WASTE COLLECTION

Opening questions for the reader before reading:

- What waste fractions[1] are collected separately in your municipality? How is the collection organised?
- How transparent and understandable is the waste collection system in your municipality?
- What are the characteristics of a good waste collection system?
- How does waste collection influence material recovery?
- What do you need to know before selecting which collection system suits your local context the best?

[1] for waste unit terminology, check the *Waste data basics* chapter.

Waste collection is a generic name for a series of activities on how waste from the location of its generation flows to the treatment or disposal facility. It includes:

1. The gathering of waste, including the preliminary sorting and preliminary storage and
2. Mechanical processing of waste for the purposes of transport without changing the composition and nature of the waste.

Let's start with an exercise.

Design a waste collection system for scenario 1 or 2 (select one). Do not yet read the chapter to the end, try to see what you can come up with on your own. Just do the brainstorming!

What would you suggest and why?

Scenario 1

- The municipality has 200,000 inhabitants. The population density is 4200 pers/km².
- 70% are high-rise block houses, 30% are private houses with gardens in the suburbs.
- The total waste per capita per year is 550 kg, which includes a lot of waste coming from local cafes and restaurants.
- The average income of local residents is below that of the EU. Most residents' income comes from the tourism and hospitality sectors.
- Challenge of the language diversity: 5 different languages are spoken by residents.
- The municipality partners with the local private waste management company which is responsible for implementing the waste and separate collection systems.
- Currently there is a 35% separate collection rate in the municipality:
    - Glass, paper and cardboard, plastic bottles and metals by drop-off system
    - No separate collection of organics
- Waste transports to a distant incineration plant, which holds a contract for 6 more years.
- There is one public recycling centre for hazardous, bulky, and garden waste, which is 10 km outside of the town with low participation rates of around 5-10%.
- Residents pay a flat base rate of tax to the municipality regardless of the amount of waste they produce or recycle.
- The municipality is interested in introducing a Pay-As-You-Throw scheme to offer fair price.

Scenario 2

- The regional government consists of 4 small municipalities of 2,000-3,000 inhabitants each with 10-15 km distance between them. The population density is 820 pers/km².
- There are no high-rise buildings. 100% are private houses with access to a garden.
- Total waste per capita per year is 350 kg.
- The average income of local residents is above that of the EU.
- 3,000 people of additional workforce commute to the region daily and weekly from neighbouring foreign countries.
- The regional government has a contract with a private waste management company to perform all municipality-driven decisions.
- There is some separate collection for mixed recyclables. No biowaste is collected.
- Mixed restwaste is disposed of in a landfill with a gate fee of 200 euros/ton.
- There is no central drop off location for hazardous and bulky waste; the service is available only on demand twice a year.
- Currently, residents pay a fixed rate for mixed waste and 50% less for recyclables.

What are the key factors about waste collection that you take into account?
What kind of waste streams/materials do you plan to collect? Why so?
How would you justify or explain your choices for the waste collection set up?

After making your plan, continue reading the chapter and see if it gives you further ideas.

Waste collection is an **organisational step:**

- Between those who generate waste and those who run the waste management system. In typical contexts, collection of municipal solid waste (MSW) is organised and managed by local municipalities. Proper collection avoids uncontrolled dumping and littering. The alternative option is that collection of MSW is organised by local municipalities, but work is done by private companies, based on public procurement.

Waste collection is a **technical step:**

- Between the place where waste is generated and the place where waste is treated. Collection technology determines which treatment technologies may be feasible in the further processing of the waste. Waste collection often accounts for ⅔ of all the cost involved in waste management and therefore has to be cost-effective and optimised.

There are many technical and organisational issues to consider when designing a waste collection system:

- Containers for the waste and recyclables,
- Collection vehicles,
- Collection frequency,
- Collection routes,
- The fee scheme for citizens and businesses.

Whatever you suggest, you have to **communicate it to citizens** because proper communication is essential.

Collection and transport of waste is the most important part of the waste management system for many reasons which we'll discuss in this chapter.

COLLECTION SYSTEM LOGISTICS

Separate collection is the cornerstone of high-quality recycling.

Why is it so important?

It is important to decide how the residents give source-separated recyclables to the waste company. It can be organised in a way that they **bring** it to the designated recycling spot (recycling centre) or the waste company **takes** it from each doorstep where waste was generated (door-to-door or kerbside/curbside system).

Door-to-door collection is proven to be the most effective model for those wanting to have better quality of materials, but is more expensive initially to arrange and run. Kerbside (door-to-door) collections are common in many countries such as Italy, Germany, Austria, Belgium. Collection is commonly weekly or bi-weekly. When you separate key recyclables, including, most importantly, the organics as these are the most fermentable and therefore require more frequent collection rounds, you can reduce the frequency of residual waste collection to once a fortnight, given it will include mostly lightweight packaging.

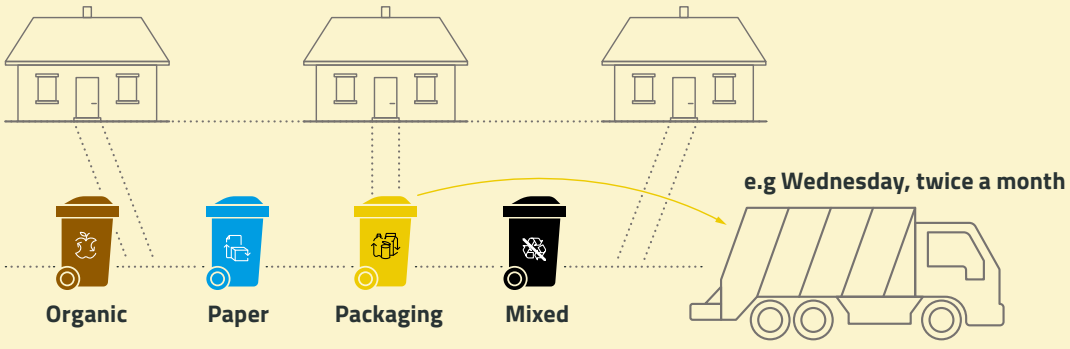
In the most intensive kerbside schemes, such as in Italy, a capture rate[2] of 80-100 kg/capita per year of just food waste is commonly achieved, equating to a participation rate of around 80%, with less than 5% impurities (waste other than organic). The capture rate with public bins (bring-system) is typically lower than for kerbside collection, around 20-50 kg/capita per year, and impurities are considerably higher, reaching averages of 10-15% in many cases.

[2] Capture rate is the % of the recyclables captured from separate collection. It is calculated by dividing the weight of recyclable material collected for recycling by the weight of all recyclables in the waste stream.

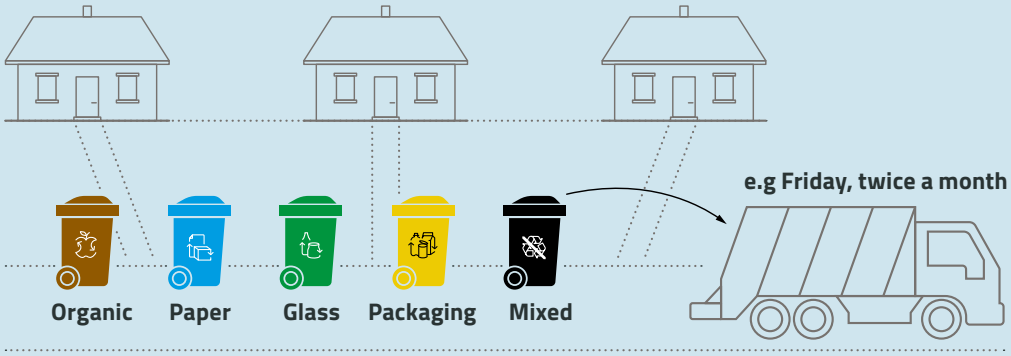
Examples of kerbside schemes

3 streams

4 streams



5 streams



Collection days and frequencies vary across the world. In hot cimates collection is organised more often, above all for organics and residual waste.
The colours of the containers for different waste streams may vary grom country to country.

Bring-systems (where people have to bring their waste to dedicated points) rely on sparsely placed waste bins or recycling centres. They are anonymous; therefore, the quality of materials is lower.

In developing countries, the informal collection system offers a living for many waste pickers, however, it is preferred to incorporate them into some kind of official network to protect their health and rights. One example of such local community cooperative can be found in Tanzania.

Waste fractions and streams

Separate collection of waste

The activity where waste is kept separately by type and nature to facilitate further handling. The decision on how to separate waste and into which fractions, is a matter of local legislation.

The list of waste fractions which are source-separated could include:

- **Waste paper.** Usually newsprint, office paper and paper packages are collected together, including corrugated cardboard.
- **Mixed packages.** In some countries soft plastic and hard plastic are collected separately, often referred to as PMD (Plastics, Metals and Drinking containers) given their similar characteristics and ease of sorting.
- **Glass bottles.** In some countries glass is separated according to colours: transparent, green, brown; but in some countries mixed colours are collected and later sorted by sensor-sorting system.
- **Organic waste.** The main objective would be receiving food waste from households. Food waste should be collected at least once a week due to its fermentability and smell.
- **Others.** PET bottles without deposit, batteries, textiles, shoes, cooking oil and many other site-specific fractions are collected as well.

Why do you think these waste fractions are collected separately most commonly? Why, for example, would metals not be collected separately?

Bins are marked by colour to simplify collection. Unfortunately, no uniform EU-wise colour coding exists. However, there are some initiatives for standardising colour coding.

An example:

Why would it be good to have the same colour coding for all waste fractions everywhere? Why do you think it isn't so already?

Organic or biowaste is the sum of two fractions of biodegradable waste:

- Park and garden waste (green waste), and
- Household kitchen waste (food waste).

The main output of the recycling of biowaste is a stabilised and sanitised organic material. Depending on the recycling process, the material can be digestate (anaerobic process) or compost (aerobic process), which are both excellent soil improvers. Although many countries claim to collect biowaste, they organise only the separate collection of green waste and do not provide any solution for citizens' food waste.

This will change: kitchen waste has to be collected separately in the EU no later than from 1st January 2024. The composition of collected biowaste relates to cultural and social factors. In areas with single-family houses, green waste is often the main fraction found in the waste bins – particularly in spring and autumn – whereas in regions with many high-rise apartment buildings, food waste is the main fraction throughout the year. This has to be taken into account when designing the collection system.

Centralised 'brown bin' collection of organics may also be replaced or combined by community composting and home composting. This helps save municipal costs with less collection needed whilst also connecting households with a more natural-based solution for managing their food scraps.

Why does organic waste need special attention in waste collection?

Collection frequency

What is the frequency of waste collection, what should be the schedule?

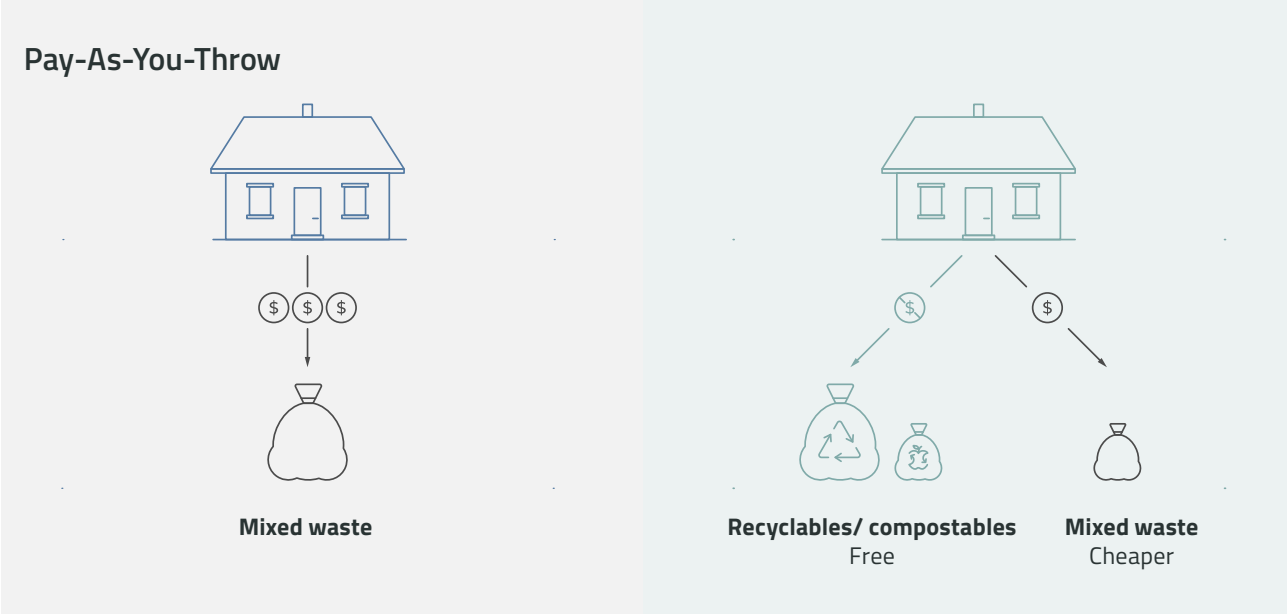
Collection frequency is usually higher in hot climates and lower in cold climates. Where food waste is collected more frequently, both acceptance of the system and participation are usually high, since nuisance odours are avoided. Food waste has to be collected even if the container is not full, given the odours it produces. Whereas glass, packaging, paper and residual waste can all be collected less frequently as they can sit in a bin for a long period of time with no big negative effects.

The fee system

What are the costs of waste collection for the citizens?

The fee system is important to foster participation in the separate collection schemes. **A Pay-As-You-Throw (PAYT)**[3] fee includes a fixed part (preferably 60-75%) covering the costs of collection and a variable part rewarding good separation, and preventing and penalising the generation of poorly separated waste. Other flexible fees can be applied through bag purchases (bags with municipality logos or stickers, indicating which waste is collected) or the purchase of differently sized bins (one bin for each type of waste). PAYT schemes should incentivise lower residual waste generation, often achieved by better sorting but also importantly via less consumption of waste.

A simplified image on Pay-As-You-Throw (PAYT) system:



Bins and containers

What does it matter what kind of containers do we have?

The way waste is stored tries to find a compromise between being cheap and nice for waste owners whilst also offering reduced workload for waste collectors, helping optimise collection rounds:

- **Manually handled receptacles.** Paper or plastic sacks and plastic or metal bins offer flexibility in collection waste at the source. They are manually handled and carried to the collection vehicle. A problem with bags is the vulnerability to sharp items. Spilled waste from broken bags creates littering but sharp objects may also injure workers.

[3] More info from: Pay-as-you-throw, European Commission

- **Containers.** Plastic wheeled bins were taken into use to increase workers productivity and reduce workload because wheeled bins are easier compared to no-wheeled metal bins. Wheeled plastic bins are used worldwide, not only for residential waste but also for commercial, light industrial waste as well as source-separated materials. In Europe, standards exist for both two- and four-wheels bins.
- **Large containers.** Larger containers have a volume of 1,5-12 m^3. They are emptied into a collection vehicle on-site; or transported individually to the treatment or disposal facility, and back.
- **Underground receptacles.** In cities with narrow streets, it is difficult to find space for bins. Cities try to overcome this problem by placing waste containers in underground pits. These are emptied by a small crane. Underground automated waste conveying systems along with robotic sorting systems will become typical in highly developed and densely populated areas.
- **Plastic bag instead of bin.** Sometimes there is no space for bins, or bins just turn out to be too expensive. Alternative would be collecting waste in plastic bags. If waste is light then picking a bag is faster than rolling a bin.

Containers may have personalised electronic locker systems. Dedicated electronic keys or cards are measures, which intend to reduce and prevent contamination with other materials; or prevent using the container by non-residents of the particular area. The last one is a question of funding the collection, which is often from local taxpayers' money.

WASTE TRANSPORT

Waste transport

The shipment of waste from the place of origin to the place of destination. It also includes the loading and unloading of waste into the collection truck.

If the transportation distance is long then waste may be loaded into larger trucks in transfer stations. A transporter of waste does not become the owner of the waste if its only task is to convey the waste shipment to the point of destination, unless otherwise agreed by the contract. The proximity between the collection round and the destination of the waste is an important factor to consider when designing a collection system, as this can have a big impact on GhG emissions.

Waste collection vehicles

Transportation of waste is expensive. One would suggest optimising it by offering service with bigger and heavier trucks, however, it is limited to how much waste a collection truck may legally contain. EU Directives limit the truck weight to trucks, one example. It has become important to compact the waste thus reducing the air-filled space and increasing the specific weight.

The trucks that are handling very large containers load them by rolling on and off (multilift-type) by using hooks or winches; or lifting them (lift dumper-type) by using chains and booms. Multilift systems are most comfortable because they do not require the driver to leave the cabin.

Multi-compartment trucks enable collecting several waste fractions in one go. A problem in this kind of collection is that when one of the compartments fills up, then the vehicle needs to be unloaded, even if the other compartments remain empty. This can be optimised however by having good data on waste generation by local citizens over a recent period of time.

Now check your initial waste collection proposal again and if needed, redesign according to knowledge from this chapter.

Based on your plan, what kind of communication would you design for households (how do you ask households to act and why) on these points:

- Waste fractions you suggest to collect
- Types of bins and how they are labelled
- Collection rounds frequency
- Fee system

What do they need to know about their waste collection? For example, how do they learn and remember the schedule?

For communications' planning, you can also check the *Communication and storytelling* chapter.

Additional reading on separate collection:

Guidance for separate collection of municipal waste

Guidance on Separate Collection - focus on biowaste collection

Ending questions for the reader to reflect upon:

- What parts in this chapter were most confusing or difficult for you to understand? Why do you think it was so?
- What kind of changes would you make in the waste collection system in your municipality? What do you think is the key challenge for your municipality?
- What do you want to take with you from this chapter?
- If and what next steps do you want to take in your work regarding this topic?
- What do you want to know more about?