



WHEN EVERY BAG COUNTS

Pay-as-you-throw
schemes in large
European cities

The experience of Ghent, Liège,
Maastricht, and Bergamo

EXECUTIVE SUMMARY





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EXECUTIVE SUMMARY

INTRODUCTION

Objectives of the report

This report documents the implementation of pay-as-you-throw (PAYT) schemes for household waste in large European cities and examines their impact on waste separation, costs, and illegal behaviours. It is based on a study commissioned by Brussels Environment to ACR+, focusing on large urban areas where several structural characteristics pose challenges to the implementation of a PAYT. These include high-rise buildings, the presence of non-resident and/or transient population, and commercial activities using municipal waste services.

The study also places particular emphasis on the consideration of disadvantaged households. The central question was how PAYT systems can be designed to reward households complying with sorting instructions, while still ensuring equitable access to waste services for low-income residents. Therefore, the study also explores the role of social provisions.

By cross-analysing a range of case studies, the report formulates general recommendations on how a PAYT system can be successfully enforced even under these complex urban conditions.

Scope of study

The study involved a detailed analysis of four European cities that have implemented PAYT systems, including models based on paid waste bags: Ghent (Belgium), Liège (Belgium), Maastricht (Netherlands), and Bergamo (Italy). These cities were selected from a preliminary list of major European municipalities applying PAYT, based on the availability of key data and information, as well as criteria relevant to Brussels-Capital Region's context (such as the use of waste bags and the inclusion of social provisions).

Social PAYT

PAYT is a pricing method for waste collection in which users are charged based on their use of the service or the quantity of waste they present to the collection service, while seeking to «incentivise» sorting by giving a higher price to residual fractions. A PAYT system generally consists of charging collection according to the collected weight, the collected volume, or according to the service provided (for example the number of collection rounds, or a predefined volume of bin and a fixed collection frequency), covering one or more fractions (generally residual waste). The total cost of waste management is often covered by different financing methods: the general municipal budget and/or flat-rate tax unrelated to the collection service, to which a variable fee can be added.

There are many forms of PAYT system: by weight, or by volume which can consist of a prepaid bag, billing for each bin collection, or a predefined rate which depends on the volume of the bin and the collection frequencies chosen by the user, to name only the most common ones.

PAYT systems are sometimes accompanied by social compensation measures for low-income households or to cover the cost of non-sortable waste such as diapers. These compensations may consist of reductions in flat-rate taxes, or a minimum service included in the flat-rate tax (for example a number of free bags), which may depend on the size of the household.

There is ample evidence of the effectiveness of PAYT systems on sorting performances. However, PAYT and its application arrangements can also impact the occurrence of illegal behaviours (sorting errors, fly-tipping, etc.), although the link between PAYT and these practices is sometimes difficult to establish. The literature highlights a key challenge: establishing a system that is sufficiently incentivising to encourage sorting, while at the same time limiting the occurrence of illegal behaviours.

Evidence shows that PAYT systems significantly improve sorting performances.

CASE STUDY 1

GHENT (BE)

Waste management organisation

Collection is mainly done door-to-door, with different methods depending on the area (collection in bags, in individual or shared bins, or in underground containers).

The company IVAGO provides collection services.

Household waste collection

Table 1: Household waste collection in Ghent

Fractions	Residual	Bio-waste	P/C	PMC	Glass
Collection frequencies	1 time per week	1 time every 2 weeks	1 time every 4 weeks	1 time per week	1 time every 4 weeks
Collection methods	30 l and 50 l bags 40 l, 60 l, 120 l and 240 l bins Access to 30 l and 60 l underground containers	40 l, 60 l, 120 l, 240 l containers Access for 10 l and 60 l in underground containers	In bulk or cardboard box (max 0.5m ³ per collection) Shared or underground containers	75 l bags Access for 30 l max in underground containers	Rigid box (max 2 of 60 l) Shared rolling bins Underground containers

Assimilated waste

Management by the municipal service of commercial waste of the same nature as household waste with a threshold for residual waste of 180 l every 2 weeks (three 60-l bags).

IVAGO also proposes a specific (paid) service to small producers above the assimilated threshold.

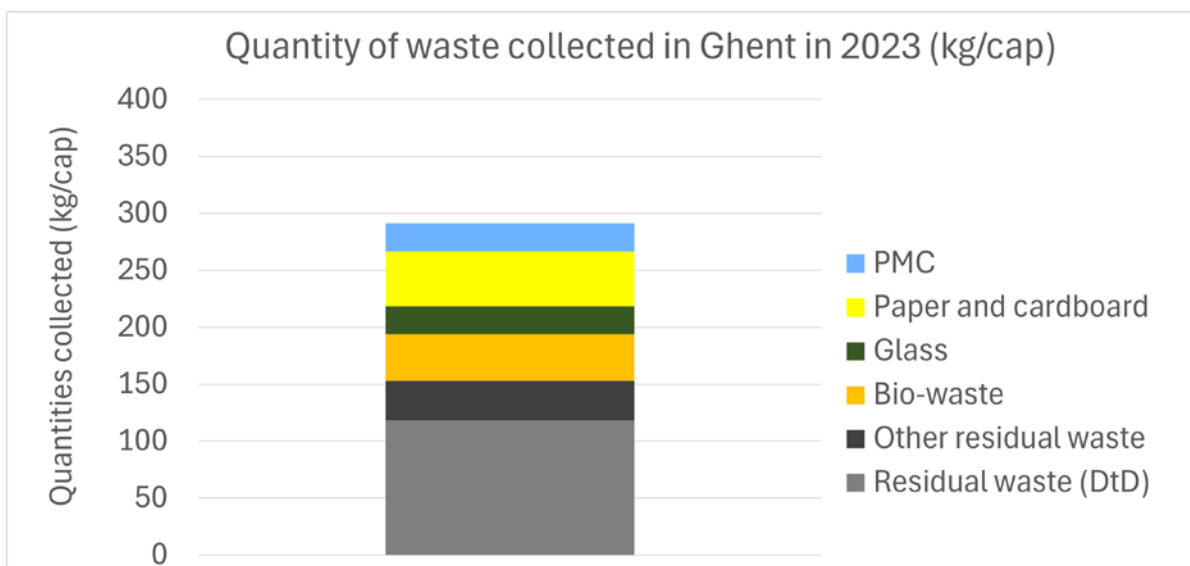


Figure 2: Collected quantities in Ghent in 2023 (kg/cap).



Population: 265 000 (2023)

Density: 1 700 inhabitants/km²

Overview of PAYT system

PAYT was introduced in 1998, in the context of the deployment of packaging sorting. The incentive nature has been strengthened over the years, with an increase in the price for residual waste and a decrease for bio-waste.

Fixed part

No fixed part, the collection is financed by the municipal budget, to which is added the contribution of the variable part.

Variable part

- Variable fee by volume: depending on the collection areas, use of prepaid bags, or pre-paid account debited for each collection of bins, or when opening underground containers,
- Paid fractions: residual waste: €0.038/l - bio-waste: €0.016/l - PMC: €0.0042/l

Social provisions

Minimum service for disadvantaged households (different criteria taken into account). The minimum service includes a certain number of collection rounds for residual waste and PMC. The number varies according to the size of the household.

Impact

Sorting performances

The implementation of PAYT seems to have had an impact, in particular on the sorting of bio-waste in the dense area. There has been a gradual reduction in residual waste collection in favour of sorting and contributions to civic amenity sites, and more marked reductions at the time of price increases.

Sorting quality

Sorting errors occurred for PMC and not for bio-waste (bio-waste is more expensive than PMC, so users tended to “divert” residual waste in PMC bins). However, controls of the content of bins seem to have limited the problem, and the quality of sorting seems now good. The accepted volume for bio-waste into underground containers by households living in apartments have also been reduced to 10 litter per use, to prevent from their use for residual waste.

Illegal dumping

The impact of PAYT is difficult to read, the changes in the various forms of illegal behaviours showing no clear correlation with the tariff adjustments.

HIGHLIGHTS

- Including sorting bags along with residual waste bags in the minimum “social” service encourages sorting among the most disadvantaged households.
- Limiting bio-waste (paid) inputs to 10 l in underground containers reduces illegal uses for residual waste.
- The service dedicated to companies above the threshold of assimilated waste seems to receive positive feedback from users.
- Setting a protocol for controlling and deploying street bins is key to limit misuse for residual waste.

CASE STUDY 2

LIÈGE (BE)

Waste management organisation

The municipality of Liège subcontracts collection to the association «Liège Collecte» which brings together three private collectors. Collection is operated door-to-door (except for glass), in bags and bins.

Household waste collection

Table 2: Household waste collection in Liège

Fractions	Residual	Bio-waste	P/C	PMC	Glass
Collection frequencies	1 time per week	1 time per week	1 time per week	1 time per week	-
Collection methods	30 l or 60 l bag	40 l, 140 l, or 240 l bin	Yellow bin Strong cardboard box	60 l blue bag	Bottle bank

Assimilated waste

Non-household producers who can use the household service (containers and frequency), with some categories (of producers/waste) excluded.

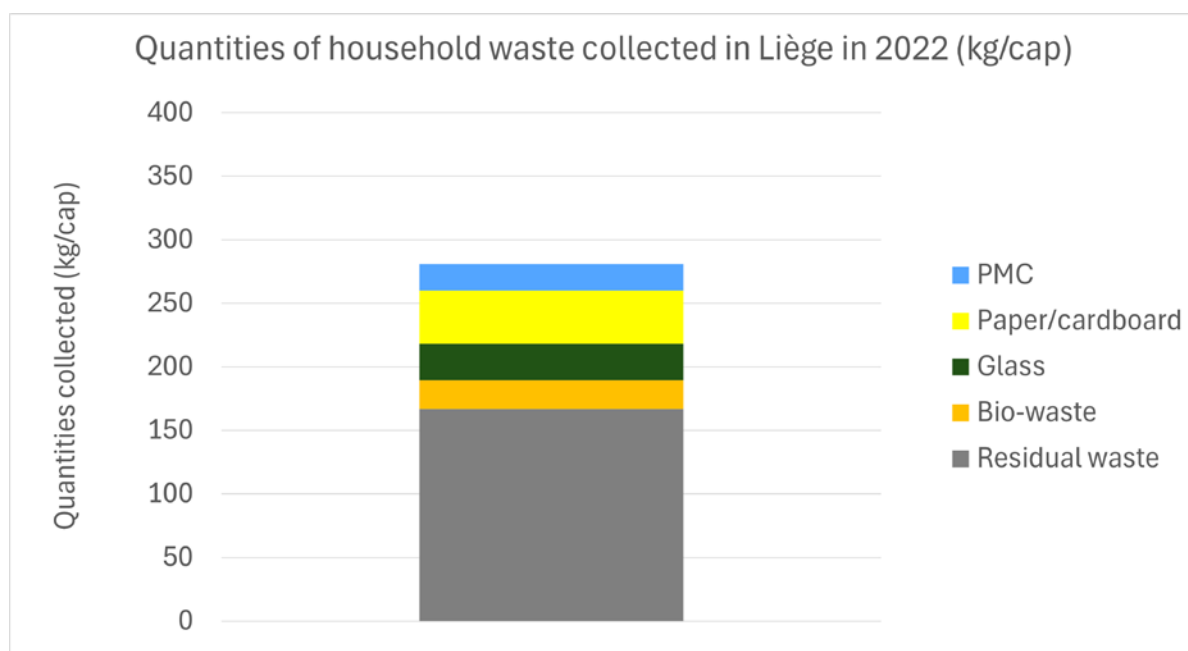


Figure 4: Collected quantities in Liège in 2022 (kg/cap).



Population: 195 300 (2022)

Density: 2 850 inhabitants/km²

Overview of PAYT system

The system was set up in 1999 in the context of the deployment of packaging sorting. Following the explosion of illegal behaviours, a minimum service was set up in 2003 as well as a reduction in the price of bags. The system has undergone some changes: (small) increase in the flat-rate tax, reduction in the minimum service.

Fixed part

- Fixed tax: €100 for a single person / €165 for a household.
- For assimilated waste, different rates: €220 per occupied building and €65 for a home activity.

Variable part

- Prepaid bags beyond a minimum service: Residual waste: €0.025/l / Bio-waste: €0.02/l.

Social provisions

Minimum service that includes free bags and collections for residual waste, bio-waste, and PMC, with quantities that depend on the size of the household. Reduction of the flat-rate tax for disadvantaged households and/or with disabilities.

Impact

Sorting performances

PAYT seems to have had an impact on the reduction of residual waste, with a transfer to the collection of packaging and paper waste, and contributions to civic amenity sites. More significant increases can be observed during tax revisions. However, the overall impact seems more limited than for other case studies, perhaps due to a later introduction of bio-waste sorting.

Sorting quality

A significant deterioration in PMC quality observed after implementation; however, subsequent quality controls appear to have helped mitigate the issue.

Illegal dumping

Sharp increase following the implementation of PAYT, then gradual decrease after the introduction of the minimum service and controls, but long return to the initial situation.

HIGHLIGHTS

- It is difficult to revert negative effects on illegal behaviours once they become widespread. This is why it is important to define a pricing system which initially limits their occurrence, even if it means increasing the incentivising nature later.
- Three measures are worth noticing:
 - The control systems implemented over the years, in particular the joint brigades bringing together cleaning agents and the police to simplify the issuing of fines and the resolution of non-compliances;
 - The «actions +» targeting different districts each year to define appropriate actions;
 - The collaboration of the different actors, particularly those operating in the field, for cleanliness issues.

CASE STUDY 3

MAASTRICHT (NL)

Waste management organisation

Waste management is the responsibility of the municipality, which collaborates with the cities of Meerssen and Valkenburg aan de Geul. Collection is done door-to-door or in underground containers for residual waste, bio-waste, and paper/cardboard depending on the area, and in underground containers for other fractions. In addition, a collection of sanitary textiles for recycling is also available.



Population: 120 000 (2023)

Density: 2 150 inhabitants/km²

Household waste collection

Table 3: Household waste collection in Maastricht.

Fractions	Residual	Bio-waste	P/C	PMC	Glass
Collection frequencies	1 time every two weeks	1 time per week	1 time per month	-	-
Collection methods	Prepaid bags of 25 l or 50 l Underground containers: standard plastic bag (< 50 l)	25 l or 140 l bins. There are also large containers in which people can empty their 25 l bins.	Bulk Cardboard box Underground containers	Underground containers, in bulk (no bags)	Underground containers

Assimilated waste

The city includes the following producers as "assimilated": offices, stores, and services, for waste assimilated to household waste in terms of quantity, nature, and composition.

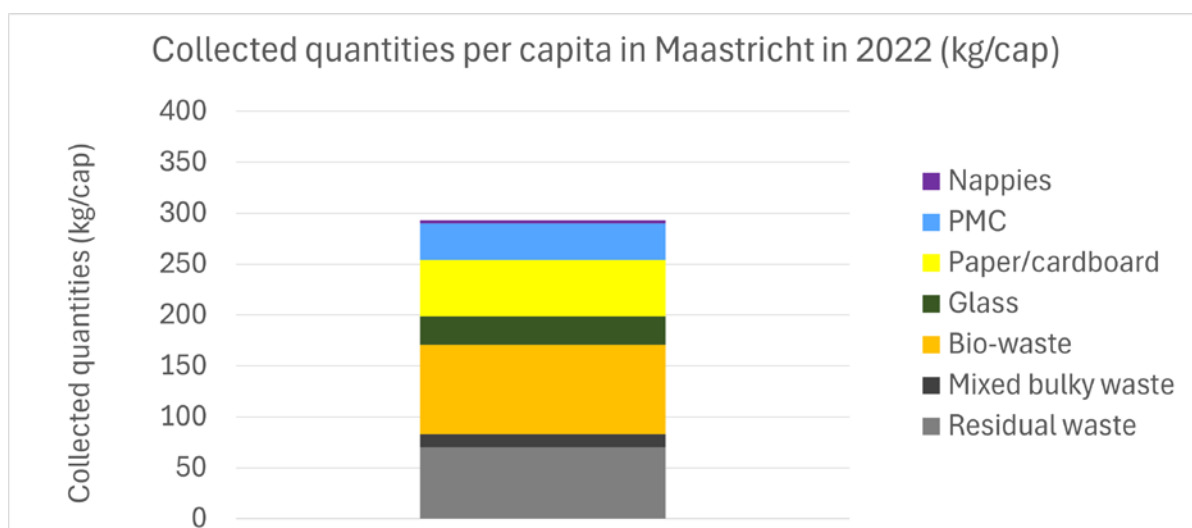


Figure 6: Collected quantities per capita in Maastricht in 2022 (kg/cap).

Overview of PAYT system

The PAYT was introduced in 2001. The price of bags increased following this introduction, then decreased in 2016. The minimum service, in place from the start, was simplified and reduced in 2017 to reflect improvements in sorting.

Fixed part

- Fixed flat-rate tax, increased for residents with garbage chutes and who do not use prepaid bags.

Variable part

- Paid bags for residual waste: €0.022/l

Social provisions

Disadvantaged households can be exempted from the waste tax if they meet various social criteria. In this case, they also receive a minimum service (worth €20 for single people and €30 for a household per year). Households producing non-sortable waste for medical reasons also receive a certain number of free bags.

Impact

Sorting performances

The PAYT system appears to have led to a rapid increase in sorting performance (particularly bio-waste), which was then consolidated by other instruments (communication, collection frequencies, etc.). It seems to have led to a significant drop in residual waste, in favour of sorting.

Sorting quality

The city is experiencing quality issues with PMC, which seems to be attributed to the underground container collection which limits the possibility of controls. Sorting bio-waste in vertical housing also appears to have encountered quality issues but it seems to have been resolved.

Illegal dumping

The link between PAYT and fly-tipping is difficult to establish, as the data does not allow for the identification of a clear correlation between their occurrence and the implementation or developments of PAYT. However, it should be noted that the city allocates significant resources to the control and elimination of fly-tipping. It seems that a recurring phenomenon is the fly-tipping of PMC bags around containers (PMC should normally be disposed of in bulk in containers).

HIGHLIGHTS

- Adaptation of the compensation system with:
 - A simplification to ensure its use by the people concerned;
 - A reduction in the volume covered by the compensatory minimum service over time to reflect progress in sorting.
- The need for good monitoring of negative behaviours before the implementation of PAYT for an objective assessment of the impact afterwards.
- Communication:
 - Residents and users: develop messages taking the user's point of view (what changes for them) and from a positive point of view («sorting pays»).
 - Elected officials: clarify the system, rely on existing good practices, and have their support for implementation. In particular, it must be made clear that the system benefits "virtuous" households.
- The importance of the resources allocated to cleanliness and controls (possibly linked to the anonymous nature of sorting and the containers used for PMC).
- Illegal bags and fraud: this is the only case study that mentions this as a recurring problem. While it seems to remain marginal, it is better to prevent from this by making bags more difficult to falsify and by alerting collection agents to the existence of non-compliant bags.

CASE STUDY 4

BERGAMO (IT)

Waste management organisation

The city is responsible for waste management, but the operational aspects are handled by Aprica Spa, a public company that manages municipal waste and cleanliness in 120 towns in northern Italy.

Household waste collection

Table 4: Household waste collection in Bergamo.

Fractions	Residual	Bio-waste	P/C	PMC	Glass
Collection frequencies	1 time per week	2 time a week	1 time every 2 weeks	1 time every 2 weeks	1 time every 2 weeks
Collection methods	Grey transparent bag with digital identifier of 40 l for households, 110 l for similar	40 l, 120 l and 240 l bins in compostable bags	120 l rolling bins	Transparent yellow bag with digital identifier of 110 l	40 l buckets or rolling bins

Assimilated waste

The Italian regulation lists 29 categories of producers that can be considered as «assimilated» to household. The regulation also lists the waste that can be included in the municipal service. The collection procedures are the same as for households. They can also decide to subcontract to a private collector which exempts them from paying the municipal fee.

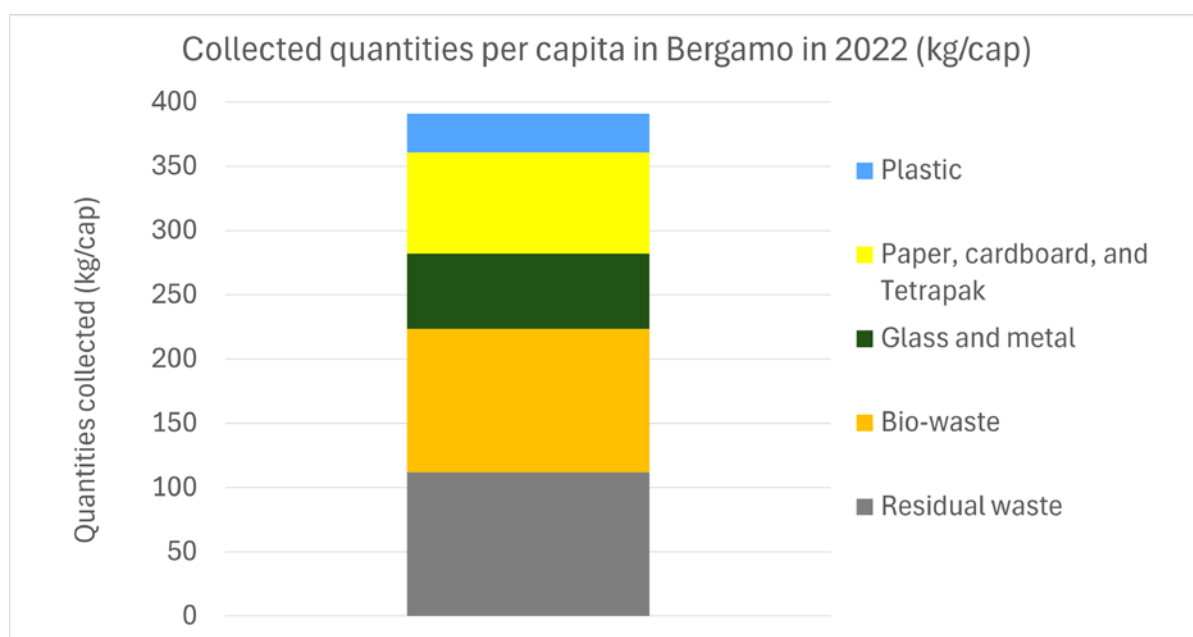


Figure 8: Collected quantities per capita in Bergamo in 2022 (kg/cap).



Population: 120 500 (2023)

Density: 3 000 inhabitants/km²

Overview of PAYT system

The PAYT was implemented in 2020, following a one-year preliminary study that defined the system, identified suppliers for the bags and dispensers, and concluded agreements with certain stores to set up the dispensers. The distribution of the first bags was done by district over 2 months, then a first year of testing was implemented, with non-compliance checks not subject to sanctions.

Fixed part

- The format of the flat rate tax is set by the Italian regulation and is calculated according to the surface area of the dwelling and the number of inhabitants. For assimilated waste, the flat rate tax depends on the type of activity and the commercial surface area.

Variable part

- Prepaid bags beyond the minimum service, for residual waste (0.01€/l) and PMC (0.0014€/l).

Social provisions

Households and assimilated producers have access to a minimum service according to their size, which gives the right to a certain number of free bags for residual waste and PMC.

These nominative bags must be collected via the social security card or a specific waste card. They also have a «target» number of bags which corresponds to an objective for «good sorters». Isolated and elderly people have a reduction in the flat-rate tax, and diaper users have additional free bags.

Impact

Sorting performances

No quality issues, and easier controls thanks to the name-coded bags

Sorting quality

No major problems with fly-tipping or cleanliness identified. Additional voluntary drop-off points are being considered for households having difficulty meeting collection times.

Illegal dumping

Increase in sorting from 73% to 77% in 2 years, and reduction in residual waste.

HIGHLIGHTS

- Nominative bags with a simple distribution system and requiring no large investments. These bags have different virtues:
 - Simplify the monitoring of behaviours, non-conformities and controls, particularly in the implementation phase, by focusing on "difficult" profiles (non-residents, people not collecting bags, etc.);
 - Enable personalised communication through vending machines;
 - Giving users a sense of individual responsibility.
- The interest in limiting the volume allocated to residual waste as a "soft" incentive promoting sorting.
- The possibility of adapting such a system to assimilated waste with services tailored to their size and profile, and pricing also defined according to the profile.
- Comprehensive and systematic controls during the implementation to identify the main problems and more difficult areas very quickly.
- A relatively complex taxation system, based on national regulations, and potentially difficult to transpose.

CONCLUSION

CROSS-ANALYSIS

Background, introduction, and type of PAYT

The cities studied present different contexts, with several characteristics that can be regarded as barriers when it comes to waste management or PAYT (density, poverty, transient population, etc.). The case studies all include a significant proportion of vertical housing, and in the case of Liège significant poverty rates.

All the case studies implemented volume-based PAYT with prepaid bags, but applied different modalities: rates for residual waste ranging from €0.01 to €0.038/l, provision or not of a minimum service for all users, different fractions concerned by the variable fees, etc.

It is interesting to note, however, that all of them offer a minimum service to some extent, to all residents or to disadvantaged households only via the compensation system, with more or less comfortable volumes, ranging from 900 to 1 600 l of residual waste per year for single-person households. The differences between household sizes are also very variable.

The implementations are quite old for all cases (apart from Bergamo), with a generally similar pattern, including the creation of a variable fee on top on an existing flat-rate tax (or its absence for Ghent). In Liège, it is interesting to note that the PAYT system underwent significant changes shortly after its introduction following the occurrence of illegal behaviours, while the other cities have generally kept the system as is. It is also interesting to note that most cities have changed certain parameters after introduction, particularly the price of bags (generally moving towards more incentives, but not always) or the minimum service (generally a reduction).

Impact

Sorting performance and quality

The quantities collected per inhabitant in Bergamo are higher than in other cities, as shown in Figure 9 on the next page. This is probably due to a «broader» management of non-household waste. As for sorting performances, it is difficult to establish correlations between the PAYT systems and the sorting rates; it can be noted that cities charging for the collection of bio-waste have lower bio-waste quantities

All the case studies offer a minimum service to some extent, either to all residents or only to disadvantaged households through a compensation system.

collected, and the minimum services generally include little volume for bio-waste. But the collection frequency of bio-waste compared to residual waste is possibly playing an important role for sorting performances: they are higher for bio-waste compared to residual waste in Maastricht and Bergamo (where the sorting rates for bio-waste are the highest among the case studies), equivalent in Liège, and lower in Ghent, which makes the use of the bio-waste collection more or less appealing to users.

It is also interesting to note that correlations can be observed between the increases in tariffs or reductions in minimum service with the evolution of sorting performances over time in most case studies.

In terms of quality, PMC seem to be more often negatively affected, but to varying degrees, quite possibly because this is the cheapest and most convenient option to illegally throw residual waste in most case studies. Collection methods also play a role: for example, collection in containers which limits the possibilities for controls might be more prone to contamination.

Sorting performance is likely influenced by how often bio-waste is collected compared to residual waste.

CONCLUSION

Non-conformities and fly-tipping

With the exception of Bergamo, all cities seem to have difficulties with illegal behaviours to varying degrees, even if the data do not necessarily allow for reliable comparisons. It is difficult to establish links between PAYT, its implementation methods, and the occurrence of non-compliances. However, it is important to note the importance of the resources allocated to controls and cleanliness in different cities. Furthermore, the different case studies seem to consider that the provision of a minimum service is a relevant means of limiting them.

Costs

While it is difficult to make reliable comparisons between the costs presented in the different cities, it does not seem that the introduction of PAYT very significant investments in the different cities. In Ghent, it seems that the prepaid bag was considered at least partly as a means of financing the collection service in addition to a flat-rate tax or the general budget. In the different case studies, it does not seem that PAYT led to a significant increase in costs. In some of the cases, however, it seems that the implementation of PAYT was motivated by the need to reduce the quantities of residual waste in order to limit the costs of treatment or the financial penalties associated with it. It should also be added that in Maastricht, controls and management of illegal behaviours represent relatively significant resources.

It is difficult to establish links between PAYT, its implementation methods, and the occurrence of non-compliances.

Assimilated waste, disadvantaged population

These points are particularly difficult to analyse, due to the lack of specific data relating to these two target audiences. It does not appear that the introduction of a PAYT system has changed the share of non-household producers benefiting from the public collection service.

Similarly, the available information does not show any notable impacts on disadvantaged households, but all the case studies introduced compensation systems which probably limited these impacts.

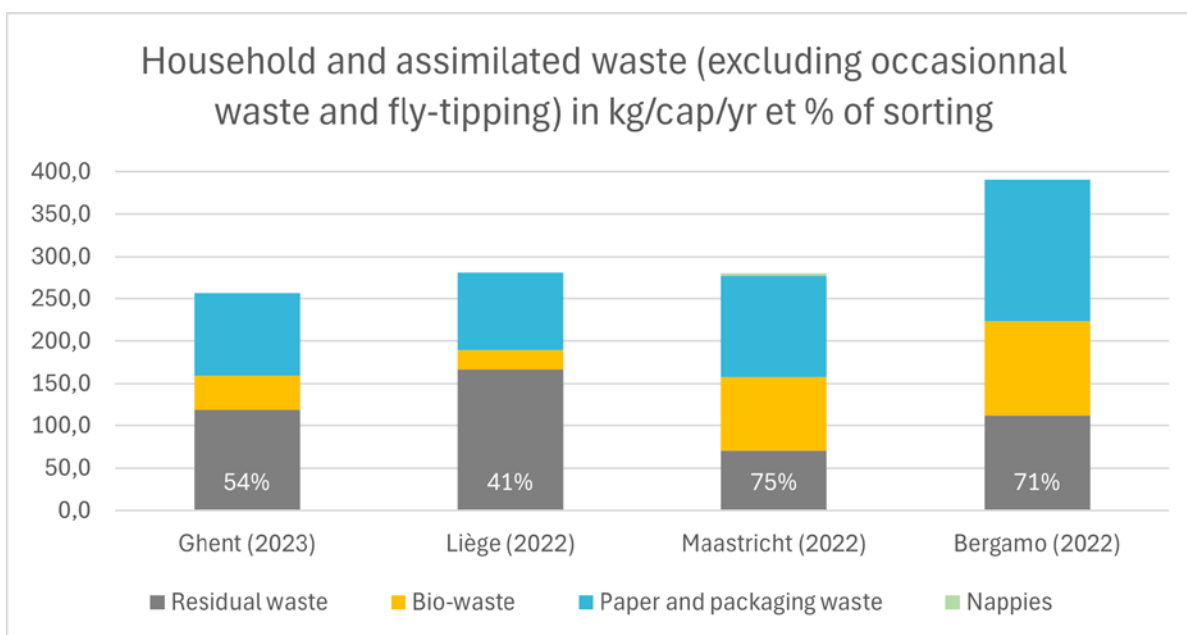


Figure 9: Household and assimilated waste (excluding occasional waste and fly-tipping) in kg/cap/yr and % of sorting (separated quantities compared to all collected quantities).

WHICH PAYT SYSTEM WORKS BEST IN LARGE CITIES?

PAYT is a powerful, yet challenging tool to implement. As shown in the different case studies, it has the potential to improve sorting performances, in conjunction with the right instruments, but it can also lead to significant issues linked with illegal behaviours. In general, PAYT can be regarded as a sort of “deterrent” for residual waste that will leads users to find alternative solutions for their waste. This will in particular encourage households that were not sorting their waste (e.g. due to misinformation, lack of suitable solutions, or lack of motivation) to do so. This means that users facing difficulties with source separation might consider using other, “illegal” solutions such as the use of street bins, contamination of sorted fractions, illegal dumping, or the disposal of their waste in locations without a PAYT. The consequences of PAYT and their positive or negative nature might reveal the strengths and weaknesses of the waste collection system.

Prerequisites

The cross analysis allows to identify some barriers making the implementation of PAYT potentially more challenging:

- **The lack of incentives for municipalities and waste collectors to increase performances:** low gate fees for residual waste treatment, lack of binding targets, lack of economic incentives, etc., might make PAYT less appealing to implement, or even counterproductive.
- **The initial financing situation of waste management,** especially if the waste costs are not visible to users (either because it is covered by the municipal budget or e.g. paid by landlords) will make PAYT look like a new tax to users.
- **Specific contextual parameters,** such the importance high-rise buildings where individualised collection systems are more challenging to set, the presence of non-resident users (tourists, commuters, or new arrivals), or high poverty rates/unregistered inhabitants that can make local decision makers reluctant to introduce new taxes.

- **Waste collection organisation:** either the use of collective, anonymous equipment making it challenging to individually charge residents, or the absence of suitable solutions to divert waste from residual waste (proper sorting schemes for bio-waste, textile waste, etc.).

To ensure a smooth implementation of PAYT and its effectiveness on waste performances, several prerequisites can be listed:

- **Ensure that all users have access to bio-waste sorting,** especially households living in high-rise buildings. A collection system that is convenient for all users is likely to lead to more diversion and limit illegal behaviour (e.g. with high collection frequencies, pre-collection equipment such as kitchen caddies and bags to limit nuisance, etc.).
- **Introduce a reliable monitoring of performances and illegal behaviours** before the implementation of PAYT, to better understand its impact: proper monitoring of the different mixed/residual flows, and of cleanliness, illegal dumping, and use of street bins.
- **Ensure a proper coordination of waste management, cleanliness, and street litter bins** whose management can be fragmented at local level, to ensure the right monitoring, controls, and resolution of issues.
- **Gradually introduce more diversion possibilities** by monitoring the content of residual waste.
- **Raise awareness among elected representatives and residents** on the costs of waste management

A collection system that is convenient for all users is likely to lead to more diversion and limit illegal behaviour.

CONCLUSION

Designing a PAYT scheme for large cities

All the studied cities were selected on the basis of their use of a **prepaid bag system**.

Therefore, the study does not allow to consider it as a preferable solution for dense areas based on the cross-analysis. However, it should be noted that this system presents several positive points: “easy” to implement, flexible when it comes to the typology of housing, easy to use by non-residents or new arrivals, and possibility to combine with other volume-based approaches such as containers with controlled opening.

The use of a **minimum service** is common to all case studies, either for all inhabitants or as a part of the compensation mechanism. Its design must be carefully considered, and so should the **pricing** of bags. To be incentivising, a minimum service should consider sorting behaviours, and possibly include bags for sorted fractions. Besides, it seems also wiser to opt for a “reasonable tariff”, and to progressively increase its incentivising nature when inhabitants are familiar with the PAYT principle.

Communication is a critical aspect of PAYT and should include clear explanation of the new system and its implications, consider the point of view of users rather than the one of the municipality, and prefer positive messages rather than insisting on the “punishing” effect. Considering more direct, targeted communication with more challenging target audiences also seems recommendable (high-rise building, foreigners and new arrivals, etc.).

All case studies showed the importance of **controls and monitoring**. The example of Bergamo, that conducted extensive sampling after implementation to identify mistakes and hotspots at an early stage, seems relevant in this regard.

Finally, the example of Bergamo shows that a “nominative”, individualised system might prove to be as effective as a “strong” PAYT scheme, while making controls more effective at the same time. Providing individual feedback (“**Know-As-You-Throw**”) seems to be another interesting way to engage households in waste separation.

Personalised feedback (“Know-As-You-Throw”) strengthens household participation in waste sorting.





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