - a review of achievements in 32 European countries (EEA Report No 2/2013)	- cross-country report presents the outcomes of analyses of municipal solid waste management in 32 European countries, - focus: Europe	http://www.eea.europa.eu/publications/managing-municipal-solid-waste/at_download/file
[WRAP 2009] Waste & Resources Action Programme (2009) / Choosing the right recycling collection system	- addresses the question which collection system is the best, in particular whether kerbside sort systems or co-mingled collections are to be preferred - focus: United Kingdom	http://www.wrap.org.uk/sites/files/wrap/Choosing%20the%20right%20recycling%20collection%20system.pdf

Author / Title	Short description / focus	Link
[UK Resource Association 2015] UK Resource Association (2015) / Putting quality recycling at the heart of a circular economy	- states the view of the recyclers as co-mingling collection - focus: United Kingdom	http://www.ciwm-journal.co.uk/wordpress/wp-content/uploads/2015/08/RA-Position-CEP-Position-Aug-2015.pdf
[UK Resource Association 2012] Costs of contamination report	- summarises the results of a survey of re-processors - seeks to identify the costs of recycling products using recovered materials and dealing with inconsistent and poor quality recyclate received by the UK municipals - focus: United Kingdom	http://resourceassociation.com/sites/default/files/Costs%20of%20Contamination%20Report%202012.pdf
[FoE 2009] Friends of the Earth UK (2009) / Briefing. Recycling collections – source separated or commingled?	- outlines the environmental and financial benefits of separating materials at the kerbside. - Focus: United Kingdom	http://www.foe.co.uk/sites/default/files/downloads/recycling_collections.pdf
Waste & Resources Action Programme (2010) / Analysis of kerbside dry recycling performance in the UK 2008/09	- provides an analysis of kerbside dry recycling performance for local authorities in the UK - explores how the nature of the collection systems and local area characteristics influence recycling performance - focus: United Kingdom	http://www.wrap.org.uk/sites/files/wrap/EVA143-000%20Kerbside%20Dry%20Benchmarking%20UK%202008-09%20Report%20FINAL%20for%20publication%20V2%201.pdf
Zero Waste Scotland (2014) / Contamination in source-separated municipal and business recyclate in the UK 2013	- The aim of the project was to determine within reasonable bounds of confidence the typical levels of contamination in dry recyclate separately collected from households by local authorities ('municipal recyclate' and business 'recyclate'): paper, card, glass, metal and plastics - focus: United Kingdom	http://www.zerowastescotland.org.uk/sites/files/zws/Contamination%20in%20source-separated%20municipal%20and%20business%20recyclate%20in%20the%20UK%202013%20240314.pdf
Nordic Council of Ministers (2015) / Guidelines to increased collection of plastic packaging waste from households	- guidelines were compiled as part of the Nordic Prime Ministers' green growth initiative - aim of these guidelines is to inspire and give recommendations on how plastic packaging waste can be collected, and how different aspects concerning collection of plastic packaging can be taken into account - focus: Nordic countries	http://norden.diva-portal.org/smash/get/diva2:788195/FULLTEXT03.pdf background information: http://norden.diva-portal.org/smash/get/diva2:782295/FULLTEXT02.pdf
Association of Catalan Municipalities for Door-to-Door Selective Collection (2014) / Economic balance of door-to-door and road containers waste collection for local authorities and proposals for its optimisation	- the paper compares the costs of the waste management model of selective door-to-door (DtD) collection with the model of collection in road containers (CONT) based on actual data from a sample of Catalan municipalities - focus: Catalan municipalities, Spain	http://www.portaaporta.cat/documents/arxiu_portaaporta_173.pdf
Association of Catalan Municipalities for Door-to-Door Selective Collection (2009) /	handbook about door-to-door collection of waste in Spanish language	http://www.portaaporta.cat/documents/arxiu_portaaporta_101.pdf

Author / Title	Short description / focus	Link
Manual de recogida selectiva puerta a puerta	focus: Spain	
IGES Institut GmbH et al. (2009) / Ökonomische und ökologische Bewertung der getrennten Sammlung von verwertbaren Abfällen aus privaten Haushalten sowie vergleichbaren Anfallstellen.	- assessment of different separate collection systems alongside economic and ecologic criteria (LCA) - modelling of scenarios and their impacts, e.g. impacts of introducing a co-mingled collection for packaging and non-packaging of the same material. - focus: Germany	http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/Dokumentationen/studie-oekonomische-und-oekologische-bewertung-getrennten-sammlung-abfaelle,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf
ZERO WASTE EUROPE (2013-2015) / Zero Waste Case Studies	4 case studies, success stories demonstrating link between introduction of separate collection and high recycling rates - focus: city of Capannori (Italy), public company Contarina (Italy), city of Argenton (Spain), municipality of Vrhnika (Slovenia)	http://www.zerowasteurope.eu/case-studies/
Association of Cities and Regions for Recycling and sustainable Resource management (ACR+) and European Container Glass Federation (FEVE) (2012) / Good Practices in collection and closed-loop glass recycling in Europe	- the objective was to increase awareness and dissemination of information on good practices with the aim of increasing the quantity of selective collection and the quality of the cullet - eight case studies - focus: different regions/cities in Europe	http://www.feve.org/images/stories/pdf2012/goodpractices-collection-closed-loop%20glass%20recycling%20in%20Europe%20-%20report.pdf Press release: http://www.feve.org/images/stories/pdf2012/en_pressrelease_acr.pdf
Waste & Resources Action Programme (2008/09) / A good practice guide for local authorities - Choosing and improving your glass collection service	Good Practice Guide provides essential information to local authority waste managers on the collection and recycling of glass. Whether planning new glass collections, or making alterations to existing schemes, it can help you introduce the most sustainable service 3 case studies - focus: United Kingdom	http://www.wrap.org.uk/sites/files/wrap/Choosing%20and%20improving%20your%20glass%20collection%20service.pdf
Federal Environment Agency (Germany) (2014) / Compulsory implementation of separate collection of bio-waste	examining the implementation of private household's obligation to collect bio-waste separately - investigates the validity of existing concerns against the expansion of separate collection of bio-waste - recommendations and targets for optimal system design are being derived - focus: Germany	http://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/summary_texte_84_2014.pdf
ICU (2014) / Erweiterte Bewertung der Bioabfallsammlung	comparison of collection systems for biodegradable waste - focus: Germany	https://www.itad.de/information/studien/ICUBioabfall24.03.2014.pdf
gab Designer und Ingenieure GmbH (2012) / Studie zur Umsetzung der Pflicht der	Assessment of requirements, costs and impacts of introducing separate collection of bio waste in Germany	http://www.kompost.de/fileadmin/docs/shop/Sonderdrucke/11.2-Getrenntsammelpflicht_11_2012_20_V2_Internet.pdf

Author / Title	Short description / focus	Link
Getrenntsammlung von Bioabfällen nach §11 KrWG	focus: Germany	
Miljøstyrelsen (2013) / Miljø- og samfundsøkonomisk vurdering af muligheder for øget enanvendelse af papir, pap, plast, metal og organisk affald fra dagrenovation	- total socio-economic cost-benefits and LCA based environmental evaluations of various options to improve recycling of paper, cardboard, plastic, metal and glass from households in Denmark - options with source separation and central sorting plants are covered - focus: Denmark	http://www2.mst.dk/Udgiv/publikationer/2013/01/978-87-92903-80-8.pdf
B. Scientific papers published in journals		
[USD 2015] Cimpan, C. et al. (Department of Chemical Engineering, Biotechnology and Environmental Technology, University of Southern Denmark) (2015) / Towards increased recycling of household waste: Documenting cascading effects and material efficiency of commingled recyclables and bio-waste collection	[...] study addresses such situations by documenting the effects, in terms of resource recovery, global warming potential (GWP) and cumulative energy demand (CED), of a transition from a self-sufficient waste management system based on minimal separate collection and efficient WtE, towards a system with extended separate collection of recyclable materials and bio-waste - focus: Europe	http://www.sciencedirect.com/science/article/pii/S0301479715300116 (abstract only)
Kuusiola, T. et al. (Benviroc Oy / Aalto University School of Chemical Technology, Department of Materials Science and Engineering, Finland) (2012) / Comparison of Collection Schemes of Municipal Solid Waste Metallic Fraction: The Impacts on Global Warming Potential for the Case of the Helsinki Metropolitan Area, Finland	- examines the sustainability of different practices to collect the metal fraction of household waste in the Helsinki metropolitan area, Finland - study is carried out by calculating and comparing the greenhouse gas reduction potential of optional practices for collecting the metal fraction of household waste - focus: Helsinki, Finland	http://www.mdpi.com/2071-1050/4/10/2586/pdf
[Dahlén et al. 2006] Dahlén, L. et al. (Luleå University of Technology / Nordvästra Skånes Renhållnings, Sweden) (2006) / Comparison of different collection systems for sorted household waste in Sweden	MSW analysis in six municipalities in southern Sweden with similar socio-economic conditions but with different collection systems - Collection data of the total waste flow, including source sorted recycling materials, in the same area have been compiled and compared - focus: Sweden	http://www.sciencedirect.com/science/article/pii/S0956053X06002169 (abstract only)
De Feo, G. (Department of Industrial Engineering, University of Salerno) (2014) / Sociological survey in a municipality with a high level separate collection programme in an area of historic unpopularity	behaviours, opinions and knowledge of citizens on MSW and separate collection were investigated in an area suffering from a serious solid waste emergency that has lasted over 17 years due to the absence of treatment facilities - focus: city of Mercato San Severino, Italy	http://www.sciencedirect.com/science/article/pii/S0956053X14000610 (abstract only)
Greco, G. et al. (Department of Economics and Management, University of Pisa / Thesis Ambiente) (2014) / Drivers of solid	research estimates the collection costs of different types of waste: paper and paperboard, multimaterial (glass, plastic,	http://www.sciencedirect.com/science/article/pii/S095965261400701X

Author / Title	Short description / focus	Link
waste collection costs. Empirical evidence from Italy.	- metal), organic, residual undifferentiated waste - analyses cost drivers significantly affecting the different types of waste - focus: sample of municipalities, Italy	(abstract only)
Cimpan, C. et al. (Department of Chemical Engineering, Biotechnology and Environmental Technology, University of Southern Denmark/RWTH Aachen) (2015) / Central sorting and recovery of MSW recyclable materials: A review of technological state-of-the-art, cases, practice and implications for materials recycling	- the paper reviews scientific literature, case studies and results from pilot projects, on the topic of central sorting of recyclable materials commonly found in waste from households - focus: Europe (World)	http://www.sciencedirect.com/science/article/pii/S0301479715001553 (abstract only)
[Miranda, R. et al. 2012] Miranda, R. et al. (Department of Chemical Engineering, Faculty of Chemistry, Complutense University of Madrid, Spain) (2012) / Analysis of the quality of the recovered paper from commingled collection systems	- presents a thorough analysis of the quality of a secondary source of recovered paper of a Spanish newsprint mill, imported from the United Kingdom against the background of spreading of commingled collection systems - focus: Spain / United Kingdom	http://www.sciencedirect.com/science/article/pii/S0921344912002212 (abstract only)
Cole, C. et al. (School of Civil and Building Engineering, Loughborough University/ Charnwood Borough Council) (2013) / The impact of Local Authorities' interventions on household waste collection: A case study approach using time series modelling	- At a local Government level there have been many interventions and changes made to household waste collection services to meet new regulatory requirements; these changes include separate collection of recyclable and organic materials. This paper has used a time series model to quantify the success of interventions introduced by a Local Authority (LA) - Focus: medium sized LA, United Kingdom	http://www.sciencedirect.com/science/article/pii/S0956053X13005047 (abstract only)
Ghiani, G. et al. (Dipartimento di Ingegneria dell'Innovazione, Università del Salento, Italy) (2014) / The impact of an efficient collection sites location on the zoning phase in municipal solid waste management	- two decisional problems arising when planning the collection of solid waste are studied; (1) the location of collection sites (together with bin allocation) and (2) the zoning of the service territory; further, the potential impact that an efficient location has on the subsequent zoning phase is assessed - capacities and characteristics of the bins to be located at each collection site - focus: not specified	http://www.sciencedirect.com/science/article/pii/S0956053X14002529 (abstract only)
[TUD 2009] Larsen, A.W. et al. (Department of Environmental Engineering, Technical University of Denmark) (2009) / Waste collection systems for recyclables: An environmental and economic assessment for the municipality of Aarhus (Denmark)	- analysis of how much the recycling rate can be increased through improvements of collection schemes, investigated in a case study of a municipal waste management system Five scenarios with alternative collection systems for recyclables (paper, glass,	http://www.sciencedirect.com/science/article/pii/S0956053X09004693 (abstract only)

Author / Title	Short description / focus	Link
	- metal and plastic packaging) were assessed - focus: municipality of Aarhus, Denmark	
Bernad-Beltrán, D. et al. (Universitat Jaume, Spain) (2014) / Attitude towards the incorporation of the selective collection of bio-waste in a municipal solid waste management system. A case study	attitude of the public towards the incorporation of selective collection of bio-waste into an existing MSWM system in a Spanish municipality is analysed - investigation of level of participation in current waste collection systems, willingness to participate in selective collection of bio-waste, reasons and barriers that affect participation, willingness to pay for the incorporation of the selective collection of bio-waste and the socioeconomic characteristics of citizens - focus: Spain	http://www.sciencedirect.com/science/article/pii/S0956053X1400378X (abstract only)
Gellynck, X. et al. (Department of Agricultural Economics, Ghent University, Belgium) (2011) / Identifying the key factors in increasing recycling and reducing residual household waste: A case study of the Flemish region of Belgium	- the objective of this paper is to identify [...] those variables of the waste collection scheme that help municipalities to reach the mandatory 150 kg goal (waste prevention) - The model covers a number of variables for household characteristics, provision of recycling services, frequency of waste collection and charging for waste services - focus: Flemish region, Belgium	http://www.sciencedirect.com/science/article/pii/S0301479711002039 (abstract only)
Põldnurk, J. (Tallinn University of Technology, Estonia) (2015) / Optimisation of the economic, environmental and administrative efficiency of the municipal waste management model in rural areas	- objective of the research was to assess (1) the environmental and economic feasibility of source sorting paper and bio-waste in rural municipalities, (2) improvement of administrative efficiency, and economic cost-effectiveness resulting in reorganisation of waste management administration, and (3) optimisation options of the municipal waste collection logistics through inter-municipal waste collection districts - focus: Harju County municipalities, Estonia	http://www.sciencedirect.com/science/article/pii/S0921344915000257 (abstract only)
Gallardo, S. et al. (Department of Mechanical Engineering and Construction, Universidad Jaume, Spain) (2012) / Analysis of collection systems for sorted household waste in Spain	- the work analyses the separate collection systems used in Spanish towns with between 5000 and 50,000 inhabitants, investigating the systems and their efficiency - focus: Spain	http://www.sciencedirect.com/science/article/pii/S0956053X12001493 (abstract only)
[Salhofer & Lebersorger 2002] Salhofer, S. and Lebersorger, S. (Department of Waste Management, Universität für Bodenkultur Wien) (2002) / Design of waste collection systems and	- paper describes the design variables of collection systems and analyses the influence of distances on the collection rate - case study: rural communities - focus: Austria	N/A

Author / Title	Short description / focus	Link
effects on waste streams: case studies from Austria		
Lebersorger, S. et al. (Institute of Waste Management, Department of Water, Atmosphere and Environment, University of Natural Resources and Applied Life Sciences Vienna) (2007) / Effect of change to an existing collection scheme for plastic packaging on peoples attitude and behaviour – a case study	- several Austrian municipalities changed their collection scheme for light-weight packaging as a consequence of changes in the legal framework. While all kinds of packaging from plastics and composite materials had previously been recovered separately, subsequently only selected components such as bottles were targeted. The effect of this change on people's attitude and behaviour was evaluated - case study: two municipalities - focus: Austria	http://www.ask-eu.com/Artikel/11903/EFFECT-OF-CHANGE-TO-AN-EXISTING-COLLECTION-SCHEME-FOR-PLASTIC-PACKAGING-ON-PEOPLES-ATTITUDE-AND-BEHAVIOUR-ndash-A-CASE-STUDY.htm (abstract only)

A large number of publications investigating different aspects of separate collection at European, national, regional and local level have been found. The studies mainly focus on:

- waste management and recycling systems as a whole,
- different designs of waste collection systems taking into account technical and non-technical aspects, addressing environmental and economic issues i.e. in the context of establishing a new resp. optimising an existing collection system, elaborating on obstacles and challenges with regard to separate collection,
- but also analysing separate collection systems for specific waste streams in detail.

However, it has to be emphasised that one **cannot find publications identifying “the optimal collection system”** for the relevant waste streams paper, glass, plastic, metal and bio-waste at European or national level. Generally speaking, this might be because local circumstances, such as the organisation of the waste management system or how long the solutions for waste management have been in place, require different solutions. Therefore, it is **difficult to draw strong conclusions**.

However, it can be summarised that publications **clearly agree on the advantages of separate collection** (please see chapter 2.2.1), even if opinions with regard to the **optimal design of collection systems differ**. For example, co-mingled collection of recyclables is still widespread in the United Kingdom, however publications have been identified arguing for separate collection of each waste stream (please see the section on co-mingled collection in chapter 2.2.1). Further, it has to be stated that other projects on separate collection in Europe produced valuable findings (please see chapter 2.2.2). The main conclusions of these studies have been recognised when drafting the recommendations on how to improve separate collection (chapter 8 of this report).

2.2 Main findings on separate collection

2.2.1 Advantages of separate collection and collection systems

The following paragraphs provide a selection of quotations from literature promoting advantages of the implementation of separate collection systems respectively discussing pros and cons of different collection systems. The debate about the convenience of co-mingled collection systems, especially in the United Kingdom, is also be addressed.

- **“Countries that have introduced mandatory separate collection** of certain municipal waste fractions, e.g. waste paper, in addition to packaging waste, or mandatory separate collection of bio-waste, **have high municipal waste recycling levels**. This indicates that **once countries have set up separate collection schemes** for at least paper, metal, plastic and glass by 2015, as required by Article 11 of the 2008 Waste Framework Directive, the **recycling rates can be expected to grow significantly** in many countries” [EEA 2013].
- **“The effects of diversifying the waste stream** can be shown through the example of municipal waste streams in Austria in 1989 and 1999. The total amount of municipal waste increased approximately 20% over this period. Clearly visible was the shift within the individual waste types. **In 1989, only 14% of municipal waste was recycled, while ten years later the proportion of wastes for recycling had already reached 50%. This could only be achieved by greatly extending the technical infrastructure as well as by informing and motivating the users of the collection systems**” [Salhofer & Lebersorger 2002].
- **“System changes, such as the implementation of kerbside separate collection of recyclable materials were found to significantly increase material recovery**, besides **leading to substantial global warming potential and cumulative energy demand savings** in comparison to the waste-to-energy-based system” [USD 2015].
- **“The percentage of recyclable materials visibly increased when the door-to-door scheme began**. Other indicators also show that this **system promotes bigger deviation rates from residual waste and per capita (cap.) amounts of recyclable waste**” (case study Lisbon) [R4R 2014].
- **“Because Catalonia and Lombardy have introduced separate collection** of different recyclables and bio-waste, these two regions are **expected to achieve 50 % recycling of MSW by 2020**. Campania is still **struggling** with the risk of waste crisis in Naples, but thanks to a change in strategy in recent years, with **more focus on separate collection** of especially bio-waste, it seems that the region has a **fair chance of achieving 50 % recycling by 2020**” [ETC/SCP 2014].
- **“[...] MBT can contribute to or ensure the achievement of the targets in the Landfill Directive, but it cannot secure sufficient recycling to achieve 50 % recycling. This level of recycling requires separate collection for material and bio-waste recycling**” [ETC/SCP 2014].

- “With kerbside collection more metal, plastic and paper packaging was separated and left to recycling. When **separate collection of biodegradables was included in the kerbside system, the overall sorting of dry recyclables increased**” [Dahlén et al. 2006].
- “**Kerbside collection would provide the highest recycling rate**, 31% compared to 25% in the baseline scenario, but bring schemes with drop-off containers would also be a reasonable solution. Collection of recyclables at recycling centres was not recommendable because the recycling rate would decrease to 20%. In general, the **results showed that enhancing recycling and avoiding incineration was recommendable because the environmental performance was improved in several impact categories**” [TUD 2009].
- “**In general, door-to-door separate collection seems to provide the best quality of recyclables.** Even if the collection costs are higher, the treatment costs are lower as it results in fewer rejects that must be disposed of and higher revenues from the recyclables (ETC/SCP, 2014b; ENT, 2014). This report also argues that door-to-door system is better suited for residential areas with single houses and the like, rather than in multi-store houses. It is more challenging to encourage and organize MSW separate collection for people living in multi-store buildings, and the result is often a lower quantity and quality of the separately collected MSW. Street garbage bins or street containers (bring systems) are often the backbone in the collection system in such areas, as opposed to door-to-door collection. These bring systems often struggle to encourage the inhabitants to separate their waste instead of putting all the waste in the mixed waste bin. **The consequence of this is a reduced amount of separately collected waste.** Furthermore, the separately collected wastes from street containers normally contain a larger percentage of impurities. **The final recycled amount of MSW will therefore be smaller compared with the amount of door-to-door collection, and the revenues for the recyclables will be lower, due to their poorer quality**” [ETC/SCP 2014].
- “It is interesting to note that there is a correlation between the levels of implementation of civic amenity sites, the % of MSW collected in the civic amenity sites and the number of fractions sorted with the directed to recycling rate. In general, **civic amenity sites have an interesting potential to improve the overall recycling rate of MSW**, on the condition that they are convenient to use (close-by and suitable opening hours) and that the number of sorted fractions is significant” (case study Odense) [R4R 2014].
- In Maia Municipality (in the Greater Porto Region), the system is based on four different coloured bins (paper, packaging, glass and residual waste), with adapted capacity depending on the type of user. Containers are equipped with an electronic identifier, for automatic data collection, recording the amount of waste collected from each customer (and allowing the possibility of implementing pay as you throw in the future). **The system allowed an increase of 10.6% of overall selectively collected quantities from January to December 2013, 24.5% for paper and cardboard collection, 35.3% of glass collection, and 61.3% of packaging collection** [R4R 2014].

Co-mingled collection

In recent years, there has been an important debate about the convenience of co-mingled collection systems, especially in the United Kingdom there is still a great controversy. However, co-mingled collection of recyclables is still widespread in the United Kingdom. To provide an example of differing opinions with regard to the optimal design of collection systems, some main findings of publications **arguing for the benefits of separate collection and potential advantages of co-mingled collection of** (instead of the widespread practice of co-mingled collection) are shortly described.

[Miranda, R. et al. 2012] analysed the quality of a secondary source of recovered paper of a Spanish newsprint mill, imported from the United Kingdom, drawing the following conclusions:

“In **commingled collection systems, all recyclable materials are collected together** in a single container, and include a mix of paper, board, glass bottles, cans, plastics, etc. Although the materials are next sorted in a materials recovery facility (MRF), **cross contamination is more likely**. Thus, total **unusable materials present in recovered paper vary between 5 and 20%**, depending on the cases, **compared to less than 1% for source-separated collections [...]** these systems yield a **very low quality material**, which **cannot be fully exploited for graphic paper recycling**, where the main potential for increasing the use of recovered paper in papermaking lies. New studies also argue that if **all the costs along the paper recycling chain are considered, commingled collection systems could not be the most economic collection method** as previously believed. In the opinion of the authors, **source segregation and separate collection are major pre-requisites for sustainable recycling**”.

The UK Resource Associations provides based on their experience with recycling operators in the UK the following statement [UK Association 2015]: “**Co-mingled waste collection coupled with poor sorting at many UK Material Recovery Facilities (MRFs)** are responsible for **high contamination rates of materials destined for recycling**, costing the UK recycling industry in excess of 50 million pounds annually [UK Association 2012]. Whilst it is acknowledged that a number of MRFs do produce high quality materials for recycling, **mandatory separate collection of bio-waste** together with more emphasis on setting up systems for paper, plastics, metals and glass will help reduce contamination and improve the quality of our secondary raw materials. As guidance to maximum acceptable levels of contamination for quality recycling the Resource Association’s “Recycling Quality Information Point (REQIP)” can be used as reference to what should be achievable in reality.

[Foe 2009] argue for the separate collection of each waste stream and see the following **benefits of source separation**:

- source separation results in less contamination of recyclables and so a higher proportion of them can be recycled;
- stillage vehicles used for kerbside separation have lower fuel use than compactor vehicles used for commingled systems;
- local bulking of sorted materials means lower mileages;
- increased revenue from sale of materials;

- lower capital costs and more local jobs;
- staff separating materials at the kerbside can give immediate feedback to householders by leaving material which can't be accepted for recycling with a note, while still taking those materials which can be accepted;
- kerbside separation of materials can easily cope with additional items – such as batteries, textiles – by adding extra compartments into the vehicle. These would be difficult or impossible to separate adequately in a MRF;
- the total cost of collection and processing together are lower in source separated systems than in commingled systems (source: WRAP (2008), “Kerbside recycling: indicative costs and performance”).

Further, in the opinion of [FOE 2009] **disadvantages of co-mingled collection** are:

- less of the material collected gets recycled (typically 12 – 15 per cent is wasted in English MRFs (source: Dougherty Group LLC for WRAP (2006), “Materials Recovery Facilities”), compared to less than 1 per cent for source separated systems);
- the risk of contamination makes it unsuitable to commingle some materials, for example glass should not be mixed with textiles or paper;
- compaction can make it impossible to recycle some materials, particularly aluminium, plastic and glass (source: ENTEC Consulting for WRAP (2006), “MRF Costing Model”);
- the trend in recycle markets is likely to be towards requiring higher quality materials. Lower quality commingled recyclables are currently being bought by re-processors in China. But in the future these processors will demand higher quality materials;
- increasing energy prices are likely to result in increased prices for recycled materials, particularly those with high embodied energy – e.g. aluminium, steel, glass, paper, plastic – which will shift the balance towards separate collection to maintain quality.

However, it must be noted here, that **co-mingled collection of two or three materials might have advantages**. For example in the report of [WRAP, 2009] states

- that two-stream co-mingled collection (i.e. when households are provided with two recycling containers collect various materials separately, typically paper/cardboard (fibres) in one and plastics, glass and cans (containers) in the other) can reduce some of the problems experienced with co-mingled collection of all materials by keeping fibres separate from containers and reducing the potential for materials to bind together.
- Two stream co-mingled systems have lower net costs than single stream systems reflecting lower MRF requirements and the opportunity to sell fibre streams direct to re-processors.

Separation of plastic and metal collected together is not usually problematic. WRAP also identifies, that where there are practical and operational barriers to kerbside sorting, two stream co-mingled collections have significant advantages over single stream collections, mainly through improved

material quality and value as a result of keeping paper and card separate from other materials, particularly glass.

According to WRAP, **single stream co-mingled collections** (a single bin for all recyclables to be sorted centrally after collection) **may be appropriate in circumstances where the other options are impractical**. These might be the densest urban areas where on-street parking and heavy traffic require fast loading without the need to return containers to the point of collection or for high density flats, transient areas and multi-occupied properties.

2.2.2 Other projects on separate collection in Europe

An interesting project with regard to separate collection in Europe is “Regions for Recycling (R4R)” [R4R 2014], a three-year European project (2012-2014) aiming to enable its **partners from 13 different Member States** to improve their recycling performance through consistent comparisons and an exchange of good practices. It is noteworthy that, despite the same framework and objectives for local and regional territories in Europe, the design of waste management systems leads to different performances, which makes comparisons very useful. **One main outcome of the R4R project was the online waste management tool for local and regional authorities**. This allows regional authorities to input data, calculate indicators, identify transferable good practices relevant to their context and to monitor their progress towards achieving EU targets. **Further, the project partners also identified and described 40 good practices** (seven topics, i.e. bio-waste collection, door-to-door selective collection, legal and economic instruments, ...)³. The following summarises the main findings of the comparison of waste management practices addressing specific waste streams.

Paper

- Some regions do not make a distinction between paper and cardboard (P&C) for packaging and for other uses. Some regions consider all P&C as one stream, while others split up the stream into packaging/non-packaging or have an even more detailed disaggregation (cardboard/newspaper + magazines/advertisements). This might reflect choices with the definition of waste fractions to be separated some territories make distinction between packaging and non-packaging, while other manage paper and cardboard waste as one fraction.
- In some regions there is a significant illegal collection of P&C (Attica Region, Sofia, Lisbon) induced by the economic crisis. These amounts are not included in the collection data.
- Paper and cardboard have a market price and are sometimes collected outside the municipal collection schemes, e.g. by private companies through their own systems. Collection data from private service providers are not always available or reported.
- The absence of mandatory obligations on the separate collection keeps the collection rates low.
- Municipal waste data generally include a share of commercial waste collected with household waste. However, this share might greatly differ from one region to another, especially for papers

³ for detailed information please see: http://www.regions4recycling.eu/R4R_toolkit/R4R_good_practices

that are possibly generated by offices. When commercial paper and cardboard is included, the quantity collected is definitely higher.

- Local instruments (e.g. landfill and incineration bans, landfill and incineration taxes, etc.) and external factors, such as the economic crisis or a large floating population, have a significant impact on the collection rate of paper and cardboard.

Glass

- Data about glass consist mainly of packaging glass. The non-packaging glass is often included in the bulky waste or in construction and demolition waste.
- Reusable / refillable bottles may lower the glass waste production because they only end up in the statistics after several uses, when they break and are re-melted.
- All glass packaging may be collected together and optically separated afterwards or collected separately (white/coloured glass).
- Non-packaging waste (flat glass) is mainly collected at the civic amenity sites.

Plastic

- Plastic packaging waste from household falls under the extended producer responsibility (EPR) schemes and is sometimes collected with other packaging waste streams (e.g. metal packaging, paper and cardboard). Those waste streams are transported mostly to sorting facilities.
- Plastic packaging waste from commercial activities is collected separately and is mostly directly transported to recycling companies.
- Plastic packaging waste collected by deposit systems are not often reported in the waste statistics.
- Other plastic waste streams (non-packaging plastic) are mostly collected with the mixed (residual) waste or with bulky waste. The non-packaging plastic is sometimes collected separately at the civic amenity centres for recycling or for incineration in the cement kilns. The collection of non-packaging plastic waste greatly varies from one place to another.

Metal

- Metal packaging is mostly collected in a mixed packaging waste fraction (e.g. with other material fractions) and sorted out afterwards in material sorting centres.
- Because of the market value of metals, scavenging of metals has become widespread in different regions, impacting on the collected quantities.
- Deposit/return scheme results in a high separate collection rate. Only cans bought from other countries ends up in the residual waste.
- In some territories, the positive value of metals can lead to the development of parallel collection schemes organised by private collection companies, which can lead to a decrease of metals collected on behalf of municipalities. The more positive the market value of the recyclable materials, the more private initiatives will arise.

- Some non-packaging metals are often included in the bulky waste which can be sorted out after collection in specific sorting centres. These quantities are not always included in the values provided by the partners, which can explain part of the differences.

Bio-waste

- The extent of home composting can have a great influence on the production of bio-waste (home composting is considered as prevention) and the quantities of bio-waste collected via door to door schemes. The presence of public green spaces and private gardens has a logical influence on the production of bio-waste.
- Consumption patterns can have an influence on the production of bio-waste; southern countries generally show a higher consumption of fresh products, entailing more bio-waste.
- The different regions do not share a common definition of bio-waste e.g. in Flanders: meat, fish, seafood, bones, etc. are legally not allowed in the bio-waste (because of hygienic reasons for the use as compost) whereas other territories do include meat in bio-waste collection.
- When bio-waste from restaurants is included in the total quantity of bio-waste collected this will result in a significantly higher bio-waste collection rate.
- Besides the kilogram per inhabitant, the share of organic waste remaining in the residual waste fraction is a good indicator (high share -> poor performance of separate collection of bio-waste). However, this indicator requires a composition analysis of the residual waste, which is the case for all the potential recyclable materials in the residual waste.
- Several local instruments such as legislative instruments (landfill and incineration bans) have a clear impact on the collection rate of bio-waste as well as several external factors e.g. climate, housing, consumption patterns, etc...
- A general discussion took place on the inclusion of home composting data in the waste data matrix. The conclusion was to consider home composting ratio as an “external factor” since it is considered as prevention and not recycling.

3 Methodological approach

3.1 Method to assess legal transposition and interpretation of separate collection and main strategies applied in EU-28 MS (national level)

As a first step the legal **transposition of the requirements on separate collection** as included in the WFD has been investigated, based on the **national legislation** in the EU-28 Member States, by applying the following steps:

- Identifying the piece of legislation(s) implementing the WFD in the countries; basis was the Eur-Lex website - national implementation measures (NIM) and further investigations;
- Screening the NIM for its relevance as regards requirements on separate waste collection;
- Subdividing the requirements for separate collection and its explanation (included in different articles of the WFD) into single requirements;
- Checking whether those single requirements are; including the wording in national language and English translations;
- Assessing what form requirement has been transposed (same wording, additional wording and deviating wording).

Relevant articles of the WFD for separate collection are Article 3(11) Definitions; 10 (2) Recovery, 11(1) Re-use and recycling and Article 22 Bio-waste. The analysis of the WFD led to the following single requirements for separate collection:

Table 3-1: Requirements on separate collection as included in the WFD

Article	Wording from Waste Framework Directive
Art. 3 (11)	Definition separate collection: "'separate collection' means the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment;";
Art. 10 (2)	Where necessary to comply with paragraph 1 and to facilitate or improve recovery, waste shall be collected separately if technically, environmentally and economically practicable and shall not be mixed with other waste or other material with different properties.
Art. 11 (1)	Member States shall take measures to promote high quality recycling and, to this end, shall set up separate collections of waste where technically, environmentally and economically practicable and appropriate to meet the necessary quality standards for the relevant recycling sectors. Subject to Article 10(2), by 2015 separate collection shall be set up for at least the following: paper, metal, plastic and glass.
Art. 22 (a)	Member States shall take measures, as appropriate, and in accordance with Articles 4 and 13, to encourage: (a) the separate collection of bio-waste with a view to the composting and digestion of bio-waste;

In order to assess in what form the legal requirements have been transposed into national legislation, four assessment categories have been applied to different interpretations and understandings of the WFD for each country. The approach is illustrated in the table below.

Table 3-2: Evaluation categories for legal assessment of national legislation

Evaluation category	Explanation
additional	The requirements of the WFD have been transposed and additional information or requirements are set out in the national legal requirement, i.e. additional definition, precision of requirement that goes beyond the text of the WFD. “additional” means that the requirement of the WFD has been transposed into the national legal implementation. Additionally, the legal text also provides information or requirements that go beyond the WFD. Since the WFD is not precise on all issues on how separate collection should implemented, there are several options on additional information or definitions that can be included in national laws that specify how certain requirements have been interpreted by Member States. Exemplary additional information are: • Type of separate collection scheme (door-to-door collection, bring system etc.) • Further definitions (i.e. high quality recycling, economically practicable, quality standards etc.) • Coverage of territory • Quantitative restrictions / exclusion of certain fractions • Responsibility for separate collection
one:one	The requirement of the WFD has been transposed exactly / literally or transposed analogously. No additional requirements or explanations are set out. If the legal national implementation transposes the legal text of the WFD literally or analogously the second evaluation category “one:one” can be applied. This category means that the legal implementation doesn't include any further information or requirement beyond that stated in the WFD.
deviating	The requirements of the WFD have been implemented into national legal requirements but have been adjusted, left out or deviate from those in the WFD. “deviating” means that the requirement is included in the national legal implementation but i.e. the wording has significantly been changed so that some parts have been left out or the meaning or intention of the WFD is changed.
not included	The requirement of the WFD is not transposed into national law. “Not included” means that the requirement of the WFD has not been transposed into national legal requirements. Besides the case that a requirement has simply not been included, it is also possible that one aspect is not included even though other related requirements have been implemented. An example for this case is the implementation of requirement 11 (1) separate collection if environmentally practicable in Germany: <i>§ 14 Promotion of recycling and other material recovery (1) For the purpose of proper, safe and high quality recycling paper, metal, plastics and glass wastes are to be collected separately from 1 January 2015 at the latest, as far as technically and economically practicable.</i> The environmental practicability has not been included in the national law even though economical and technical practicability has been. This evaluation does not rate the reasonableness of not including certain requirements to prevent the avoidance of the obligation of separate collection.⁴ Neither shall “Not included” be understood as negative rating, it only evaluates that a certain requirement is included in the national legal requirement.

In order to complete the picture of the Member States interpretation of the WFD requirements, the project team assessed additional literature sources, including publications on interpretation at national level.

⁴ In this specific case not including “environmentally practicable” could be interpreted as intention to prevent the avoidance of the obligation of separate collection if this is environmentally not practicable.

3.2 Preparing an overview of waste collection systems applied in EU-28 MS (national level)

Before analysing the collection systems applied in each of the EU-28 capitals, this preliminary step summarised the situation of separate waste collection and most common system applied on national level. This is an important information in order to:

- get an overview of systems applied on EU-28 level and the status-quo of separate collection;
- compare the systems and identify the most common systems at the EU-28 level;
- and also lay the groundwork to know to what extent the systems applied in the capital are representative of the rest of the country.

The purpose is to collect and summarise **information on main systems applied in the country** (regional, local level), including information from national and regional Waste Management Plans (WMP), strategies and, if necessary, from selected stakeholders **concerning separate collection**. Differentiation has been made between the applied systems; i.e. door-to-door separate collection, door-to-door co-mingled collection with subsequent separation, bring-in collection points, civic amenity collection points, and application of deposit return schemes (i.e. beverage containers). Beside the main systems applied (main system defined as the system mostly applied in terms of inhabitants connected to the described system) variations and other applied systems, and the differences in implementation between rural/urban settlements have been shortly explained where possible.

Information collected on national level included:

- A brief overview of recycling performance (recycling % increase and separate collection) over time in the country;
- A description of main systems in place by type and materials collected; bring points, door-to-door, co-mingled collection, civic amenities, EPR & deposit systems and regional differences/variations/other systems (if existent) and their geographical coverage;
- Information on performance of the system and development over time in the country;
- Highlighting any changes of the system that was made to meet WFD, if any;
- An overview table on (see below) on systems in place over the country: indicate primary and secondary (most typical) options for materials and other options.

Main sources of information considered were:

- National Waste Management Plan;
- National Act on Waste, national strategies, collection and treatment plans and alike
- National reports including information on waste collection, available information form Ministries, website, etc.

The main feature of the national overview on collection systems is the following table summarising information on separate collection systems applied in the country.

Table 3-3: Template to provide overview of main separate collection systems in each of EU-28 countries

Collection type	Paper	Glass	Plastic	Metal	Bio-waste
Door-to-door collection 	Primary	Secondary	Very rare	Very rare	Separate bins or bags on demand
Co-mingled (door-to-door) 			Primary collection for plastic and metal (co-mingled)		
Bring points 	Secondary, but main form at sparsely populated areas	Primary	Secondary, but main form at sparsely populated areas		Secondary, but main form at sparsely populated areas
Civic amenities 	Additional collection for all streams on top of other waste types, i.e. hazardous waste from households				

The template includes an example how to fill-in the table. The **primary** system applied defined as the systems to which the majority of inhabitants are connected. The secondary system is indicated as the system that is used to complement the main system (e.g. door-to-door collection of paper accompanied bring point systems). The overview also includes systems that are applied only in few regions/cities by using the terms rare/very rare. If necessary further explanations are included to describe the system, e.g. in the case bags/bins are available on demand only, or in case there is a distinction between main systems applied in urban/rural areas.

3.3 Assessing existing separate waste collection systems in EU-28 capitals

The next step of the project was to provide a detailed description of the separate collection of waste fractions in all the 28 capital cities of the EU, including both quantitative and qualitative information and provides inputs to the preparation of the scoreboard. The information collected and collated was used to produce the ranking scoreboard of cities based on performance and serve as basis of selection for best practice case studies as well. Collecting and collating similar data and information on the 28

capital cities was carried out by experts with native or near-native language skills carrying out the steps outlined for each allocated city.

3.3.1 Template for research on capital cities

A comprehensive overview of the separate collection systems in place in the 28 capital cities of the European Union demanded a common reporting template for the cities. A factsheet approach was used, that standardises the information sought during the data collection phases of this task. This provided a useful template for quality assurance and served as a means of presenting and organising the collected information. It also helped to identify data gaps left after the desktop research phase and thus can guide the ongoing efforts of the search.

The chief rationale for making each city a key data point, rather than the various fractions, is that the research for most data points was conducted on a city by city basis rather than cross cutting figures for a given data type (for example, tonnes (t) of separately collected glass). Where found, cross cutting data covering one of the above points was shared across all team members to ensure its integration into the city factsheets.

The information and data generated by this work was also used to assess the cities for the scoreboard described later on. To facilitate the scoreboard it was essential that the quantitative data collected on the cities are comparable. A proposed template for the city factsheets was discussed with and approved by the Commission during the kick-off meeting for finalization in the inception report.

Some of the factsheets include household-like commercial waste in the data on waste quantities collected, and distinguish between household waste and these similar wastes if applicable. The assessment concentrated on the fractions paper, metal, glass, plastic, and bio-waste. The main elements of the template cover:

1. Background information on the city;
2. Detailed and overview information on collection systems;
3. Indicators on performance;
4. Qualitative information supporting understanding.

3.3.2 Desk research

The desk research undertaken as part of this activity supplemented this existing knowledge of the team members and provided a significant share of the information on what type separate waste collection is currently employed in the European capital cities. This also provided a valuable point of departure of both the desk research and the stakeholder interviews.

The desk research aimed at the following issues:

1. Consult known data sources for quantitative data on cities.
5. Consult literature for information on separate collection in cities.
6. Identify schemes for specific fractions in cities (often implemented at national level).

7. Identify data and information gaps.

The search focused on known data sources and published literature on separate collection and waste management in European cities. The primary sources for the desk research included:

8. Ministry of Environment, European Environment Agency (EEA), waste statistic intuitions;
9. Regional waste authorities;
10. Municipal associations and single municipalities;
11. Waste associations, large waste management companies;
12. City associations (Local Governments for Sustainability (ICLEI) etc.);
13. Non-governmental organisations (NGO);
14. Waste management plans will be used as additional information source in case information on status-quo of applied separate collection systems are included (e.g. for comparison of capitals with regions).

Further, the project team received valuable inputs from the Association of Cities and Regions for Recycling and sustainable Resource management (ACR+). This association has a wide range of members, including municipalities and city councils, but also waste associations and other key stakeholders included in waste management. Those contacts were also used extensively for including information on separate collection in the cities. Furthermore, ACR+ has recently conducted a study on the systems of separate collection in 18 EU capitals; information and contacts from realizing this study were important starting point.

For most cities it was possible to gather comprehensive data on the waste generation, collection and treatment within the specific waste streams. The absolute quantities of waste separately generated, collected and recycled within the four key waste streams (paper, plastic, metal and glass), biodegradable waste were supplemented, where possible, by more comparable measures (t per person or per household). Where these were not directly available from source, calculate was based on the collected coverage figures.

3.3.3 Interviews with relevant stakeholders

The first step in this process included the identification of relevant stakeholders that were be able to provide the information required for this assessment. The majority of stakeholders were primarily from the city authorities, the waste handing companies running the collection programmes, and the EPR schemes that are relevant in a city (given that they tend to be applied on a national level).

Interviews, either in person (where convenient), by telephone or by email were conducted relevant stakeholders to assess the quality of information already collected in the desk research and to gain information and data not available through desk research. Interviews were not formally structured, but lead by the demand for data and information in the given case based on the draft fact sheets.

3.3.4 Normalising and collating results

The next step was to seek to modify the collected raw data where necessary to create comparable data between cities.

Key metrics to enable inter-city comparison and ranking (as demanded by WP3) included:

1. Waste generation data (amount of MSW expressed as t and kg/capita. Alternatively, waste from households was used in case the collection system covers only municipal waste and information on share of waste from households within MSW was available)
2. Collection rate for separately collected fractions (collected quantity in t / generated quantity in t);
3. Collection rate for all separately collected fractions (total separately collected waste / total municipal waste generation);
4. Quantity of separately collected fractions per person and/or per household;
5. Losses of separately collected waste (not suitable for recycling) as a share of separately collected waste;
6. Setup costs for separate collection per unit of collection capacity (in Euro(€) per household or per person);
7. Running costs for separate collection per unit capacity (in € per household or per person) and per tonne of collected material.

It was planned to include the costs of different collection systems; the focus was not only on the cost level itself but more on its structure (i.e. fees, taxes or general budget of municipal waste management). Normalising the costs associated with the separate collection systems was a particularly difficult task: there are a variety of cost measures that are, in principle, comparable, but it was difficult to compare them in practice. In terms of costs to consumers, the different billing mechanisms (specific waste fees; specific tax stream; general taxation) and the fact that these tend to be related to waste management generally, rather than separate collection specifically, makes any formal normalisation for the purpose of comparison highly problematic.

In addition, costs associated with separate collection, particularly with regard to initial setup costs, but also running costs, can reflect a wide variety of factors: the existing infrastructure before such a system was implemented; the wider structure of the urban built environment; geographical and demographic features of the city/country; the timescale over which the measure was introduced; the particular means of financing (as part of a stand-alone scheme or part of a wider investment package, for example). These factors should be captured where possible, during the desk research and interview phases, but they will still make the normalisation of costs for separate collection problematic.

Normalising and collating the data from the desk research and interviews also functioned as a quality control for the collected data. Immediate horizontal data comparisons can help identify unexpectedly low or high values.

3.4 Development of scoreboard to identify case studies

The aim of the scoreboard was to produce a matrix that allows the ranking of the capitals according to their performance in the separate collection of relevant waste fractions. While developing the scoreboard, several aspects from the previously completed tasks had to be taken into account, i.e. significantly difference in data availability for the 28 capitals.

The first step was to populate one Excel file containing all data gathered in the capital factsheets, thus allowing a deeper analysis of the performance of specific elements across the capitals. This overall data scoreboard provided the technical basis for the development of the **headline scoreboard** allowing the identification of the case studies. It also allowed the analysis of which kind of data were sufficiently available to allow a comparison across the capitals. In the end, there was insufficient data about the costs of separate collection as well as recycling outputs and inputs of different collection systems across the capitals. These aspects were, therefore, not further considered.

Good data was available across all 28 EU capitals for: collection rates of all relevant waste streams, i.e. paper, plastic, metal and glass; total generation per waste stream; financing system established; and coverage of the city with the different collection schemes (door-to-door, bring points or civic amenity sites). Based on the data availability described above, thirteen indicators were chosen to form a “headline scoreboard” to assess the performance of the 28 capitals. The table below provides an overview of the key indicators used in the headline scoreboard.

Table 3-4: Main indicators and their features used for the development of scoreboard

	Indicator	Explanation
1.	MSW generation (kg/capita)	Total amount of municipal solid waste (MSW) generation in the capital divided by the number of inhabitants. The indicator sets the basis of separate collection in terms of waste generated. Very few cities differentiate the source of MSW collected between households and other sources.
2.	Residual waste from total MSW generation (%)	Percentage of MSW that is collected as residual waste. i.e. waste not subject to separate collection. This indicator provides an indication of how much waste is not covered by separate collection.
3.	Quantity of waste fractions separately collected by all systems (%)	Percentage of MSW that is separately collected by (door-to-door, bring point and civic amenity site collection) within the relevant fractions (paper, plastic, metal, paper and bio-waste). This indicator provides an overview of the separate collection performance compared to unsorted collection.
4.	Quantity of waste fractions separately collected door-to-door (%)	Percentage of MSW that is separately collected door-to-door within the relevant waste fractions (paper, plastic, metal, paper and bio-waste). This highlights the implementation of door-to-door collection.

	Indicator	Explanation
5.	Glass capture rate (%)	The capture rates is the percentage of the estimated generation of a waste fraction (based on national or city residual waste composition data, where available) that is collected separately. This indicator might not include the amount of a fraction collected from sources other than households. For most cases, only national waste composition data available to calculate capture rates.
6.	Paper capture rate (%)	
7.	Plastic capture rate (%)	
8.	Metal capture rate (%)	
9.	Bio-waste capture rate (%)	
10.	Co-mingled stream capture rate (%)	In some cases, it was not possible to disaggregate co-mingled collection data. Only the total amount of waste streams collected co-mingled is available, i.e. plastic and metal but also other dry recyclables. As such, a "co-mingled" collection rate was calculated for all cities (a combined collection rate for the fractions co-mingled) in order to have a comparable indicator.
11.	Glass bring point city coverage (No. of bring points/100 000 inhabitants)	This key indicator was assessed by calculating the amount of glass bring points by 100,000 inhabitants using the total amount of glass bring points within the capital territory. This indicator is used to compare the density of bring sites across the capitals, in general better coverage yields better collection rates. It was chosen because most capitals use bring sites as main means of collection for glass waste.
12.	Bio-waste collection rate (kg/cap)	Bio-waste collection rate provides an overview on the amount of bio-waste that is separately collected per inhabitant. This indicator allows the comparison between capitals since separate bio-waste collection is not yet well established across the EU.
13.	Paper collection rate (kg/cap)	Paper collection rate provides an overview on the amount of paper-waste that is collected per inhabitant. The reason for the choice of this indicator is that paper is traditionally collected separately.

⁵ Additional information was included in the scoreboard in order to provide a better overview of the separate collection systems applied in the 28 EU capitals. Mostly these were information that could not be evaluated on a quantitative but rather qualitative basis.

	Indicator	Explanation
	PAYT system established (y/n)	Qualitative indicator, indicates whether a pay-as-you-throw system is established (Yes or No). This indicator was assessed because it was one of the few pieces of information related to costs and financing of the separate collection in the capitals that was available. Also PAYT generally fosters better waste separation, see chapter 2.
	Co-mingled collection y/n (fractions)	Qualitative indicator, indicates whether certain streams are co-mingled (Yes or No) This additional indicator was assessed because generally the source separated collection of dry recyclables yields better recycling material see chapter 2.
	add. Fract.	This indicates whether other fractions in addition to glass are collected at the bring point.
	National MSW re-use and recycling rate from EUROSTAT in (%)	Indicator on how much of the total MSW generated is re-used or recycled on national level in percentage. The free market for recyclables does not allow capitals to track exact recycling rates of the waste they collect. For informative purposes the national percentage of waste re-used and recycled was used as a proxy on recycling rates.

For all 28 EU capitals, the above illustrated indicators have been calculated and compiled. The Excel file containing the headline scoreboard consist of an overview sheet that shows the results for all indicators in comparison in an alphabetical order.

In addition for each of the thirteen indicators a sheet has been developed, where the capitals are ranked according to their performance (higher and lower performance in relation to the average across the capitals). The top three performing capitals were highlighted in green per indicator. The figure below illustrates the Excel sheet for indicator six 'Paper capture rate'.

Scoring	Higher Performance (above average)	Lower performance (below average)	3 Best performers	** national dat
City (Country)	Capture rate		City (Country)	Capture rate
Amsterdam (Netherlands)	34,5%		Ljubljana (Slovenia)	84,2%
Athens (Greece)**	57,6%		Tallinn (Estonia)	74,2%
Berlin (Germany)	65,6%		Helsinki (Finland)**	73,2%
Bratislava (Slovakia)	42,8%		Riga (Latvia)**	66,5%
Bucharest (Romania)**	11,3%		Berlin (Germany)	65,6%
Budapest (Hungary)**	13,3%		City of Luxembourg (Luxembourg)**	60,9%
Brussels (Belgium)	34,5%		Dublin (Ireland)	60,8%
Copenhagen (Denmark)**	35,7%		Vienna (Austria)	58,9%
Dublin (Ireland)	60,8%		Athens (Greece)**	57,6%
Helsinki (Finland)**	73,2%		London (United Kingdom)**	44,5%
Lisbon (Portugal)**	38,0%		Prague (Czech Republic)	43,2%
Ljubljana (Slovenia)	84,2%		Bratislava (Slovakia)	42,8%
London (United Kingdom)**	44,5%		Lisbon (Portugal)**	38,0%
City of Luxembourg (Luxembourg)*	60,9%		Copenhagen (Denmark)**	35,7%
Madrid (Spain)**	12,8%		Brussels (Belgium)	34,5%
Nicosia (Cyprus)**	11,3%		Amsterdam (Netherlands)	34,5%
Paris (France)	17,7%		Stockholm (Sweden)**	22,8%
Prague (Czech Republic)	43,2%		Paris (France)	17,7%
Riga (Latvia)**	66,5%		Rome (Italy)	14,0%
Rome (Italy)	14,0%		Budapest (Hungary)**	13,3%
Sofia (Bulgaria)**	4,1%		Madrid (Spain)**	12,8%
Stockholm (Sweden)**	22,8%		Nicosia (Cyprus)**	11,3%
Tallinn (Estonia)	74,2%		Bucharest (Romania)**	11,3%
Valletta (Malta)**	3,6%		Vilnius (Lithuania)	6,8%
Vienna (Austria)	58,9%		Sofia (Bulgaria)**	4,1%
Vilnius (Lithuania)	6,8%		Warsaw (Poland)	3,6%
Warsaw (Poland)	3,6%		Valletta (Malta)**	3,6%
Zagreb (Croatia)	2,3%		Zagreb (Croatia)	2,3%
Average	35,7%		Average	35,7%

Figure 3-1: Scoreboard sheet for the performance of the 28 EU capitals 'Paper capture rate'

Finally, the overview of all indicators allowed the identification of the overall best performing capitals, meaning the capitals that were among the top three performers for several indicators.

Based on the outcome of the ranking, five cities to be included in the case studies on good practice examples for separate collection were identified. Chapter 7 **includes the headline scoreboard** with indicators and results as described above, the list of selected cities and the good practice examples.

3.5 Elaboration of good practice examples/case studies

The purpose of this task was to 'tell the story of success' for the cities showing best performance in several indicators as described before in chapter 3.4. In particular, the case studies focus on the key features for increasing the separate collection performance and the development over time, as well as obstacles and problems. It appears that the five cities selected apply different collection systems (door-to-door collection/bring points and strict separate collection/partly co-mingling approach) and show a different development over time (short time development versus long time development). Therefore, a further objective was to explain how the collection system works in detail in each of the five cities, how it developed over time, what changes have been made and what fee system is applied. The following questions were guiding the elaboration of the good practice examples:

Key features/elements of the system currently in place
• What is collected door-to-door, what in bring-sites (coverage or contribution of various systems to overall collection) • Most important collection routes that contributed to the achievement of the current performance (which waste stream is most important to achieve high overall performance) • Ownership and management of the system • Key stakeholders • If possible recycling rates etc. and development over time (e.g. for fractions) • In bullets
Performance over time
• Was the current performance reached after a gradual improvement or were there sudden changes? • When was the current system started? • How has the performance changed compared to previous system? • What was the main contributions to change/main instruments having influence?
Fee/charge system
• What are key features of the fee/charge system? (PAYT, free collection of recyclables, etc.) • How was it developed/adapted over time? (Was the improved collection rate linked to any changes in the fee system) • What are the key recommendation from involved stakeholders/administration for cities introducing a fee system?
Main success factors/Main obstacles
• Main success factors (i.e. communication, fee system, easy access, etc.) • What have been barriers/obstacles? How did they overcome barriers? • What are the main recommendations for other cities who want to introduce/boost separate collection? • With what fraction to start? Who to involve? How to proceed?
Overall conclusion/Further aspects

Interviews with relevant stakeholders

The city case studies have been constructed based on further interviews with few selected experts involved in the waste management system applied in the city from administration and/or operation side. All information sources including the interviews are cited in the examples.

4 Legal transposition and interpretation of separate collection and main strategies applied in EU-28 MS (national level)

4.1 Legal transposition of separate collection in EU-28 MS

The results of the legal assessment are summarised in Table 4-1 below. In the UK and Belgium there is no national legislation transposing the Waste Framework Directive, so regional legislation has been assessed. In the case of the UK the regions are a) England and Wales (UK EW) b) Scotland (UK Sco) and c) Northern Ireland (UK NI). For Belgium the three regions are a) Brussels region (BE Br) b) Flanders (BE Fl) and c) Wallonia (BE Wa). As such, 32 legal transpositions were assessed for 28 Member States.

Table 4-1: Overview of Member States and region acronyms

Acronym	Country	Acronym	Country
1. AT	Austria	17. IE	Ireland
2. BE Br	Belgium Brussel region	18. IT	Italy
3. BE Fl	Belgium Flanders	19. LT	Lithuania
4. BE Wa	Belgium Wallonia	20. LU	Luxemburg
5. BG	Bulgaria	21. LV	Latvia
6. CY	Cyprus	22. MT	Malta
7. CZ	Czech Republic	23. NL	Netherlands
8. DE	Germany	24. PL	Poland
9. DK	Denmark	25. PT	Portugal
10. EE	Estonia	26. RO	Romania
11. ES	Spain	27. SE	Sweden
12. FI	Finland	28. SI	Slovenia
13. FR	France	29. SK	Slovakia
14. EL	Greece	30. UK EW	United Kingdom England and Wales
15. HR	Croatia	31. UK Sco	United Kingdom Scotland
16. HU	Hungary	32. UK NI	United Kingdom Northern Ireland

Table 4-2 includes as an overview the results of the legal assessment. Each requirement is described in detail in the following chapter.

Table 4-2: Results of the legal assessment

Requirement	Member State																											SUM								
	AT	BE Br	BE Fl	BE Wa	BG	CY	CZ	DE	DK	EE	ES	FI	FR	EL	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK EW	UK Sco	UK Ni				
1. Article 3 (11) Definition separate collection																																	2	27	2	1
2. Article 10 (2) waste shall not be mixed”																																	1	18	8	5
3. Article 11 (1) high quality recycling”																																	3	13	7	9
4. Requirement technically practicable																																	1	22	5	4
5. Requirement economically practicable																																	1	21	6	4
6. Requirement environmentally practicable																																	1	20	7	4
7. Article 11 (1) quality standards																																	1	12	6	13
8. Article 11 (1) separate collection paper, metal, plastic and glass																																	2	12	16	2
9. Article 22 WFD: Bio-waste																																	4	9	16	3

not included	deviating	one:one	additional

4.1.1 Requirement 1: definition separate collection

The WFD defines separate collection in Article 3 (11) as follows: “‘separate collection’ means the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment”. **26 Member States and regions** have transposed the separate collection definition “one:one”.

Additional interpretation of the definition of separate collection compared to one determined in the WFD have been assessed in **Finland and UK Sco**.

The Finnish [FI Waste Act 2011] goes beyond this definition by specifying the specific treatment as “**preparation for re-use, recycling, other types of recovery or other specific treatment**”. In Scotland separate collection has to ensure that “(i) dry recyclable waste is kept separate from other waste; (ii) waste from one dry waste stream is kept separate from waste in another such stream; and (iii) food waste is kept separate from other waste;” [UK Scotland No. 148 2012].

Deviating definitions of separate collection have been assessed in **DK and AT**.

In **Denmark** waste management and separate collection is only partly regulated by national law, since Danish municipalities have a very extensive legal ground for regulating requirements on source separation and separate collection of household and household-like waste. There is no requirement that these fractions shall be collected separately, but it is required that the majority of these fractions are recycled or in some cases prepared for reuse, which makes separate collection the preferred choice for municipalities implementing waste collection. [DK BEK 2012] defines a collection system as “a regulation specific scheme in which the municipality takes over responsibility for the further handling of the waste at the collection site, and which is organised as a collection- or bring scheme”.

Regarding **Austria** the collection of non-hazardous municipal waste is regulated under the Waste Management Acts of the nine Austrian Federal Provinces. Requirements on separate collection are not, therefore, regulated only at the national level. The national waste management act [AT AWG 2002] determines that recoverables are “a) waste that is collected separately from other types of waste in order to deliver such waste in a certifiable manner for admissible recovery.”

SE has **not included** the definition of separate collection in national legislation transposing the WFD.

The legal commentary to the **German** Circular Economy Act [DE KrWG 2012] deals with issue of admissibility of co-mingled collection, especially the separation of the wet and dry fractions with subsequent separation. It states that this form of separation of certain waste fractions from residual waste is not based on the material properties of the waste but is based on subsequent separation and treatment. Such a system goes against the definition of separate collection that explicitly intends to separate the relevant waste streams from residual waste.

4.1.2 Requirement 2: waste shall not be mixed

The second requirement that has been identified in Article 10 (2) WFD regarding separate collection is that in order to “facilitate or improve recovery, waste [...] shall not be mixed with other waste or other material with different properties”. For the assessment of national transpositions, the prohibition of the mixing was interpreted as applying to waste and materials with different properties in all waste

streams. For this reason it was evaluated whether exceptions were made. **18 Member States** did transpose this requirement one:one in national legislation.

PL has included **additional provisions** meaning more specific explanation regarding the prohibition to mix waste with other waste or other material with different properties.

Altogether seven Member States and two regions have implemented this requirement in a deviating way into national legislation, they are **AT, BE Br, CZ, HR, MT, RO, SE and UK Sco**. Some Member States have included the allowance of co-mingled collection into national legislation including the mixing with materials with different properties. For this reason they were rated deviating.

Austrian legislation only refers to the prohibition of mixing or blending of waste if this hinders examinations or treatment operations required by waste law [AT AWG 2002] and not to the prohibition to mix waste in general. The **Czech** law [CZ Act 185 2001] simply states that waste producers are obliged to collect wastes sorted by individual types and categories, without directly prohibiting the mixing of waste. In **Spain**, according to [ES L22/2011], co-mingled collection of material of the same fraction is allowed if “a further proper separation is guaranteed as long as it doesn’t suppose a reduction of quality of the obtained materials nor an increase in cost”. **Croatia** has not directly transposed the mixing ban of waste, instead the law mentions that “Waste whose valuable properties can be used must be collected and stored separately so as to allow the management of such wastes” [HR ZOGO 2013]. In the **Maltese** law the non-mixing of waste only refers to waste that has been separately collected and not to waste in general meaning that waste that has not been separately collected might be mixed if it does not hinder recovery [MT 184 2011]. **Romanian** national legislation does not refer to “other material with different properties”, but requires that operators who provide waste collection and transport shall not mix the wastes [RO Law 211 2011]. As stated above (see chapter 4.1.1), in **Sweden**, separate collection is only partly regulated on national level. The national law stipulates that municipalities may issue regulations on how certain types of waste must be stored and transported separately from other waste, and was thus rated deviating. **Scotland** only refers to dry recyclable waste in the legislation that shall not be mixed with other waste that cannot be recycled and not to all relevant waste streams [UK Scotland No. 148 2012]. In the **Brussels region** the requirement of not mixing waste with different properties refers to waste that undergoes recovery operations (and not directly to collection). Another reason for the deviation is that non-mixing shall only apply where technically, environmentally and economically practicable [BE Brussels waste 2012].

Seven Member States did not transpose that waste shall not be mixed with other waste or material with other properties in order to facilitate or improve recovery, these are **DK, FR, LT, PT and SK**.

4.1.3 Requirement 3: high quality recycling

According to Article 11(1), paragraph 2 of the WFD, Member States have to set up a separate collection scheme in order to promote high quality recycling. It therefore has been assessed whether Member States interpreted what they understand by high quality recycling, if there are thresholds, or if they only referred to recovery in general.

14 Member States transposed this requirement **one:one** in their domestic laws.

The **Italian** law makes **additional** provisions. Regions are required to develop criteria that must be followed by municipalities in order to meet a minimum percentage for separately collected municipal waste to promote high quality recycling. Also, initiatives encouraging the implementation of the waste hierarchy have to be pursued by the public administration. These include inter alia the establishment of tendering conditions that make provisions for the use of material recovered from waste, thus enhancing the quality of recovered products and promoting recycling [IT DL152/2006]. An additional understanding of high quality recycling has been assessed in **Luxembourg**, where the aim of separate collection is to “provide quality recycling is to keep the material as long as possible in the economical loop and thereby achieving a high level of resource efficiency” [LU Waste 2012]. **Scottish** legislation specifies that any person or producer has to take all steps to ensure that the waste meets any quality standard for the management of material included in the waste and that the waste is managed in a manner that promotes high quality recycling. This was evaluated as additional because it relates high quality recycling to the management of materials included in the waste.

Deviating legal transposition of this requirement have been assessed in **6 Member States** and one region including **AT, BE Br, HU, MT, NL, PT and SE**, most of them because they do not refer to high quality recycling but only recycling.

In the case of **Austria**, waste management in general has to focus on recycling. The law does not specify that this is directly related to the separate collection and does not mention the quality of the recycling [AT AWG 2002]. In **Hungary**, there has been a translation error in the official Hungarian version of the WFD. Whereas the original English reads “Member States shall take measures to promote high quality recycling and, to this end, shall set up separate collections of waste (...) to meet the necessary quality standards for the relevant recycling sectors”, the **Hungarian** text refers to collection “*where the quality standard required by the recycling sector can be ensured*” (és az érintett újrahasznosítási ágazatok szükséges minőségi előírásainak megfelel.). It is possible that this has led to confusion while transposing the WFD into domestic law. Nevertheless, the Hungarian law prohibits the incineration and co-incineration of waste that can be recycled, thereby indirectly promoting the recycling of aforementioned waste [HU CLXXXV/2012]. **Portugal** did not transpose most of the requirements in general. Regarding high quality recycling of waste, the law solely refers to “separation of waste at source in order to promote their recovery” and not recycling. For this reason, this was evaluated as deviating. **Sweden** only refers to a collection system of packaging waste that shall not impair recycling and that waste treatment operations of this waste shall effectively contribute to reach the targets for the recycling. It mentions neither high quality recycling nor all relevant waste streams (only packaging waste). In **Malta** the establishment of separate collection in order to promote high quality recycling already had to be implemented by 31st December, 2013. The deviation was identified due to the fact that the law specifically states that the separate collection system includes co-mingled collection to achieve this [MT 184 2011]. The **Swedish** provisions outlined in [SE 1073 2014] refer to the establishment of a collection system for packaging waste that shall not impair recycling and that assures operations that contribute effectively to reach the targets for the recycling. This transposition was evaluated as deviating because it only refers to packaging waste and it only refers to recycling.

Nine Member States did **not include** the requirement to take measures to promote high quality recycling in national and regional legislation. These are **CZ, DK, EE, FI, FR, LT, LV, PL and SK**.

The **German** law [DE KrWG 2012] refers not only to high quality recycling, but also relates the terms ‘proper’ and ‘safe’ to high quality recycling. According to the legal commentary, ‘proper’ is related to the compliance of recycling with other provisions made in this act and other acts, especially regarding packaging waste. ‘Safe’ means that no accumulation of pollutants occurs due to the recycling process. In terms of recycling in general, the legal commentary [DE GK-KrwG 2013] specifies that the use of separately collected waste for energy recovery is not in conformity with designated purpose of recycling.

Furthermore, an understanding of high quality recycling is provided in the legal commentary [DE GK-KrwG 2013] since high quality is not specified in the Circular Economy act. Since recycling itself is already a high quality form of recovery the resulting recycling needs to be of high quality. The quality of the recycling can only be assessed through a life-cycle assessment that considers energy demand, accumulation of pollutants and the implications for the resource economics etc. In general, and on a preliminary basis, it can be assumed that a recycling is of high quality if the prognosis of the responsible waste manager shows that it takes place on an ecological high level.

4.1.4 Requirement 4: technically practicable

Similar to Article 10(2) of the WFD in Article 11(1) paragraph 2, the precondition to set up separate collection for all waste streams is that it is “technically, environmentally and economically practicable” in order to promote high quality recycling. According to the *Guidelines on the interpretation of key provisions of Directive 2008/98/EC on waste*⁶ “‘Technically practicable’ means that the separate collection may be implemented through a system which has been technically developed and proven to function in practice.” For the assessment of this requirement it was evaluated whether the Member States included a definition containing deviating or additional interpretation of ‘technically practicable’ or if the wording was transposed one to one.

Altogether **18 Member States and three regions** include a **one:one** transcription of the precondition of ‘Technically practicable’ for setting up a separate collection system. **UK Sco** included an additional interpretation of this requirement into domestic law.

Deviating interpretation of this requirement has been found in the legal implementations in **AT, CZ, PT, SK** and **UK NI**. **Austrian** domestic law refers to the application of the waste hierarchy, including recycling in general, specifying that it shall be considered if it is technical feasible. The [AT AWG 2002] includes the basic principles of the waste hierarchy by taking i.e. ecological soundness, technical feasibility and economic considerations into account but not explicitly mentioning separate collection and was therefore evaluated as deviating. The same situation occurs for **CZ** and **PT**. For **Slovakia** the requirement was regarded as “deviating” in the sense of the WFD requirement, since specification on “technical practicability” of separate collection of biodegradable waste is included, but with no reference to paper, glass, metal, and plastic. In **Northern Ireland** Article 18 of [UK Northern Ireland No. 127 2011] does refer to the establishment of separate collection by the district councils if technically

⁶ http://ec.europa.eu/environment/waste/framework/pdf/guidance_doc.pdf

practicable. However, this is not a general requirement, and only applies ‘where keeping waste separate facilitates or **improves recovery**’. It was thus rated as deviating.

Four Member States did **not include** the setting up of a separate collection where technically practicable in their legislations these are **DK, LT, PL, and SE**.

An **interpretation of ‘technically practicable’** has been found in legal commentary of the German waste management act [DE GK-KrwG 2013]. The benchmark for technical practicability is not the general abstract possibility of separate collection, nor does technical practicability refer to the best available technique. Instead, technically practicable refers to the practical feasibility of separate collection. This means that given circumstances for collection e.g. space for additional containers and circumstances for further treatment (esp. expected quality of collected materials) as well as technical and organisational capacities are decisive for technical practicability. For example, if the establishment of separate collection requires additional pre-treatment (e.g. sorting) this is not considered as an obstacle to implement separate collection in the sense of technical practicability.⁷

4.1.5 Requirement 5: economically practicable

Similar to Article 10(2) of the WFD in Article 11(1) paragraph 2 the precondition to set up separate collection for all waste streams is that it is “technically, environmentally and economically practicable” in order to promote high quality recycling. According to the *Guidelines on the interpretation of key provisions of Directive 2008/98/EC on waste* “‘Economically practicable’ refers to a separate collection which does not cause excessive costs in comparison with the treatment of a non-separated waste stream, considering the added value of recovery and recycling and the principle of proportionality.” For **17 Member States and 4 regions** the **one:one** implementation of the requirement to set up separate collection if ‘economically practicable’ was assessed.

Only **Finland** included **additional interpretation** to the obligation of separate collection if ‘economically practicable’, by specifying in the [FI Waste Act 2011] that the conditions for the establishment can differ in different regions. For this reason, further provisions may be given by government decree taking into account the population density of an area, the quantity of waste generated and the possibilities for its recovery, and the environmental impacts and costs caused by arranging separate collection. Still, a benchmark for ‘economically practicable’ or a definition is not included in the law.

⁷ [DE GK-KrwG 2013] technisch möglich: Maßstab der technischen Möglichkeit ist nicht die allgemeine (abstrakte) Möglichkeit der Getrennterfassung, da diese im Zeitpunkt der Verabschiedung des Gesetzes offensichtlich gegeben ist und nicht anzunehmen ist, dass der Gesetzgeber eine Regelung ohne Anwendungsbereich schaffen wollte. Auch ist für die technische Möglichkeit weder auf den Begriff "Stand der Wissenschaft und Technik", noch auf nur eine "theoretische, spekulative Möglichkeit" sondern auf die praktische Umsetzbarkeit abzustellen. Folglich entscheiden die konkreten (objektiven) Gegebenheiten der Erfassung (z.B. Platz für zusätzliche Behälter) und deren weiteren Verwertung (insb. die erwartete Qualität der Erfassungsmenge) sowie individuelle (subjektive) Merkmale (wie z.B. die technische Leistungsfähigkeit und der Organisationsgrad) über die technische Möglichkeit der Getrenntsammlung und deren weitere Verwertung. Erfordert dies z.B., eine (ihrerseits technisch mögliche) Vorbehandlung (z.B. Sortierung), steht diese der technischen Möglichkeit der Getrenntsammlung nicht entgegen, ihre Kosten lassen womöglich aber die wirtschaftliche Unzumutbarkeit begründen.

Analogously to the requirement ‘technically practicable’ **AT**, **CZ** and **PT** have transposed the precondition of economical practicability for the establishment of a separate collection system in a **deviating way**. The domestic law refers to the application of the waste hierarchy, including recycling. In **Austria**, the hierarchy shall be applied in an ecologically sound manner [AT AWG 2002], however the term “ecologically sound” does not directly refer to separate collection. Nevertheless, the law states that a deviation from the waste hierarchy is only acceptable if the effects, inter alia for the separate collection, of the alternative do not harm the environment. For **Slovakia** the requirement was regarded as “deviating” from the WFD requirement, since specification on “economical practicability” of separate collection of biodegradable waste is included, with no reference to paper, glass, metal, and plastic. The **Scottish** transposing national act also deviates from the requirement of the WFD. Hereafter an authority does not need to provide separate collection containers of dry recyclable waste if “the property is in a rural area, and the authority considers that the separate collection of dry recyclable waste from the property would not be environmentally or economically practicable” and also if the authority assumes that the dry recyclable waste will be deposited at bring sites [UK Scotland No. 148 2012]. In **Northern Ireland** the requirement of economical practicability is transposed like the requirement of technical practicability in Article 18 of [UK Northern Ireland No. 127 2011]. Likewise, it does refer to the establishment of separate collection by the district councils if economically practicable, but this only applies where keeping waste separate facilitates or **improves recovery**. Therefore, it was rated as deviating.

Four Member States did not include the setting up of a separate collection where economically practicable in their legislations these are **DK**, **LT**, **PL**, and **SE**.

The **German legal commentary of the waste management act** [DE GK-KrwG 2013] provides an interpretation of the requirement ‘economically practicable’. According to this commentary, the costs related to a separate collection shall not be disproportionate to the costs incurred by the general waste disposal system that collects the unsorted residual waste or a combined system separating the wet and dry fractions. Another aspect of the practicability and reasonableness are the financing options of the waste disposer and collector. The argument that waste fees need to be raised to implement a separate collection system is not acceptable, but the generally higher costs for public operators than for private operators have to be taken into account. This is permissible because, due to their exemplary function, public operators are intended to accept additional costs.

4.1.6 Requirement 6: environmentally practicable

Similar to Article 10(2) of the WFD in Article 11(1) paragraph 2 the precondition to set up separate collection for all waste streams is that it is “technically, environmentally and economically practicable” in order to promote high quality recycling. According to the *Guidelines on the interpretation of key provisions of Directive 2008/98/EC on waste* “‘Environmentally practicable’ should be understood such that the added value of ecological benefits justify possible negative environmental effects of the separate collection (e. g. additional emissions from transport).” A total of **16 Member States and 4 regions** did legally transpose this requirement into domestic law **one:one**.

Additional **interpretation** to the obligation of separate collection if ‘environmentally practicable’ has only been found in **Finland**. As already described under the previous requirement, the [FI Waste Act 2011] specifies that the conditions for the establishment of a separate collection system can differ in

different regions. For this reason, further provisions may be given by government decree taking into account the population density of an area, the quantity of waste generated and the possibilities for its recovery, and the environmental impacts and costs caused by arranging separate collection. Still a benchmark for 'environmentally practicable' or a definition is not included in the law.

The legal transpositions that were evaluated as **deviating** concern **AT, CZ, DE, PT, SK** and **UK Sco**. The argumentation for the deviation is analogous to the one provided in chapter 4.1.5.

Four Member States did **not include** the setting up of a separate collection where environmentally practicable in their legislations these are **DK, LT, PL, and SE**.

It has to be noted that **Germany** did include 'economically and technically practicable' in the legislation but has left out 'environmentally practicable' [DE KrWG 2012]. An explanation for this is included in in the legal commentary and can be summarised as follows. Member States are not obliged to transpose the wording of a Directive one:one. The benchmark for implementation is that the intended goal of the European legislation can be achieved through the national transposition. Within this boundary the Member States are free to choose the way to implement the Directive into domestic law if the minimum legal requirements are considered. As already stated in Article 1 of the WFD "This Directive lays down measures to protect the environment", whereby it can be assumed that no measure, including recycling, shall be conducted without considering environmental protection, and that recycling that harms the environment more than another waste management operation is not permissible.

On the basis of this understanding, it cannot be assumed that the German waste management act is not compliant with the requirements of the WFD. The aim of the *Kreislaufwirtschaftsgesetz (KrWG)* is a circular economy that always targets the recovery operation that provides the highest quality. According to the KrWG in order to assess the best option of recovery the environmental practicability has to be taken into account since the prioritisation of recycling under every circumstance would yield environmentally harmful results. Therefore, setting up a separate collection system that is less environmentally sound compared to another disposal system is not permissible according to the KrWG.

4.1.7 Requirement 7: necessary quality standards for the recycling sectors

Article 11(1) paragraph 2 not only contains the requirement that "Member States shall take measures to promote high quality recycling and, to this end shall set up separate collection of waste where technically, environmentally and economically practicable" but also that Member States shall consider that the separate collection system must be "appropriate to meet the necessary quality standards for the relevant recycling sectors". The WFD provides neither an indication on what the necessary quality standards are, nor does it name the recycling sectors. This leaves significant space for interpretation. While assessing the legal transposition of this requirement, the focus was to identify whether Member States have additionally interpreted what they understand by 'quality standards' that the recycling sectors need, and whether prescriptions on quality have been made.

Eight Member States and **4 regions** did not provide additional interpretation of this requirement but transposed it **one:one** into domestic law.

The **Italian** environmental code [IT DL152/2006] includes an **additional understanding** of ‘necessary quality standards for the recycling sectors’. It states that regions are required to establish criteria that municipalities have to follow in order to meet the minimum percentage for municipal waste separate collection to be met within each Optimal Management Area. Although this does not provide an additional interpretation of quality standards, it does specify a minimum percentage of separate collection (65% by 2012) to meet the necessary quality standards for the different recycling sectors, and was hence evaluated as additional.

The **AT, BE Br, DE, HU, NL** and **SE** transpositions have been evaluated as **deviating**. In the **Swedish** national environmental law [SE 808 1998] ‘quality standards for the recycling sectors’ are not explicitly mentioned, but it refers to reuse and recycling where additional regulations may be issued by the government for these purposes, i.e. regarding the storage and separate collection of particular waste types. In **Austria**, the text implies that ordinances will determine to include further requirements for treatment [AT AWG 2002]. In **Germany** the national transposition refers to high-quality ‘recovery’ whereas Article 11(1) of the WFD specifically refers to ‘recycling’.

A total of **Twelve Member States and one region** did not include the requirement that separate collection shall be appropriate to meet the necessary quality standards for the relevant recycling sectors: **BE FI, CZ, DK, EE, FI, FR, HR, LT, LU, LV, PL, PT** and **SK**.

4.1.8 Requirement 8: separate collection by 2015 at least for paper, metal, plastic and glass

Another general obligation of Article 11(1) paragraph 3 of the WFD, if certain preconditions are met, is that the Member States have to introduce a separate collection by 2015 for at least paper, metal, plastic and glass. To evaluate this requirement, it was assessed whether the mentioned deadline by 2015 was included in the national transposition, if this was not given it was rated as deviating. Altogether **nine Member States and three regions** included this requirement one:one in domestic laws.

Scotland’s legal transposition of the WFD includes that authorities must provide to every occupier of a domestic property in its area containers for the separate collection of glass, metal, plastic and paper from the 1st January 2014 [UK Scotland No. 148 2012]. This was evaluated as **additional** because Scotland included a stricter deadline for this requirement. The **Romanian** legal transposition of the WFD requires that for paper, plastic, glass and metals local public administration authorities have to provide the separate collection already starting with year 2012 which is additional since it is earlier than 2015 [RO Law 211 2011].

BE Br, BE FI, BG, CZ, EE, FI, LT, PL, SI and **SK** require separate collection for these waste streams, but did not include the 2015 deadline. They were thus rated as **deviating**.

It has to be pointed out that some Member States included additional obligations for separate collection but did not mention the deadline of implementation as required by the WFD and for this reason were evaluated as **deviating**. **Hungary** for example prescribes that public service companies shall set up separate collection systems that mainly favours door-to-door collection whereas bring points are only seen as complementary system [HU CLXXXV/2012]. In **Austria** the Federal Minister of Agriculture, Forestry, Environment and Water Management must determine which waste streams are

to be separately collected in any given case, if necessary to ensure that duties of the collection and recovery system can be fulfilled, or is required by the nature of the waste [AT AWG 2002, Article 29 (4d)]. In addition, by 1st January 2018 **at least one separate collection option** for each collection category has to be provided in every municipal territory [AT AWG 2002, 29b (1)]. Even though it is not clearly stated in the law, it can be deduced that separate collection systems are already established for all relevant waste streams and that therefore, the law focuses on the expansion of separate collection options. Furthermore, the Federal Minister of Agriculture, Forestry, Environment and Water Management is authorised to issue additional ordinances that can include requirements concerning the type of collection as well as technical specifications, i.e. number, volume and collection frequency of established collectors [AT AWG 2002]. In terms of packaging waste national legislation even requires specific separate collection targets [AT VVO 2014].

Earlier deadlines for the establishment of separate collection have been assessed in **MT** and **ES**, but were rated as **deviating** since they include the allowance of co-mingling.

The **Maltese** waste law [MT 184 2011] calls for separate collection for the relevant waste streams to be established by the 31st December, 2013, but also explicitly allows this to be co-mingled collection. The same applies to **Spain** where a separate collection scheme should be in force before 2015 but also including the allowance of co-mingled collection [ES L22/2011].

As described above for other requirements in **Denmark** and **Sweden**, waste management in general and separate collection in particular is **only partly regulated by national law**, leading to a deviating national transposition of single WFD requirements. This was also evaluated for the requirement to set up a separate collection system by 2015. The Danish law [DK BEK 2012] refers in several consecutive articles to the collection of the relevant waste streams, determining that municipal council shall establish collection schemes. For some recyclable wastes (glass, plastic, metal) the collection scheme should be organised in such a way that **substantial amounts** are collected for recycling. The Danish transposition was therefore rated as deviating. Sweden focusses on packaging waste and especially waste paper (e.g. newspaper) that, according to the law [SE 927 2011], have to be separated at source and then be collected by an authorised collector. Both of these domestic laws differ significantly from the requirement but still refer to the collection of the relevant waste streams and for this reason were assessed as deviating.

Only **NL** and **PT** did not legally implement the requirement to set up a separate collection for at least paper, metal, plastic and glass by 2015. Requirements for separate collection of packaging waste (paper, metal, plastic and glass) seems to be fulfilled in the legislation of both Member States. However, specification for separate collection of non-packaging paper, metal, plastic and glass and 'by 2015' is not included.

Aside from the establishment of a separate collection system, there is the possibility to specify in the domestic law which type of collection system must be set up. The only country that specified the system is **Hungary**, where door-to-door collection is the designated the primary option. The **German** legal commentary to the circular economy act [DE GK-KrwG 2013] states that both door-to-door and bring systems (including civic amenity sites) are permissible according to the law. The choice of the collection system is incumbent upon the public waste management authorities that are protected by the guarantee of municipal self-administration.

4.1.9 Requirement 9: encourage separate collection of bio-waste

Unlike the mandatory separate collection of paper, metal, plastic and glass, the WFD in Article 22(a) only requires measures to **encourage** the separate collection of bio-waste, with a view to composting and digestion, by the Member States. Contrary to the other requirements, most Member States did not transpose this requirement one:one. Most of them made additional or deviating provisions. Only **Six Member States and three regions** legally transposed this requirement **one:one**.

Several different **additional interpretations** of the requirement of separate bio-waste collection have been assessed in the Member States. The **Austrian** law on bio-waste [AT BW 1992] specifies that if bio-waste is not recovered directly at the household or establishment, it must be made available for separate collection or be delivered to a designated collection point. In **Spain** the transposing domestic law [ES L22/2001] does not prescribe the separate collection of bio-waste, but local environmental authorities shall promote measures and actions to be undertaken at Community level for separate collection of bio-waste for composting or anaerobic digestion. Examples for possible measures and actions are included in the law, e.g. domestic and community composting, authorisations of treatment facilities, including details on technical requirements for the proper treatment of bio-waste and the quality of the materials obtained. Separate bio-waste collection is obligatory in **Romania**, and the local public administration authorities have the responsibilities to collect it for composting and digestion [RO Law 211 2011]. In **Slovenia**, the public service must provide separate collection of kitchen waste and green garden waste from households not later than 30 June 2011. The Slovenian law makes the separate collection of bio-waste mandatory by June 2011 for public services. Obligations are also described for producers of bio-waste: they are not allowed to mix bio-wastes if it hampers composting or digestion and if they do not compost their bio-waste on their own they have to separate it so that it can be separately collected by public services [SI OGRS 39 2010].

Altogether **16 Member States** have made **deviating provisions** regarding the WFD requirement for the encouragement of separate bio-waste collection.

The legal situation in **Flanders** stipulates that in general organic household waste has to be kept separately and collected separately [BE Flanders VLAREMA 2012]. **Bulgarian** national legislation deviates from the WFD requirements because it only refers to bio-waste collected in public areas, parks and gardens, as well as bio-waste originating from commercial and industrial sites. These bio-wastes have to be treated by composting or anaerobic digestion according to [BG WMA 2012]. On the other hand, municipalities in the **Czech Republic** are obliged to provide places for the separate collection of bio-waste, but this national legal transposition does not refer to treatment options to be applied [CZ Decree No. 321 2014].

In **Germany** bio-waste has to be collected separately, under certain preconditions, by January 2015 (thus over fulfilling the requirement of the WFD) and the government is authorised to lay down which requirements have to be applied to the separate collection of bio-waste. It does not refer to the bio-waste treatment to be applied and was thus evaluated as **deviating** [DE KrWG 2012]. **Estonian** national legislation does not directly refer to the separate collection of bio-waste, it only states in more general terms that only separated bio-waste is accepted at treatment facilities and that in order to be composted bio-waste needs to be separated and was thus evaluated as deviating [EE KeM määrus Biojäätmed 2013].

In **France** the legal situation is different. The transposition directly refers to the mandatory separate collection at source of bio-waste, especially for big producers, in order to promote material recovery [FR CdE 2015]. **Greek** law [EL Law 4042/2012] requires that, by 2015, the rate of separate collection of bio-waste must reach at least 5% of the total weight of organic waste, and by 2020 at least 10% of the total weight of organic waste, but gives no indication of the treatment option to be applied. **Croatian** national transposition deviates because it not only refers to the composting and digestion of bio-waste separately collected but also to energy recovery, which is not included in the WFD [HR ZOGO 2013].

According to the **Hungarian** waste act [HU CLXXXV 2012] the aim is to separately collect bio-waste, but the favoured option deviates from the WFD. It is stated that “after treatment a high quality organic material can be redirected to natural circulation of organic matter and to divert biodegradable waste from landfills.” The **Irish** legal transposition of this requirement stipulates that the Minister shall take measures to not only encourage the separate collection of bio-waste with a view to the composting and digestion of bio-waste but also regarding the treatment of bio-waste in a way that fulfils a high level of environmental protection, and the use of environmentally safe materials produced from bio-waste [IE S.I. No. 126 2011]. The **Italian** legal transposition also does not specify the treatment option for separately collected bio-waste, but just generally states that it shall be in line with a high level of environmental protection [IT DL152 2006].

In the **Netherlands**, municipalities are required to collect separately from households vegetables, fruit and garden waste at least once a week [NL WMB 1979]. In **Scotland** the requirement to set up separate collection for bio-waste is only transposed for food waste and excludes rural areas. These transpositions refer only to food waste, not bio-waste generally, and do not specify which treatment option should be applied. Similar legal transpositions have been assessed in **Poland** [PL AKCOiM 1996] and **Slovakia** [SK Act 223/2001] where municipalities are responsible for the separate collection of bio-waste, but face no requirement for treatment. In addition Slovakia excludes kitchen waste from the separate collection obligation. All of these legal transpositions were evaluated as **deviating**.

The **Latvian** law [LV AAL 2010] does not directly require the separate collection of bio-waste instead, the separate collection of bio-waste with a view to the recovery, composting and recycling, as well as measures for treatment of bio-waste shall be included in the WMP. Because it is not included in the national law this requirement was rated as deviating.

4.2 Definitions of municipal solid waste

There is no common definition on municipal solid waste at EU level and the included waste types and sources vary within the Member States. Different definitions on municipal waste strongly influence the interpretation and comparison of waste data, including data on generation and treatment.

Fifteen MS and two Belgium regions include in the definition on municipal solid waste (MSW) household waste and household-like waste (also named waste similar to household waste, from similar establishments). The other **12 MS and one Belgium region** have definitions that do not apply those terms (see Table 4-5 including full definitions).

Three Member States (**BG, LT, HU**) and **two regions of Belgium** do not include any specifications on the generating source of municipal waste. All other Member States include specifications about the waste source, if not being households. Most Member States include public administration (bodies,

buildings,...), public buildings and institutions and small business, commercial activities, and service in the definition. When collected together with municipal waste, industrial waste is included in the definition, although some countries except waste from production processes. In some Member States agricultural activities, street cleaning, waste from parks and cemetery activities, sewage sludge from households, trade activities etc. are also included in the definition, while explicitly excluded in other countries. Table 4-3 provides an overview of sectors included in the municipal solid waste definition of 24 Member States and one Belgium region.

Table 4-3: Specifications on waste source included in municipal solid waste definition in EU-28

MS	Adminis- tration	(Public) institutions , buildings	Small business, commerce, service	Industr y	Street cleaning, parks, cemetery	Others and exceptions
AT	x	X	x			Agriculture, markets
BE-FL	x		x	x		
CY		X	x	x	x	markets
CZ						
DE		x	x	x		
DK		x		x		
EE						provision, service, trade
ES			x			
FI			x	x		
FR					x	sewage sludge
GR		x	x	x		
HR		x	x	x		Excluding: agriculture and forestry, production
IE			X	X*	x	*including non-process industrial waste
IT					x	
LU				NO*		*exception of production and agriculture and forestry waste
LV			x			trade
MT			x	x		hotels, restaurants, hospitals
NL			x			
PL			x	X*		trade, crafts, education, * exception for production waste, ELV and hazardous waste
PT		NOT	NOT	NOT		
RO					x	markets
SE						latrine and sludge

MS	Adminis- tration	(Public) institutions , buildings	Small business, commerce, service	Industr y	Street cleaning, parks, cemetery	Others and exceptions
SI			x	x		trade
SK					x	
UK		x	x			

There are also differences in the waste **types** included in the definitions. Most of the Member States (18 and two Belgium regions) have *not* specified what type of waste is included in the definition of municipal solid waste, while 9 Member States and one Belgium region do specify what kind of waste is included (see Table 4-4). Most of those definition include, beside residual waste, bulky waste and bio-/kitchen waste. For most of the definitions, the list included is not exhaustive, but meant as an example.

Table 4-4: Specifications on waste type included in municipal solid waste definition in EU-28 Member States

MS	Bulky waste	Recoverables (paper, glass, metal, plastic)	Bio- / Kitchen-/ Garden waste	Hazardous household waste	Other
AT	x	x	x	x	WEEE, textiles
BE-FL		x	x		C&D
CY	x		x		
FR	x	x		x	
IT	x		x		
LU	x				
MT	x				
RO	x				
SE	x		x	x	latrine, sludge
SI		paper	x		textiles, wood

Table 4-5 includes for comparison the full definition of municipal solid waste (MSW) in the Member States as retrieved from waste acts, waste management plans and legislation (also included in national factsheets, list in Annex I).

Table 4-5: Definitions of municipal solid waste in EU-28 Member States

MS	Definition of municipal (solid) waste (MSW)
AT	The Austrian Waste Management Act includes a specific definition of MSW [AT AWG 2002] Article 2 (4) 2: Waste from private households and other wastes of similar nature or composition; for waste classification the European List of Waste (LoW) has to be considered [...]; mixed municipal solid waste in the sense of the LoW remains mixed municipal waste even when it has been subject to a waste treatment operation that has not substantially altered its properties. Explanation as included in the Federal Waste Management Plan 2011 [AT WMP 2011]:

MS	Definition of municipal (solid) waste (MSW)
	“Waste from households and similar establishments” is made up of the following components: residual waste, bulky waste, recoverables (paper, glass, metal, plastic, textiles, etc.), biogenic waste, and hazardous household waste and waste electrical and electronic equipment and basically corresponds to the definition of “household waste” under sec. 2 (4) (2) of the Waste Management Act of 2002. Such waste comes from households, administrative bodies of trade, industry or public administration, from kindergartens, schools and hospitals, small businesses and agriculture, from markets and other sites of waste generation, insofar as they are connected with municipal waste collection or waste collected contracted by the municipality/ies.
BE	Brussels Region: Article 3 (6) of the Ordinance on waste prevention and management states that "municipal waste means household waste and wastes that are assimilated by order of the Government, due to their nature, composition, origin, quantity or their management [BE Brussels waste 2012]. Flanders: MSW is not defined in Flemish legislation. Household waste (huishoudelijk afval) is understood as MSW that contains several wastes from different sources including residual waste, municipality wastes and separately collected waste fractions such as bio-waste, plastic, paper, metal, glass, construction and demolition waste [BE Flanders OVAM 2013]. Wallonia: MSW is defined in the waste catalogue from Wallonia as follows “Municipal wastes (household waste and similar waste from commerce, industries and administrations) including separately collected fractions [BE Wallonia Code 1997].
BG	According to the [BG WMA 2012] Municipal solid waste is defined as the household waste and waste similar to household waste.
CY	According to the National Waste Management Plan (which is under consultation): “Municipal Waste: means the household waste and other similar waste from commercial activities, industries and institutions, including separately collected fractions and other categories of municipal waste such as bulky, garden and park waste, waste from market and street-cleaning waste.” [CY NWMP 2014]
CZ	Municipal waste is any waste generated on the territory of a municipality during the activity of natural persons and which is given as municipal waste in the Waste Catalogue, except for wastes generated by legal persons or by natural persons authorized to do business. [CZ Act 185 2001, §4 b)]
DE	The “Circular Economy Act” [DE KrWG 2012] does not include a specific definition of Municipal Solid Waste. According to the German Federal Statistical Office [DE DESTATIS 2014a] municipal waste can be classified as: Municipal waste comprises all wastes of chapter 20 (of the European List of Waste*) (household waste and similar commercial and industrial waste and waste from public institutions, including separately collected fractions) and all wastes of subchapter 15 01 (packaging - including separately collected municipal packaging waste). A further distinction can be drawn between typical household municipal waste and other municipal waste.
DK	There is no direct definition of the term “Municipal solid waste” in the Danish legislation. However, in Annex 2 (the Catalogue of Waste) in the waste legislation, waste collected by the municipality covers household- and household like waste from businesses, industry and institutions, including separately collected fractions [DK BEK 2012].

MS	Definition of municipal (solid) waste (MSW)
EE	[EE Jääts 2004] §7 “Municipal waste” means waste from households, and waste produced in trade, provision of services or elsewhere which because of its composition or properties is similar to waste from households.
ES	Article 3 of [ES L22/2011] defines: 1. Domestic waste: waste generated in households as a consequence of domestic activities and similar waste generated in industry and services. This category also includes other wastes generated in households such as WEEE, clothes, batteries and accumulators, furniture and waste and debris from minor building and reparation works. Waste coming from street-cleaning, green and recreational areas-cleaning and beach-cleaning, as well as dead domestic animals and abandoned vehicles will also be considered domestic waste. 15. Commercial waste: waste generated by wholesale and retail commercial activities of restoration services, bars, offices and markets as well as waste from the rest of the service sector. The Autonomous communities (regions) of Spain have slightly different definitions for municipal waste. However, the national definition includes household waste and commercial waste that is similar to household waste. Commercial waste that is managed privately is excluded from MSW. Nevertheless, if municipalities decide to undertake the collection and management, then this waste amount is included in MSW (it depends on the municipalities and regions) [ES MSW Modelling Tool 2014].
FI	Municipal waste refers to waste generated in households and waste comparable to household waste generated in production, especially in the service industries. The general common feature of municipal waste is that it is generated in the consumption of final products in communities and is covered by municipal waste management systems [FI STAT 2015].
FR	MSW is defined by the following waste types: street sweeping, sewage sludge and garden and park waste (from municipal sources), household waste (recycling centre and bulky items, household hazardous waste and mixed & separately collected household waste). Finally, MSW includes trade waste similar in nature to household waste [FR EEA 2013]. Household wastes (Déchets Ménagers, DM) are the wastes generated by households and collected by the municipality. Compared to household wastes and wastes of a similar nature and composition (Déchets Ménagers et Assimilés, DMA) it is calculated excluding wastes of a similar nature and composition, meaning that commercial waste collected by municipalities are not included. Household and wastes of a similar nature and composition (DMA) is the waste collected from households and similar waste. Waste produced by municipal services, sewerage waste, street cleaning waste, market waste do not fall within this scope (p. 7) [FR ADEME 2014].
EL	The MSW are classified under chapter 20 "Municipal wastes (household waste and similar commercial, industrial and institutional wastes... Packaging Waste classified in category 15.01 “packaging (including separately collected municipal packaging waste)” is also included as MSW. [GR NWMP 2014]
HU	Municipal solid waste (MSW) is provided in the Waste Management Act [HU Waste Act 2012 p.12 and p.44] as meaning waste from household and waste similar to household waste from other sources.
HR	“Municipal waste” means waste generated by households or any other waste comparable in nature and composition to household waste, excluding production waste and waste from agriculture and

MS	Definition of municipal (solid) waste (MSW)
	forestry. "Mixed municipal waste" means waste from households as well as commercial, industrial and institutional waste, which because of its nature and composition is similar to waste from households, from which no fractions have been excluded by means of a special operation (such as paper, glass, etc.) and is indicated in the Waste Catalogue under subheading 20 03 01.
IE	Municipal waste is made up of household waste, commercial waste (including non-process industrial waste) and cleansing waste such as street sweepings and municipal parks and cemeteries maintenance waste. This includes biodegradable waste [IE EPA 2015].
IT	The Legislative Decree 152/2006 ("Environment Code") [IT DL152/2006 defines Municipal Waste (MW) as: a) household waste, including bulky waste, originating from premises and places used as residential areas; b) non-hazardous waste originating from premises and places used for purposes other than those referred to in a), similar to municipal waste in terms of quality and quantity; c) street sweepings; d) litter of any type or from any source found on public or private roads and land that is subject to public use or on the seashore or lakeshore and on river banks; e) organic waste from green spaces such as gardens, parks and cemeteries; f) waste from exhumations and other waste originating from cemetery activities other than those referred to in b), c) and e).
LT	The [LT WML 1998] defines municipal waste as household (generated in household) waste and other waste, which by nature and composition is similar to household waste.
LU	Article 4 (8) "Municipal waste" means household and household like waste; Article 4 (5) "Household waste" means all waste from household sources; Article 4 (7) "Household like waste" means all waste whose nature, volume and size are identical or similar to those of household waste or bulky waste but that have origins other than households, with the exception of production waste and waste from agriculture and forestry [LU Waste 2012].
LV	"Municipal waste – waste produced in a household, trade, in the process of provision of services or waste produced in other places that because of its properties, is similar to domestic residues." [LV AAL 2010]
MT	MSW is defined as "waste produced from households, and other waste which because of its nature and composition is similar to household waste". Other waste may be commercial and industrial waste from e.g. hotels, restaurants, hospitals and bulky refuse [MT WMP 2014, p.66].
NL	Annex 4 of the Waste Report of the Netherlands of the years 2006-2010 [NL NAC 2013]: 'municipality waste' as such entails 'consumer waste' and several flows of 'company wastes' (as for example waste from municipal cleaning services). 'Consumer waste' subsequently entails household waste, and large household waste (p15; [NL NAC 2013]).
PL	Municipal (solid) waste is waste generated in households (excluding end-of-life vehicles) and other waste from other waste generators, which is similar to waste from households and does not contain hazardous waste. Sources of generation of MSW are: households and infrastructure (e.g. from trade, services, crafts, education, industry – except for waste generated during the production processes and other) [PL NWMP 2014, p. 10]; [PL WLA 2012 §3 (1)].
PT	Any urban solid waste from households and other waste which, by their nature or composition, is similar to waste from households. MSW does not include Industrial, Commercial & Institutional (ICI) waste [PT MSW Modelling Tool 2014]. Comment [TAC PT 2015]:

MS	Definition of municipal (solid) waste (MSW)
	The definition includes all waste that by their nature and composition are similar to those from households, including from industrial sources (if they do not come from the production process - see definition of industrial waste), trade, services and institutions. The responsibility of municipalities, however, it is limited to 1.100 liters/day
RO	According to [RO WMP 2004] “municipal waste” refers to both household waste and bulky waste separately collected and to waste resulted from the public areas cleaning (parks, markets and street waste) and “collection of municipal waste is in the responsibility of the municipalities, either directly (by special services subordinated to Local Councils) or indirectly (by commissioning this responsibility with a contract, to specialized sanitation companies).”
SE	According to Miljöbalken, household waste is waste from households like garbage, kitchen waste, latrine and sludge. With the household waste is also included bulky waste and hazardous wastes from households. Waste from industry and commercial entities, which is similar to these fractions (household-like), is also considered household waste [SE RP 1997].
SI	Municipal waste is waste from households or waste which is by its nature or composition similar to household waste, i.e. waste from the manufacture, trade, service or other activity. Mixed municipal waste is waste that is classified as waste EWC number 20 03 01 from the waste classification list. Biodegradable components of municipal waste are waste paper, kitchen waste, waste textiles and wood waste [SI WMP 2012-2020].
SK	Municipal wastes are wastes from households generated on the territory of a municipality during the activity of natural persons and wastes of similar properties and composition, the producer of which is a legal person or a natural person – an entrepreneur, except the wastes generated during the immediate performance of activities making up the subject of business or activities of a legal person or a natural person – an entrepreneur; wastes from real properties used by natural persons for their recreation are also considered as wastes from households, for example from gardens, huts, cottages, or for parking or keeping a vehicle used for the needs of households, particularly from garages, garage stalls and parking lots. Municipal wastes are also all wastes generated in a municipality during cleaning public roads and spaces that are the property of the municipality or in the administration of the municipality, and also during the maintenance of the public greenery, including parks and cemeteries and other greenery on plots of land of legal persons, natural persons and civic associations. [SK Act 223/2001, §2 (14)]
UK	In the waste management plans (WMP) for the different regions, a distinction is made between municipal waste, household waste and waste collected by local authorities. In the WMP for England, municipal waste is defined as “household waste and commercial waste similar to household waste” [UK WMP 2013, p.7]. This is a broadened definition from the original one that included only “waste collected by local authorities” and was changed following discussions of the UK with the European Commission [UK ZWW 2010, p.16]. The Welsh Zero Waste plan however uses the original definition of municipal waste (The Municipal Sector Plan 2011 and Collections, Infrastructure and Markets Sector Plan 2012 (which are part of the Wales waste strategy) distinguish between local authority collected municipal waste and municipal waste collected by others) [UK ZWW 2010, p.6]. In the Scottish Zero Waste plan, municipal waste is defined as ‘waste from households and commerce collected by or on behalf of local authorities’ [UK ZWS 2010, Annex 1, p.4] and in the Plan for Northern Ireland, municipal waste means ‘waste from households and other waste which is

MS	Definition of municipal (solid) waste (MSW)
	similar in nature to waste from a household', including commercial waste which is similar in nature to waste from a household' ("in agreement with the European Commission the way in which municipal waste is defined in NI has been broadened. Previously, the definition only included waste which was collected by Councils but this has been changed to include all waste from households and all wastes of a similar nature and composition to waste from households, whoever collects it. As a result, the definition now includes commercial waste which is similar in nature to household waste") [UK NIW 2013, p.16].

4.3 Main strategies on separate collection applied in EU-28 MS

The collection of municipal waste is a municipal task. Usually individual municipalities or groups of municipalities are free to choose what kind of waste collection system they apply. However, the national or, in some Member States, the regional authorities have to ensure that the municipalities comply with national (and hence European) law, and that the territory as a whole fulfils the EU targets on collection and treatment as set in the WFD and other waste directives. Thus, a strategic approach is usually set and followed at national and/or regional level. Municipalities can be obliged to follow a certain strategy or to implement a certain type of collection system.

Usually, this general strategy is set in the waste management plan of a country/region, in some cases accompanied by specific strategies (e.g. as regards bio-waste). In 23 Member States waste management planning is organised at national level (some of them in combination with obligatory or non-mandatory regional/municipal plans). **DE, IE, IT, FR** and **UK** do not have national waste management plans, but only regional waste management plans. Some Member States have recently published new waste management plans (**BG, CY, CZ, IE, EE, LT, MT, SI, PT** published waste management plans in 2014 and 2015). Other Member States have new drafts available that are not yet officially adopted (**HR, EL**). **Croatia** is currently drafting a new plan, **Romania** has started the tendering procedures. The available waste management plans and further documents have been assessed in order to summarise the main strategic approach of the Member States as regards waste collection. The assessment mainly focused on the collection of bio-waste and packaging waste rather than on other specific waste streams (e.g. WEEE, batteries, waste oils, etc.).

All information about waste management plans and strategies are summarised in the national factsheets provided as separate documents. A list of documents accompanying this report is included in Annex I/10.1.

5 Separate waste collection systems applied in EU-28 MS

Waste collection systems applied in the EU-28 Member States vary widely in their configuration, and there are various systems to collect recyclables like paper/cardboard, glass, metal and plastic and bio-waste. The project investigated what collection systems are in place in the countries. This is not an easy task, as systems also vary at regional and even municipal level in most of the Member States. This is because the choice and practical implementation of waste collection tends to be the responsibility of the municipality or district authorities. To get an overview of waste collection in the Member States, the following categories for the available collection systems were applied:

- **Primary system:** Defined as the system applied for the majority of the inhabitants; most inhabitants connected to this compared to other systems applied in the same country.
- **Secondary system:** This is the system second most applied in the country.
- **Rare or very rare systems:** Further systems, seldom applied.

The categories apply in terms of coverage by inhabitants; meaning that if the system is applied in large cities, and the majority of inhabitants live in such cities, it is indicated as **primary system**. If there is a difference between collections systems applied in rural and in urban areas, it is also indicated within the national factsheet. Systems applied are differentiated into the following categories:

- **Door-to-door collection systems:** all systems in bags, special bags, bins, containers collected directly at households with regular frequency
- **Co-mingled (door-to-door) collection:** similar to the above, but different waste fractions, i.e. plastic and metal are collected in the same bin
- **Bring points:** containers at public places for different fractions
- **Civic amenities / Civic amenity sites:** typically enclosed and sometimes staffed collection sites, where recyclables and generally also hazardous waste, bulky waste, Waste of Electrical and Electronic Equipment (WEEE), used batteries, construction waste, solvents, etc. from households can be brought by citizens
- **Deposit and return:** typically applied on beverage bottles (cans) made of glass, plastic, (metal)

The following chapters describe:

- **The waste collection system applied in each EU-28 Member State:** The chapter provides for each Member State a short summarising text on the existing collection system and its specifications.
- **Door-to-door and bring collection system:** The description groups the applied collection systems by the number of fractions collected individually door-to-door (including bins/sacks) and where waste types are collected co-mingled in one bin/sack (e.g. plastic and metal) or by bring-systems.
- **Waste types:** This includes a short summary on how the waste is mainly collected within the Member States by fraction (bio-waste, paper & cardboard, metal, plastics and glass).

The overview includes solely the **primary collection system applied** in the Member States, i.e. the one to which most inhabitants are connected to. This means information is generalised and particularities of the systems are not included in this summary.

Complete information also describing further collection systems applied in the Member States are included in the national factsheets national factsheets provided as separate documents. A list of documents accompanying this report is included in Annex I/chapter 10.1.

5.1 Door-to-door collection in EU-28 Member States

Within the primary applied collection systems, paper/cardboard (**14 MS** - AT, BE, BG, CY, DE, DK, EE, FI, HU, IT, LU, LV, NL, SI, UK) and **bio-waste** (in all cases including food and kitchen waste) (**14 MS** - AT, BE, CZ, DE, FI, EE, IT, HU, LU, NL, SI, SE, IE, UK) are the most commonly waste fractions separately collected door-to-door. **Glass** is collected primarily door-to-door in **Seven MS**. Only four MS (AT, LV, NL, DK) primarily collect **plastic** separately door-to door; in only **three MS** (FI, NL, DK) separate door-to-door collection is the primary route for collecting **metal**.

Door-to-door collection of **co-mingled metal and plastic** is the primary collection route for these materials in **seven MS** (BE, BG, CY, DE, FR, IT, HU, LU, SI). The door-to-door collection of **co-mingled paper, plastic and metal** is the primary collection method for these fractions in RO and MT, while the door-to-door collection of **co-mingled paper, plastic and metal and glass** is the primary collection systems for these materials in the UK. In EL and IE, paper, glass, plastic and metal are primarily collected co-mingled door-to-door in one bin.

Table 5-1: EU-28 MS where separate door-to-door is the primary collection system (by fraction)⁸

Collection type	Paper	Glass	Plastic	Metal	Bio-waste
Door-to-door (single fraction) 	AT, BE, BG, CY, DE, DK, FI, HU, IT, LU, LV, NL, SI, UK	BG, FI, LU, LV, NL, SI, MT	AT, LV, NL, DK	FI, NL, DK	AT, BE, CZ, DE, FI, EE, IT, HU, LU, NL, SI, SE, IE, UK
Co-mingled (metal and plastic) 			BE, BG, CY, DE, FR, IT, HU, LU, SI		
Co-mingled (3 fractions)	RO, MT: paper, plastic, metal UK: plastic, metal, glass				
Co-mingled (All in one bin)	EL, IE: paper, glass, plastic, metal				

⁸ **Note:** The information included in table refers to the **primary system** (the main system, majority of inhabitants connected to) applied in the MS, other systems (i.e. bring points) may accompany this system. In some regions of the country other systems (e.g. bring-points) might be primary.

Door-to-door collection primarily applied in the Member States vary **from one bin** – only collecting residual waste, completely relying on bring-point systems for recyclables and bio-waste, **up to six separate bins/sacks** (including the bin for residual waste) for the separate collection of all four recyclable fractions (paper/cardboard, glass, metal, plastics) and bio-waste. The systems applied as door-to-door collection are:

- **6-bin/sack system** (residual waste + 5 bins/sacks): This system is applied in **the Netherlands** (bigger towns), which uses separate bins/sacks for each of the four recyclable fractions and for bio-waste.
- **5-bin/sack system** (residual waste + 4 bins/sacks): **Luxembourg and Slovenia** provide separate bins for glass, paper/cardboard and bio-waste and collects metal and plastic in a co-mingled bin.
- **4-bin/sack system** (residual waste + 3 bins/sacks): **Ten MS apply** variations of this system. All ten countries collect paper/cardboard in one bin. The remaining two bins are used for a variety of separately collected or co-mingled materials (see Table 5-2), e.g. BG, LT, DE, BE, IT are collecting additional metal and plastic co-mingled in one bin/sack. UK adds glass to the plastic/metal bin.
- **3-bin/sack system** (residual waste + 2 bins/sacks): **Five MS** apply a 3 bin/sack system, all collecting paper/cardboard, however mingled with other fractions in some cases and one additional recyclable fraction or bio-waste (see Table 5-2)
- **2-bin/sack system** (residual waste + 1 bins/sacks): **Czech Republic, France, Romania, Greece and Sweden** are applying as a primary system only two bins/sacks as door-to-door collection and are relying on bring-systems for the other fractions. Fractions collected are varying (see Table 5-2).
- **1-bin/sack system**: According to the information assessed, there are still five MS (**Croatia, Portugal, Slovakia and Spain**) where only residual waste is collected in front of the door, all other separated waste fractions have be brought to bring points. However, it has to be mentioned that e.g. in the case of Spain and Czech Republic density of such bring-points is high (basically at “every corner”).

The following table includes more detailed information on what waste fractions are collected on door-to-door basis in the Member States.

Table 5-2: Number of bins/sacks for door-to-door collection and collected fractions

Number of bins/sacks	Fractions collected within door-to-door collection system	MS	Number EU MS
6-bin/sack system	paper & cardboard metal plastic glass	NL ⁹	1

⁹ In the Netherlands applied in bigger towns, in rural areas less bins/sacks

Number of bins/sacks	Fractions collected within door-to-door collection system	MS	Number EU MS
	bio-waste residual		
5-bin/sack system	paper & cardboard metal + plastic (co-mingled) glass bio-waste residual	LU, SI	2
4-bin/sack system	paper & cardboard metal + plastic (co-mingled) glass residual	BG, LT¹⁰	10
	Same as BG, LT, but bio-waste instead of glass	DE, BE, IT	
	paper & cardboard plastic glass residual	LV	
	Same as LV but bio-waste instead of glass	AT	
	Same as LV but metal instead of glass	DK¹¹	
	Paper & cardboard metal glass residual	FI¹²	
	paper / cardboard metal + plastic + glass (co-mingled) bio-waste residual	UK¹³	
3-bin/sack system	paper /cardboard metal + plastic (co-mingled) residual	CY, HU	5
	Paper/cardboard	EE¹⁴	

¹⁰ In Lithuania a 4-bin/sack system is applied for individual households; not for apartment buildings

¹¹ In Denmark for apartment buildings the primary collection method for glass is door-to-door collection while bring points is secondary. For houses it is opposite

¹² System applied in Finland in single-family houses. In apartment buildings separate bins for paper, glass and metal.

¹³ In the UK various systems are applied and it is difficult to get an overview. Bio-waste (incl. food waste) is collected for about 50 %. As regards recyclables, separate bins for glass are also common, as well as co-mingled collection of all four recyclable fractions (including paper).

¹⁴ In Estonian rural areas only residual waste is collected as door-to-door system; in cities also other fractions

Number of bins/sacks	Fractions collected within door-to-door collection system	MS	Number EU MS
	bio-waste residual		
	paper /cardboard + metal + plastic + glass (co-mingled) bio-waste residual	IE	
	Paper/cardboard + metal + plastic (co-mingled) glass residual	MT	
2-bin/sack system	metal + plastic (co-mingled) residual	FR	5
	Paper/cardboard + metal + plastic (co-mingled) residual	RO	
	Paper/cardboard + metal + plastic + glass (co-mingled) residual	EL	
	bio-waste residual	SE, CZ	
1-bin/sack system	residual	SK, ES, HR, PT, PL ¹⁵	6

Note: The information included in table refers to the **primary system** (the main system, majority of inhabitants connected to) applied in the MS, other systems; in some regions of the country other system (e.g. bring-systems) might be primary.

The overview includes solely information about the main system applied in the country (primary system). Many variations of this main system are possible within the countries. For Greece, for example there are also systems in place collecting the recyclable material separately in two, three or four bins. In some regions (e.g. Sparti and Karditsa region) strict separate collection of recyclables has been implemented.

Information about other systems applied in the country (not included in the tables above) are included in the national factsheets provided as separate documents. A list of documents accompanying this report is included in Annex I/10.1.

5.2 Bring point collection in EU-28 Member States

The vast majority of countries applies bring-point systems for the **collection of glass (18 MS - AT, BE, DK, CY, CZ, DE, EE, ES, FR, HR, IT, HU, LT, PT, PL, RO, SE, SK)**; the systems mainly provide separate containers for the collection of different coloured glass (white, green, brown). **Paper/cardboard** collection is realised within bring points for **ten MS (CZ, EE, ES, FR, HR, LT, PT, PL, SE, SK)**. **Plastic**

¹⁵ In Poland cities only residual waste is collected as door-to-door system; in rural areas also other fractions.

(packaging) is collected in bring-points in **Six MS** (BG, LU, LV, MT, SI, SE); in five cases together with **metal**; in Sweden in a separate container. **Two MS** collect metal separately in bring containers (AT, EE). One MS (Spain) also collects bio-waste within bring systems.

Civic amenity sites are used as additional collection systems usually accepting the same fractions as collected in the bring containers. For **tree MS** (CZ, SK, LV) civic amenity sites is the primary collection system for metal (CZ, SK, LV) and bio-waste (SK). In Poland, civic amenity sites are rare.

Table 5-3: EU-28 MS relying mainly on bring systems (by fraction)¹⁶

Collection type	Paper	Glass	Plastic	Metal	Bio-waste
Bring pints 	CZ, EE, ES, FR, HR, LT, PT, PL, SE, SK	AT, BE, DK, CY, CZ, DE, EE, ES, FR, HR, IT, HU, LT, PT, PL, RO, SE, SK	SE ES, HR, LT, PT, PL (all plastic/metal in one container)	AT, EE, SE	ES
Civic amenity sites 	Primary collection: CZ (metal waste), SK (metal and bio-waste), LV (metal) Addition collection of all waste streams: all countries PL: rare distribution of civic amenity sites				

5.3 Applied collection systems per waste streams

Paper/cardboard collection:

- **14 MS** have implemented **separate bins/sacks to the household** in order to separate paper/cardboard (AT, BE, BG, CY, DE, DK, FI, HU, IT, LU, LV, NL, SI, UK).
- **Four MS** do **co-mingled door-to-door** collection with two or three additional fractions (RO and MT with plastic and metal, IE and EL with plastic, metal and glass).
- **Ten MS** rely mainly on bring-points (CZ, EE, ES, FR, HR, LT, PT, PL, SE, SK).

Glass collection

- **18 MS** rely basically on bring-systems for glass is mainly collected within **bring systems** (AT, BE, DK, CY, CZ, DE, EE, ES, FR, HR, IT, HU, LT, PT, PL, RO, SE, SK);
- **Six MS** apply door-to-door systems for glass, collecting glass in a separate bin (BG, LU, LV, NL, SI, MT)
- **Four MS** have **door-to-door** collection of glass, but **co-mingle** with other fractions (FI with paper and metal, UK with plastic and metal and EL and IE with paper, plastic and metal).

¹⁶ **Note:** The information included in table refers to the **primary system** (the main system, majority of inhabitants connected to) applied in the MS, other systems; in some regions of the country other system (e.g. door-to-door) might be primary.

Plastic collection

- **Nine MS** provide **co-mingled** bins/sacks for **plastic and metal** together to the **households** (BE, BG, CY, DE, FR, IT, HU, LU, SI).
- **Four MS** collect **plastic (packaging) as separate fraction** within a **door-to-door** collection system (AT, LV, NL, DK).
- **Five MS co-mingle** besides plastic and metal **other fractions** (RO and MT paper, UK glass, and EL and IE paper and glass).
- **Six MS** (ES, HR, LT, PT, PL, SE) rely on **bring-points** for plastic (packaging), collecting metal and plastic in one bin with the exception of SE collecting plastic (packaging) in a separate bring-container.
- **Four MS** (CZ, FI, EE, SK) so far **do not provide** systems in order to separate plastic from the residual waste bin within main collection system. For those countries, it might be possible to deliver plastic (packaging) to civic amenities.

Metal

- **Nine MS** collect **metal and plastic co-mingled** in one bin/sack within **door-to-door** collection systems (BE, BG, CY, DE, FR, IT, HU, LU, SI).
- **Six MS co-mingle** besides metal and plastic **other fractions** (RO and MT paper, UK glass, and EL and IE paper and glass).
- **Two MS** collect only metals in one bin/sack (NL, DK).
- For **Eight MS bring points** is the primary collection system for metal. 5 MS collect the metals together with plastic in one container (ES, HR, LT, PT, PL); 3 MS collect metals as a single fraction (AT, EE, SE)
- **three MS** do collect metal only at **civic amenities** (CZ, LV, SK).

Bio-waste collection:

- **14 MS** have implemented a **door-to-door collection** system for bio-waste, including the collection of food waste (AT, BE, CZ, DE, FI, EE, IT, HU, LU, NL, SI, SE, IE, UK).
- **Two MS** have door-to-door collection systems **for garden waste only**, e.g. DK is collecting garden waste (kitchen-waste only rare) and RO offers separate bins for waste from parks and gardens.
- **Twelve MS** so far **do not collect bio-waste separately** from the residual waste fraction (BG, CY, ES, FR, EL, HR, LT, LV, PL, PT, SK and SI). All of these countries have so far only implemented pilot studies on separate bio-waste collection or/and collect bio-waste (i.e. garden waste) in civic amenity sites. LV offers bio-bags or bins on demand however no information is given how broad the coverage of this system is.

5.4 Summary and interpretation of data

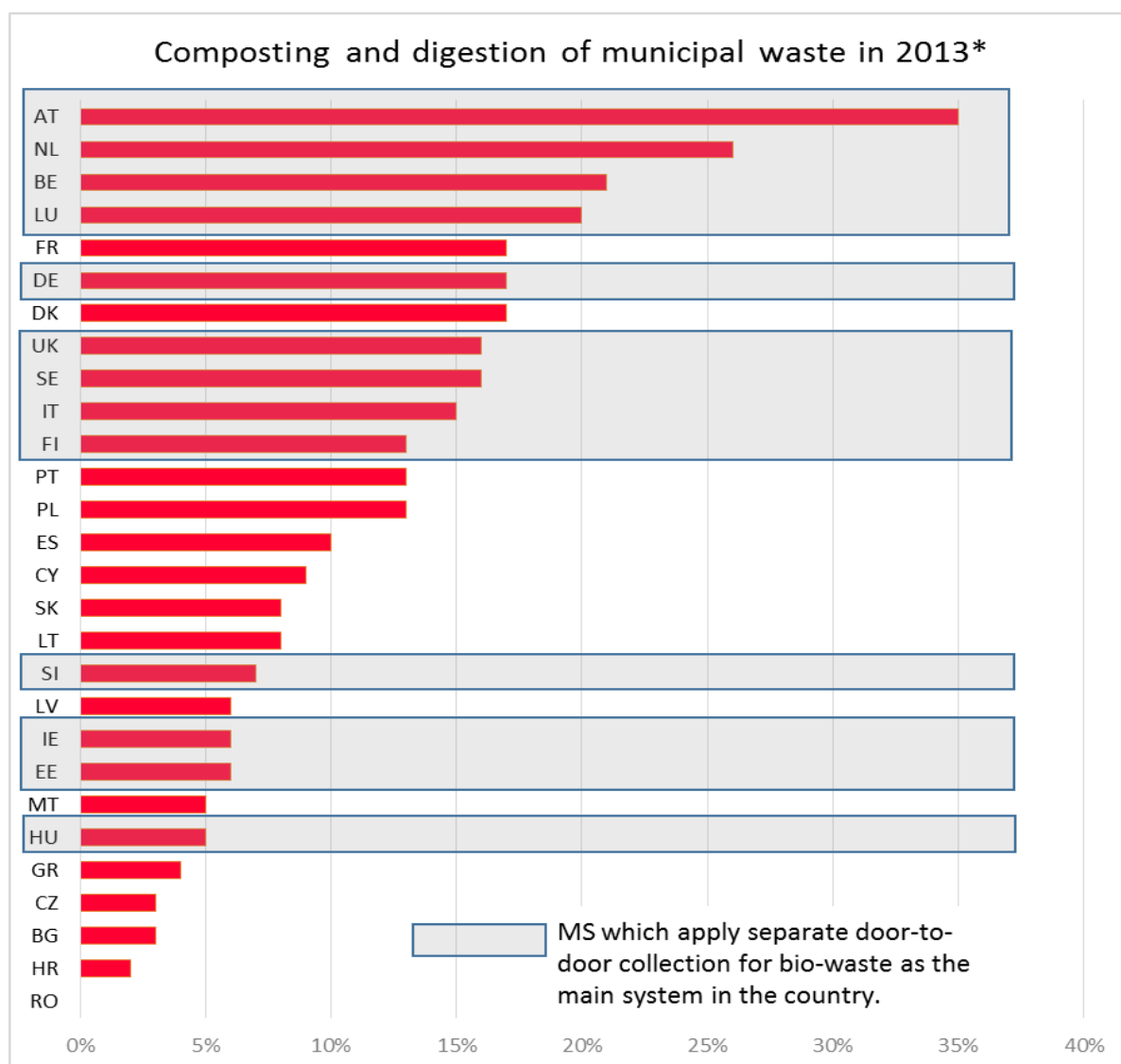
The information provided in the previous chapters can be summarised as follows:

- **Paper/cardboard** is **mainly** collected within **door-to-door system** (18 MS, five of them co-mingled with two or three other recyclable fractions); while ten MS rely mainly on bring-points.
- **Glass** is **mainly** collected within **bring systems** (18 MS); ten MS apply door-to-door systems for glass, of which four co-mingle glass with two or three other recyclable fraction
- **Plastic (packaging)** is collected **primary** within **door-to-door** collection systems in 18 countries, of which only four collect plastic only, all other apply co-mingling with one (metal), two or three other fractions. **Six MS** collect plastic (five together with metals) via bring-points. **Four MS (CZ, FI, EE, SK) so far do not provide systems in order to separate plastic from the residual waste bin within main collection system.**¹⁷
- **Metal** is collected within **door to door systems** by 17 MS. Two MS collect metal separately, nine collect metal together with plastic and further six MS co-mingle metal with additional fractions. For eight MS, bring points are the primary collection point for metal (five MS together with plastic in one container). Three MS collect metal only at civic amenities (CZ, LV, SK).
- **Bio-waste including food waste is separately collected door-to-door in 13 MS**, and a further **two MS have door-to-door** collection systems for **garden waste** only. **13 MS do not collect bio-waste separately as primary collection system** (BG, CY, CZ, ES, FR, EL, HR, LT, LV, PL, PT, SK and SI).

It would be interesting to assess any potential correlation between the primary collection systems in place and the eventual recycling rates achieved. A preliminary examination focusing on bio-waste has been conducted here using EUROSTAT data. EUROSTAT statistics provides data for composting and digestion together¹⁸, therefore the percentage given in Figure 5-1 might be overestimated as regards recycling (composting) operations.

¹⁷ Note: it is not sure if plastic packaging in these cases is collected at civic amenity sites

¹⁸ Note: The press release [EUROSTAT 2015] Press release Environment. 54/2015, 26 March 2015 counts composting (=recycling) as both aerobic and anaerobic treatment. Anaerobic digestion however in general is seen as energy recovery operation. Composting data only (aerobic treatment) is not available at EUROSTAT.



*Source: Data from [EUROSTAT 2015] Press release Environment. 54/2015, 26 March 2015

Figure 5-1: Composting and digestion rate of municipal waste in 2013 [EUROSTAT 2015]

Member States with high rates of composting/digestion have, in most cases, applied separate collection of bio-waste on door-to-door basis (bring systems for bio-waste including the collection of food waste are not applied except of Spain). Exceptions are DK and FR, which do not provide bio-waste bins to households, but still show comparably high recycling/recovery rates. For SI, IE, EE and HU it should be noted that door-to-door collection of bio-waste has been implemented only in recent years and, even if reported as the primary system, does not yet cover all households. In these countries, treatment technology might not yet be fully in place.

Further, it might be possible to compare the capture rates of municipal solid waste (MSW), meaning recycled amount versus generated amount based on national municipal waste composition, being more meaningful because it is accounted how much bio-waste is collected from the total amount generated.

6 Separate waste collection systems applied in EU-28 capitals

6.1 Waste generation in EU-28 capitals

Waste generation in the 28 capital cities of the EU displays some large variations spanning from around 270 (Dublin) up to 666 kg/cap (Luxembourg), with the average at 445 kg/cap. These differences can be explained by econometric factors (such as the household size, household expenditure or gross domestic product (GDP)) but also by other factors such as tourism and daily commuters a city attracts. However, the differences can mainly be explained by the type of waste sources included in the statistical data on generation of waste.

Cities (and local authorities) are generally responsible for collecting the household part of MSW. However, the collected data do not indicate whether the collection systems put in place actually cover commercial waste as well. Only five cities (Budapest, Copenhagen, Dublin, Helsinki, and London) provide an indication regarding the level of inclusion of commercial waste in the generation data presented here. The reasons for this data issue is that:

- Businesses operating in the cities might be encouraged to take responsibility for the collection of their waste
- Businesses might not be allowed to deliver their waste in the municipal waste collection schemes
- Large businesses might be responsible for their own waste collection, but smaller businesses located in mixed use buildings (buildings where both households and businesses co-exist) use the household collection system
- Businesses might use a separate collection scheme for the recyclables and use the municipal waste scheme for their residual waste
- Businesses might have access to bring or civic amenity sites but not to door-to-door collection schemes

One or more of these reasons can make it impossible for municipalities to adequately distinguish between household or commercial sources with respect to the waste they collect. Copenhagen is one example for this problem, as the generation data refer to household waste and only a small part of the commercial waste (from mixed use buildings mainly), which explains also the large difference in Copenhagen waste generation compared with the national figures.

The issue of type of waste sources collected can also potentially explain the differences between national generation figures and capital city generation figures presented in Figure 6-1. Other reasons for these differences include the household size (smaller in capital cities) and GDP per capita.

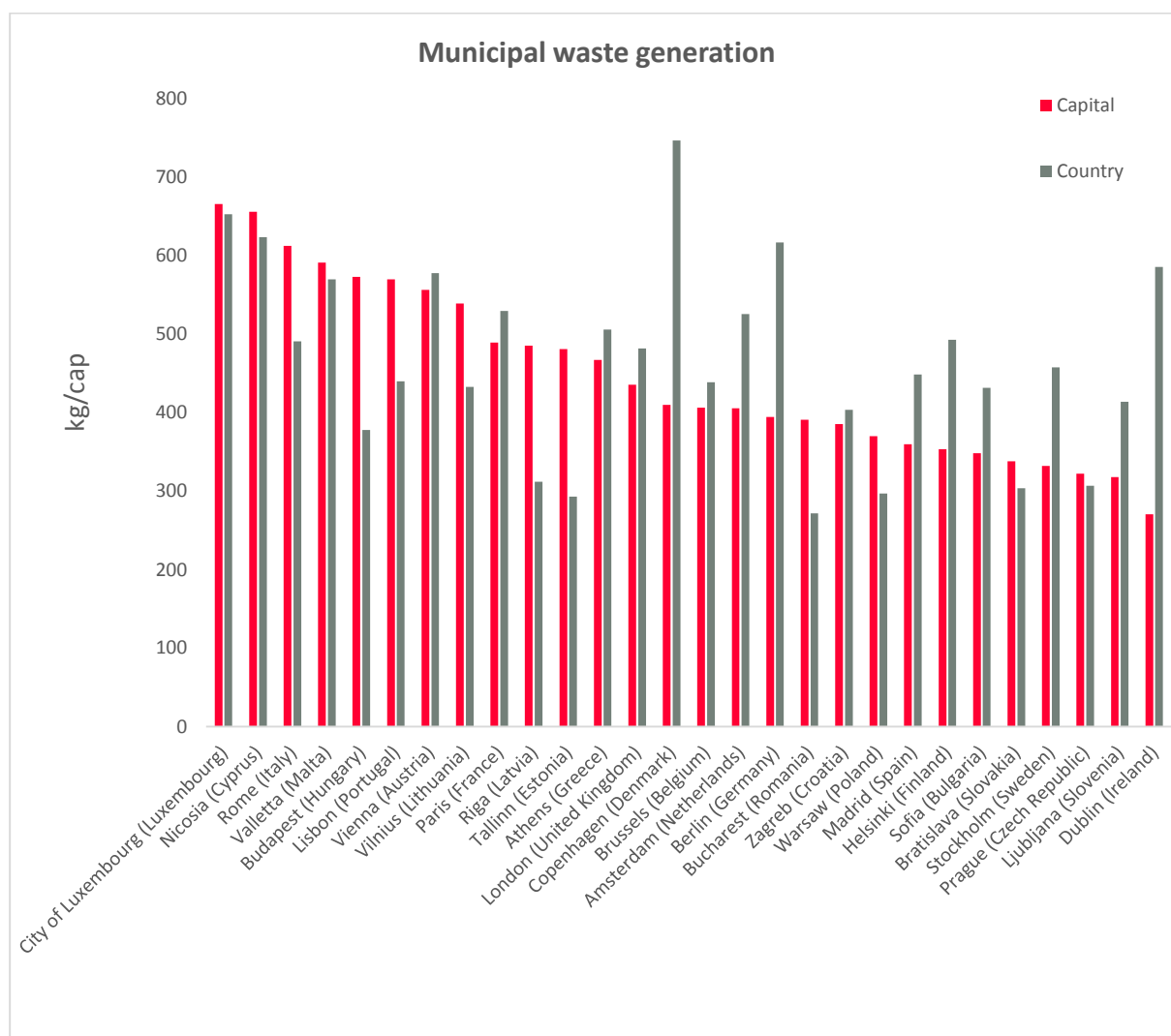


Figure 6-1: Municipal waste generation in the EU-28 Member States and their capitals*

* National data refer to 2013, while capital city data reference year varies

6.2 Data availability and assumptions for the EU-28 capitals

The collection of information and data for a varied set of municipal waste collection elements is bound to meet limitations.

In this section, a table is presented aiming at summarising all the data deficiencies and assumptions made, in order to transparently inform the reader before any analysis is undertaken.

The data limitations are distributed into three clusters: issues around the waste type that each city data refer to, data unavailability and gap filling regarding the collection of specific material fractions, and information on the composition of the generated waste in each capital city. If a city is not mentioned in Table 6-1 below, then its dataset provided is complete (although still open to the uncertainties mentioned in section 6.1).

Table 6-1: Notes on data in Capital City Fact Sheets

Issues on municipal and/or commercial waste amounts
Issues on definition of municipal waste (reference to household waste only, reference to household waste and (household-like) commercial waste, no specification on source of waste). Data reported for most of the capitals refers to municipal waste, in most of the cases meaning household waste and household-like commercial waste. They rarely provide relative shares between the two sources.
Data reported for Budapest, Dublin and Helsinki refer to waste from households only.
Copenhagen figures refer to 80-90 % household waste and 10-20 % commercial waste
Some data sources for some cities provide total generation and per capita generation of waste in the city, but based on population data, these numbers might not match (e.g. in Madrid). In those cases, the total generation data is used and the per capita generation is then calculated based on total generation, divided by the population.
Collected amounts per fraction
Many cities have very recently changed their collection systems in order to comply with the Waste Framework Directive's deadline to implement separate collection from 1 January 2015. Due to this, several cities have a performance reflecting a system that was not operational over the entire year or the full area of the city. For example in Budapest, the new collection system for households was completed only by the end of 2014, the data presented here is to be understood as a performance achieved by a system readiness of approximately 60% compared to what is expected from year 2015 onwards at least for paper, metal and plastic.
Budapest presents no amount for separate collection of metals. Metals are collected from co-mingled door-to-door, bring and civic amenity systems but the metals' amount is reported together with plastics.
Metals and plastic, collected through a co-mingled door-to-door system are reported in one aggregated figure for Brussels and its disaggregation is not possible.
The separately collected amount for glass from civic amenity sites in Helsinki is not available, but it is very small amounts and it is ignored. Paper collected from bring sites is reported together with door-to-door separately collected paper.
The separately collected amounts for metals and bio-waste from civic amenity sites in Lisbon are not available.
Metals and plastic, collected through a co-mingled door-to-door system are reported in one aggregated figure for Ljubljana and its disaggregation is not possible
Separately collected plastics and metals from bring sites in Ljubljana is included in the amounts collected from door-to-door separate collection. Therefore, the total amounts collected are correct, but no figures for bring sites are available.
Luxembourg collects metals, plastics and composite materials in a co-mingled door-to-door system. Separate amounts for these fractions are not available.

Madrid does not report amounts for metals and plastics collected through bring sites separately, so a total figure for metals and plastics is available. Moreover, packaging waste (plastic, metals and tetrapak) is collected through a co-mingled door-to-door system and no disaggregation of the total figure is possible.
Nicosia collects metals, plastics and drink cartons in a co-mingled door-to-door system. Separate amounts for these fractions are not available.
For Paris, collected amounts for paper & cardboard, plastics, metals and glass from civic amenity sites are missing and excluded from the total collected amounts for these fractions. Therefore, total collected amounts for Paris should be perceived as minimum collected amounts.
For Riga, collected amounts for paper & cardboard, plastics, metals and glass from civic amenity sites are missing and excluded from the total collected amounts for these fractions. Therefore, total collected amounts for Riga should be perceived as minimum collected amounts.
Rome runs a co-mingled door-to-door system and a mobile collection system for plastic, metals and glass. The collected total quantity is not possible to disaggregate into individual fractions. However, the total quantity for these two systems is only around 20% of the total collected for these materials from all systems. Therefore, collected quantities from the co-mingled door-to-door system and the mobile collection system are excluded.
Metals from bring sites in Sofia are reported together with plastics. Disaggregation of the figure is not possible.
Valletta collects paper & cardboard, metals and plastics in a co-mingled door-to-door system. Separate amounts for these fractions are not available. No allocation is made into separate fractions for the total amount as this is the main collection system in the city, delivering by far the largest separate collected quantities.
Deposit return scheme and producers responsibility data exist at national level for Croatia but it is not possible to separate data from the two schemes or to scale the data down for Zagreb only.
Composition of waste generated¹⁹
Few cities report the composition of generated waste. For the five fractions in question 10 cities provide with composition data: Amsterdam, Bratislava, Brussels, Dublin, Paris, Prague, Tallinn, Vienna, Vilnius and Zagreb. Another 3 cities (Berlin, Ljubljana and Rome) provide partial composition data.
For cities with no or partial composition data identified in course of this project, the generated amounts of the five fractions are estimated based on national compositions, available through the European Reference Model on Municipal Waste Management (www.wastemodel.eu).
The capture rates, estimated as the ratio of collected vs. generated amounts per fraction, might not include the amount collected from sources other than households.

¹⁹ The absence of composition data for a city indicates that it was not included in the city fact sheet.

6.3 Separate waste collection systems applied and collected amounts

The separate collection systems in place in the 28 capital cities encompass mainly door-to-door separate collection of materials, door-to-door collection of co-mingled materials, bring and civic amenity sites.

Table 6-2: Overview of collection systems in place in the EU-28 capital cities²⁰

Capital city	Door-to-door separate 	Door-to-door co-mingled 	Bring points 	Civic amenity sites 
Amsterdam	X		X	X
Athens	X	X	X	
Berlin	X	X	X	X
Bratislava			X	X
Brussels	X	X	X	X
Bucharest			X	
Budapest	X	X	X	
Copenhagen	X		X	X
Dublin	X	X	X	X
Helsinki	X		X	X
Lisbon	X		X	X
Ljubljana	X	X	X	X
London	X	X	X	X
City of Luxembourg	X	X	X	X
Madrid		X	X	X
Nicosia	X	X	X	X
Paris	X	X	X	X
Prague			X	X
Riga	X		X	X
Rome	X	X	X	
Sofia	X	X	X	X
Stockholm	X		X	X
Tallinn	X	X	X	X
Valletta	X	X	X	X
Vienna	X		X	X
Vilnius	X		X	X
Warsaw	X	X		
Zagreb	X		X	X

In all cities, there are several systems in place operated by the municipality and/or producers or private companies. Altogether, door-to-door separate collection system is available in 24 cities, door-to-door

²⁰ **Note:** Different collection systems in a capital city may target different materials

co-mingled collection system can be found in 16 cities, and 27 cities include bring sites for at least one material, while 23 cities have at least one civic amenity site in place. The cities select among these four main systems in order to form an appropriate combination for an integrated collection system for dry recyclables and bio-waste (see Figure 6-2). Many cities have only recently established a door-to-door separate collection in order to comply with the Waste Framework Directive 2015 deadline. Since the city information do not always refer to current (2015) collection structure, door-to-door separate collection coverage might be slightly underestimated.

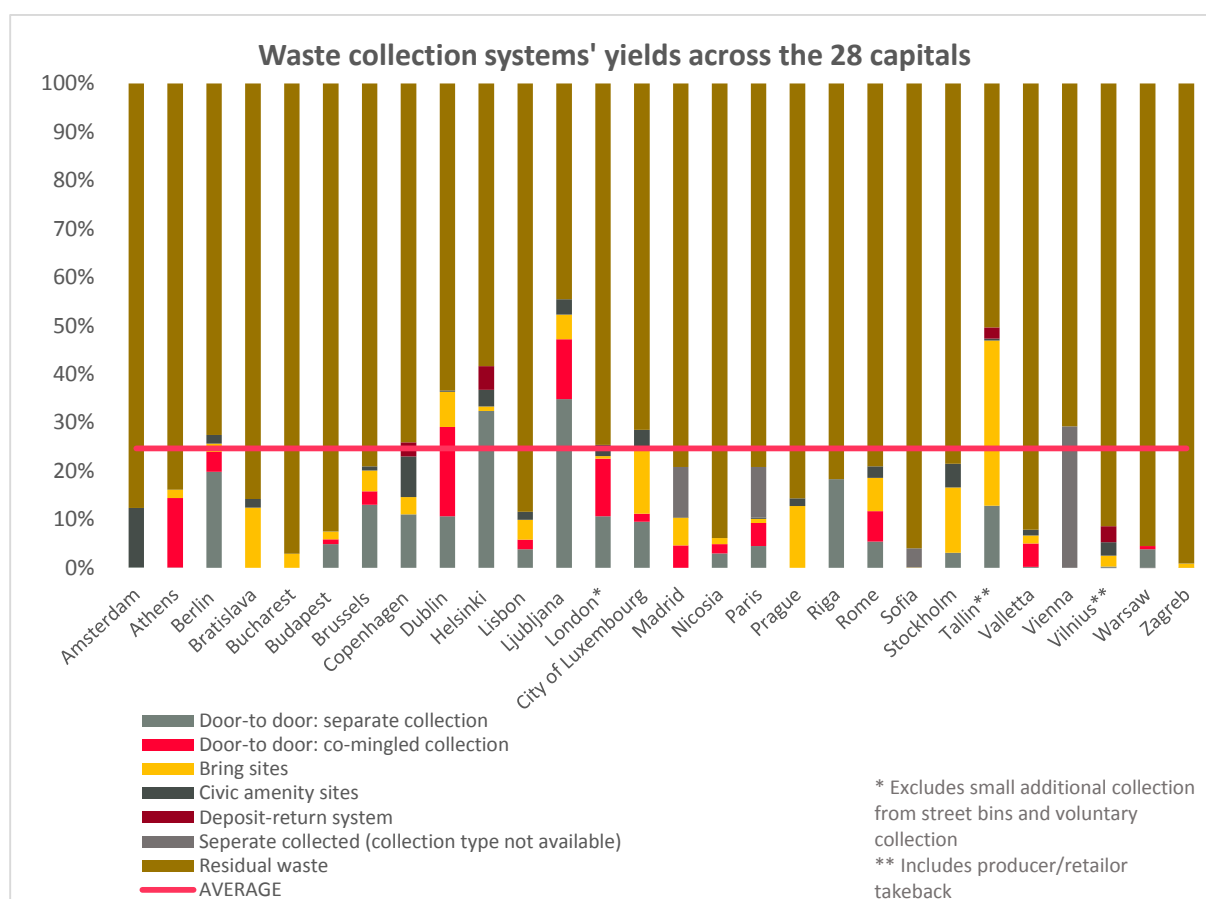


Figure 6-2: Separately collected amounts of five fractions in the 28 EU-capitals*

***Note:** Residual waste refers to all generated waste, except for the separately collected amounts for the five fractions

Most cities focus their separate collection schemes on paper and cardboard, glass, plastic, metals and bio-waste, therefore the difference between the amount collected from these five fractions and the amount of total separate collection is rather small. On average, the EU capitals collect 80 kg/cap from these five fractions (while 108 kg/cap is collected separately for all waste fractions), which is around 19 % of total MSW generation. The highest collection rate is 189 kg/cap (Luxembourg), while the lowest is 5 kg/cap in Zagreb. However, these absolute numbers are influenced by the level of MSW generation, so if the amount collected for the five fractions is expressed as percentage of generation, Ljubljana collects the highest amount (55 %), while Zagreb still has the lowest collection rate (1 %). As Figure 6-3 demonstrates, six cities (Ljubljana, Luxembourg, Rome, Stockholm, Tallinn and Vienna) perform very well in terms of quantity per capita collected with annual amounts exceeding 160 kg/cap

for the five fractions. However, some of these cities have a very high waste generation as well, therefore, the collected amounts are easier to reach compared with cities with low MSW generation. If the collection rate for the five fractions is expressed as percentage of the total MSW generation, then five cities (Dublin, Helsinki, Ljubljana, Stockholm and Tallinn) end up with a percentage of separate collection of the five fractions, higher than 30 %.

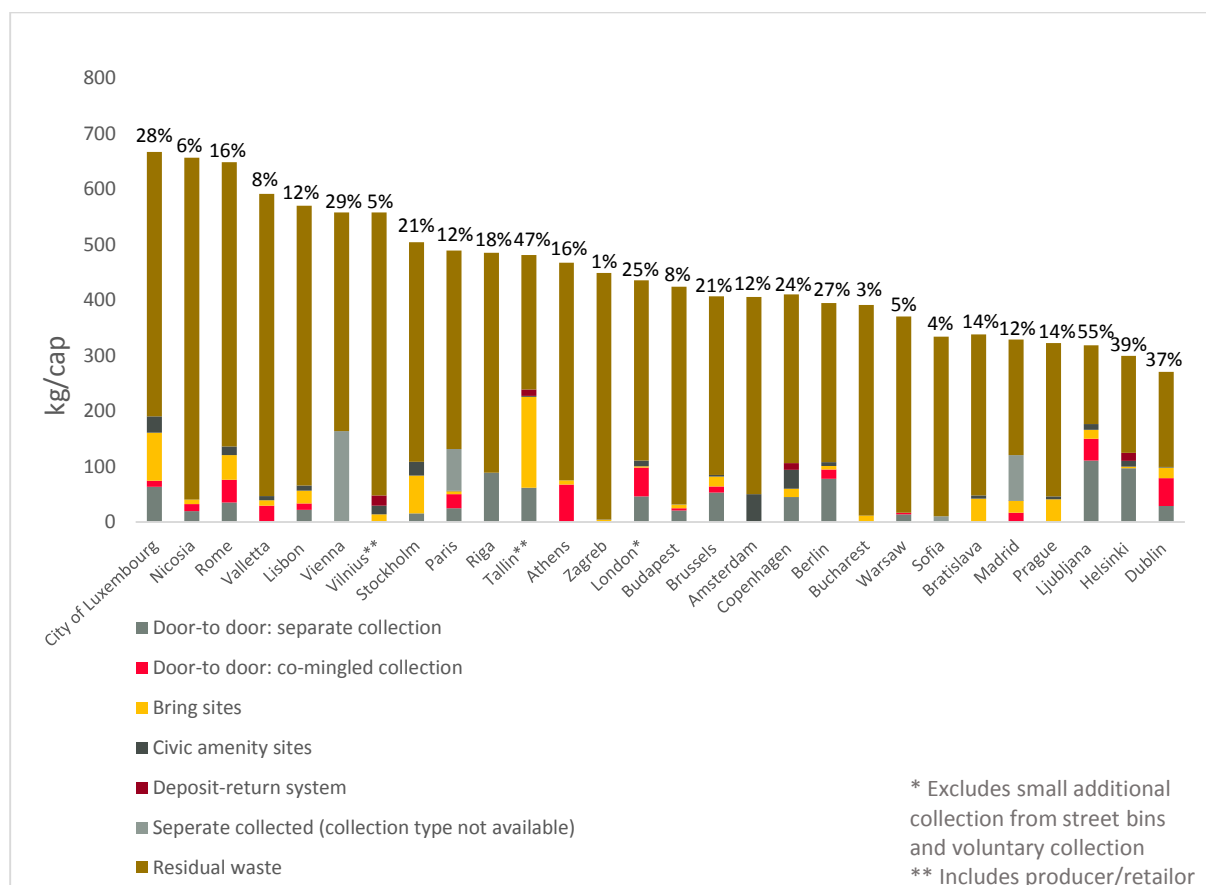


Figure 6-3: Separately collected amounts of five fractions in the 28 EU-capitals*

***Note:** Figures on top of city columns denote the percentage of the five fractions separately collected compared with total MSW generation

6.4 Separate waste collection systems and fractions targeted

The capital cities use a combination of collection systems in order to optimise the collection rate for the targeted fractions and also in order to adjust waste collection to the particularities of each city (e.g. building density). According to the information on targeted fractions per collection systems, it seems there are some trends regarding preferable fractions targeted by each system. Table 6-3 gives an overview of the systems applied and the corresponding targeted fraction across the 28 EU capitals.

Table 6-3: Overview of collection systems in place, fractions collected per system and collection frequency across the EU-28 capital cities²¹

Capital city	Door-to-door separate collection 	Door-to-door co-mingled 	Bring points 	Civic amenity sites 
Amsterdam	Paper/Cardboard: biweekly (pilot) Bio-waste: weekly		Paper/Cardboard, Plastic, Packaging, Glass	All five fractions
Athens	Bio-waste: biweekly	Paper/Cardboard, glass, plastic, metal: daily	Paper, glass	
Berlin	Paper/Cardboard: varies Glass: 3/4-weekly Bio-waste: biweekly	Plastic, metal: weekly/biweekly	Glass	All five fractions
Bratislava			Paper, glass, plastic	All five fractions
Brussels	Paper/Cardboard: biweekly Glass: on demand Bio-waste: weekly	Plastic, metal, composites: biweekly	Glass	All five fractions
Bucharest			Paper, glass, plastic, metal	
Budapest	Paper/Cardboard: weekly/4-weekly Bio-waste: weekly	Plastic, metal: 4-weekly	Paper, glass, plastic, metal	All five fractions
Copenhagen	Paper/Cardboard: biweekly/4-weekly Glass, metal, plastic, bio-waste: on demand		Glass	All five fractions
Dublin	Glass: weekly/bi-weekly Bio-waste: monthly	Paper/Cardboard plastic, glass, metal: weekly/biweekly	Paper, glass, metal	All five fractions
Helsinki	Paper/Cardboard: on demand Glass, metal: 4/8-weekly Bio-waste: varies		Paper/Cardboard, glass, metal	Paper/Cardboard, glass, metal, Bio-waste
Lisbon	Paper/Cardboard: weekly Glass: 1-3 days per week		Paper/Cardboard, glass, plastic, metal	Paper/Cardboard, glass, plastic, metal

²¹ Note: Blank cells denote the absence of that system in the city

Capital city	Door-to-door separate collection 	Door-to-door co-mingled 	Bring points 	Civic amenity sites 
	Bio-waste: daily Plastic: N/A			
Ljubljana	Bio-waste: daily/weekly/biweekly Paper/Cardboard: weekly/3-weekly	Plastic, metal: weekly/3-weekly	Paper, glass, packaging	All five fractions
London	Paper/Cardboard: weekly/biweekly Glass: weekly/biweekly Plastic: weekly/biweekly Metal: weekly/biweekly Bio-waste: weekly/biweekly	Paper/Cardboard, glass, plastic, metal: weekly/biweekly	Paper/Cardboard, glass, plastic, metal	All five fractions
Luxembourg	Paper/Cardboard: weekly Glass: weekly Bio-waste: weekly	Metal, plastic, composite: biweekly	Paper, glass, bio-waste	All five fractions
Madrid	Paper/Cardboard: N/A	Plastic, metal, drink cartons	Paper/Cardboard, glass, packaging	Paper/Cardboard, glass
Nicosia	Paper/Cardboard: weekly	Plastic, metal, drink cartons: weekly	Glass	All five fractions
Paris	Glass: weekly	Paper/Cardboard, plastic, metal, composite: 2 times per week	Glass, bio-waste	All five fractions
Prague			Paper/Cardboard, glass, plastic	All five fractions
Riga	Paper/Cardboard: weekly Glass: weekly Plastic: weekly		Paper, glass, plastic, metal	Paper/Cardboard, glass, plastic, metal
Rome	Paper/Cardboard: 2 times per week Bio-waste: 3 times per week	Plastic/metal or plastic/metal/glass: 2 times per week	All five fractions	All five fractions
Sofia	Paper/Cardboard: weekly Glass: monthly Plastic: weekly Bio-waste: monthly	Plastic, glass, metal: varies	Paper/Cardboard, glass, plastic, metal	All five fractions

Capital city	Door-to-door separate collection 	Door-to-door co-mingled 	Bring points 	Civic amenity sites 
Stockholm	Paper/Cardboard: upon agreement Glass: upon agreement Plastic: upon agreement Metal: upon agreement Bio-waste: weekly/biweekly		Paper/Cardboard, glass, plastic, metal	All five fractions
Tallinn	Paper/Cardboard: 1-2 times per week Bio-waste: 1-3 times per week	Mixed packaging waste under EPR scheme	Paper/Cardboard, glass, plastic, metal	All five fractions
Valletta	Glass: monthly	Paper/Cardboard, plastic, metal: weekly	Paper/Cardboard, glass, plastic, metal	All five fractions
Vienna	Paper/Cardboard: weekly Glass: 4-weekly Plastic: biweekly Metal: biweekly Bio-waste: weekly/biweekly		All five fractions	All five fractions
Vilnius	Paper/Cardboard: biweekly Glass: biweekly Plastic: biweekly Metal: biweekly		Paper/Cardboard, glass, plastic, metal	All five fractions
Warsaw	Glass: monthly Bio-waste: monthly	Paper/Cardboard, plastic, metal: weekly/monthly		
Zagreb	Bio-waste: weekly		Paper/Cardboard, glass, plastic, metal	All five fractions

6.4.1 Door-to-door separate collection

Overall, 25 cities operate a door-to-door collection system based on source-separated fractions. This type of collection system mainly focuses on paper and cardboard, glass and bio-waste. On average across all capital cities, the amounts collected are:

- 29 kg/cap for paper, ranging from 0 to 58 kg/cap, with data from 14 cities
- 6 kg/cap for glass, ranging from 0 to 25 kg/cap, with data from twelve cities

- 9 kg/cap for plastic, ranging from 1 to 32 kg/cap, with data from four cities
- 1 kg/cap for metal, ranging from 0 to 1 kg/cap with data from four cities
- 20 kg/cap for bio-waste, ranging from 1 to 73 kg/cap, with data from 16 cities²²

The collection frequency varies among the capital cities, but it is mainly biweekly for most fractions. Bio-waste collection tends to be more frequent, presumably due to the nature of this fraction, while many cities apply more frequent collection during the warmer period of the year. For some materials (e.g. glass), collection in some cases happens upon demand from the households. Most of the cities provide households with bins for separate collection of the targeted materials, although there are kerbside collection cases based on colour-coded bags as well. Cities applying door-to-door collection for recyclables/bio-waste have mostly achieved total coverage (100%) of this collection system, although there are a few cases where much of the city is not covered (due to e.g. recent implementation of the system or partial pilot application).

6.4.2 Door-to-door co-mingled collection

This system is the least common system among the capital cities, with only half of them applying it. This system needs to be accompanied with an effective sorting facility in order to extract clean fractions from the mixed collected quantities. It mainly targets dry recyclables (paper, plastic, metals and to a lesser extent glass) that are easier to separate in a central sorting facility. On average across all capital cities, the amounts collected are:

- 30 kg/cap for paper, ranging from 2 to 53 kg/cap, with data from five cities;
- 5 kg/cap for glass, ranging from 1 to 12 kg/cap, with data from three cities;
- 6 kg/cap for plastic, ranging from 1 to 12 kg/cap, with data from 6 cities;
- 3 kg/cap for metal, ranging from 2 to 4 kg/cap, with data from four cities.

The yields of recyclable material from this type of collection system are relatively comparable with the material yields from the door-to-door separate collection system. However, it is unclear whether the co-mingled quantities include reject material (or contaminants), which would reduce the quantity of the pure recyclable fraction and also reduce the quality of the recycling process.

The material targeting varies a lot among the cities that employ this type of door-to-door collection system. Three cities target all materials (except for bio-waste), three cities target paper/plastic/metal, two cities target plastic/metal/glass and seven cities target plastic/metal. All cities that apply co-mingled collection include plastic in the mix, with paper being the second most popular material.

The collection frequency is weekly or biweekly for most cities, although the frequency varies a little across the capitals. The coverage for this system is rather high, reaching 100% in most cases.

²² The ranges for the data often start from 0 kg/cap. This is because many cities have only recently established a separate collection system or because there is a system in place with small city coverage.

6.4.3 Bring collection system

Most of the EU capitals include a type of bring system for centrally collecting recyclables. The advantage of this system mainly is that the collection points across the city are reduced substantially compared to door-to-door systems. Only one city (Prague) relies exclusively on bring systems for the separate collection of waste, avoiding door-to-door collection. Bring systems are mainly perceived as complementary to door-to-door collection and they may target specific materials that are not covered by door-to-door collection. For example, in the case of glass, all cities (27) with a bring system target glass. However, only 15 of them collect glass door-to-door as well, while the rest rely exclusively on bring or civic amenity sites.

Bring systems mainly targets the paper and glass fractions. On average across all capital cities, the amounts collected are:

- 12 kg/cap for paper, ranging from 1 to 76 kg/cap, with data from 17 cities;
- 12 kg/cap for glass, ranging from 0 to 53 kg/cap, with data from 24 cities;
- 7 kg/cap for plastic, ranging from 0 to 26 kg/cap, with data from ten cities;
- 2 kg/cap for metal, ranging from 0 to 9 kg/cap, with data from ten cities;
- 19 kg/cap for bio-waste, ranging from 0 to 33 kg/cap, with data from three cities.

Bring systems seem to be rather effective for increasing glass yields, as bring systems are on average more effective in terms of collected quantities compared to the door-to-door systems (see table 6-3). Two cities that have bring systems (Luxembourg and Rome) for bio-waste have seen rather impressive results with higher collected amounts compared to the door-to-door separate collection schemes (the other data for bio-waste comes from Paris with limited coverage and 0 kg/cap). It is not clear, however, if the bring systems are complementary to door-to-door separate collection (both Rome and Luxembourg have them) or additional: Luxembourg employs door-to-door collection for bio-waste and bring points mainly for garden waste.

The density of the bring collection points is estimated at 190 points per 100,000 inhabitants on average, ranging from 12 to 850 points per 100,000 inhabitants. There are large variations across the cities, while in some cases, the density of the bring points varies according to the fraction targeted.

6.4.4 Civic Amenity sites

In total, 25 cities include at least one civic amenity site targeting at least one of the five fractions investigated in this study. These sites typically are established as generic recycling stations, able to receive many waste fractions and not only confined to MSW. In fact, most of the sites target batteries and WEEE with the aim at separating these hazardous materials from the residual MSW amounts (presumably also motivated by the relevant EU Directives). Civic amenity sites also serve as receivers of bulky waste, where citizens can deliver their waste with their own vehicle²³. In most cases (in 21 out

²³ It is not clear how the data for civic amenity sites are obtained. Specifically, the collected quantities from these sites might be difficult to distribute according to source (e.g. MSW, C&DW, etc.)

of 25 cities), civic amenity sites receive all of the five fractions analysed here, while in three cities no bio-waste is accepted. The collected per capita amounts of materials in the civic amenity sites are lower than the collected amounts in each of the other systems examined, except for glass and metal (presumably because these materials are present often in bulky waste such as furniture).

Civic amenity sites usually require a large parking/uploading area and also for the many different types of containers they accommodate. On average across the EU capital cities, there are 3 sites per 10,000 inhabitants.

6.4.5 Overall performance of collection systems

The Table 6-4 shows the average collected amount per capita per collection system and per material across the 28 EU capitals. The figures of the table might be influenced by collection coverage of door-to-door systems, for which data is not always available. Twelve cities provide with coverage data and report coverage ranges from 2% to 100% coverage for door-to-door separate collection. 10 cities provide with coverage data and also report ranges of 2% to 100% coverage for door-to-door co-mingled collection. The average collected amount (yield) for the cities that cover 100% of their territory is provided in brackets in the table below. The differences between average yields from all cities and from cities with 100 % coverage are not always straightforward (for example, cities with 100 % coverage seem to collect less paper per capita in the door-to-door separate collection). This is because collection systems are not always standalone but instead they are part of a wider integrated system.

Table 6-4: Average material yields per collection system across the EU-28 capital cities²⁴

Yields per system (kg/cap/year)	Paper/Cardboard	Glass	Plastic	Metal	Bio-waste
Door-to-door separate	29 (23)	6 (15)	9 (1)	1 (1)	20 (14)
Door-to-door co-mingled	30 (31)	5 (1)	6 (8)	3 (3)	-
Bring points	12	12	7	2	19
Civic Amenity	3	2	1	2	6

6.5 Capture rates for collection systems

In this section, the effectiveness of each system regarding specific materials is examined based on the capture rate, which is defined as:

- **Capture rate:** The share of the generated quantity of a given material that is separately collected. This usually requires sorting analysis of residual waste (available at city or national level)

In order to obtain capture rates for each material, the collected amount through each system for each material needs to be compared with the generated amount of the same material in the respective city. For 13 capital cities²⁵ data for **total waste generation for a particular waste fraction** (e.g. paper) and

²⁴ **Note:** Figures in brackets refer only to cities with data on coverage and 100 % coverage.

²⁵ Capital cities where data on total waste fraction generated and the amount separate collected for at least one material are: Vienna, Berlin, Ljubljana, Prague, Rome, Vilnius, Amsterdam, Bratislava, Paris, Brussels, Dublin, Tallinn and Zagreb.

for the **amount collected separately** are available. It has to be noted that this data is not easily available in most of the cities as it requires sorting analysis of residual waste on city level (in order to get tot total amount of a fractions generated). For the capitals where data is available at city level, this data has been applied.

Amsterdam, Bratislava, Brussels, Dublin, Paris, Prague, Tallinn, Vienna, Vilnius and Zagreb have complete waste composition data available. Berlin, Rome and Ljubljana provide partial data on composition and these are used in the graphs below, supplemented by national composition data. For the cities where no city-level waste composition data was available, the national MSW compositions included in the European Reference Model on Municipal Waste Management (<http://www.wastemodel.eu/>) have been used.

Paper/Cardboard

This material fraction presents with the highest absolute collected quantity on average across the 28 capital cities. Separate collection of paper/cardboard has a long tradition in most cities, following the long history of paper recycling advancements.

Based on Table 6-4, paper is mainly collected in door-to-door collection systems, followed by bring systems and civic amenity sites in terms of yields. However, this material has the highest generation in all cities, second only to bio-waste therefore targeting paper would likely increase substantially the separately collected quantities.

Figure 6-4 shows the capture rate for paper/cardboard across the EU capitals. According to this estimation, cities manage to capture 36 % of the generated paper on average, it can also be used in order to assess the effectiveness of collection systems with respect to paper/cardboard. Ljubljana, Tallinn, Helsinki, Riga and Berlin manage to collect more than 65 % of the paper/cardboard generated. All five top performing cities have a door-to-door separate collection scheme in place for paper/cardboard that provides all or most of the collected quantity, supported by bring (except for Berlin) and civic amenity sites. **Given the much higher yield for paper/cardboard collection through the door-to-door system (and that one top performing city does not provide paper bring sites), door-to-door separate collection seems to be the best system for collecting this material.**

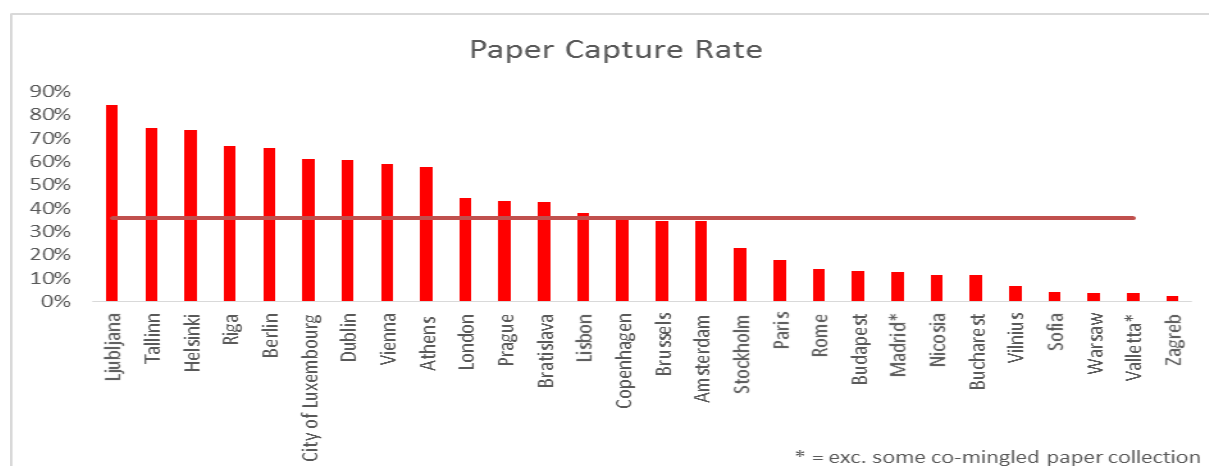


Figure 6-4: Capture rate for paper/cardboard across the 28 EU capital cities.
(The thick line represents the average.)

Glass

Contrary to paper/cardboard, the highest average yields across the EU capitals come from bring sites, despite the fact that the majority of cities have a door-to-door separate collection scheme in place. Bring systems produce the highest average yield for glass; only one capital city does not provide with bring glass points, thus it seems that the effectiveness of this system has been acknowledged. Bring systems also seem to perform much better than the door-to-door systems (very few cities collect co-mingled glass).

In order to analyse these general trends, it is important to consider that glass recycling has a long tradition in most cities. Therefore, glass is targeted to a great extent by all collection systems examined, except for co-mingled door-to-door collection. For example, all bring systems in place across the 28 capitals target glass. In that way, if glass is separately collected door-to-door, usually it is also collected from bring points in the same city. Moreover, glass is also included in many of the deposit-return systems that primarily utilise refillable or one-way glass bottles. Data from deposit-return systems are not shown as it is debatable when this data is part of the waste generation in the city in general. However, it is important to note the example of Helsinki, where the deposit-return system delivers around 3 times more collected glass annually than all other systems combined.

Figure 6-5 shows the capture rate from all collection systems in place for glass, compared with the generated glass waste in the city. On average, around 44 % of generated glass is captured through the use of a separate collection system. The best performing cities, managing to capture more than 75 % of the generated glass are Ljubljana, Tallinn, Brussels, the City of Luxembourg, and Dublin. Ljubljana and Tallinn rely exclusively on bring and civic amenity sites for collecting glass, while Luxembourg, Brussels and Dublin also include a door-to-door separate collection scheme. However, also in Luxembourg, Brussels and Dublin, the main contributor to the total collected quantity are the bring systems and civic amenity sites. **Based on these considerations, the effectiveness of bring banks for delivering high capture rates for glass, should be underlined.**

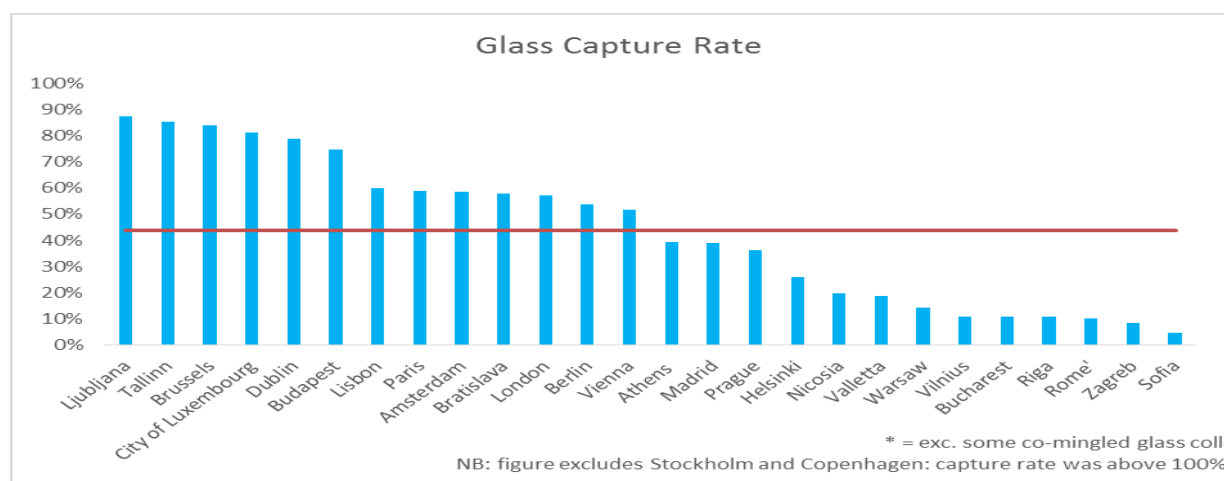


Figure 6-5: Capture rate for glass across the 28 EU capital cities.

(The thick line represents the average.)

***Note:** Stockholm and Copenhagen produce rates higher than 100% and excluded from the graph. These rates might be caused by differences in the national and city compositions (e.g. because of higher presence of businesses in cities), import of waste or reporting issues (e.g. from deposit-return systems)

Plastic

Plastic waste collection yields are approximately equally distributed into door-to-door systems and the bring sites (civic amenity sites yield on average low quantities). In general, door-to-door separate collection of plastic is not widely implemented across the EU capitals (only 8 out of 28) so far, while plastic collection mainly occurs through co-mingled collection and central collection points. Many cities collect packaging as co-mingled material and separate them afterwards in centralised sorting facilities.

Figure 6-6 shows the capture rate for plastic across the EU capital cities. Besides three cities that stand out, capture rates for plastics are relatively low, with an average capture rate of around 12%. Riga, Bratislava and Tallinn stand out in the figure with capture rates above 39%. Each of these cities rely exclusively on one single system for collection of plastics; Riga has established a door-to-door separate collection system while Bratislava and Tallinn rely on bring systems. From the cities that follow, Prague also relies only on bring sites, while Dublin collects all plastic through a co-mingled door-to-door system.

It is important to underline here, that nine cities (Budapest, Brussels, Lisbon Ljubljana, City of Luxembourg, Madrid, Nicosia, Rome and Valletta) **report total collected quantities for the co-mingled door-to-door system** without a breakdown into specific fractions. For all these cities, the co-mingled plastic quantity collected is ignored and for some cities (e.g. Nicosia), this has a profound effect in terms of underestimating the plastic capture rate.

Although plastic collection can be effective by the use of various systems, there is an indication that door-to-door separate collection can deliver high capture rates. **Therefore, it is safe to assume that door-to-door separately collection is the most effective system, especially if it is supported by bring or civic amenity sites.**

BOX 6-1: Separate collection of plastics in London

The London factsheet aggregates information from all 33 boroughs that constitute the greater London area. The collection of plastic waste from households in the 33 boroughs occurs either through door-to-door separate collection or door-to-door co-mingled collection. Data coverage is excellent, and this provides an excellent opportunity to compare the relative performance of separate and co-mingled collection. This focuses on plastic as it is the most common material collected in the co-mingled system.

The households connected to a **separate collection** scheme for plastic waste deliver approximately **35 kg/household** annually of recyclable plastic, while households connected to a **co-mingled** collection system, only deliver approximately **14 kg/household/year**. This seems to indicate that, in London at least, the advantage gained in collection levels by implementing separate collection for plastic, although it should be noted that this does not necessarily take into account the different demographics, population density and urban structure of the boroughs implementing each system.

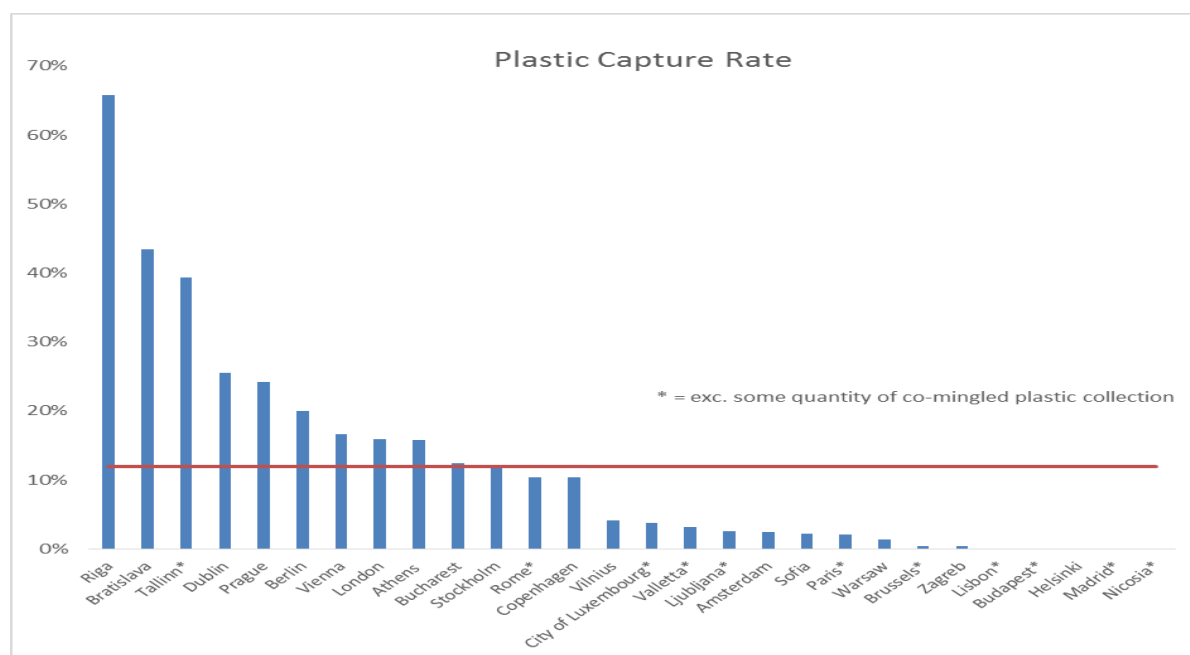


Figure 6-6: Capture rate for plastic across the 28 EU capital cities.

(The thick line represents the average.)

***Note:** No data for Madrid. It is important to underline here that seven cities (Budapest, Brussels, Ljubljana, City of Luxembourg, Nicosia, Rome and Valletta) Ljubljana and Brussels produce rates higher than 100% and excluded from the graph. These rates might be caused by differences in the national and city compositions (e.g. because of higher presence of businesses in cities), import of waste or reporting issues (e.g. from deposit-return systems)

Metal

Metal waste has the lowest generation on average in MSW from the five fractions examined here, according to an average EU composition estimated for the European Reference Model on Municipal Waste Management. This is part of the reason for the relative low yields for metal collection across the EU capital cities. Metals, like glass, give the highest yields when centralised collection systems (bring and civic amenity sites) are in place.

Only six out of 28 cities have implemented source separated door-to-door collection schemes for metals. On the other hand, door-to-door co-mingled collection of metals is common, presumably because metals are easier to extract from mixed waste (e.g. using magnets or eddy current separators). The easy extraction of metals from mixed waste might also explain the absence of separate collection schemes: cities that apply incineration or Mechanical Biological Treatment (MBT) on mixed waste can rely on these technologies to recover significant quantities of metals.

The recovery of metals from mixed waste (and the absence of focus on source separation schemes) could also explain the relatively low capture rates for metals, as Figure 6-7: shows. On average, the EU capitals manage to capture 16 % of the generated metal quantity. However, Helsinki appears to collect around 70 % of the generated metals. Although Helsinki is one of the few cities with door-to-door separate collection of metals, the majority of the amount comes from civic amenity sites (the city also offers bring sites). Five more cities (Prague, Vienna, Rome, Luxembourg and Stockholm) appear to collect more than 35 % of generated metal. It should be noted that for Rome and the City of

Luxembourg, the capture rates are underestimated as metals collected in co-mingled systems are excluded. Rome, Stockholm, Luxembourg and Prague rely only on bring or civic amenity sites for metals collection (Prague and Luxembourg collect only through civic sites), while Vienna also provide a door-to-door separate collection service (in total only six cities provide a door-to-door separate collection for metals; also Amsterdam, Copenhagen, London and Vilnius). However, in all cities with a door-to-door separate collection system in place for metals, the overwhelming majority of collected quantity comes from the bring or civic amenity sites.

Given that Vienna has no detailed data on the origin of collected metals, and given the inefficiency of co-mingled collection where applied. **It appears that centralised collection through bring systems or civic amenity sites is the most effective way to increase metal collection.**

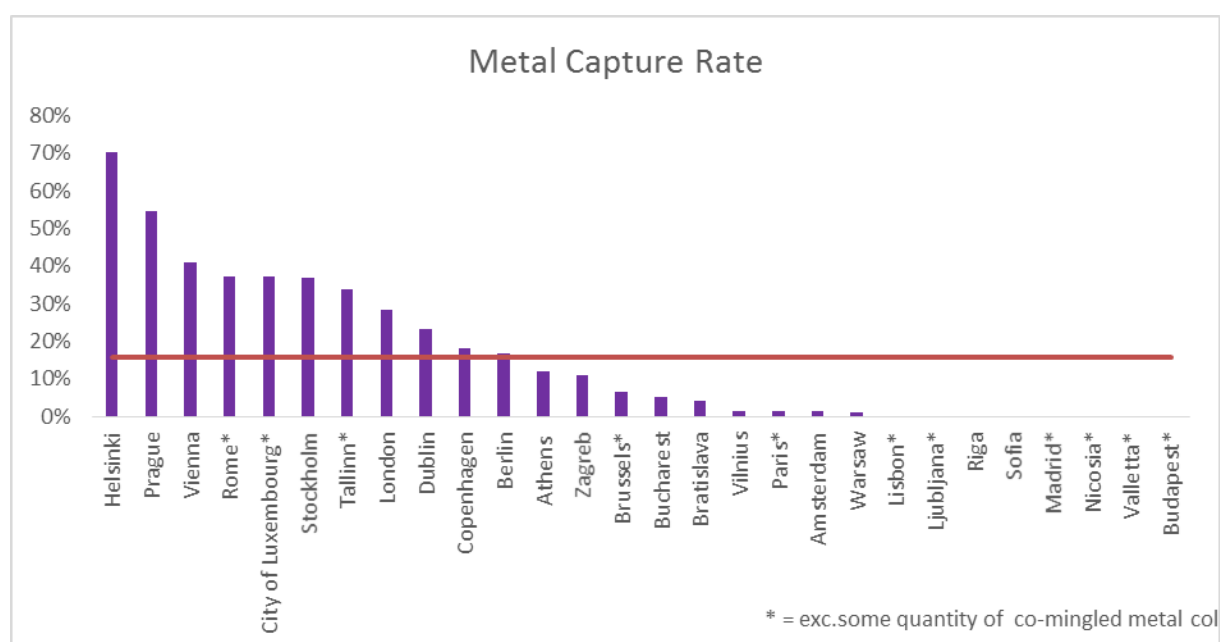


Figure 6-7: Capture rate for metal across the 28 EU capital cities*

***Note:** No data for Madrid, and Valletta. For Budapest, all metal is presented together with plastics. For Brussels, Ljubljana, City of Luxembourg, Nicosia and Rome, some metal quantities are included in the plastic data, so the figures presented here are underestimated.

Aggregated material through co-mingling collection

The fact that for many cities, it is impossible to disaggregate collected quantities for individual fractions collected through co-mingled collection systems, might cause a bias to the conclusions drawn in this report. Both the absolute collected amount (in kg/cap) and the capture rates discussions are influenced by the absence of fraction-specific data.

Since most co-mingled systems collect both plastic and metals (and to a much lesser extent also paper/cardboard or glass), a capture rate estimated on the basis of summing together these two materials would reveal information on the performance of those cities.

In Figure 6-8, the capture rate for the sum of plastic and metal fractions is shown. In 5 cities, the quantity for plastic and metals, also includes some cardboard, while for 2 cities, it also includes some

paper. The best performing cities include such cities where disaggregation of data is possible (e.g. Riga and Tallinn) and their systems have been analysed in the previous sections.

On the other hand, cities like Ljubljana, Madrid and Nicosia perform very well in collecting plastic and metal through co-mingled systems. Ljubljana for example collects 93 % of all collected plastic and metal through a co-mingled door-to-door system and a co-mingled bring system, with the separate collection of the fractions in civic amenity sites. Madrid relies exclusively on a co-mingled door-to-door and a bring systems for collection of these two materials, while Nicosia has only a co-mingled door-to-door system in place. All three cities co-mingle these materials with composite materials as well (mainly referring to drink cartons, tetrapak), but these extra cardboard quantity is small compared to plastic and metals within the co-mingled material.

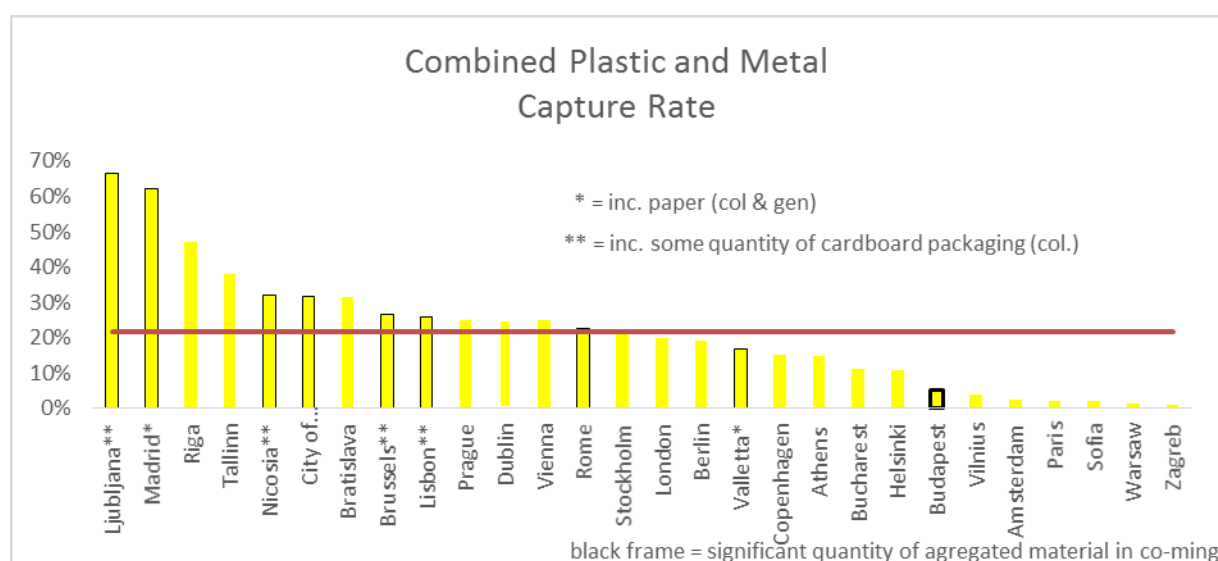


Figure 6-8: Combined capture rate for plastic and metal across the 28 EU capital cities.

Bio-waste

Of the five analysed fractions, bio-waste has the highest generation within MSW. Therefore, the separate collection of bio-waste is a prime candidate for significantly increasing total separately collected amounts. This is supported by the relatively high yields of collected bio-waste, especially considering that bio-waste collection does not share the long recycling history of more (monetarily) valuable materials such as paper and glass. Bio-waste yield is second only to paper on average across the EU capitals in terms of collected amounts: however, if co-mingled collection is excluded (since by definition it is impossible to implement for bio-waste), collected amounts for paper and bio-waste through the rest of collection system is similar.

Most of the EU capital cities (19 in total) rely on door-to-door separate collection for collecting bio-waste, supported in most cases by the civic amenity sites. However, two examples of bring systems implemented (Luxembourg and Rome; Vienna and Paris also have this system in place, but no data on yields is available for Vienna and the coverage for Paris is very low) show impressive results in terms of collected amounts.

Figure 6-9 shows the capture rates of bio-waste across the 28 EU capital cities. On average, the EU capitals manage to collect 16 % of generated bio-waste, but the average figure is heavily influenced by

the group of cities not currently targeting this material at all. Regarding individual city performances, Ljubljana stands out with a 73 % capture rate. The Slovenian capital relies on a door-to-door collection system, which delivers 95 % of collected quantities, supported by civic amenity sites that contribute to overall collection with minor amounts. The door-to-door collection scheme is differentiated in terms of collection frequency but is mainly a weekly collection system.

Behind Ljubljana, Dublin, Helsinki, Vienna, Tallinn and Rome manage to collect more than 30 % of the generated bio-waste. All these cities operate a door-to-door separate collection scheme with varying collection frequency, while in most, except for Helsinki, civic amenity sites also accept bio-waste. However, the breakdown of collected amounts show that the big majority of collected bio-waste amounts comes from **the door-to-door system, which is proven to be the most appropriate for increasing bio-waste separate collection**. Rome is an exception, as data show that the majority of collected quantities comes from bring and civic amenity sites.

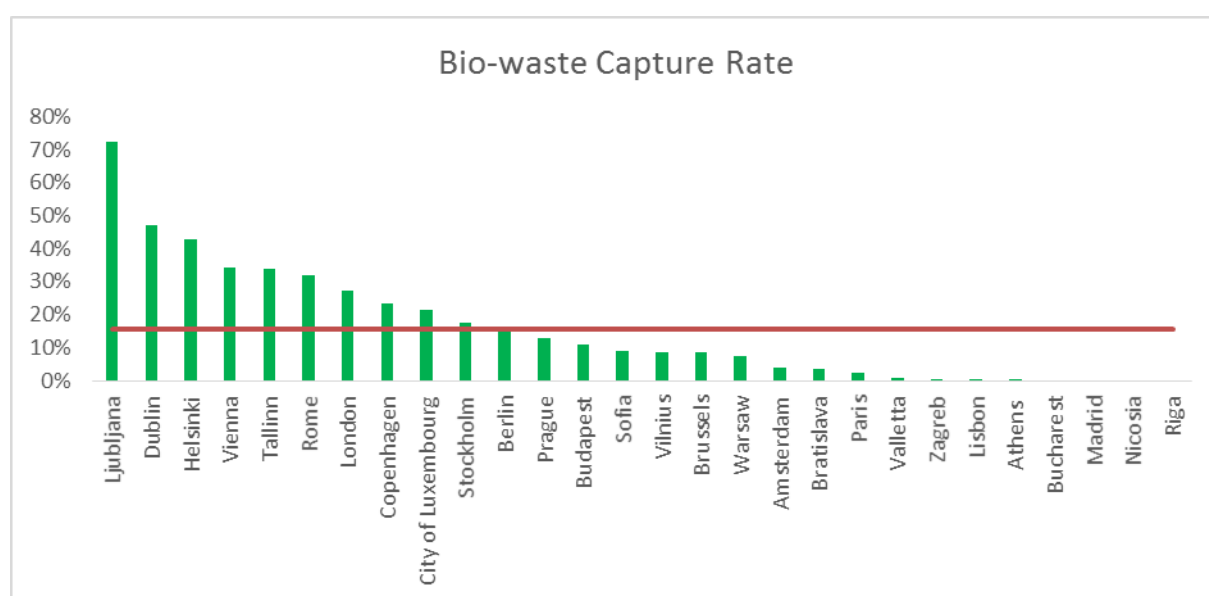


Figure 6-9: Capture rate for bio-waste across the 28 EU capital cities

6.6 Costs and fee system (PAYT) associated with collection schemes

An investigation of the costs associated with the four types of collection systems for separately collecting MSW fractions would help assess the efficiency of each system in terms of value added for each Euro spent. Unfortunately, data on setup and running costs for each system are very scarce across the 28 EU capital cities and thus the analysis performed in this chapter is fragmented.

From the limited data availability, however, it seems that the door-to-door separate collection is the most expensive system in terms of running costs, with all other systems being approximately at the same level. It also seems, though, that establishing a door-to-door separate collection system is cheaper than the bring points system. Overall, civic amenity sites bring the lowest costs, although the capture rates for the five analysed materials are rather small for this system. It should be reminded that civic amenity sites are primarily established for the collection of other materials, such as bulky waste, WEEE etc.

Door-to-door separate collection

Only four cities provide information on setup costs for this system, while eight cities have data on the running cost of this system. On average setup cost seems to be rather low, with about 3 €/cap spent on establishing a door-to-door system. The data is not detailed enough for estimating the differences in setup costs for targeting different numbers of fractions. Budapest has the highest investment out the four cities with data of about 11 €/cap, but this amount is supposed to cover the co-mingled system as well. However, the Hungarian capital only targets two fractions for door-to-door separately collected (these two fractions account for about 65 % of the total separate collection in the city).

Regarding running costs, 11 €/cap are spent annually on average in the eight cities with data. However, this average is shaped primarily by Helsinki which spends 49 €/cap, while all other cities spend less than 12 €/cap. Helsinki, however, targets paper, glass, metals and bio-waste with the door-to-door system, but this cannot solely explain the high costs, given that e.g. London and Copenhagen target five and four materials respectively as well.

Door-to-door co-mingled collection

Regarding setup costs for this system, only information from Budapest is available, but the Hungarian data refer to both co-mingled and separate collection of door-to-door systems. Therefore, no conclusions can be made for the setup costs of this system.

Four cities provide data on running costs of this system. On average cities spend 4 €/cap annually for this system, substantially cheaper than door-to-door separate collection (even without the Helsinki figures). Paris spends the highest annual amount, collecting three fractions co-mingled.

Bring points

The three cities with data on setup costs for bring points spent on average 5 €/cap in establishing the collection points. Presumably the setup costs are strongly related to the density of the bring sites, however, density data are only available for one of the cities, so no correlation can be made.

Regarding the running costs, six cities with data spend annually also 5 €/cap. Bratislava and Prague spend the most (12 and 10 €/cap respectively). However, although Prague has the highest bring points density in the EU, Bratislava's density is lower than the average across the EU capital cities. Therefore, again, no correlation can be made with the level of costs and sites' density.

Civic amenity sites

Setup costs for amenity sites are almost negligible (0.5 €/cap), if the information from the two cities with data availability is taken into account. The running costs of the sites are also relatively low at 4 €/cap. This average, though, is influenced greatly by Copenhagen with 17 €/cap spent annually, which could be partially explained by the density of the sites (Copenhagen has the second higher density for civic amenity sites, second only to Berlin). Again, however, the data do not allow for any correlation between the density of the sites and the running costs.

Cost to consumer and sources of funding

The cost to consumer data is also limited and present large differences among the cities, spanning from 51 (Vilnius) to 280 (Amsterdam) €/cap annually. On average from the available data, consumers pay around 145 €/cap/year for their separate collection. It should be noted that the data resolution does not allow in many cases to see if this cost refers to separate collection or to the cost of MSW management altogether.

Cities make use of various sources of funding for the separate collection, primarily waste fees from the citizens, but also producer responsibility schemes, sales of the collected materials or Pay-as-you-throw (PAYT) schemes. These sources of funding differentiate according to fraction collected: usually more valuable materials such as metal are cheaper to the consumer than others. Some cities (e.g. Ljubljana and Budapest), in order to incentivise separate collection use fees from the residual waste collection to fund separate collection activities: fees are set only on residual waste and providing the service of collection of recyclables without user charges.

In general, the collection is performed by publicly owned companies, but exceptions with privatised schemes exists (e.g. in Dublin, each household individually contracts waste collection).

Pay-As-You-Throw Schemes

In this section, considerations about funding of the various collection schemes are underlined with a particular focus on PAYT.

PAYT schemes are generally payment systems for waste collection in which households are charged according to the amount of waste they generate. In practice this is facilitated through an interplay of the three principal components [Reichenbach 2008]:

- a) Identification of the waste generator
- b) 'measurement' of the generated waste
- c) 'unit pricing' as the means to convert the individual contribution into a corresponding charge

„Such forms of direct unit pricing realised for the different types of generated waste works as a financial incentive to minimise overall waste production and divert an increased portion of recyclable materials away from the conventional routes for waste disposal. PAYT (...) implies that this strategy is first of all meant to **increase the economic pressure** especially on the part of those households whose waste generation and disposal behaviour **generate the largest impact to society and the environment**. The firsts and foremost observed effect following the adoption of PAYT is an increase of recycling activity, ideally coupled with efforts to achieve a reduction in overall waste generation.” [Reichenbach 2008, p.2809]

A study from the European Commission has been conducted in 2012, including the assessment of PAYT schemes at European level [EC 2012, pp. 86f]. This study comes to the result that 17 Member States have established one or more PAYT schemes for municipal waste, however emphasising that such schemes are varying within a Member State because implementation takes place at municipal level.

Some of the PAYT schemes include a **combination of flat rate fees or taxes** (e.g. certain annual amount) **and a variable element**, which may be linked to container sizes (volume-based schemes), number of sacks (sack-based scheme), frequency of collection (frequency-based scheme) or the weight

collected (weight-based scheme) or a combination of these elements. PAYT is usually applied to **mixed residual waste**, however it can also include bio- and garden waste or paper waste (as for a large amount of graphic paper). [EC 2012, pp. 86f]

However, the intention of such a system is that the separate collection of recyclable materials such as bio-waste, paper, glass, and metal is stipulated and is (partly or completely) cross-financed by a higher charge for residual waste. Usually, the collection of source separated dry recyclables in a PAYT scheme is free of charge for the consumer, and this collection is cross-financed by funds collected through the PAYT on residual waste.

Member States not implementing PAYT schemes fund the waste management by **flat rate charges** or **municipal taxes** rather than variable charging schemes.

Table 6-5 summarises the type of funding used in the 28 capitals. PAYT schemes mainly refer to charges on residual waste (and in some cases separately collected door-to-door schemes for bio-waste) that are used to fund the separate collection of recyclables.

Table 6-5: Fixed or PAYT funding schemes for the collection schemes implemented by the 28 EU capital cities

	PAYT*	Fixed fee + PAYT**	Flat rate	N/A
	Berlin, Budapest, Dublin, Helsinki, Ljubljana, Tallinn, Vienna	Copenhagen, Stockholm, Warsaw	Amsterdam, Brussels, Lisbon, London, Luxembourg, Paris, Vilnius	Athens, Bratislava, Bucharest, Madrid, Nicosia, Prague, Riga, Rome, Sofia, Valetta, Zagreb
Average collection rate (separate collected/generated MSW quantities)	35 %	17 %	17 %	10 %

*Note: PAYT system where costs for residual waste collection cross-finances the separate collection of dry recyclables and/or bio-waste (e.g. residual waste bin is more expensive than bio-waste bin). In addition the costs for households residual waste collection depend on bin size and/or collection frequency.

**Fixed fee may stand for fixed price per household or bin combined with additional costs considering bin size and/or collection frequency.

Out of the 17 cities where information on the type of charges for waste management is available, **seven cities apply a form of PAYT scheme** with three additional cities applying a combination of a fixed fee and PAYT. The remaining seven capitals apply flat rates as a waste fee. Although variations in the effectiveness of the PAYT schemes exist among the cities that apply it, on average cities with PAYT perform much better than the cities with a flat rate, according to Table 6-5.

The fee system in **Berlin** consists of a basic waste collection fee (since 2015, tariff per utilisation unit and quarter) of 6.15€ and variable tariffs for residual waste, bio-waste and paper and cardboard waste collected on door-to-door basis.

Costs for residual waste bins are between 55€ (60 litre bin) to 261€ (1,100 litre bin) to be paid quarterly if collected once per week. For bio-waste the costs per bin are between 25 (60 litre bin) and 78€ (1,100 litre bin); this is half up to three times cheaper compared to residual bin. Additional fee is taken for garden waste (4 € per sack).

All recyclables are collected free of charge (as required by Germany law under the Packaging ordinance). However for paper and cardboard (containing to a large amount non-packaging paper as newspaper, graphic paper, journals etc.) a small fee is charged (e.g. 2 to 2.70 € (240 litre bin, per month).

In addition, the running costs of the civic amenity sites are cross-financed by the charging system. The annual average costs per capita is 72.9€. The separate collection rate for Berlin is 27 %

Budapest also operates a form of PAYT scheme for residual waste. Citizens can choose one out of five different bin sizes and their collection frequency and charged accordingly. The guiding principle is that citizens are charged according to the quantity (or volume) of waste they produce, making the Budapest charging system a PAYT scheme.

In **Copenhagen**, the collection of residual waste is funded through a fixed fee per household combined with a PAYT element. The fee is estimated according to the container volume registered at the property. For collection of recyclables, there is a fixed fee annually, differentiated for each of the collected fractions:

- Paper: 12.4€/year per household
- Cardboard: 10.7€/year per household
- Glass: 7.9€/year per household
- Plastic: 3.2€/year per household
- Metal: 3.2€/year per household
- Garden waste: 13.8€/year per household

The funding of bring and civic amenity sites is done through the municipality's waste budget.

Domestic waste collection in **Dublin** follows the pay as you throw principle, operating on a competitive commercial basis. Typically, residents pay per bin lift and/or per kg of residual waste (sometimes also per kg of garden waste) and/or an annual service fee. Due to the multiple options from a pool of commercial systems, in Dublin citizens might belong to a pure PAYT scheme or to a combined system where a flat fee is supplemented with a PAYT varying element. The EPR scheme for packaging also subsidises the collection of packaging waste.

For **Helsinki**, the door-to-door collection costs are covered by a waste fee, which is calculated on the basis of container size and emptying frequency, which is essentially a PAYT scheme. Paper & cardboard is an exception from the rest of the recyclables as its collection costs are covered by a producer responsibility scheme.

Ljubljana has a PAYT scheme in place for bio-waste, as its collection is charged according to bin size and emptying frequency. On the other hand, the city has applied the more common PAYT scheme for residual waste, so that the costs of collecting source-separated paper/cardboard and collecting co-mingled recyclables in a door-to-door system, are covered by the residual waste fees.

In **Stockholm**, the citizens pay a waste fee for the management of their waste. This fee is constructed so that it promotes the waste hierarchy, so it should for instance be cheaper to source separate waste compared to put it in the residual waste bin. The fee comprises various elements pertaining the waste weight or volume, towing distance and collection frequency. Thus, in Stockholm, the waste charging system is a combination of a PAYT scheme and a flat rate.

In **Tallinn**, residual waste and bio-waste charges for consumers are approximately 2 to 10 € per container emptying, charges for bulky waste collection approximately 7-18 € per m³; depending on the type of waste, size of container, collection frequency, collection area and service provider.

In **Vienna**, the financing of the collection and treatment of all municipal waste is based on the residual waste fraction in order to create an incentive for separate waste collection. Thus, property owners are charged a quarterly waste management fee calculated from the volume of the residual waste containers installed on their properties and the frequency of bin emptying. This residual waste management fee finances the collection and treatment (e.g. including operation of civic amenity sites etc.) of all municipal waste in Vienna with the exception of packaging material (and used electrical appliances, batteries). The more material is collected separately, the smaller the container volume that needs to be installed, and the lower the cost. In 2014, the annual waste management fee for a standard single family house (average waste arising) on average was 229.32€.

In **Warsaw**, citizens are charged a flat rate fee per flat and per household (depending on people per household), but the source of funding for waste collection also includes a PAYT element.

If a correlation is performed between the type of charge applied and the collection rate, defined as ratio of collected amounts through separate collection and MSW generation, the cities applying PAYT perform on average much better than the rest. The least performing cities base their funding on flat rates.

6.7 Barriers for further increasing separate collection

Separately collecting specific fractions from municipal waste requires not only the implementation of an appropriate collection system but also the active participation of citizens to separate their waste. The level of citizen engagement has a direct impact on the efficiency of a collection system.

One aspect where citizen engagement has an enormous impact is the level of impurities included in the separately collected fraction. Properly informing citizens about the type and kind of waste that should be placed in separate bins is vital for reducing impurities and obtaining a high quality recyclable material. Unfortunately, it has not been possible to gain access to data on contamination rates for the separately collected materials or for the individual collection systems. However, it is generally accepted that deposit-return systems deliver the purest material fractions, followed by the door-to-

door separate collection system together with the bring sites. The co-mingled collection is in general associated with higher levels of impurities.

Although a door-to-door separate collection scheme is proven the most efficient for some of the fractions considered here, it is also associated with high costs, which could be proven a barrier for its establishment. In that perspective, a relatively adequate alternative seems to be a well-planned, dense network of bring sites, which might increase separate collected amounts considerably.

Individual materials also suffer from specific barriers to separate collection. For example, climate conditions influence greatly the collection frequency of bio-waste. Many cities examined offer a higher collection frequency in the warmer periods of the year, while differences are observed among southern cities with Mediterranean climate conditions and northern cities. These differences have an impact on both the quality of collected material (when warm, collected bio-waste might have started to degrade) and the cost of the system (increased collection frequency is more costly).

In addition, the different systems applied are difficult to compare with each other. The cities investigated here present great differences in terms of population, urban architecture and density, climate conditions, costs (affected by e.g. salaries), funding mechanisms etc. Therefore, a system that is successful in one location cannot necessarily be easily transferred to another location without first identifying and examining and accounting for the differences in the structure of the cities.

The ownership and management responsibility for the collection system(s) applied in a city determines to a great extent the limits for public authorities intervention. Partially or fully privatised systems need different incentives for improvement than systems run exclusively by public authorities. Another management aspect is related to the type of waste covered by a collection system. Bring points and civic amenity sites might be used for waste other than of household or even municipal origin. This fact makes it difficult for authorities to monitor the efficiency of systems and of policy initiatives.

As the amount of waste material collected for recycling in most cities is significantly lower than that amounts generated (see Figure 6-4 to Figure 6-9), there is still room for increasing collection rates even in the most successful cities.

6.8 Short summary of EU-28 capital performance

To sum up the assessment of the separate collection systems applied in the EU capital cities, the following table includes a short summary for each capital cities.

All further information about the waste management systems applied in the capitals are included in the capital factsheets provided as separate documents. A list of documents accompanying this report is included in Annex II/10.1 10.2.

Table 6-6: Summary of status-quo of separate collection in 28 EU-Capitals

Capital city	Summary
	Amsterdam has no separate door-to-door collection system established except for bio-waste in one district. The main separate collection scheme are bring points. Paper/cardboard, glass and plastic packaging are collected in this way while metal is only collected at civic amenities. The separate collection rate on total municipal waste generation in Amsterdam is 14% which is very low and well below average of the performance in the country. All waste management services are covered by municipal service tax that has to be paid by every household.
Athens	Athens separate collection system uses the co-mingled door to door collection scheme for all dry recyclables and the bring point scheme for paper and glass. In addition there is a bio-waste pilot project in place. Waste collection is financed by the municipal service tax but the cost to consumers is not available. The effectiveness of the separate collection system cannot be evaluated due to missing data.
Berlin	Berlin has almost 100% coverage of separate door to door collection for the source separated collection of paper, glass and bio-waste as well as for the co-mingled collection of the recycling bin (of metal and/or plastics, or composite materials). A PAYT scheme is in place. Output data of recycling shows the good effectiveness of the system paper and glass rates are 90% and plastic, metal and composite material is 41% with some improvement possibilities.
Bratislava	In Bratislava separate collection takes place solely by bring systems including paper/cardboard, glass, and plastic. Metal bio-waste is collected at civic amenities. The separate collection rate on total municipal waste generation is not very high (21%). In total, 16% of the municipal waste generated is recycled.
Brussels	Brussels has full coverage of collection for businesses and households with differentiated separate collection schemes, including the co-mingled collection of plastic, metal and composite material in one bin. The separate collection system is effective because low amounts of paper, glass and metal in residual waste. However, there is potential to increase the collection rate of plastic and bio-waste.
Bucharest	No door-to-door systems in place, the city relies exclusively on bring points. No collection of bio-waste, only dry recyclables are targeted. The capture rates of all dry recyclables are low. Improvements needed, as the performance of the bring points' system is limited. Fee system is poorly established, in one District of Bucharest the waste fee was disestablished with the last election. Data about waste management is hardly available.
Budapest	Budapest has changed its collection system from bring sites to door-to-door collection covering 100% of households in 2014. Paper is collected separately in all households, while metal and plastic is co-mingled for central sorting. Green waste from gardens is collected separately on demand, using pay per bag system. However, bring sites for glass was kept as main collection route. The residual waste is collected under a PAYT scheme, as such separate collection of the dry recyclables is free of charge. While the capture rate for glass is rather high, the results for other recyclables are relatively low.
Copenhagen	The city of Copenhagen relies on door-to-door separate collection for all of the five fractions, except for bio-waste, where only garden waste is collected. The door-to-door system is complemented by bring (glass only) and civic amenity sites (all dry recyclables and garden waste). No co-mingled system is in place in Copenhagen. The city is performing particularly well in glass collection, while further improvements are needed for plastics and metals, as much of these fractions end up in mixed waste.
Dublin	As of 2012, separate collection of household waste in Dublin is fully privatised. This means that individual households are free to choose a waste collection company or otherwise dispose of their waste legally. Dry recyclables are placed in a separate bin and collected free of charge. Just over half of the five fractions separately collected in Dublin are collected through the co-mingled door-to-door system for dry recyclables (most of which is paper). Bio-waste (food waste and garden waste) is also separately collected door-to-door in significant quantities. Glass is mostly collected at bring points. Dublin performs well in most of the indicators of separate collection in this report, but it should be noted that the quality of the material collection, and thus the extent to which it is recycled or incinerated, is difficult to ascertain. Contamination of the co-mingled dry recyclables has been an issue in the past in Dublin. Although steps have been taken to alleviate this problem, the outcomes are still unknown. Waste fees are relatively high.

Capital city	Summary
Helsinki	In Helsinki a door-to-door separate collection system covers all fractions, except plastics. Plastic is not targeted for recycling at all, but is instead incinerated together with other mixed waste. The door-to-door system is accompanied with bring systems (except for bio-waste) and civic amenity sites. No co-mingled system is in place in Helsinki. The city is among the top three best performers with respect to capture rate for metals, paper/cardboard and bio-waste. Further improvement is possible by increasing the effectiveness of glass collection and introducing separate collection for plastic wastes.
Lisbon	Lisbon is covered partly by a co-mingled door-to-door system for packaging and partly with a door-to-door system targeting paper and cardboard. The door-to-door systems are complemented by bring points. Bio-waste is only collected from some businesses and public gardens. Significant improvement is possible for all fractions, except for glass which achieves already relatively high efficiency.
Ljubljana	From 2011 on Ljubljana has invested in the modernisation of the waste management infrastructure leading to the separate collection rate of 60% on total municipal waste generation and a coverage of almost 100%. The separate collection system is effective for paper and glass, however improvement in the collection of plastic and metal could be achieved. Plastic and metal is collected door-to-door collection co-mingled whereas paper is collected in a separate bin. The capital uses a PAYT charge that is included in residual waste collection fees as source of funding.
London	London has a wide variety of separate collection systems in place. London's municipalities generally rely on door-to-door co-mingled collection of dry recyclables (paper/cardboard, glass, plastic and metal). Some municipalities separately collect some of these fractions (particularly paper, with 26% household coverage), while some also separately collect bio-waste. Paper and bio-waste are collected in considerably larger, although approximately 75% of the door-to-door collected paper is co-mingled with other (dry) waste fractions. Quality of the co-mingled dry fractions varies significantly, and the final destination of waste is not easily discernible. The bring point system delivers far lower output; it does not play a significant role as regards collected amounts.
City of Luxembourg	In the capital of Luxembourg paper, glass and bio-waste are collected in door-to-door separate system. Plastic, metal and composite material is co-mingled collected door-to-door. The system is accompanied by bring-systems. The total amounts for recycling and composting of municipal waste was 37.7 % of total generation in 2012, more information on recycling and losses is not available. Households have to pay for the separate door-to-door collection of paper, glass and bio-waste whereas the co-mingled collection is free of charge (covered by EPR scheme).
Madrid	In Madrid only household waste is collected separately by the co-mingled door-to-door collection of packaging waste (excluding commercial like household waste). The other waste streams paper/cardboard and glass are mainly collected by bring points. There is no separate collection of bio-waste which should be introduced. 11.6 % of total municipal waste generation was collected separately in 2014.
Nicosia	The separate collection system in Nicosia is based on different collection schemes including separate door-to-door collection of paper and the co-mingled door-to-door collection of plastic, metal, drink cartons in one bin. The effectiveness of the separate collection system cannot be evaluated due to missing data.
Paris	The separate collection system in Paris is based on different schemes that are shared between municipal services and private contractors. In terms of collection coverage 65 % of households with door-to-door separate collection of glass and 100 % of households with door-to-door co-mingled collection of plastic, metal and paper/cardboard. The separate collection system is effective, the glass recycling rate is almost 100% and the recycling rate of the dry recyclables is 71%. However, waste generation rates indicate that there are still large amounts of recyclables in residual waste, i.e. plastic and paper. Costs for separate collection are co-mingled bin 311€/t, glass collection (bring point) 186 €/t and glass collection (door-to-door) 156 €/t.
Prague	Prague separate collection system is solely based on bring systems including bring points for the collection of paper, glass, plastic and civic amenities for same waste streams and additionally metals and bio-waste. Both bring schemes are free of costs for the inhabitants and are financed by the waste budget. Recycling rates are high however, the collection rates should be raised, 28.5% of municipal waste generation are separately collected.

Capital city	Summary
Riga	For Riga information is rather scarce as there are no unified statistics available. The city operates a combination of door-to-door collection (separate bins for paper, glass, plastics), bring points and civic amenities for all waste fractions (metal, plastics, glass, paper). There is no separate collection system in place for bio-waste, there is a need to further develop the system and engage citizens.
Rome	The city of Rome is currently changing the collection system, the new systems introduced (but not yet with full coverage) includes a door-to-door separate collection systems for all fractions and a bring points' system for paper, glass and metals/plastics. The old system, still in place for a part of the city relied on co-mingling door-to-door collection (Plastic/ metal or plastic/metal/glass). Rome has achieved relatively high capture rates for metals and bio-waste. For the remaining materials, improvement is possible, pending the full establishment of the newly introduced separate collection systems.
Sofia	The separate collection system in Sofia depends mostly on bring point collection of all fractions except bio-waste for which a pilot project is ongoing. Co-mingled door-to-door collection of the dry recyclables plastic, glass and metal waste is in place. The effectiveness of the separate collection system cannot be evaluated due to missing data.
Stockholm	In Stockholm the municipality is responsible for the separate collection of bio-waste, while the dry fractions are covered by producer responsibility schemes. The city has no door-to-door collection systems in place, except for bio-waste (12% coverage for households and 36% for businesses). Bring systems cover collection of all dry recyclables, complemented by civic amenity sites for all fractions. Overall the efficiency of the separate collection systems in Stockholm is satisfactory, with glass collection being very efficient. Further improvement is possible by focusing on plastic and paper/cardboard (and to a lesser extent on metals and bio-waste).
Tallinn	In Tallinn, there are a number of waste management models for separate collection of waste operating in Tallinn run by the municipality and private actors. Tallinn collects around 53% of the municipal waste separately, accounting for separately collected municipal and packaging waste. Almost 100% of households are covered with door-to-door separate collection of paper and bio-waste and a co-mingled door-to-door collection of mixed packaging materials.
Valletta	Valletta currently relies on door-to-door co-mingled collection of dry recyclables (paper, plastic and metal). Collecting well over half of the total amount of separately collected material in this way. Separate door-to-door for glass has recently been introduced, while a network of bring sites also receive all dry fractions (paper, glass, plastic and metal). Door-to-door collection takes place under the auspices of the state-owned WasteServ Malta Ltd. Actual collection of the dry recyclables is managed and conducted by one of two EPR fulfilment schemes - GreenPak or Green MT. Household waste collection – both residual and recyclables – is free at the point of delivery. The costs come out of the central government budget and supplemented by the fees payable by producers under the packaging EPR schemes.
Vienna	Vienna has full coverage with differentiated separate collection schemes, no co-mingled collection of waste streams is in place. The separate collection system is effective however, there is considerable potential to increase the collection rate especially for plastic.
Vilnius	In Vilnius 20% of households are covered by door-to-door separate collection for paper, cardboard, glass and plastics (separately), the rest of the households must deliver those fractions to bring points and civic amenity sites. Also bio-waste (garden waste) can be delivered at civic amenity sites. In addition, a deposit and return system is in place for all kind of packaging products, primarily drink containers. Altogether, the capture rates of all dry recyclables are low.
Warsaw	Warsaw has introduced a new waste collection system in August 2014 that includes the source separated collection of glass and bio-waste as well as the co-mingled collection of plastic, metal, paper and cardboard within door-to door collection schemes. In 2014 19.92 % of the total waste collected in Warsaw was covered by a separate collection scheme. The financing system applied is a fixed fee with PAYT elements where the annual cost to consumers are higher if separate collection is not applied.
Zagreb	In Zagreb separate collection takes place mainly by bring systems including paper, glass, plastic packaging and metals at bring points. Only bio-waste is collected by a pilot separate door-to-door collection system in selected neighbourhoods. The separate collection rate on total municipal waste generation is very low (9.6%). The effectiveness of the separate collection system cannot be evaluated due to missing data.

7 Good practice from capitals (case studies)

7.1 Scoreboard and selection on case studies

Applying the indicators as described in chapter 3.4 and including all data as discussed intensively in chapter 6, a final **headline scoreboard** has been created including the results of the 13 indicators. The final scoreboard including all results per indicator is presented in Table 7-1 below. The overview of all indicators allowed the identification of the overall best performing capitals, meaning the capitals that were among the top three performers for several indicators.

The capitals that showed the best performance for at least three indicators are:

The cities that showed the best performance for at least three indicators are:

- **Ljubljana** is among top three performers **ten** times;
- **Helsinki** is among top three performers **seven** times;
- **Tallinn** is among top three performers **four** times;
- **Dublin** is among top three performers **four** times;
- **Vienna** is among top three performers **four** times.

Further, these cities have the **highest waste capture rates** for the combined five fractions measured as waste collected separately (in systems outside the residual waste bin) including all types of separate collection (door-to-door, bring-points and civic amenity sites). Please refer to Table 3-4 presented earlier for details on how the capture rates are calculated.

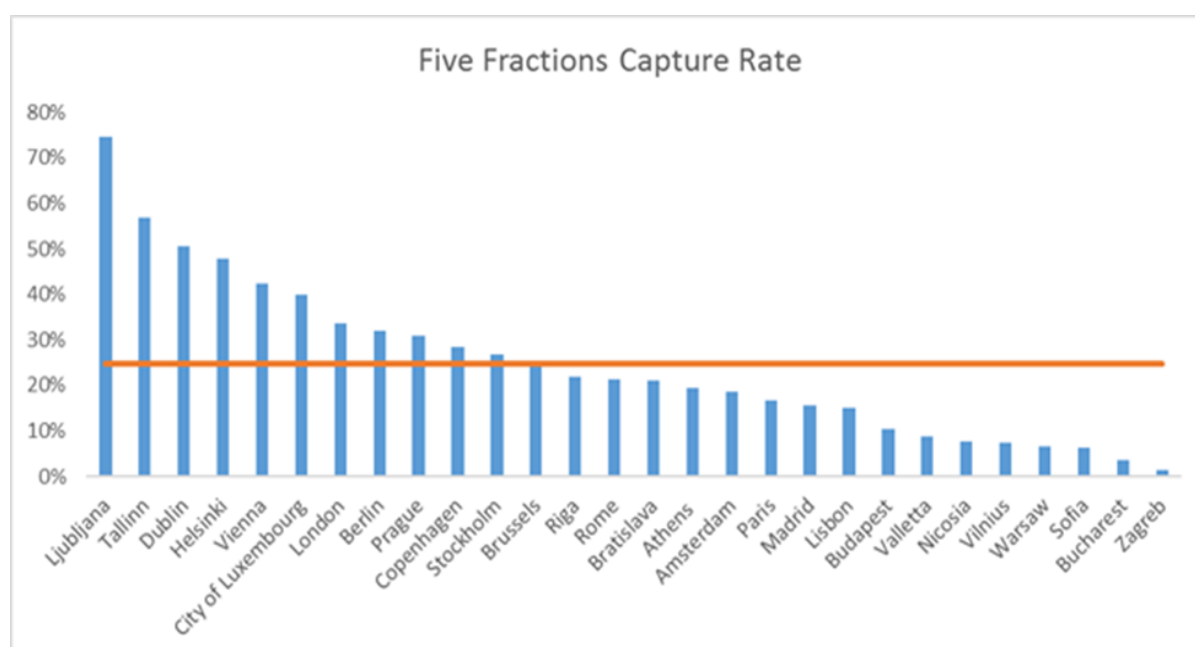


Figure 7-1: Capture rate for sum of paper, metal, glass, plastic, bio-waste for EU-28 capitals

Even if the waste collection systems are very different in the selected case studies (strict separate collection/co-mingling approaches) and development over time (cities with long and constant improvements of capture rates/separate collection versus cities with rapid improvements during the last 5-10 years, i.e. Ljubljana and Tallinn) it appears the following applies for all five cities:

1. All cities apply a PAYT system, charging more for residual waste and cross-financing the collection of other separate collected fractions.
2. Cities where the municipality and the producer responsibility schemes or free market mechanisms for recyclables are combined smartly and in a harmonized way, can achieve high collection rates.
3. It is suggested that the fee system combined with the municipal regulations which set the minimum standard for collection are the primary success factor for the collection of bio-waste.
4. If implementing a separate collection system it is recommended to start with paper, then cardboard, glass and metal. The most challenging fraction to collect separately is considered to be bio waste.
5. The communication to households should be very clear about what can and what cannot be placed in each bin. Interest should be cultivated in the general population about how waste is managed.
6. The co-mingled approach can work well, but the collected material can be sorted to produce clean fractions only if there is very little unwanted contamination. Reducing contamination in the co-mingled bin is the largest challenge.

Table 7-1: Headline scoreboard including results for 28 EU-Capitals

3 Best performers																			
	Indicators																		
	MSW generation kg/cap.	% of residual waste on total MSW	% of separate collection (all systems)	% of separate collection (only d2d)	Glass capture rate**	Paper capture rate**	Plastic capture rate**	Metal capture rate**	Plastic, metal and aggregated comingled capture rate**	Co-mingled collection y/n (fractions)	Bio-waste capture rate**	No. of glass bring points per 100 000 inhabitants	add Fract.	Bio-waste collection kg/cap	Paper collection kg/cap	PAYT system established (y/n)	NATIONAL MSW reuse and recycling rate in % (EUROSTAT)		
City (Country)																			
Amsterdam	405,7	86,0%	12,4%	0,2%	58,4%	34,5%	2,5%	1,4%	2,2%	all fractions separately collected	4,0%	375	*	4,7	24,7	n	49,55		
Athens**	467,5	83,9%	16,1%	14,4%	39,4%	57,6%	15,8%	12,1%	14,9%	Plastic, Metal,Glass, Paper	0,2%	102	*	0,3	53,8	n	17,1		
Berlin	394,7	64,6%	27,4%	23,9%	53,9%	65,6%	20,0%	16,9%	19,1%	Plastic, Metal, Composite material	15,7%	177		21,7	50,3	y	64,5		
Bratislava	338,3	78,7%	14,2%	0,0%	58,0%	42,8%	43,4%	4,3%	31,4%	Plastic, Glass, Paper	3,4%	265	*	4,3	18,5	n	12,96		
Bucharest**	391,3	97,0%	2,9%	0,0%	10,7%	11,3%	12,4%	5,3%	11,0%	not available	0,0%	41	*	0,0	4,4	n	2,58		
Budapest **	424,2	93,7%	7,6%	5,9%	74,6%	13,3%	0,0%	0,0%	5,3%	Plastic, Metal	10,7%	24	*	12,4	11,2	y	25,37		
Brussels	406,7	74,9%	20,9%	15,8%	84,1%	34,5%	0,0%	0,0%	26,7%	Plastic, Metal, Composite material	8,4%	49		13,4	36,6	n	57,2		
Copenhagen**	398,0	67,4%	23,7%	11,4%	107,2%	35,7%	10,3%	18,0%	15,2%	all fractions separately collected	23,3%	405		37,2	32,1	y	45,21		
Dublin	270,8	59,0%	36,6%	29,1%	78,8%	60,8%	25,5%	23,2%	25,0%	Plastic, Metal, Paper (glass to limited extent)	47,1%	17	*	29,0	41,2	y	36,63		
Helsinki **	285,0	54,7%	38,6%	34,0%	25,7%	73,2%	0,0%	70,2%	10,8%	all fractions separately collected	42,7%	12	*	42,6	60,5	y	33,4		
Lisbon**	570,1	78,2%	11,5%	5,8%	59,8%	38,0%			25,9%	all fractions separately collected	0,2%	231	*	0,5	29,1	n	26,05		
Ljubljana	318,2	40,0%	55,4%	47,2%	87,5%	84,2%			66,7%	Plastic, Metal	72,5%	850	*	76,5	41,0	y	39,5		
London**	435,7	69,2%	25,4%	22,5%	57,1%	44,5%	15,9%	28,4%	19,7%	Plastic, Metal,Glass, Paper	27,3%	20	*	38,0	44,0	n	45,55		
Luxembourg**	666,0	56,4%	28,4%	11,1%	81,2%	60,9%			31,5%	Plastic, Metal, Composite material	21,6%	57	*	51,6	74,7	n	46,83		
Madrid**	328,8	87,9%	11,6%	5,2%	39,0%	12,8%			62,0%	not available	0,0%	163	*	0,0	10,0		27,21		
Nicosia**	656,2	93,9%	6,1%	4,9%	19,9%	11,3%			31,9%	Plastic, Metal, Composite material	0,0%	209		0,0	19,4	n	21,12		
Paris	489,4	80,6%	11,6%	10,3%	58,8%	17,7%	2,1%	2,5%	2,2%	Plastic, Metal, Composite material, Paper	2,3%	42	*	1,6	24,0	n	38,76		
Prague**	322,5	71,3%	14,3%	0,0%	36,1%	43,2%	24,2%	54,5%	25,1%	all fractions separately collected	12,9%	265	*	3,6	19,1	n	23,05		
Riga**	485,5	82,0%	18,3%	18,3%	10,6%	66,5%			47,0%	all fractions separately collected	0,0%	53	*	0,0	51,7	n	15,61		
Rome	612,9	70,9%	16,3%	6,5%	10,1%	14,0%			22,5%	Plastic/ metal ("light multi-material" fraction), plastic/metal/glass ("heavy multi-material" fraction)	32,0%	583	*	49,0	24,0	n	38,19		
Sofia**	348,3	93,8%	4,0%	0,0%	4,7%	4,1%	2,2%	0,0%	2,1%	Plastic, Metal,Glass	8,8%	13	*	10,5	1,5	n	25,22		
Stockholm**	504,4	70,7%	21,5%	3,1%	130,8%	22,8%	11,7%	36,6%	21,7%	all fractions separately collected	17,5%	29	*	28,5	34,9	y	47,62		
Tallinn	481,2	46,6%	47,2%	12,8%	85,3%	74,2%			37,9%	all fractions separately collected	33,8%	65	*	35,8	103,6	y	31,79		
Valletta **	591,3	84,0%	7,9%	5,0%	18,5%	3,6%			16,6%	Plastic, Metal, Paper	0,8%	201	*	2,5	3,9	n	12,22		
Vienna	556,7	64,8%	29,2%	0,0%	51,6%	58,9%	16,6%	41,0%	24,8%	all fractions separately collected	34,1%	165	*	60,6	73,0	y	59,2		
Vilnius	539,4	89,0%	5,5%	0,3%	10,9%	6,8%	4,1%	1,6%	3,8%	all fractions separately collected	8,7%	194	*	15,5	6,4	n	19,83		
Warsaw	370,3	80,1%	4,5%	4,5%	14,3%	3,6%	1,4%	1,1%	1,4%	Plastic, Metal, Paper	7,5%	0		8,9	1,7	y	19,43		
Zagreb	449,1	90,3%	1,0%	0,0%	6,3%	1,6%	0,2%	11,0%	0,6%	Plastic, Metal	0,2%	180	*	0,3	2,2	n	14,58		
Average	446,7	75%	19%	10%	49%	36%	11%	17%	22%		15,6%	184		19,6	32,1		32,01		
**only national waste composition data available to calculate capture rates																			

**only national waste composition data available to calculate capture rates

7.2 Case study for Ljubljana (SI)

Key features/elements of the system currently in place

The waste collection system in Ljubljana and nine surrounding municipalities is managed by **the publicly held (100%) company Snaga** (Snaga d.o.o.; www.snaga.si). The separate collection in place in Ljubljana includes:

- **door-to-door collection in separate bins** for: paper and cardboard, glass, co-mingled collection of packaging waste²⁶ (99% of households) and bio-waste (82% of households)
- **bring points** (eco islands) for: paper, glass and packaging waste intended for all users who wish to deposit separately collected waste, not only those living in the vicinity
- **bring-in civic amenity sites** (collection centres) for: paper, glass, packaging, hazardous waste, WEEE, bulky waste, scrap metals, textiles
- underground collection points replacing bins (from households and from eco islands)
- mobile collection points for household and commercial sector for: household hazardous waste, WEEE, waste batteries, edible oils

According to 2014 data, Ljubljana achieved **total of 60% (190kg/cap)** of **separately collected waste** out of totally generated municipal waste (320kg/cap) [SI Ljubljana 2015]. By fraction the percentage breakdown of total collection for separate collection in 2014 was as follows:

- 29.4 % paper, glass, packaging
 - 42 % packaging
 - 40.9 % paper
 - 17.1 % glass
- 22.8 % bio-waste
- 47.8 % other (mixed municipal waste, hazardous waste, bulky waste)

A **key ingredient** for Ljubljana's successful results was the **introduction of door-to-door collection**, especially of **biodegradable waste** (kitchen and garden waste), which was the largest contribution to the sharp increase in recycling rates. As separate collection increased, the amount of residual waste constantly declined. The scheme, fully operated by Snaga's human resources, was backed up by Snaga's well managed communication strategy in cooperation with other relevant stakeholders

²⁶ Packaging includes: beverage bottles and food, bottle cleaners and detergents, beverage cans, AL-FE cans, composite packaging for milk, juice, etc., plastic bags and pots, cosmetic products plastic packaging, packaging for CDs and DVDs, plastic and aluminium foil, which are wrapped products, packaging Styrofoam from bins at households and at ecological collection sites (eco islands). [1]

(media, local NGOs, European Parliament Information Office) which achieved great results and managed to gain public support and engagement. [SI ZWE 2015]

Results: in the last two years, the share of still useful things that end up in waste bins is steadily decreasing and the awareness for responsible consumerism is raising (as demonstrate opinion polls and surveys). The result is also visible in Ljubljana's REUSE Centre where the statistics show that in mid- 2014, 75 items per day changed the owner and today the average number of items sold reach number 100. [SI Snaga 2015]

Snaga's partner in waste prevention and reuse story is the REUSE centre (a centre, furnished in used furniture, includes a small shop, storage room and a repair-room with a corner for visitors to learn some small sewing repairs) that encourage people not to throw away old and used things, but to give them a chance to be repaired and resold at a small price. REUSE centre bids reuse second-hand items, minimise the amount of waste and create green workplaces. [SI Snaga 2015]

A visit to the Re-Use Centre is also part of Ljubljana's educational programme, which finds fun, practical ways to present priority aspects of waste management to children and pupils. Here, young people can see the importance of creativity, innovation, social entrepreneurship, the creation of green jobs and the inclusion of vulnerable groups. [SI Snaga 2015]

In autumn of 2014, Snaga expanded the initiative on a national level. With the collaboration of Chamber of Local Public Economy started the initiative "Together for a better society " whose aim is to achieve a sustainable and more responsible society together with public companies including:

1. to reduce the amount of food waste
2. think critical about purchasing intentions
3. drink tap water instead of bottled one
4. buy more things from second-hand or borrow them ...

One of the most acclaimed action was a practical demonstration of the amount of food waste in fifteen Slovenian cities as part of the European Week for Waste Reduction, which showed how much food on annual average Slovenian discarded. The move has attracted a lot of attention among citizens (installations that simulate the amount of food waste were placed in front of municipal buildings in the core markets and other busy locations) and came out in media coverages – newspaper, informative programmes, daily news broadcast on national television, national, commercial and local radio stations, the most visited websites ... In addition, the campaign was presented at the official site of the European Week for Waste Reduction and competes for the prize European Week for Waste Reduction Awards.[SI Snaga 2015]

Snaga has also installed waste bins supporting the food-waste reduction campaign 'Raise your voice against food waste'. Waste bins installed in the city and various events in city districts have banners such as 'Just because we are on the streets, it doesn't mean we're hungry!', 'We are full of thrown-away food' and 'Raise your voice against food waste'. They warn against inappropriate attitudes towards food and call on us to change things. Visitors to the events receive a food storage container

with a small encouragement to take what they cannot eat at a restaurant with them, to save leftovers from lunch for the next time and to learn how to store food properly. [SI Snaga 2015]

Performance over time

Ljubljana has achieved significant results in a short time particularly due to the following decisions and commitments:

- Snaga's management decision to reduce the company's profit losses by improving waste collection system
- Snaga's waste collection system improvement project management decision to start with optimising the collection method and collection transportation routes
- City of Ljubljana including City Manager approval of the suggested approach
- City Council decision to introduce necessary local legislative framework amendments enabling the implementation of the approach. [SI Snaga 2015]

The collection system in Ljubljana developed as follows [SI ZWE 2015] :

1. The current waste management system in Ljubljana was developed when Slovenia became a member of the European Union in **2004**. At the time, the national municipal waste management plan included separate collection, regional mechanical biological treatment plants (MBT) plants, and two large-scale incineration plants. The city began with separate collection of paper, cardboard, glass, other packaging and the remaining mixed waste (residual waste) in road-side containers in **2002**.
2. In **2006** Snaga started to change the system and started collecting biodegradable waste (kitchen and garden waste) at the doorstep for all households.
3. Prior to actions in **2012** Snaga set benchmarks using the best practice examples from other capitals and formulated goals and targets which they wanted to reach.
4. They started in **2012** by removing the roadside containers for paper and packaging and started collecting them door-to-door, with the same system as it started collecting biodegradable waste six years before. They first pilot tested the model in **2011** in Brezovica - one of the smaller suburban municipalities. The main principle was to gradually reduce the volume of the mixed municipal waste bin and introduce/increase over time the packaging waste and waste paper bins collected (yellow and blue lid bins) followed also with the change in the cost charge system (cost reduction for households). The system was highly effective: within months packaging recycling increased more than three times while residuals fell by 29%. After this successful test, Snaga decided to implement the model in Ljubljana and all suburban municipalities.
5. Meanwhile plans for building incineration plans (as per national plan) were delayed and finally halted due to the strong opposition of local residents (Kidričevo, 2005) and lack of demand due to increased separate collection Snaga was sharply increasing the separate collection rate in the city which made the investment in incineration redundant (Ljubljana, 2012). 'Ecologists without

Borders', Slovenian member of the 'Zero Waste Europe network', organised two site visits for Slovenian waste management companies and operators see the best Zero Waste practices.

6. Using what they learned from these visits, Snaga and Ljubljana City Council announced the commitment to adopt a Zero Waste approach, and to fully scrap the plans for incineration. In September 2014, the adoption of the Zero Waste strategy by Ljubljana (and 3 other pilot municipalities) was publicly announced at the Low Chamber of the Slovenian Parliament.

In **ten years**, the quantity of recovered materials in Ljubljana increased from **16 kg per person in 2004** to **145 kg in 2014**. By 2014, the average resident produced just 283 kg of waste, 61 % of which was recycled or composted. This means that the amount of waste being sent to landfill decreased by 59 % in ten years, and total waste generation decreased by 15 %. This reduction is even more remarkable when considering that Ljubljana already generated relatively low amount of waste for the European standards, being its generation of 2014 a 41% less than the EU average (481kg per person). [SI ZWE 2015]

Further figure shows data resulting from analysis of residual waste bin which Snaga performs every months. Analysis results for years 2011 and 2014 are used to present the performance over time clearly indicating the success of separate collection system for various fractions: paper, glass, plastic. [SI Snaga 2015]

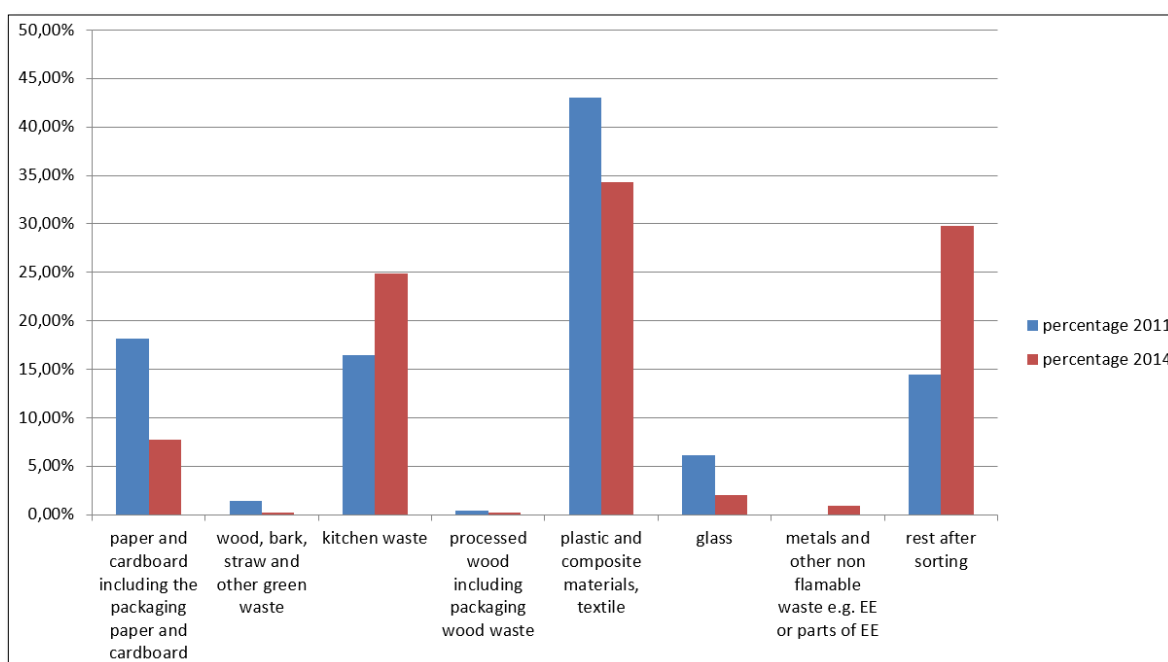


Figure 7-2: Separate collection performance in Ljubljana over time

Fee/charge system [SI Ljubljana 2015]

1. **PAYT** (pay as you throw): around the year 2000 the system was introduced for mixed municipal waste; starting from April 2013 it was introduced for door-to-door collection system and co-mingled door-to-door collection as follows:
 - step 1: 50% collection frequency reduction and introduction of yellow lid bin for packaging waste
 - step 2: 75% collection frequency reduction and introduction of blue lid bin for waste paper
2. By using **specialised software**, Snaga designed an optimised waste collection route and was able to reduce the frequency of waste collection as a measure to encourage people to separate waste at source and to reduce waste management costs for households. Time necessary to collect waste from the same number of consumers was reduced by 10% and the route length was shortened by 17% [SI Snaga 2015] ; this resulted in lowering the monthly cost per household to 7.96€ (in 2014). The costs for households in Ljubljana are among lowest in Slovenia – average yearly cost across the country is 150€/household per year compared to less than 100€/household per year in Ljubljana [SI ZWE 2015].
3. **Changes in the relevant local legislation** were also required to enable the implementation of the new PAYT system; in cooperation with the City of Ljubljana. The Ordinance (revised and accepted in 2012 by the City Council of the City of Ljubljana) is the basis for SNAGA performing public services in the City of Ljubljana since it sets out its competencies and the user's rights and obligations. It allows for the thorough collection of packaging and paper and changed frequency of removing individual types of waste (Snaga therefore lowered the frequency of collection for residual waste while keeping the collection of recyclables and compostables the same). The system enables to adjust the size of the bins for the residual waste – PAYT system implemented in practice. Also due to these changes the average Slovenian share of separately collected municipal waste exceeded **while incurring lower municipal waste management costs (2.398.104 € spent of planned 5.500.000 €)**. [SI Ljubljana 2015]
4. Snaga issues **monthly invoice for 10 different services** including residual waste collection fees which incorporate among others for the separate collection relevant fees for:
 - separate door-to-door collection for packaging waste; producers fee covers the processing of collected waste;
 - separate door-to-door collection for bio-waste (indicated separately on the monthly invoice but included in the total of 7.96€); and
 - waste disposal in collection centres.

Separate waste collection pays off: in December 2014 Snaga issued a credit note to all households in the amount of the December invoice for waste management. The main reason for the credit note is a strongly increased share of separately collected waste and consequently a smaller share of waste disposed of in landfill. Such actions are permitted by the Rules of tariff system for public service in

the environmental field which has proven to be a good legislative solution that works for the benefit of citizens.

Main success factors/Main obstacles

Main success factors in Ljubljana were political commitment, introduction of appropriate infrastructure and equipment for the citizens' use, a tailor-made public awareness campaign, good management and clear setting of goals and targets including:

1. further increasing separate collection rates,
2. reduction of annual total waste generation per inhabitant,
3. reduction of annual residual waste. [SI ZWE 2015] [SI Snaga 2015].

The overall aim of Ljubljana is to demonstrate significant increase in resource efficiency and sustainability of our society. This is achieved by addressing the three pillars of sustainability:

Environment

- extending the usability of consumer goods through waste prevention and reuse and repair.
- improving waste recycling via technical innovations and opening a Regional Centre for Waste Management Ljubljana (in November 2014);

Society

- engaging communities and businesses in resource efficient behaviours through social innovation,
- developing multi-stakeholder approach for increased collaboration and finding solutions how this collaboration will ensure a faster transition towards resource efficiency;

Economic

- boosting green jobs in the waste sector and,
- developing new SMEs and business opportunities. [SI Snaga 2015]

A path towards set goals included the methodological approach which included:

1. setting up door-to-door collection system to enable conditions for separate collection
2. optimising bring points set up (higher frequency and better layout around the city than residual waste containers)
3. reducing residual waste collection frequency.
4. introducing measures to encourage people to use the system and separate at source and tailor made communication campaign focused on promotion of prevention and reuse. [SI ZWE 2015]

Shortly after introducing the door-to-door collection system Snaga achieved significant increase in separately collected fractions (e.g. packaging waste) and reduction in collected residual waste. In 2013, Snaga lowered the frequency of collection for residual waste while keeping the collection of

recyclables and compostables the same. For areas with low-density population (predominately single-family housing) one collection round every other week was introduced at first, but it soon changed to one collection round every three weeks. In densely populated areas (mainly multi-apartment buildings) residual waste was collected weekly whereas compostables and recyclables waste collected several times per week. This fully meets the key operational principles of intensive kerbside collection, i.e. if recyclables and compostables are collected more often than residuals, citizens who do not want their waste sitting around have an incentive to separate at home.

Despite intensive communication campaigns carried out by Snaga before and during the introduction of the new scheme, at the beginning users in areas with low separate collection rates opposed the reduced frequency for residual waste. Containers with residuals were packed full with waste. But in the face of the pressure from residents and media, Snaga insisted on reduced collection frequency and further strengthened communication about the reasons for the change. As part of their strategy, Snaga organised a field trip for the media to see themselves that containers for residual waste were full of recyclables. After taking out recyclables, the residual waste that actually belonged in that bin was a lot less than what people thought.

As a result of this exercise, local and national media changed their mind and joined Snaga in asking the citizens to better sort their waste. Quantities of separately collected fractions continued growing, and by November 2013 the separate collection rate reached 55%. At the same time, average monthly waste management costs for households had fallen too due to reduced frequency of waste collection.

In 2013 Snaga also shifted its communication strategy and redefined its activities, goals and responsibilities. They decided to move their key efforts away from awareness raising on separate collection, and towards encouraging citizens to reduce the amount of waste they produce, promoting reduction, reuse and responsible consumption. The company launched the campaign “**Get used to reusing**” which was later expanded to the national level in cooperation with the Chamber of Commerce.

Snaga also focused on **food waste**, and ways that citizens can be more responsible about the amount of food they buy and throw away. The media, local NGOs, and food service providers joined this work. Towards the end of 2013, the first **reuse** centre in Ljubljana opened its doors. Snaga survey showed that thanks to these efforts almost 70% of residents make sure that their products are being reused when they do not need them anymore.

Since user satisfaction is based on quality of service and communication, Snaga manages three web pages and uses social media. One of those web pages (www.mojiodpadki.si) is addressed to their users, allowing them to have information on consumption and to communicate with the company. Users may set up a free SMS reminder on the waste collection schedule, monitor collection costs and update their services. Additionally, Snaga develops targeted and carefully designed promotion material and brochures, for example More than guidance for waste management, 2015²⁷ to clearly

²⁷ http://www.snaga.si/sites/default/files/snaga_si/stran/datoteke/vec_kot_napotki_za_ravnanje_z_odpadki_2015.pdf

communicate waste collection system improvement progress information, explain roles of different stakeholders (citizens, Snaga, authorities), and provide guidance on how to prevent waste generation or reuse it. The **brochure/campaign won the annual POMP award** for the best achievements in the field of content marketing in Slovenia in the category of best design, and several other local awards. Furthermore, the European Commission published results of the Eurobarometer public opinion survey on quality of life, which showed that 87 % satisfied inhabitants range Ljubljana in the second place among the EU capitals in the field of cleanliness. [SI Ljubljana 2015]

Overall conclusion/Further aspects

Ljubljana has been declared the **European Green Capital for 2016** and is the first European capital on its way towards a Zero Waste society [SI Snaga 2015]. Among the five finalists, Ljubljana was the only one without an incineration plant nor a plan to build one, giving it a significant advantage over the other candidates. Even more this apparent disadvantage became an alternative solution that replaces disposal and energy recovery in the framework of a comprehensive waste management plan, namely the move towards a Zero waste society [SI GreenLjubljana 2015].

The common European commitments — prevention of waste generation, re-use and maximum material recovery — are being effectively fulfilled with the implementation of a Zero Waste Strategy. including the following targets [SI Ljubljana 2015] [SI ZWE 2015] [SI Snaga 2015] :

1. Need for further optimisation of waste collection to ensure achievement of environmental objectives on separate collection of waste set by legislation:
 - increase separate collection to 78% by 2025 and to 80% by 2035
 - reduce yearly total waste generation to 280 kg/cap
 - reduce annual **residual waste to 60 kg/cap by 2025** and 50 kg/cap by 2035
2. Need to increase customer satisfaction and thus participation in the waste collection system
3. Not only a recycling society, but also a society of responsible consumers
4. Further infrastructure development and modernisation of collection infrastructure e.g. underground collection points requires additional funds that will need to be ensured
5. Further the separation of waste in public areas, outdoor events and workplace
6. In 2016 introduce sustainable and Zero Waste event standards for all public events in Ljubljana
7. Upgrade of the Regional Centre for Waste Management Ljubljana (RCERO Ljubljana, operated by Snaga d.o.o.) will contribute to improvement of Ljubljana waste collection operations from the standpoint of the possibility of discarding several fractions at the same location, mainly by optimizing and adjusting the transportation vehicles also leading to decreasing of running costs.

The **Regional Waste Management Centre** is the largest cohesion and environmental project in Slovenia and will solve the waste problems of one third of the country. The key part of the regional centre is three facilities intended for mechanical-biological processing of waste, for separately collected biological waste to produce compost, and for residual municipal waste. The treatment

plant, as this centre is commonly known, will use the most advanced and sustainable technology for waste management in Europe and ensure green jobs. With a special learning trail, it will also bring the waste management perspective closer to people in a creative way. [SI Snaga 2015]

The Centre is due to start operating in November 2015 and currently includes 37 municipalities. It will use the most up-to-date and sustainable waste management technology in Europe and will also provide green jobs, comprehensive solution to the thorny waste management issue in strict compliance with the provisions of the EU Directives. In addition to this, the project reduces greenhouse gas emissions (especially methane), enables the acquisition of secondary energy and the optimal use of available landfill space and assures the security of water sources. These facilities will guarantee that after processing, on site just 20% of the waste will remain which it is not possible to use as a raw material or energy source, and this remaining waste will be disposed of without harmful environmental effects. [SI Ljubljana 2015]

7.3 Case study for Helsinki (FI)

Key features/elements of the system currently in place

The following fractions are collected applying the following collection types²⁸

Table 7-2: Summary of separately collected amounts in Helsinki

Collected waste (t)	Paper and cardboard	Glass	Metal	Bio-waste
Door-to-door	97%	66%	20%	84%
Bring points	3%	34%	7%	
Civic amenities	1%		73%	16%
Total	100%	100%	100%	100%

Paper and bio-waste are the two single most important waste streams for achieving the high capture rate. The two fractions make up 94% of the total amount of material collected via door-to-door collection, bring points, and civic amenity sites [FI Factsheet 2015]. For both streams the main collection type is door-to-door collection.

Helsinki Region Environmental Services (HSY) is the municipal authority responsible for collection of bio-waste (and also cardboard, glass, metal and residual waste) both from households and public administration the Helsinki Metropolitan Area. HSY is also responsible for collecting hazardous waste and remaining mixed waste (for the energy recovery), and providing the waste management regulations guiding waste sorting [FI HSY 2015]. HSY also process the separately collected bio-waste by anaerobic digestion (started in 2015) and composting [FI FSWA 2015].

²⁸ Source: Helsinki factsheet [FI Factsheet 2015]

HSY started its operation in January 2010. The Helsinki Region Environmental Services Authority municipal federation was established by the basic agreement approved by the councils of the member municipalities (Helsinki, Espoo, Kauniainen and Vantaa). HSY is thus a public organisation owned by the four municipalities [FI HSY 2015] .

Paper is collected and handled by the producer responsibility scheme, currently being handled by several private actors (amongst these are Lassila & Tikanoja Plc, Paperinkeräys, and SITA). The market for paper collection is very heterogeneous and non-organised [FI HSY 2015a], and there are no good statistics of the collection and performances of the system as a whole.

Performance over time

The collection of bio-waste **has increased relatively smoothly** since 2004 with a small decrease in 2009-2010 due to the economic crisis [FI FSWA 2015].

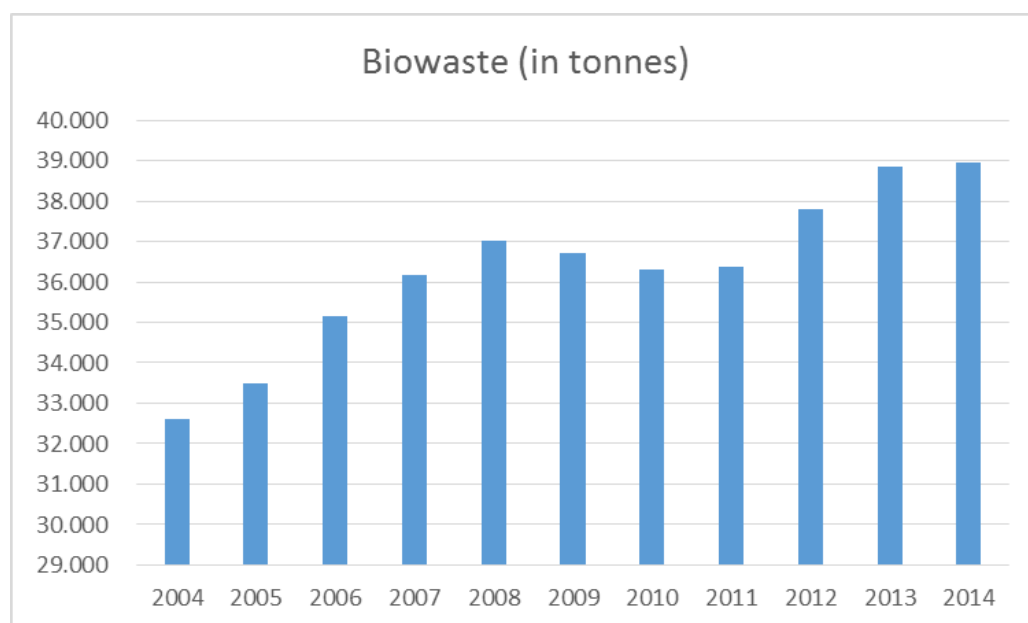
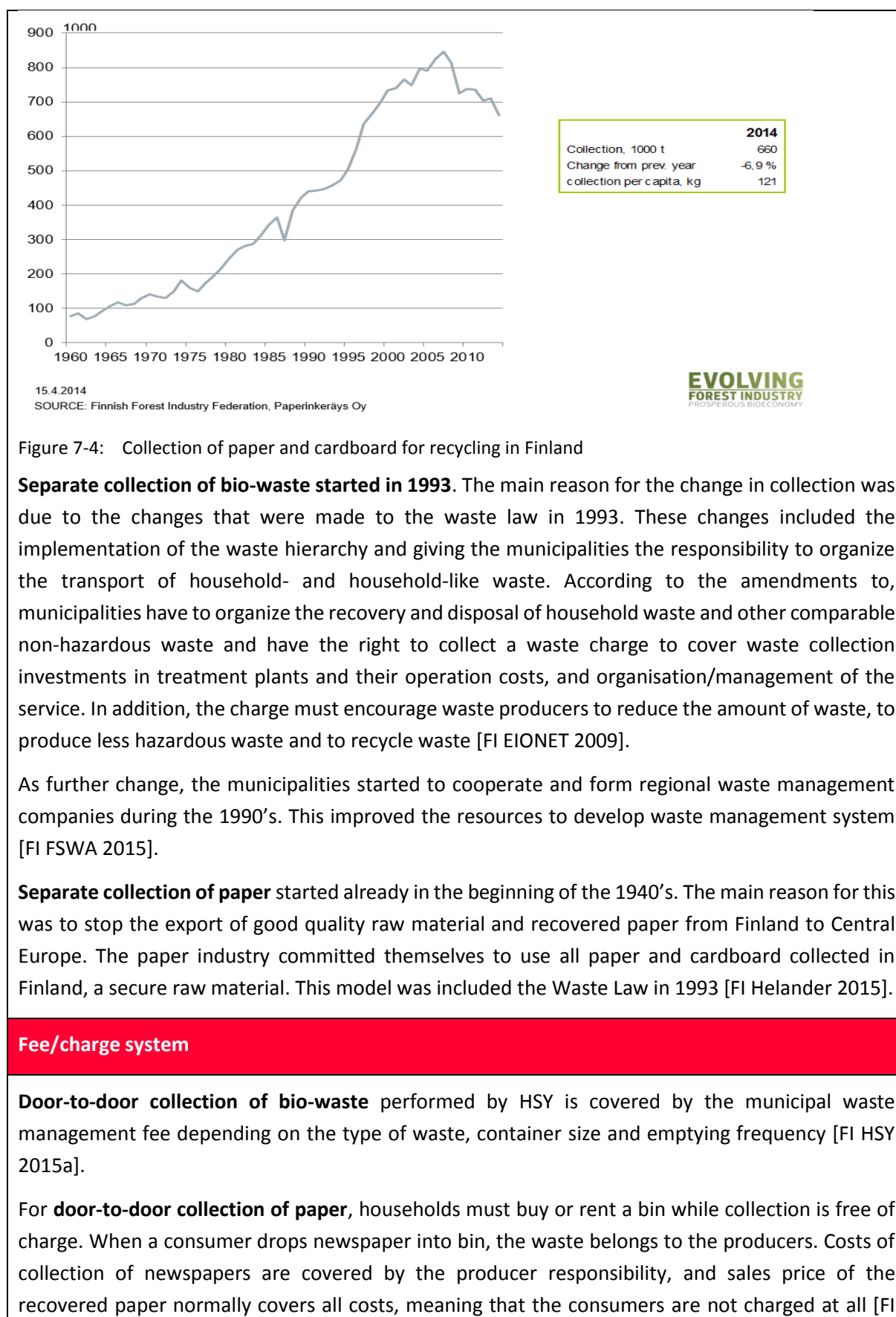


Figure 7-3: Bio-waste collection in Helsinki 2004-2014*

*Source: HSY:n jätehuollon vuositilasto 2014, Table 1.1

The collection of paper waste from Finland as a whole has increased dramatically since the 1960's but has been dropping since 2007. There are no regional statistics for Helsinki [FI Helander 2015].



Helander 2015]. The paper bring points are financed via a waste fee with compensation related to the producer responsibility [FI Factsheet 2015]. The delivery of paper and cardboard, glass, metal and limited amounts of wood is free of charge in civic amenity sites. Garden waste, mixed waste and other types incur a fee [FI Factsheet 2015].

The **fee system encourages recycling**: having bio-waste collected costs less than having residual waste collected. Paper collection is free (except for the renting of the bins) [FI HSY 2015a].

Main success factors/Main obstacles

The consequent **implementation of the PAYT concept** within the fee system is the main success factor for the collection of bio-waste [FI HSY 2015a], combined with the fact that the municipal regulations set the minimum standard for collection, i.e. requiring door-to-door collection of bio-waste, packaging, paper at the properties over a certain size (number of households) [FI FSWA 2015].

Educating people from an early age, **raising environmental awareness**, helping people understand the system, and making the system easily accessible are considered key success factors for paper collection [FI EIONET 2009]. It is suggested that it might be extremely difficult to teach people to sort in a right way with a comingled collection system [FI EIONET 2009]. It is further recommended that the private sector is involved in paper collection, rather than keeping it entirely under the municipalities. Finally, it is important to note that one has to be patient as it takes years for a waste collection system to take root in society [FI Helander 2015].

Bio-waste collection involves challenges such as e.g. smell, need of cleaning the bins, need for a separate trash can in the kitchen, which can be challenging [FI HSY 2015a].

In general, a successful implementation of separate collection would likely need to involve supportive legislation, the municipalities as well as the private sector (both small and medium sized operators), as well as education at schools [FI Helander 2015].

It is recommended to start with paper, then cardboard, glass and metal [FI HSY 2015a]. It is further suggested to use separate bins for paper and other for different kind of packaging (pizza boxes, sugar bags, cornflakes packaging etc.) [FI Helander 2015]. The most challenging fraction to collect separately is bio-waste due to the challenges mentioned above [FI HSY 2015].

Overall conclusion/Further aspects

- Paper and bio-waste are the two single most important waste streams for achieving Helsinki's high performance: these two fractions make up 94% of the total amount of material collected.
- Paper is collected and handled by the producer responsibility scheme, managed by several private actors.
- The main reason for the changes (and the success) in waste collection are the changes in the Finnish waste law in 1993, including the implementation of the waste hierarchy and giving

the municipalities the responsibility to organise the transport of household and household-like waste. Further, the municipalities started to cooperate with each other and form regional waste management companies.

- It is suggested that the fee system, combined with the municipal regulations which set the minimum standard for collection, are the primary success factors for the collection of bio-waste. Further, information to consumers, education of the public and creating a simple and accessible system is considered crucial for success.
- If implementing a separate collection system, it is recommended to **start with paper, then cardboard, glass and metal**. The most challenging fraction to collect separately is considered to be bio-waste.

7.4 Case study for Tallinn (EE)

Key features/elements of the system currently in place

Under the **Organised Waste Collection Scheme (OWCS)** in Tallinn, mixed municipal waste, paper and cardboard and bio-waste are collected in separate containers located next to residential buildings [1]. Paper and cardboard can also be brought to the civic amenity sites or bring points. Glass, plastic and metals waste is collected as part of the door-to-door co-mingled collection system (three fractions in one bin) under producer responsibility schemes and can also be brought to the civic amenity sites or bring points.

In addition to OWCS in Tallinn, packaging waste, which is under producer responsibility, is collected through a network of **packaging collection stations**.

In 2012, total (municipal) waste generation was 202 011 t, corresponding to 481.17 kg/capita. Household waste is estimated to account for about 42% of the total MSW. Approximately 53%, or 256.97 kg/capita, of the generated MSW is estimated to be collected separately. The biggest share of separately collected materials was paper and cardboard (40%) followed by glass (21%), bio-waste (14%) and plastic (10%). [EE Tallinn FS 2015]

Bring sites for glass and paper and (door-to-door) separation of bio-waste and glass collect the highest amount of waste. The **capture rate** of collection is highest for **glass (85%)** and **paper (74%)**. Capture rate for **bio-waste, at 33%**, is also remarkable.

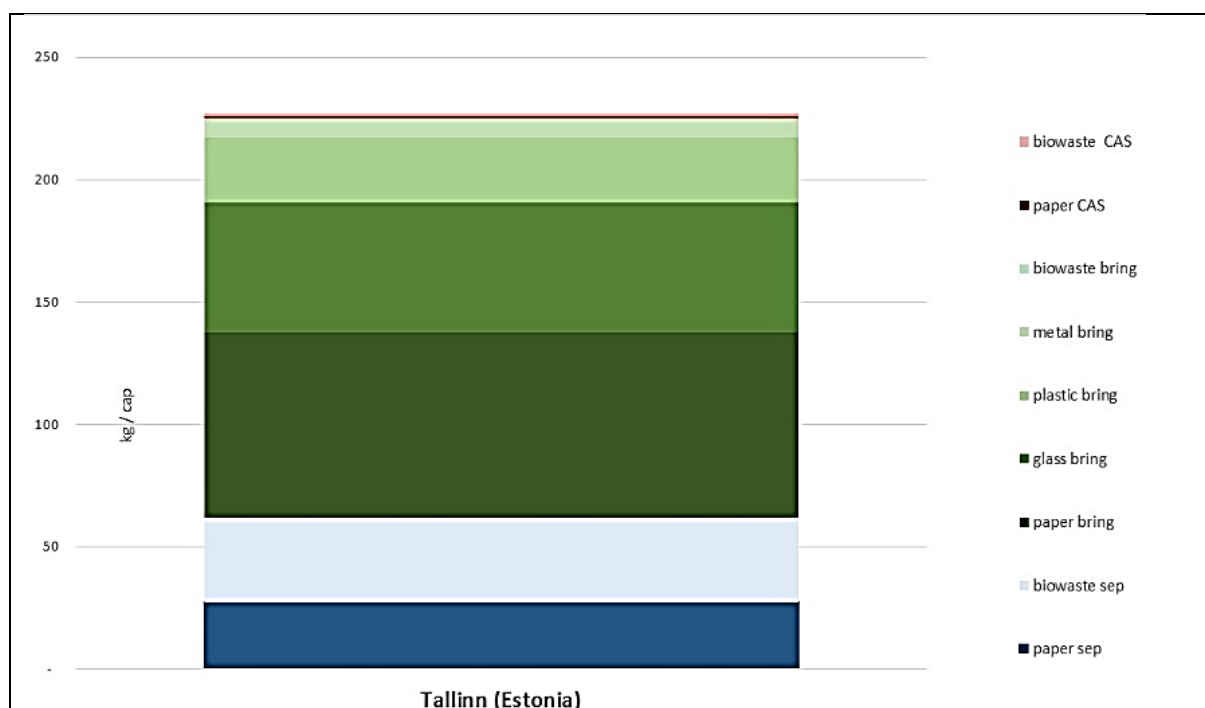


Figure 7-5: Separate collection amounts in Tallinn per fraction in 2012.

The Tallinn City Environment Department is responsible for organising and developing waste management, organising procurement, and inspecting and supervising packaging waste collection. The municipal police provide supervision and district administrations contribute to awareness raising, supervision and collection of park and garden waste. Tallinn city is divided into 13 areas for organised waste collection. There is an **obligation for the residential buildings, businesses and other organisations to join the municipal organised waste collection scheme**. Organised waste collection covers municipal mixed waste, paper and cardboard, bio-waste and bulky waste; however packaging waste is not covered by the municipal OWCS. Under producer responsibility, packaging waste is collected through a network of packaging collection stations.

Waste collection market and most of the **waste management companies are owned by private stakeholders**, restricting local authorities' participation in organising waste management to waste collection procurement and supervision. [EE Tallinn FS 2015]

Performance over time

The implementation of the current system in Estonia and Tallinn began in 2005. Waste generation in Tallinn has slightly decreased over the period of 2002 and 2014. The amounts of separately collected **paper waste and bio-waste have increased** the most, especially after 2006. In addition, the amount of packaging waste collected with the **MSW has slightly decreased since 2006** [EE Kivimägi et al. 2015] [EE Kivimägi et al. 2013]. The major improvement started in 2007 with the start of separate collection of bio-waste.

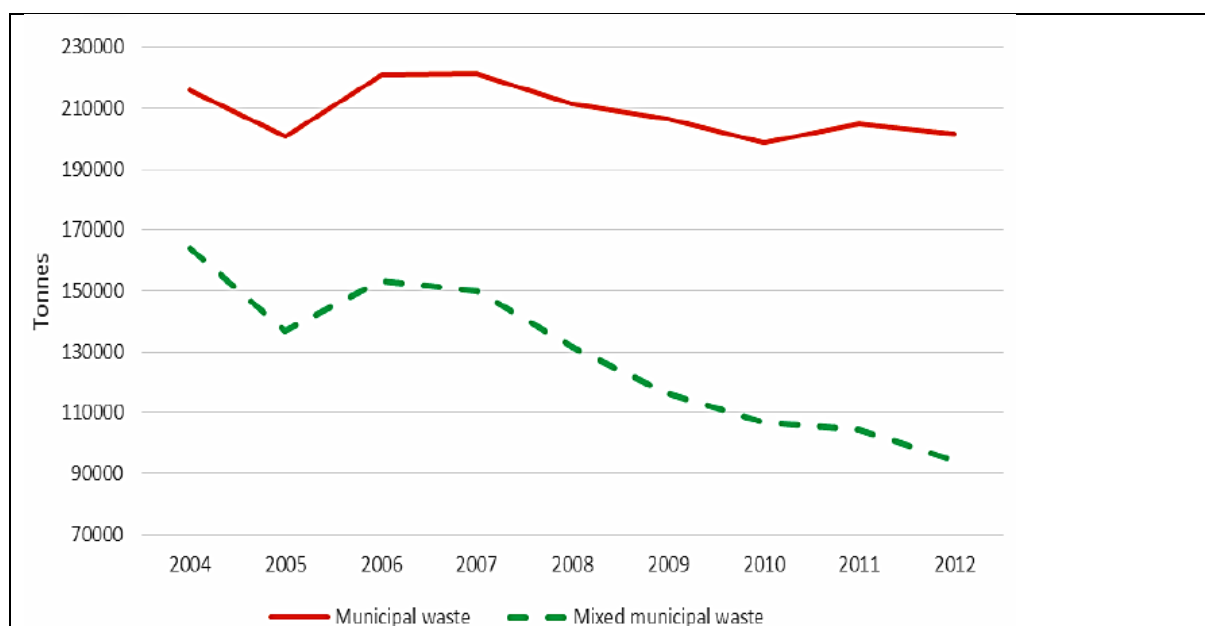


Figure 7-6: Generation of municipal waste (total and mixed) in Tallinn 2004-2012

Fee/charge system

Waste types collected under the organised waste collection can only be handed over to the waste management company with contractual rights to serve in the area or, in case of free market, to a company with appropriate waste permit. In 2014, out of 13 designated waste collection areas in Tallinn:

- **three** areas (Haabersti, Kristiine, Kesklinn) had a temporary free market with organised waste collection from a specific type of container (deep waste containers),
- **five** areas (Nõmme, two Mustamäe areas, Kesklinn (Vanalinn) and Pirita) had a temporary free market for waste collection, and
- **five areas** were covered by the organised waste collection (two areas in Põhja-Tallinn and three in Lasnamäe).

Five of thirteen areas had a contract with the Tallinn Waste Centre. [EE Tallinn FS 2015]

For residual waste and bio-waste, charges for consumers are approximately 2€ - 10 €/container emptying, charges for bulky waste collection approximately 7€ - 18 €/m³ depending on the type of waste, size of container, collection frequency, collection area and service provider. Apart from this, **all forms of separate collection are free of charge.** [EE Tallinn FS 2015]

Table 7-3: Waste collection fees in Tallinn

Container (m ³)	New fee in pilot districts 2013 (€)	Min. fee in pilot districts 2012 (€)	Max. fee in pilot districts 2012 (€)	Average fee in pilot districts 2012 (€)	Average fee in all districts 2012 (€)
0,14	2,34	1,53	4,00	2,72	2,46
0,24	2,58	2,35	4,95	3,40	2,93
0,8	5,40	4,63	8,25	6,52	5,67
1,1	7,14	6,12	7,14	6,63	6,06
2,5	16,14	11,58	21,93	17,73	15,02
4,5	24,00	20,84	34,51	28,04	24,76
0,24 Bio-waste	2,58	1,53	4,22	3,27	3,19

Since the implementation of OWCS in those districts that were still on the free market, the collection fees have gone up due to inflation, while waste collection fees within OWCS were lower than the free market prices and have remained the same or even reduced due to the pressure of the public procurements [EE Kivimägi et al. 2013]. **Waste collection fees on the free market are approximately 30% higher than those in OWCS.** Waste collection fees within the organised waste collection system are also more stable.

Main success factors/Main obstacles

There are a **number of waste management models for the separate collection** of waste operating in Tallinn. In the organised waste collection model, the municipality chooses, through a public procurement process, a waste management company to provide waste collection services to waste generators. In so-called free-market waste collection model, municipal waste management service market is open to all eligible waste management companies. Waste generators (residents and businesses) choose appropriate permitted waste collection service provider.

Another waste collection model is operated by the Tallinn Waste Centre. This is a municipal establishment under the jurisdiction of Tallinn Environment Department, and established in 2013 to provide more centralised municipal waste collection service for the city, and to supervise and mediate actions of waste collection providers and waste generators [EE Tallinn FS 2015].

The establishment of the organised waste collection scheme has incorporated many households that were not previously engaged in formal waste collection. There are more than 30 000 properties in Tallinn that act as waste holders, including private houses, enterprises and apartment houses; approximately half of them are private houses (ca 15,000). Compared to the regulation of free market, approximately 2 000 households that were not previously engaged in formal waste collection have been incorporated into the organised waste collection system.

A direct result of the implementation of the OWCS has been a decrease in the littering of green areas and the surroundings of public containers within the first few months of implementation. In addition, the waste collection logistics have been optimised and the environmental impact of waste transportation has been reduced [EE Kivimägi et al. 2015] [EE Kivimägi et al. 2013].

The source sorting of biodegradable waste and recyclables like packaging and paper waste has improved due to the implementation of OWCS, which has been supported and accompanied by massive public awareness campaigns.

Further aspects

In Estonia, municipal waste is considered as a single waste stream, whereas in many other EU member states the waste management system organised by the local authorities covers only household waste. Thus, a large share of municipal waste is commercial waste collected together with waste from households. **Household waste is estimated to account for around 42% of the MSW** [EE Tallinn FS 2015].

As local **authorities are restricted to organising waste collection procurement and supervision**, and with the introduction of the changes to the Waste Act in 2014 and further legislative changes in 2015, local authorities are no longer liable to be the only client of the waste collecting companies, resulting in the Tallinn Waste Centre having to compete on the free market with other waste collecting companies [EE Tallinn FS 2015]

7.5 Case study for Dublin (IE)

Key features/elements of the system currently in place

[IE NWR 2012] [IE DoE 2014]

The waste collection and management system in Dublin **was completely privatised** at the beginning of 2012. Individual households engage one of the numerous waste collection companies to provide waste services. Some of the companies are collection companies that deliver the waste to a third party, while others are integrated waste management companies, that handle the waste from collection, sorting and eventual recycling or recovery.

The majority of the recyclables collected in Dublin are collected in **co-mingled** mixed dry recyclable bins door-to-door.

A significant quantity of **bio-waste is also collected door-to-door**, in separate bins, and generally include both kitchen and garden waste.

Glass is generally only collected at **bring sites**, although **some collection companies** accept **glass mixed with the other dry recyclables** (paper & cardboard, metal and plastic).

Door-to-door separate collected bio-waste, door-to-door co-mingled dry recyclables (paper & cardboard, metals and plastic), and the collection of glass at bring points, are the three most important waste types and collection routes contributing to Dublin's capture rate. Although there is also quite a large quantity of plastic also in the co-mingled collection.

Although Dublin collects and a reasonable amount of recyclables separated from the mixed municipal waste stream, the co-mingled approach does have its disadvantages, particularly in terms of contamination. Un-contaminated mixed dry recyclables can be effectively sorted without a significant loss of material and quality, but when the waste is contaminated, it is often only useful as RDF. There has also been a move toward increasing incineration in the Dublin region (and Ireland as a whole) to reduce dependence on fossil fuels for energy, which provides a local market for RDF.

The Irish packaging producer responsibility scheme – administered by REPAK, the only fulfilment organisation – subsidises the collection of dry recyclables from households and businesses using the fees paid by producers and importers. This reduces the effects of the volatility in the secondary resources market to an extent and directly supports waste collectors.

Performance over time

The system in Ireland is quite new, and Ireland as a whole has gone from having relatively little recycling in 2000 to having one of the highest recycling rates in Europe in 2013 (34% in 2013 according to EUROSTAT, this is together with Belgium fourth place after Slovenia and Germany). The economic crisis was felt particularly strongly in Ireland, and this is reflected in the drop municipal waste generation and recycling from 2007 onward.

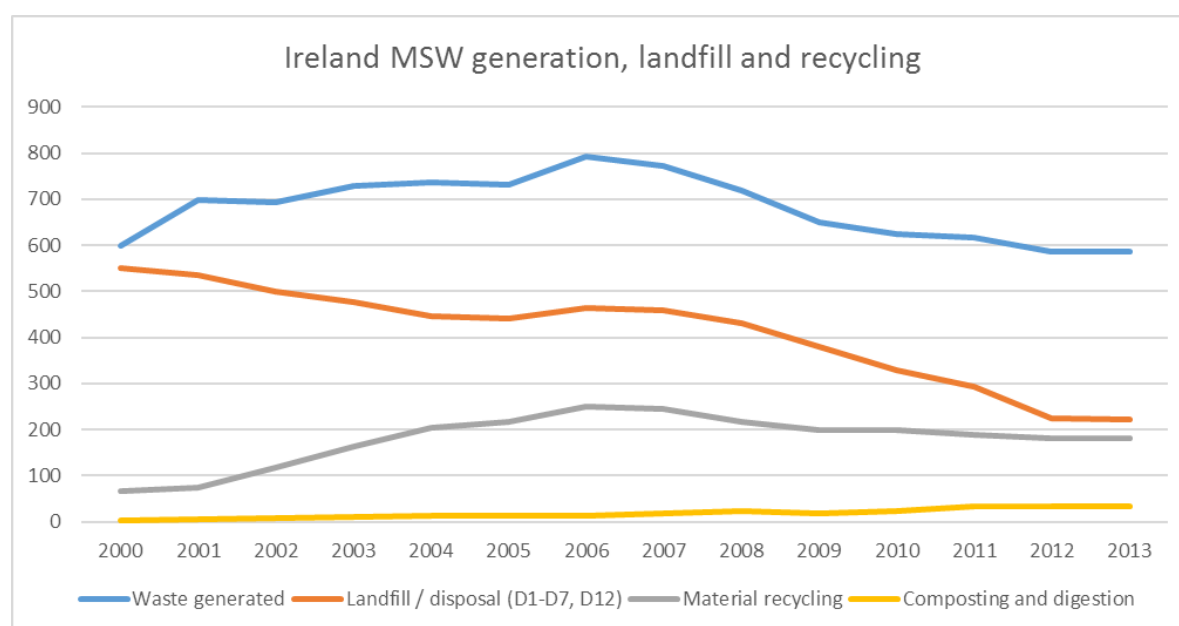


Figure 7-7: Ireland MSW generated, landfilled and recycled*

*Source: Eurostat> env_wasmun

Waste collection in Dublin was fully privatised in January 2012, when Greyhound recycling and Recovery took over the operation of the existing municipality customers. Dublin city council is one of the last Irish municipalities to privatise their household waste collection service.

Current recycling rates for Dublin are very difficult to obtain: recycling and (energy) recovery are reported together with separately collected material from commercial sources. REPAK reports that

recycling of packaging waste from households increased from 241 868 t in 2013 to 245 442 t in 2014 [IE REPAK 2014].

However, in 2013, of the 321 091 t of separately collected packaging waste from households, 79 223 t went to incineration [IE REPAK 2014]. When one considers that this must be largely comprised of the burnable fractions – paper and plastic, one can see that over 35% of the plastic and paper (the fractions that can be incinerated) must in fact incinerated rather than recovered. This is approximately in line with national figures, which indicate that just under half of the plastic waste recovered in Ireland goes to incineration with energy recovery [IE NWR 2012].

Table 7-4: Separately collected packaging waste incinerated in Dublin in 2014*

	Paper	Glass	Plastic	Metal	Wood	Tonnes	Incinerated	% incinerated
Domestic	126 401	90 117	87 643	16 929	0	321 091	79 223	25%
Commercial	212 650	25 038	74 545	5 073	73 658	390 963	82 153	21%
Total	339 051	115 155	162 188	22 003	73 658	712 054	161 376	23%

*Source: REPAK Annual report 2014

Reducing contamination will remain the key challenge in the coming years.

Fee/charge system

Waste collection in Dublin is fully privatised. Individual households engage one of the numerous collection companies to collect residual and mixed recyclable waste, and if needed bio-waste. There is no obligation to engage a collection company, however, and all wastes (including residual waste) can be deposited at one of the five civic amenity sites in operation in the city for a fee. Delivery of recyclable waste to these facilities is free of charge.

Payment for waste collection in Dublin is primarily based on these amount of residual waste collected – collection of dry recyclables is free of charge. The amount of payment for residual waste depends on the operator – it is an open market – and each operator has a variety of pricing schemes depending on customer requirements. However, pricing is typically based on frequency of collection and either the size of bin or, increasingly, by weight of residual waste collected. As such, it is a typical pay as you throw system. There is typically also an annual subscription fee.

The typical consumer costs for collection of a residual bin and a recyclable bin is anywhere between about 200€ and 300€. However, the cost is highly dependent on how much waste a household recycles and how much ends in the residual bin, as many operators now charge by weight.

Some operators, **charge for the collection of bio-waste** (which tends to be mixed kitchen and garden waste). **Others do not charge for bio-waste collection**, as providing a separate bio-waste collection bin is expected to reduce contamination of the mixed dry recyclables.

The collection of recyclables is subsidised by the **Irish packaging producer responsibility scheme**. Repak, the only authorised fulfilment body, administers the scheme. Members (product manufacturers and importers) pay a fee based on the amount of packaging they put on the market. This money is used to subsidise the separate collection of packaging waste. The subsidies are

differentiated based on origin (household or commercial) and type of material collected, and are paid per tonne of material collected.

There is no obligation to be a member of Repak. It is also possible to self-comply with the packaging producer responsibility regulations. Also, companies have to put a certain amount of packaging on the market to fall under the producer responsibility obligations.

Main success factors/Main obstacles

Privatisation has changed the relationship between main actors in the system; there is now a **stronger focus on service and communication**. It is in the economic interests of the waste management companies to obtain clean waste fractions from households. And as such the communication to households is very clear about what can and what cannot be placed in each bin, and additional networked services like reminder text messages about collection days, online accounts, and feedback on waste collected are provided.

Households, in engaging a collection company rather than a default non-choice, are also forced to take an interest in how their waste is managed.

The co-mingled approach can work but the collected material can be sorted to produce clean fractions only if there is very little unwanted contamination. **Reducing contamination in the co-mingled bin is the largest challenge**. Waste collection companies monitor the performance of households, and the waste types that enter the dry recyclables bin. Some companies have run trials with cameras in the collection vehicle to identify addresses that deliver contaminated dry recyclables for example. By doing so, they can pinpoint the source of contamination and take measures therefrom.

The fee system seems to work in bringing down overall waste quantities per household.

Privatise – let the market decide. Although one key danger of this could be that the price of raw materials has a large impact on the ability to profit from sales of recyclate. Implement an EPR scheme for packaging to fund/subsidise collection and/or sorting.

7.6 Case study for Vienna (AT)

Key features/elements of the system currently in place²⁹

Ownership, management of the system and key stakeholders

In the City of Vienna, waste management is entirely **municipally owned**. The Municipal Department “MA 22 - Environmental Protection” is in charge of the non-operational business such as implementation and enforcement of waste legislation. The responsible organisation for the collection of municipal waste is the Municipal Department “MA 48 - Waste Management, Street Cleaning and Vehicle Fleet” of the City of Vienna. All bins/containers for separate collection of recyclables are emptied by vehicles and personnel of MA 48; private companies are not involved.

According to the principle of producer’s responsibility, manufacturers and importers are responsible for the collection and treatment of packaging material. On behalf of and financed by such producers and importers, the MA 48 is also in charge of the collection of packaging waste and hands over such wastes to private companies for treatment.

Further, it is noteworthy that major disposal and recovery facilities are all (directly or indirectly) owned by the City of Vienna.

Thus, the established management system involves only very few stakeholders.

Coverage and contribution of various systems to overall performance

In 2013, Vienna generated approximately 1 million t of municipal waste. Currently, **40 % of municipal waste generated is collected separately** (~ 400 000 t, including inert waste). Especially separately collected paper and cardboard (~ 127 000 t) and bio-waste (~ 107 000 t) significantly contribute to the high share of separate collection. Further, 12 000 t of metals, 10 000 t of plastic bottles, and 28 000 t of glass are collected separately.

The Waste Management Act for Vienna stipulates the compulsory collection of residual waste and recyclables for the entire municipal territory. In general, all properties in Vienna are included in the public waste collection system (100 % collection coverage for households and businesses since 1991). **There is no co-mingled collection of recyclables** in the City of Vienna.

Paper, glass (clear and coloured glass), plastic (bottles only), metal, and bio-waste (+ kitchen and canteen waste from catering industry) are collected separately door-to-door, via bring collection points and via civic amenity sites. In terms of annual collected quantities, a distinction between door-to-door collection, bring collection points, and civic amenity sites cannot be provided for statistical reasons. However, the following overall capture rates apply (calculated based on a sorting analysis from 2009: it is assumed that current capture rates are even higher):

- paper: 58.9 %, glass: 51.6 %, plastic: 16.6 %, metal: 41 %, and bio-waste: 34.1 %

²⁹ All information from [AT Vienna FS 2015] and [AT MA 48 2015]

Regarding plastic fractions, it is noteworthy that in the City of Vienna only plastic bottles are collected separately. All other plastic fractions are mixed with residual waste (the collection system was changed in 2005, please see below “performance over time”).

Performance over time

Start of the current system

The current system started in the 1970s with the separate collection of paper and glass. In the 1980s, separate collection was also introduced for metal (1985) and plastic (1989). Bio-waste is separately collected since 1990. By 1991, the separate collection system covered all of Vienna (100 % collection coverage for all five fractions).

Main changes/improvements and effects

The overall collection system in the City of Vienna has gradually been improved since the 1990s. The following aspects should be emphasised:

Civic amenity sites: The introduction of civic amenity sites at the beginning of the 1990s showed very positive effects (today: 18 civic amenity sites in place, one open on Sundays). Illegal littering of fridges, furniture etc. was significantly reduced and citizens could get rid of recyclables not fitting into the residual bin free of charge.

Paper:

- Collection system and collection rates gradually improved, no sudden changes
- Improvements: focus to place the bin/container directly on the property rather than on sidewalks resp. bring collection points
 - Resulted in higher capture rates, allowed for economic viable collection
 - Problem of bins/containers falling over due to wind could be solved

Glass:

- Collection system and collection rates gradually improved, no sudden changes
- Improvement: in 2004, noise reduced lift-type containers (two-chamber) were implemented for the first time (share in 2009: ~ 80 %) -> benefits:
 - It only takes one person to lift and empty the container with a crane -> economic viable (the previous system required three person to empty two separate containers)
 - Quality of collected recyclables could be improved (less “sorting mistakes”)
 - But: not suitable for certain areas, i.e. with overhead lines for the tramway

Plastic:

- The collection of plastic items was initiated as early as in 1989 (foils, yoghurt cups and hollow items)

- The coming into force of the Packaging Ordinance on 1 October 1993 led to the collection of all types of plastic packaging covered by the ordinance in one mixed system as “plastics and composite materials”.
- **From autumn 2004 to spring 2005, the system was switched over to a new collection scheme for hollow plastic items (plastic bottles) only (via bring collection points and civic amenity sites)**, focusing on plastic fractions that actually are suitable for material recovery
 - Before changing the collection scheme, 65-70 % of collected plastic fractions could not be utilised (residual waste, “sorting mistakes”), only 30-35 % were suitable for material recovery
 - Today 70-80 % of separately collected plastic bottles can be used for material recovery, only 20 – 30 % cannot be utilised (it is assumed that these waste amounts are incinerated with energy recovery)
 - “Sorting mistakes” have been reduced
 - Efficiency of sorting plants has been significantly be increased
- Since 2013 the City of Vienna also offers **door-to-door collection of plastic bottles** in one-family house areas by means of “yellow bags” (today: ~ 43,000 households). The switch made it possible to double the collection rate in these test areas.
- Commercial enterprises are provided with containers for collecting plastic foils.

Metal:

- Collection system and collection rates gradually improved, increase of recycling rates over time (i.e. final obligation to pre-treat waste in Austria 2009 led to an increase of metal recovery), no sudden changes
- The system in place comprises separate collection of all metals:
 - Metals are either collected separately via bins/containers or separated from the slag after incineration or in case of mechanical treatment directly removed from the residual waste by means of separators for ferrous and non-ferrous metals. With this system, today an overall metal recycling rate of 90 % can be achieved
 - However, there have been political discussions if the current collection system should be changed and focus on separate collection of metal cans only. However, for political reasons this is not feasible, even if such a system might (in combination with mechanical treatment and slag recovery) have advantages.

Bio-waste:

- Bio-waste collection system gradually improved since 1990.
- A bio-waste bin should be provided where a) large quantities can be collected **and** b) good quality can be expected
 - Less densely inhabited zones: place the bin/container directly on the property

- In dense urban areas: place the public containers on sidewalks and in parking lanes + civic amenity sites
- At the beginning of the 1990s, collection routes for collection vehicles were planned based on the street course/randomly and not based on the residential structure and districts (condensed urban areas vs. less densely inhabited zones) -> at that time this was regarded to be an advantage, since different bio-waste qualities were mixed in the collection vehicle
- 15 years ago: change of collection routes -> planning of collection routes now based on residential structure, meaning that a collection vehicle empties either bins/containers in less densely inhabited zones or in condensed urban areas
- As a result, good quality bio-waste from less densely inhabited zones and lower quality bio-waste from dense areas (lower quality due to open access, “sorting mistakes” etc.) was collected separately and treated in the composting plant (production of compost with different qualities)
- Since 2006, in addition to the composting plant a biogas plant is in place:
 - Now good quality bio-waste from less densely inhabited zones is transported to the composting plant to produce high quality compost
 - Bio-waste with lower quality from dense areas rather transported to the biogas plant for energy generation

Fee/charge system

The current fee system in the City of Vienna has been established already during World War II and has – in its main characteristics – remained unchanged since then.

The financing of the collection and treatment of all municipal waste is based on the residual waste fraction in order to create an incentive for separate waste collection. Property owners are charged a quarterly waste management fee calculated from the **volume** of the residual waste containers installed on their properties and the **frequency** of bin emptying (contract **only** between the City of Vienna and the property owner; separate contract property owner and tenant via tenancy agreement). A bin volume of 120 l and the collection frequency “once a week” are taken as a basis for calculating the “basic” waste management fee for a property owner. For example, currently 4.40€ are charged for emptying **one** residual waste bin with a volume of 120 l. In case a property owner needs more than one 120 l bin to dispose of residual waste, the fee of 4.40€ is multiplied by the number of bins resp. the volume etc. The “basic” waste management fee for a property owner (i.e. 4.40€) is set by the municipal council, considering political interests as well as cost calculations of the MA 48.

Based on its long-term experience, the MA 48 is in charge of determining the initial number and volume of bins/containers and the corresponding emptying frequency for a property owner. In case that the initial determination of the required bin volume etc. turns out to be inappropriate, the property owner might call the MA 48 that will evaluate the situation on-site and subsequently

reduce/increase the overall volume/number of bins etc., again affecting the quarterly waste management fee.

In 2014, the annual waste management fee for a standard single family house on average was 229.32€.

This residual waste management fee finances the collection and treatment (e.g. including operation of civic amenity sites etc.) of all municipal waste in Vienna with the exception of packaging material (and WEEE, batteries). The more material is collected separately, the smaller the container volume that needs to be installed, and the lower the cost.

Additional PAYT charge: e.g. civic amenity sites offer waste locks for residual waste, however they charge 2€ per 150 l of residual waste to be disposed of.

The collection and treatment of packaging material is financed via manufacturers and importers according to the principle of producer's responsibility. Fees from collection and recovery systems (e.g. ARA-System, "Altstoff Recycling Austria") and revenues from marketing of recyclables contribute as source of funding. Thereby, costs for collection and sorting of licensed packaging waste can be completely covered.

It can be concluded that the current fee system was not developed/adapted over time since it has proved to be effective.

Key recommendation for cities introducing a fee system:

1. Keep the fee system simple, traceable and flexible (i.e. "just one call" to reduce/increase bin volume as required)
2. Introduce a fee system based on the volume of residual waste bins and the emptying frequency, allowing for incentives to separately collect recyclables and thus reduce residual waste amounts (PAYT)
3. Ensure that recyclables can always be disposed of free of charge (door-to-door and bring collection points), even if this might be difficult from a financial perspective when a new collection system is introduced; however, the possibility to return recyclables free of charge will significantly influence the success of the overall separate collection system; in this context, civic amenity sites play an important role since a citizen, that once could dispose of the waste free of charge at the civic amenity site will come back the next time
4. A waste collection system being completely in municipal ownership is also advantageous to the fee system; to provide just one example: in case some citizens do not pay (i.e. for the paper bin), a private company might increase the overall fee for all citizens and "punish" correct behaviour instead of a court procedure; in case the municipality is in charge of waste collection, a constant fee level can be sustained, an "all pay = low fee" principle (in case a property owner will not pay, the city can always issue an official decision in case of need; however, in the City of Vienna this is not necessary).

Main success factors/Main obstacles

a) Main success factors

- Long tradition of waste management in the City of Vienna, good performance of the current system based on **gradual improvements over a long period of time**
- Waste collection system **completely in municipal ownership**, in addition major recovery and disposal facilities are in property of the City of Vienna. This allows for planning reliability and sound quality management (i.e. the waste collector MA 48 is well aware of possible problems that might occur in a waste treatment facility due to low quality of collected material and therefore has a high interest in delivering high quality material).
- Principle “**quality instead of quantity**”
- **Awareness raising/communication** played a key role in Vienna (very detailed information can for example be retrieved from the Viennese Waste Management Plan/Waste Prevention Programme: <https://www.wien.gv.at/umwelt/ma48/beratung/umweltschutz/awk.html#awp>)

b) Barriers and obstacles

For political reasons (regarded to be “cheaper”), separate collection of paper waste was handed over to private companies 15 years ago (public tendering).

- According to MA 48, the result was far from satisfactory, waste collection services were not adequately fulfilled, i.e. bins/containers not emptied at all etc. -> citizens complained to MA 48, however, due to contract agreements, there was only little scope for MA 48 to influence the situation
- It was decided that MA 48 will collect paper waste again on its own after agreements with private companies have ended (after five years)
- Lessons learned: keep waste collection services in municipal hand to a) be able to respond to criticism appropriately/avoid undesirable developments and b) avoid loss of public image, caused by other companies.

c) Main recommendations for other cities how to introduce/boost separate collection

Who to involve: Municipal services in general: keep **everything** in municipal ownership and **collect relevant waste streams on your own**. If this is not possible, at least make sure that all wastes **remain under ownership** of the city council, and ensure that any contracts with private companies allow for political control; start new companies if required (i.e. operating a waste treatment facility) and ensure that the city council maintains political control.

With what fraction to start - important aspects to be taken into account:

In general, focus on high quality of separately collected recyclables, follow the principle “**quality instead of quantity**”

Before starting with separate collection: ensure that a dense and well-functioning collection system for residual waste is in place. The absence of which will lead to illegal littering and “sorting mistakes” in bins/containers for recyclables; provide sufficient bins/containers for residual waste to compensate for seasonal fluctuations of waste arising.

Once a reliable residual waste collection system is established, start with separate collection of **paper**. High collection and high capture rates are possible and allows for economic viable collection improvements; place the bin/container directly on the property if possible (to avoid the “wind problem”).

Continue with separate collection of **glass**:

- Separate collection of the two groups “clear glass” and “coloured glass” is sufficient, since glass industry does not necessarily require three fractions (“clear”, “brown”, “green”) for recycling purposes.
- Consider the implementation of two-chamber lift-type containers, that can be emptied economically viable by only one person.

Separate collection of **plastic fractions**:

- Recommended to focus on separate collection of plastic fractions **based on the quality of the recyclables and not based on waste amounts**. Even if this means that less material is collected, the quality of materials collected will be much better (less “sorting mistakes”) and therefore such materials actually are suitable for recycling.
- A focus on separate collection of certain plastic fractions only (such as plastic bottles) allows for **a high efficiency of sorting plants** (less fractions).

Separate collection of metals:

- Focus on separate collection of **metals cans only (aluminium and tinplate)**
- Recover all **other metals** from the slag after incineration or by means of mechanical treatment

Separate collection of bio-waste:

- Focus on separate collection of certain bio-waste only (lawn cuttings, weeds, leaves, tree and hedge, windfall, trimmings, herbaceous plants, unseasoned and uncooked fruit and vegetable scraps, old bread, coffee grounds and tea leaves/bags)
 - Use good quality bio-waste from less densely inhabited zones to produce high quality compost in composting plants
 - Use lower quality bio-waste from densely populated areas to produce energy in biogas plants
 - Establish different collection routes based on the expected quality of the collected material
 - Do not separately collect waste of animal origin and kitchen waste via bio-waste bin (hygienic problems, unpleasant smell etc.)

- Dispose of waste of animal origin as residual waste
- Implement specially designated kitchen waste bins for catering industry
- Do not collect eco plastic bags via bio-waste bin/containers
 - Compost production not possible
 - Eco plastic bags in bio-waste leads to an increase of “sorting mistakes”, since it is difficult for the citizen to differentiate (confirmed by survey)
- Marketing of compost products: keep the selling price low, but do not provide produced compost for free, since the image of “bio-waste can become a valuable product” has to be transferred to the citizen.

d) Other recommendations

Re-use can play an important role. Carefully evaluate if potential waste can be re-used and create a market for attractive discarded items, and start initiatives such as the “MA 48 bazaar”, where goods from civic amenity sites are sold to citizens.

Awareness raising (see [AT EULE 2015] waste website for children), **public relations, positive image** of the waste management authority etc. play a very important role, especially when a new separate collection system is introduced. Even if it is obvious that a “mix” of instruments and measures is the key, the following examples can be emphasised here:

- In the City of Vienna for example all collection vehicles can easily be identified through corporate design. Since the MA 48 has a positive image among citizens, this is permanent positive advertisement
- Design of bins/containers: professional design very important. Recognition value, must be easy to identify etc.
- Location of bins/containers: easy accessible; very important: bins/containers shall not be old, dirty, not levelled etc.
- Again important: if the waste collection system is completely in municipal ownership, it is much easier to develop a successful overall communication strategy (i.e. corporate design of all bins, vehicles etc.)

Additional waste treatment infrastructure: in case a new waste incinerator is needed, it should be located in the city area to make sure that a connection to the existing heating network is possible (to make efficient use of both heat and power)

In 2010, the City of Vienna received the “World City Closest to Sustainable Waste Management” award, honouring the exceptional efforts the city has made in order to strengthen its position in the environmental and sustainable waste management sector.

8 Recommendations

KEY RECOMMENDATIONS

1. **Separate collection** of waste fractions leads to higher recycling levels, as the fractions collected separately are usually sent to recovery operations, in particular to recycling.
2. Involving the **private sector** in collection and treatment can help reduce costs and reduce the management burden. However, there is often a lack of transparency and information availability. There is also concern that budget surpluses might be kept within the private company and not re-directed to the municipality/household or connected to the fee system. If involving the private sector, minimum collection and treatment standards should be set and a robust reporting system for data on waste collection and treatment should be put in place.
3. **Door-to-door collection systems** result in the highest capture rates and yields of recyclables. Collection costs for such schemes might be higher; however, capture rates and revenues are also usually higher, and rejection rates and treatment costs lower.
4. **Strict separate collection** (one recyclable in one bin) usually leads to better recycling rates. The quality of the collected material is better and rejection rate is lower. The co-mingled approach can work, but the collected material can only be sorted to produce clean fractions if there is very little unwanted contamination - reducing contamination/ "sorting mistakes" in the co-mingled bin is the largest challenge. The trend in recyclate markets is likely to be towards requiring higher quality materials.
5. Implementation of **Pay As You Throw (PAYT)** for (residual) waste collection within the fee system is one of the main success factors for successful separate collection of waste fractions.

8.1 Recommendation addressing the European Commission

Clarify the calculation/measurement/counting methods for reporting on generation of municipal solid waste, household waste and its recycling:

- The amount of MSW generated per capita is different in part because of differences in what is included in the reporting. Waste management and the waste markets have changed significantly during the last 30 years. In the past, municipalities tended to collect all municipal waste types regardless of the generating entity, be they households, institutions or retailers. This has now changed due to the introduction of producer responsibility schemes and market orientation of the waste sector, with less responsibility falling on the public sector. This is supported by the fact that the heading of chapter 20 of the European List of Waste (Commission Decision (EU) No 2014/955/EU of 18 December 2014) dealing with municipal waste is defined as: Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions. Therefore, there is a need to link the definition of municipal waste to the relevant codes in the European List of Waste. This will provide a much more reliable common understanding among Member States of what municipal waste is. It will also help create a better understanding of the wastes to be included in the calculation of the recycling percentage of municipal waste.

- Recycling rates must reflect true recycling in order to enhance traceability, measure EU targets and compare data from European countries. The most appropriate data reflecting the real situation would be output data. It should be ensured that recycling rates are applied universally, although this would also need further clarification, i.e. with or without rejects, and clarify how output from MBT is reported. It should also be noted that there are four calculation methods for meeting the targets set for 2020: these imply quite substantial differences in the levels of effort required to meet the 50% recycling /preparation for reuse target.

8.2 Recommendation addressing the national/MS level

8.2.1 Recommendations regarding the setting of national legislation

- **Introduce mandatory separate collection systems** for certain municipal waste fractions, e.g. waste paper, in addition to packaging waste, or mandatory separate collection of bio-waste. This usually results in **high municipal waste recycling levels**. Fractions that are separately collected are usually sent to recovery operations, in particular to recycling.
- Introduce **clear definitions** of what is meant by separate collection in the national legislation and refer to high quality recycling and treatment standards.
- Define what is meant by **high quality standards**, elaborate treatment standards and apply them.

8.2.2 Recommendations regarding connected treatment infrastructure

When discussing and outlining the **national/regional strategy on waste management**/when planning the national/regional waste management plan, consider that:

- The overall **arrangement of available waste treatment technology can strongly influence** the collection structure reacting to that treatment infrastructure; while decisions on technologies tend to be taken on higher regional or national level, the arrangement of collection infrastructure is mainly organised on municipal level. Investments in large facilities, often under the regime of public private partnership (PPP), and with contract conditions obliging municipalities to deliver the same type/amount of waste for many years, can hinder improvements in separate collection on municipal level and the development towards more re-use/recycling...
- Invest wisely in MBT and only in connection with the introduction of separate collection systems. MBT technologies can be seen as either an **interim solution** in order to reach the targets to divert bio-waste from landfills and can also help increase the recycling rate to a certain extent, however it **cannot secure sufficient recycling**. MBT can be seen as **add-on technology** that should be used to properly treat mixed municipal waste, which will be generated even in the presence of separate collection systems. For certain waste fractions, (e.g. metals) MBT might deliver the same quality of material as separate collection, but for most fractions the quality of secondary raw material produced is lower (e.g. bio-waste, paper, glass, plastics).

- **Reconsider the necessity of investing/installing incinerators** for mixed municipal waste. Experience from cities showed that by investing the money in separate collection infrastructure and campaigns instead, the amount of mixed municipal waste destined for incineration can decrease quickly, decreasing the demand for incineration.

8.2.3 Recommendations regarding the support of the municipalities

- Waste collection is mostly in the **competences at municipalities**. National administration can however, support municipalities by providing good practice examples, guidance on separate collection, organising information exchange workshops for the municipalities, and spreading information about separate collection systems.
- The national administration should **regularly perform and publish the results of waste sorting analysis**. These analysis should preferably include different types and sizes of municipalities. Sorting analysis is the basis for planning collection systems and for monitoring waste collection performance, however it is often too cost-consuming and difficult to organise on town/village level.

8.3 Recommendation addressing the municipal/capital level

8.3.1 Recommendations for setting up and design of collection system

When **deciding on/improving the (new) collection system**, be aware that:

- Door-to-door separate collection seems to provide the **best quality of recycling**.
- Even if the **collection costs are higher** for implementing a door-to-door system, the **treatment costs are lower** as it results in fewer rejects that must be disposed of and higher revenues from the recyclables.
- Door-to-door separate collection is **better suited for residential areas with single houses** and the like, rather than in multi-store houses; it is more challenging to encourage and organise separate collection for people living in multi-store buildings, and the result is often a lower quantity and quality of the separately collected waste.
- **Introducing separate collection of one fraction might also increase the capture rate of other separately collected fractions** (i.e. when separate collection of bio-waste was included in the door-to-door collection set, the overall sorting of dry recyclables might also increase).
- **High-end solutions** (e.g. weighing equipment for door-to-door collected bins or electronic identifiers for automatic data collection, recording the amount of waste collected from each customer in bring-points and connected to a PAYT system) have expensive set-up costs, but they can quickly and significantly improve separate collection, and investments will pay off in the long term due to revenues gained from recyclables and less disposal costs.

- Compare different technical options for separate collection systems. **Invest time and money in visiting/comparing existing collection schemes** in other municipalities and learn from good/bad experience before tendering the infrastructure.

When deciding on **which fractions to be collected separately**, reflect that:

- It is recommended to **start with paper** and then cardboard, or paper & cardboard together.
- Next include **glass and metal**.
- The most challenging fraction to collect separately is considered to be **bio-waste**. However, bio-waste is also the most important fraction to separately collect to reduce the amount of residual waste and to reach the targets connected to the diversion of biodegradable waste from landfills. However, it must be noted that separate collection and recycling of other fractions might have higher environmental benefits measured per tonne of recycled material.

When relying heavily on **bring-systems as the primary collection system**, consider that:

- Bring systems often struggle to encourage the inhabitants to separate their waste instead of putting all the waste in the mixed waste bin with the **consequence of a reduced amount of separately collected waste**.
- the separately collected wastes from bring-point systems might contain a larger percentage of impurities; the **final recycled amount of MSW will therefore be smaller compared with the amount of door-to-door collection, and the revenues for the recyclables might be lower, due to their poorer quality**

When considering **co-mingling solution for door-to-door collection**, consider that:

- **Paper co-mingled with other waste streams** (in particular glass, but also metal and plastic) **cross contamination is higher** than for paper/cardboard collected as one stream in a separate bin (cross-contamination between 5 and 20% compared to 1% in single stream collection) yielding in lower quality material and less potential for recycling into new paper;
- Usually, separation of **plastic and metal collected together** usually does **not lead to sorting difficulties**;
- For other fractions, **loss** is estimated about **12 to 15 %**, which is waste resulting from Material Recovery Facility (MRF);
- The **total cost** of collection and processing **together** tend to be **lower in source separated systems** than in commingled systems;
- The **risk of contamination** makes it unsuitable to commingle some materials, for example glass should not be mixed with textiles or paper;

- **Compaction procedures** can make it **impossible to recycle** some materials, particularly aluminium, plastic and glass;
- The trend in **recyclate markets** is likely to be towards requiring **higher quality materials**; lower quality commingled recyclables are currently being bought by re-processors from outside of Europe (e.g. China);
- It might be extremely **difficult** to teach people **to sort in a right way with a comingled collection system**;
- The **co-mingled approach can work**, but the collected material can be sorted to produce clean fractions **only if there is very little unwanted contamination** - reducing contamination/ “sorting mistakes” in the co-mingled bin is the largest challenge.

When setting up/improving **civic amenity sites**, consider that

- There might be a correlation between the number of sorted fractions; meaning that the more fractions a costumer can deliver the better will be the separation in general/the more frequent he will use the civic amenity site (as costumer learns the he can get rid of mostly everything at one central point) – bundle activities with civic amenity sites.
- Besides that, they need to be convenient to use (close-by and suitable opening hours)

8.3.2 Recommendations as regards fee system and PAYT

When setting up the **fee system** for the collection system consider that:

- A **smart fee system connected to the collection service will provide significant support to an introduced collection system**: In particular the application of a ‘pay-as-you-throw-system’ (PAYT) encourages households to (i) produce less waste, (ii) separate waste;
- As a first step, the **amount (volume) of residual waste generated** by a household should be taken into account in the waste bill, by either having different price categories for different collection frequencies (higher price for higher collection frequency, e.g. once/twice a week) or by providing different waste bin sizes (60 l / 120 l / 240 l);
- It is recommended that **the fee system** should be set at a level so that it encourages recycling;
- As a further step, the fractions separately collected shall be **‘cross-subsidised’ by the fee for the residual bin**, e.g. make paper collection and or the collection of bio-waste (door-to-door) free of charge; charge more for the residual bin. Such a system will encourage separate collection and increase recycling;
- Fee **systems that leave allow the households ‘to save money’** are considered to be more encouraging than flat rate or top-up systems. This means potentially selecting a relatively high basic

fee, but allowing the possibility to reduce this by reducing collection frequency or the size of the residual waste bin ;

- Fee systems where **the profit**, gained from better sorting at source and connected better quality of saleable recyclables, **is directly connected to reducing waste fees** at household level are more encouraging, than systems where such profits are kept by the municipality or the private sector;
- **Not charging for waste services** at all (no waste fee), **connecting the waste fee to other services** (e.g. to electricity, street clearing, water bill), or funding the waste system **general taxation systems** (e.g. property tax, land tax, municipal tax) will not encourage the public to participate in the separate collection system.

8.3.3 Recommendations regarding responsibilities

When setting up the framework for **responsibilities and management** and the **inclusion of private operators** consider that:

- The **involvement of non-profit operators for collection** (e.g. owned by municipality) are considered to be more encouraging for separate collection, as profit (e.g. by selling recyclables to market or reducing administrative costs etc.) are directed back to the municipality/ back to the public (i.e. households) by reducing the waste fees;
- On the other hand, **decisions about how to organise a given collection system** with the aim of reaching a certain target (e.g. set by the municipality) should be **taken by the operators**. They are more likely to be in a position to choose the most cost-efficient collection method.
- It appears, however, that cities where the **municipality and the producer responsibility schemes or free market mechanisms** for recyclables **are combined smartly** and a harmonised way, can achieve high collection rates;
- The fee system, combined with **the municipal regulations which set the minimum standard** for collection, are the primary success factors, particular for the **collection of bio-waste**;
- The **involvement of the private sector in paper collection** might be beneficial, rather than keeping it entirely under the municipalities.
- When involving the private sector, transparency about costs, fee system and the outcomes (collected waste amounts, applied waste operations to that waste, reached rate for recovery/recycling) should be ensured, and reporting and control routines put in place.

8.3.4 Recommendations regarding information to public

When setting up/introducing new collection systems, changing the current system or adding new components to the collection system, it is a prerequisite to inform the users. These are some important considerations:

- The **communication to households** should be very clear about **what can and what cannot be placed in each bin/container**. Households should be encouraged to take an interest in how their waste is managed;

- Accompany each step of change (e.g. additional bin) with **targeted awareness campaigns** informing and motivating to users to participate using different information channels;
- Invite press and interested stakeholders (associations, NGOs) to explain/demonstrate the new steps in the collection system. **Perform, if possible, highly-visible and visualised events** (e.g. public sorting of residual waste bin, demonstrating how much recyclables are still in there, etc.).

It is important to note that one has to be patient as it takes time for a waste collection system to take root in society.

8.3.5 Recommendations as the monitoring of collection performance

In order to **measure the result of the applied collection system** it is necessary to regularly monitor progress. This can be achieved by:

- **Regularly performing sorting analyses** involving the different settlement structures found in the municipality – sorting analysis can provide a broad picture of what is collected correctly and incorrectly, and where there is potential for improvement.
- When involving the private sector in collection, **monitor collected amounts and treatment methods.**
- **Collect and publish key waste data** of your municipality (e.g. kg/inhabitant and fraction collected, recovery/recycling rates).

9 Information sources

9.1 Information provided by stakeholders for national factsheet

Member State	Reply data	Contact Person
AT		
BE	04.09.2015	Marc Leemans, OVAM, Public Waste Agency of Flanders
BG	04.09.2015	Svetlana Bojkova, Ministry of the Environment
CY	21.09.2015	Elena Christodoulidou, Ministry of the Environment
CZ		
DE	07.09.2015	Nora-Phoebe Erler, Federal Ministry of the Environment, Nature Conservation, Building and Nuclear Safety
DK	03.09.2015	Marianne Bigum, Danish Environmental Protection Agency
EE	21.08.2015	Pille Aarma, Ministry of the Environment
ES	07.08.2015	Margarita Ruiz Sáiz-Aja, Ministry of Agriculture, Food, and the Environment
FI	08.09.2015	Sirje Stén, Ministry of the Environment
FR		
GR		
HR		
HU	04.09.2015	Éva Katalin Bori, Ministry of the Environment
IE		
IT	03.09.2015	Sagnotti Giulia, Ministry of the Environment
LT		
LU		
LV		
MT		
NL		
PL	10.09.2015	Monika Kosińska, Ministry of the Environment
PT	03.09.2015	Manuela Guimarães, Portuguese Permanent Representation to the European Union
RO		
SE		
SI	04.09.2015	Lucija Jukic-Sorsak, Ministry of the Environment
SK	26.08.2015	Ivana Jušková, Ministry of the Environment
UK	04.09.2015	Robert Vaughan, Department for Environment, Food & Rural Affairs (Defra)

9.2 Information provided by stakeholders for capital factsheets

Name of institution	Contact (Name)	Date	Information regarding
Amsterdam (Netherlands)			
Municipality of Amsterdam (Research, Information and Statistics)	Rogier van der Groep	10 March 2015	Information on statics availability and district information
Rijkswaterstaat - National executive department for infrastructure and water works	Bas van Huet	11 March 2015	Interview and obtaining via this national level all quantitative data related to waste management in Amsterdam
Municipality of Amsterdam	Aart Bastmeijer	18 March 2015	All financial data from the municipality of Amsterdam
Rijkswaterstaat - National executive department for infrastructure and water works	T. Houtman	24 March 2015	Legal clarifications on the obligation for the separate collection of waste
Athens (Greece)			
Cleaning – Recycling and Maintenance of equipment Athens Municipality	Ioannis Bakountouzis	March 2015	Most information was provided. Additional information was provided via e-mail and telephone
Berlin (Germany)			
Berlin Senate Department for Urban Development and Environment	Ms Busch	13 March 2015	Packaging waste
Berlin Senate Department for Urban Development and Environment	Ms Busch	13 March 2015	Packaging waste
	Ms Schulze	18 March 2015	All waste streams, barriers to implement separate collection
ALBA Group	Ms Schröder & Mr Küber	18 March 2015 27 March 2015	Composition of recycling bin, recycling rates; Information on setup and running costs (recycling bin) cannot be provided, confidential, not to be published
Der Grüne Punkt – Duales System Deutschland GmbH	Mr Schneider	19 March 2015	Bring collection points: Information on setup and running costs ((public “bottle bank” containers) cannot be provided, confidential, not to be published
Waste management utility BSR	Ms Nogueira	20 March 2015 25 March 2015	Confirmation of data as included in the factsheet, information on running costs
Bratislava (Slovakia)			
Odvoz a likvidácia odpadu a.s. Bratislava (OLO a.s.)	Jana Slovákova	Sept 2015	Checking the factsheet
Brussels (Belgium)			

Name of institution	Contact (Name)	Date	Information regarding
Bruxelles Propreté	Mr. Debry	May 2015	Information regarding the collection system, e.g. the waste management including collection, sorting and treatment
Bruxelles Environnement	Mr. Jérôme Sobrie	April-May 2015	Information on the general administration and planning and the municipal organisation
Bucharest (Romania)			
Directia Utilitati Publice - Serviciul Managementul Deseurilor si Salubritate	Elena Bercus	March 2015	Most information was provided. Additional information was provided via e-mail and telephone
Budapest (Hungary)			
Budapest Municipality, Department of Infrastructure and Environment	Mr Attila Hadnagy	19 Feb 2015	Data on separate collection of waste and management of waste.
Budapest Municipal Public Services Co. Ltd (FKF Zrt.)	Mr István Bokor	19 March 2015	All aspects of setting up and running the separate collection systems.
Copenhagen (Denmark)			
Dansk Retursystem (Danish Take-back System)	Birgitte Ettrup	27 Feb to 26 March 2015	Information on the Danish take-back system for beverage containers
Københavns Kommune (Municipality of Copenhagen)	Chanette Tina Winberg	23 Feb to 24 March 2015	Various data on separate collection in the municipality
Københavns Kommune (Municipality of Copenhagen)	Anders Kiil	24 March to 15 April 2015	Various data on separate collection in the municipality
Dublin (Ireland)			
Dublin City Council	Sandra Smith	26 Feb 2015	Information on costs and quantities, an indication of where more info could be found.
Repak Ireland	Declan Martin	18 Feb 2015	Information on the functioning of the EPR system for packaging.
Helsinki (Finland)			
Suomen Palautuspakkaus Oy PALPA (administers and develops deposit-based systems for beverage containers in Finland)	Marjo Olkkonen	17 March 2015	Data on the collection rates for the deposit-system for beverage containers (only available nation wide)
HSY (The Helsinki Region Environmental Services)	Kimmo Koivunen	8 April 2015	Data on the collection of glass, metal and bio-waste as well as more general municipal data.
HSY (The Helsinki Region Environmental Services)	Ira Hanf	4 May 2015	Data on the collection of glass, metal and bio-waste as well as more general municipal data.

Name of institution	Contact (Name)	Date	Information regarding
Lassila & Tikanoja Plc	Merja Helander	April 2015	Data on the collection of paper
Lisbon (Portugal)			
Lisbon City Council	Manuel Severino	9 March 2015	Waste collection data, Organization of the waste collection scheme in Lisbon
Ljubljana (Slovenia)			
City of Ljubljana	Jelka Žekar	4 Nov 2015	Direct contact person in the City of Ljubljana responsible for the separate collection system; additional information about Ljubljana legal framework which was adapted to allow introduction of PAYT system, marketing campaign and regional waste centre; liaising directly with Snaga d.o.o.
	Nataša Jazbinšek Seršen	23 March 2015	Responsible for the separate collection system in Ljubljana and liaising with Snaga d.o.o.
Snaga d.o.o., public waste management company	Igor Petek	25 March 2015 25 April 201 2 Oct 2015	confirmation of data as included in the factsheet, additional data related to all waste streams and the system in general, setup and running costs, EPRT scheme
	Nina Stankovič	25 March 2015 2 Oct 2015	The system in general and Snaga's role; Snaga's responsible person for liaising with the City of Ljubljana in relation to separate collection system
	Tamara Vidić Perko	25 March 2015 13 April 2015	Alternative contact in case of absence
London (United Kingdom)			
WasteDataFlow	Liz Glynn	3 Feb 2015	Extraction of disaggregated data for London boroughs
WasteDataFlow	Andrew Cattermole	30 Jan 2015	Extraction of disaggregated data for London boroughs
London Waste & Recycling Board	Beverly Simonson	9 April 2015	Comments on fact sheet
Greater London Authority	Doug Simpson	13 May 2015	Provided links to strategy etc. And opinion on state of recycling/sep col in London.
City of Luxembourg (Luxemburg)			
Ville de Luxembourg	Mr Wulff	5 May 2015	Wide-ranging information on separate collection and the availability of data.
Madrid (Spain)			
Madrid City Council	José Luis Cifuentes Sastre	16 Sept 2015	Waste collection data, Organization of the waste collection scheme in Madrid
Nicosia (Cyprus)			

Name of institution	Contact (Name)	Date	Information regarding
Sanitation Department, Nicosia Municipality	Maria Thiseos	March 2015	Most information was provided. Additional information was provided via e-mail and telephone
Paris (France)			
Direction de la Propreté et de l'Eau	Lardin, Isabelle	April-July 2015	No information was provided
Municipality of Paris (Maire de Paris)	Cabinet de la Maire de Paris	March 2015	No information was provided
Prague (Czech Republic)			
Municipality of Prague (Waste Department)	Pavla Ochechova	Sept 2015	Checking the factsheet
Riga (Latvia)			
Riga City Council	Nadežda Vanaga	20 Feb 2015 12 March 2015	Information on institutional system for the separate waste collection in Riga City, reports of the waste collection companies on the collected waste amounts
Vides pakalpojumu grupa Ltd	Anita Kļaviņa and Guntars Levits	27 Feb 2015 3 March 2015 12 March 2015	Information about the study provided over the phone, information request regarding data of the waste collection company submitted via e-mail. Detailed information on the company's operation received during the telephone interview on 12/03/2015.
Ragn-Sells Ltd	Inese Letinska	23 Feb 2015 27 Feb 2015	Information about the study provided over the phone, information request regarding data of the waste collection company submitted via e-mail, response discussed over the phone.
EcoBaltia Vide Ltd	Dace Jansone	27 Feb 2015 3 March 2015 9 March 2015 12 March 2015	Information about the study provided over the phone, information request regarding data of the waste collection company submitted via e-mail. Overall information on the company's operation received during the telephone interview on 12/03/2015.
Clean-R Ltd	Māris Vējiņš	27 Feb 2015 3 Feb 2015	Information about the study provided over the phone, information request regarding data of the waste collection company submitted via e-mail, detailed information on the company's operation received during the telephone interview on 03/03/2015.
Ministry of Environmental Protection and Regional Development	Rudite Vesere	6 March 2015	Information about the study provided during the personal interview. Issues discussed mostly focused on barriers to implementation of separate collection system in the capital.
Rome (Italy)			

Name of institution	Contact (Name)	Date	Information regarding
“Assessorato Ambiente – Comune di Roma” (Environmental Office – Rome Municipality)		5 March 2015 11 March 2015	No feedback received.
“Servizio Recupero e Riciclaggio rifiuti urbani e assimilati” (Municipal Waste, Recovery and Recycling Technical Office – Rome Municipality)	Dr. Marta Giovanni Gerenzani	5 March 2015 10 March 2015 18 March 2015	Some data received most of them out of scope. Further additional data collected as verbal information.
“Osservatorio Provinciale Rifiuti – Provincia di Roma” (Provincial Waste Observatory)	Dr. Vincenza di Malta	5 March 2015	No data have been provided, only data at a Regional level managed
		9 March 2015	No further information has been provided.
“Dipartimento Tutela Ambientale Protezione Civile” (Environment Protection Agency – Emergency Land Agency)		9 March 2015 11 March 2015	No answers.
“Opendata Database Service” of the Municipality of Rome		9 March 2015	No answers.
ZeroWasteLazio (Local Association engaged in the regional waste management)		9 March 2015	No answers.
Sofia (Bulgaria)			
Head of Department “Contract Preparation, Management and Control” Sofia Municipality	Teodora Polimerova	March 2015	Most information was provided. Additional information was provided via e-mail and telephone
Stockholm (Sweden)			
Stockholm Vatten – Waste Administration	Niels Lundkvist	17 March 2015	Various data on municipal collection rates and collection systems
Returpack	Katarina Lundell	17 April 2015	Collection data from Returpack
FTI AB	Carolina Landerdahl	7 May 2015	Recycling data from FTI AB
Tallinn (Estonia)			
SEI Tallinn, Stockholm Environmental Institute	Harri Moora	26 Feb 2015 5 March 2015	Data on recycling rates and systems in place. Overview of the factsheet and suggestion for sources
Tallinn Environment Department	Aleksandr Taraskin	6 March 2015 9 March 2015	Data on collection systems, available statistical data, overview of the capital factsheet, organised municipal waste

Name of institution	Contact (Name)	Date	Information regarding
			collection system in Tallinn and barriers to separate collection implementation. Further contact suggestions
Estonian Environment Agency, Keskkonnaagentuur	Marit Leevik, and Cäthy Kuusik,	6 March 2015 10 March 2015 12 March 2015	Door-to-door collection of source separated waste, information for collected residual waste, system description, and recycling of collected waste information
Eesti Pandipakend	Rauno Raal	12 May 2015	Deposit refund system
Ministry of the Environment, Keskkonnaministeerium	Liina Laiverik	12 March 2015	Recycling of collected waste
Tallinn Waste Centre, Tallinna Jäätmekekus		13 March 2015	Bring collection points (textiles)
Valletta (Malta)			
National Statistics Office Malta	Jeffrey Galea	7 April 2015	General information on Malta separate collection –inc. some data
WasteServ Malta	Daniela Psaila	21 April 2015	Data on co-mingled collection
WasteServe Malta	Clyde Falzon	13 April 2015	Further contacts
WasteServe Malta	Suzanne Cassar Dimech	13 March 2015	Data on separate collection
WasteServe Malta	Tonio Montebello	16 March 2015	Further contacts
WasteServe Malta	Audrey Grima Baldacchino	12 March 2015	Information and data on separate collection
Vienna (Austria)			
Municipal Department “MA 48 - Waste Management, Street Cleaning and Vehicle Fleet” of the City of Vienna	Ms Katharina Weinmar	21 April 2015	First comments on the draft version of the capital factsheet submitted by MA48
	Ms Petra Haller	23 April 2015	Telephone conversation to discuss open questions, request for additional information
	Ms Katharina Weinmar	12 May 2015	Final comments on the draft version of the capital factsheet submitted by MA48
Vilnius (Lithuania)			
Vilnius city municipality, Environmental Protection Division	Vita Braškienė	23 Feb 2015	Email requesting information about Door-to-door collection of source separated waste from individual households. Official EU support letter was also sent.
Vilnius city municipality, Environmental Protection Division	Vita Braškienė	10 March 2015	Telephone interview with Vita Braškienė regarding the request for information sent by email on 23/02/2015. Instead the municipality representative suggested contacting two companies responsible for collection: PI “Žalias taškas”

Name of institution	Contact (Name)	Date	Information regarding
			and PI "Pakuočių tvarkymo organizacija" and search the website of the Environmental Protection Agency for further information.
PI "Žalias taškas"	Elzė Rudienė	12 March 2015	Information about Door-to-door collection of source separated waste from individual households. Company representative promised to send response by email.
PI "Žalias taškas"	Elzė Rudienė	12 March 2015	Email requesting to submit information about Door-to-door collection of source separated waste from individual households as a follow up of the interview. Official EU support letter was also sent.
PI "Pakuočių tvarkymo organizacija"	Lina Bolytė	12 March 2015	Telephone interview with the administrator Lina Bolytė – Burbulienė regarding information about Door-to-door collection of source separated waste from individual households. Company representative promised to send response by email.
PI "Pakuočių tvarkymo organizacija"	Lina Bolytė	12 March 2015	Email requesting to submit information about Door-to-door collection of source separated waste from individual households as a follow up of the interview. Official EU support letter was also sent.
PI "Žalias taškas"	Elzė Rudienė	13 March 2015	Email with the requested information.
PI "Žalias taškas"	Elzė Rudienė	13 March 2015	Telephone interview with Elzė Rudienė regarding submitted data and specifying that data is of 2014.
PI "Pakuočių tvarkymo organizacija"	Lina Bolytė	13 March 2015	Telephone interview with administrator Lina Bolytė – Burbulienė regarding the request sent by email on 12/03/2015. The company representative refused from providing the data and suggested to forward the request to Vilnius city municipality.
Vilnius city municipality, Environmental Protection Division	Vita Braškienė	13 March 2015	Telephone interview with Vita Braškienė regarding information needed and responses received after the recommended companies were contacted. Representative of the municipality agreed to review the available data and provide the requested information. She requested to send specific questions and promised to respond next week.
Vilnius city municipality, Environmental Protection Division	Vita Braškienė	13 March 2015	Email to the municipality listing specific questions about setup and running costs of collection systems.

Name of institution	Contact (Name)	Date	Information regarding
Vilnius city municipality, Environmental Protection Division	Vita Braškienė	16 March 2015	Email with the answers to questions. Only part of requested information was provided.
PI "Žalias taškas"	Elzė Rudienė	16 March 2015	Telephone interview with Elzė Rudienė regarding submitted data correction.
Warsaw (Poland)			
Biuro Gospodarki Odpadami Komunalnymi Urzędu m.st Warszawy (Municipal Waste Department of the Warsaw City Hall)	Ms. Monika Geras	10 March 2015	Information from the publicly available sources were confirmed, i.e. with regards to: waste collection schedule and Pay as you throw (PAYT) scheme, collection of biodegradable waste, source of funding, separate waste collection points (PSZOK in Polish), law regulations and recycling levels. Discussion on the list of more detailed questions (15 questions), which was prepared and sent to the City Hall together with a request for the information and data.
Biuro Gospodarki Odpadami Komunalnymi Urzędu m.st Warszawy (Municipal Waste Department of the Warsaw City Hall)	Ms. Monika Geras	13 March 2015	Answers for questions with 2 annexes with waste data representing information on amounts of collected waste in 2013 and 2014. Mostly answers refer to publicly available information (websites) and/or law regulations. For some questions only general information was obtained, i.e. in case of: coverage by the separate waste collection, differentiation between door-to-door system/bring system and recycling level.
Zagreb (Croatia)			
Croatian Environment Agency	Ms. Đurđica Požgaj	10 March 2015	clarification
Environmental protection and energy efficiency fund	Mr. Gulijano Grum	27 March 2015	information
City of Zagreb Municipality	Ms. Irena Jerković	30 March 2015	Additional information and data verification

9.3 Information sources

Information sources cited within this report are listed below. Additional information sources used to elaborate the national and capital factsheets are included in the respective factsheets.

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[AT BW 1992]	Verordnung über die getrennte Sammlung biogener Abfälle, BGBl. Nr. 68/1992 idF. BGBl. Nr. 456/1994 / Ordinance on the Separate Collection of Biogenic Waste, Federal Law Gazette No 68/1992 as amended by Federal Law Gazette No 456/1994, https://www.ris.bka.gv.at/GeltendeFassung/Bundesnormen/10010685/Getrennte%20Sammlung%20biogener%20Abf%C3%A4lle%2c%20Fassung%20vom%2023.03.2015.pdf , accessed 23 March 2015.
[AT EULE 2015]	Umweltbildung der Stadt Wien. Digitale Mist-Fibel. Mülltrennung in Wien, Mülltrennung in Wien, http://www.eule-wien.at/mistfibel/swffiles/handbuch.html#12 , accessed October 2015.
[AT MA 48 2015]	Telephone interview with MA 48,, 9 October 2015.
[AT Vienna FS 2015]	Assessment of separate collection schemes in the 28 capitals of the EU, Vienna Factsheet under this study, September 2015, unpublished
[AT VVO 2014]	Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Vermeidung und Verwertung von Verpackungsabfällen und bestimmten Warenresten (Verpackungsverordnung 2014), BGBl. II Nr. 184/2014 / Ordinance on the Prevention and Recovery of Packaging Waste and Specific Waste Products (Packaging Ordinance of 2014)), http://www.bmlfuw.gv.at/dms/lmat/greentec/abfall-ressourcen/abfall-altlastenrecht/awg-verordnungen/verpackvo/Verpackungsverordnung-2014-BGBLA_2014_II_184/Verpackungsverordnung%202014%20BGBLA_2014_II_184.pdf , accessed 23 March 2015.
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10 Annex

10.1 Annex 1: National factsheets

List of available national factsheet for each EU-28 Member State. All documents are available as separate documents attached to this report.

No	EU-28 Member State	Title of document
1	Austria	AT National factsheet
2	Belgium	BE National factsheet
3	Bulgaria	BG National factsheet
4	Cyprus	CY National factsheet
5	Czech Republic	CZ National factsheet
6	Germany	DE National factsheet
7	Denmark	DK National factsheet
8	Estonia	EE National factsheet
9	Spain	ES National factsheet
10	Finland	FI National factsheet
11	France	FR National factsheet
12	Greece	EL National factsheet
13	Croatia	HR National factsheet
14	Hungary	HU National factsheet
15	Ireland	IE National factsheet
16	Italy	IT National factsheet
17	Lithuania	LT National factsheet
18	Luxemburg	LU National factsheet
19	Latvia	LV National factsheet
20	Malta	MT National factsheet
21	Netherlands	NL National factsheet
22	Poland	PL National factsheet
23	Portugal	PT National factsheet
24	Romania	RO National factsheet
25	Sweden	SE National factsheet
26	Slovenia	SI National factsheet
27	Slovakia	SK National factsheet
28	United Kingdom	UK National factsheet

10.2 Annex 2: Capital factsheets

List of available capital factsheets for each EU-28 capital. All documents are available as separate documents attached to this report.

No	EU-28 Member State	Title of document
1	Austria	AT Vienna Capital factsheet
2	Belgium	BE Brussels Capital factsheet
3	Bulgaria	BG Sofia Capital factsheet
4	Cyprus	CY Nicosia Capital factsheet
5	Czech Republic	CZ Prague Capital factsheet
6	Germany	DE Berlin Capital factsheet
7	Denmark	DK Copenhagen Capital factsheet
8	Estonia	EE Tallinn Capital factsheet
9	Spain	ES Madrid Capital factsheet
10	Finland	FI Helsinki Capital factsheet
11	France	FR Paris Capital factsheet
12	Greece	EL Athens Capital factsheet
13	Croatia	HR Zagreb Capital factsheet
14	Hungary	HU Budapest Capital factsheet
15	Ireland	IE Dublin Capital factsheet
16	Italy	IT Rome Capital factsheet
17	Lithuania	LT Vilnius Capital factsheet
18	Luxemburg	LU Luxemburg Capital factsheet
19	Latvia	LV Riga Capital factsheet
20	Malta	MT Valetta Capital factsheet
21	Netherlands	NL Amsterdam Capital factsheet
22	Poland	PL Warsaw Capital factsheet
23	Portugal	PT Lisbon Capital factsheet
24	Romania	RO Bucharest Capital factsheet
25	Sweden	SE Stockholm Capital factsheet
26	Slovenia	SI Ljubljana Capital factsheet
27	Slovakia	SK Bratislava Capital factsheet
28	United Kingdom	UK London Capital factsheet

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