

WASTE MANAGEMENT IN THE BARCELONA METROPOLITAN AREA

DREAM

DIAGNOSI
REFLEXIÓ
ESTRATÈGIA
ACCIONS
METROPOLITANES

DREAM COLLECTION

The DREAM collection (an acronym for the Catalan words for Diagnosis, Reflection, Strategy and Metropolitan Actions) proposes the construction of metropolitan narratives in the Barcelona metropolitan area based on a focus of resilience that implies assessing the risks to establish metropolitan strategies.

The new strategic lines of the AMB are contained, therefore, in a series of volumes that all follow a single methodology. The collection is divided into three main themes that are expressed by three different colours: economy and social rights (yellow), governance (violet) and sustainability (green). The first volume (red) provides the framework for the collection and explains the DREAM methodology applied to the other volumes. These are written by various specialists, together with the AMB's Strategic Planning Area, and each one deals with a sectoral area from diagnosis and reflection to subsequently establish a set of strategies and associated metropolitan actions.

VOLUME

This publication, the result of collaboration between the Strategic Planning and the Environment Areas of the Metropolitan Area of Barcelona, presents the institution's strategy for the transition towards a waste-management model that enables selective-collection targets to be achieved and at the same time incorporates the principles of the circular economy: reduce the consumption of raw materials and extend the life cycle of materials. To achieve this, as Eloi Badia states in the introduction to this volume: "It is necessary to promote the adoption of new business models that will enable the amount of waste generated to be reduced, with products designed to facilitate their reuse, or, as a last resort, to ensure they can be recycled."



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The transition from a linear economy (where resources are extracted, used and discarded) to a circular economy (which maintains the usage value of resources that are increasingly scarce) is one of the principal challenges that global economies will have to tackle in the coming years. Cities, and especially metropolitan areas, are not immune to this global challenge: we are the places where the majority of the population live, we consume the largest share of resources and produce the largest part of the waste.

In the year 2018, following years of work, the European Union approved the legislative changes that should serve to redefine the European production and consumption model, in order to gear it towards an economy that enables prosperity without overwhelming the planet's limits, and to generate environmental, economic and social benefits.

The role of the local authorities is essential to address this challenge with shared responsibilities. Each metropolitan inhabitant produces close to 450 kilos of waste, and, even though we could convert 90% of this waste into new products through recycling or reuse, we only make use of 35% of it, because levels of selective collection are still a long way from those legally demanded.

It is necessary to promote the adoption of new business models that will enable the amount of waste generated to be reduced, with products designed to facilitate their reuse, or, as a last resort, to ensure they can be recycled. However, to close the cycle, new models of waste collection and treatment that will improve compliance with selective-collection targets are also needed.

In this sense, the document presented here aims to be a reflection from different viewpoints regarding the role that the metropolitan authority should play in the transition process that is starting to take place.

Eloi Badia

Vice-president of the AMB Environment Area

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DIAGNOSIS

Natural resources are fundamental for guaranteeing human health, economic activity, well-being and quality of life, but the availability of these resources is limited by the dynamics of the ecosystems of which they form part.

The use of resources to satisfy human needs causes an environmental impact at all stages, from the moment of extraction until they are transformed into products and services and, subsequently, discarded. This impact has both a global aspect (climate change, heavy metals, persistent organic compounds, chemical pollution, etc.) and a regional one (air pollution and aquifer contamination, littering of the environment, etc.), with both aspects being inter-related.

In addition, once their useful life is over, products also become waste, with environmental and social impacts that it is necessary to consider and minimise. The production of waste is closely related with the resources that are used, and with the forms of producing and distributing products.

Growing worldwide demand is causing problems due to shortages and, for resources that are incorporated into the goods markets, volatility of prices. The consequence is greater competition for resources, which has the potential to cause instabilities in many regions of the world. The Member States of the EU rely on the rest of the world for the supply of resources such as fuels, and a series of key raw materials, and therefore are vulnerable to risks due to supply shortages.

REFERENCE FRAMEWORK FOR THE WASTE MANAGEMENT SYSTEM

SUSTAINABLE DEVELOPMENT GOALS

At the Rio+20 Conference, the United Nations agreed to establish a series of measurable and action-oriented sustainable development goals. These goals are of a social, economic and environmental nature and are the basis of the so-called Agenda 2030, this being the year by which all governments have committed to achieving them. In total there are 17 general goals that are broken down into 169 targets (United Nations, 2015).

Among the Sustainable Development Goals (SDG) are those related with environmental limits that keep the planet safe for life and also those that guarantee conditions of a good, healthy, safe and fair life for people. The intersection of these two types of limits guarantees environmental safety and justice on the path towards sustainable development and is the space where the economy should be developed. This concept, known as “Doughnut Economics” (Raworth, K., 2017) has recently been popularised by Kate Raworth.

CITIES AND THE TRANSITION TOWARDS A NEW ECONOMIC MODEL

Today, some 50% of the world's population lives in cities and it is expected that by 2050 the percentage will be 75% (<https://population.un.org/wpp/>). Cities amass materials and nutrients; they consume some 75% of natural resources and generate some 50% of the world's resources and 80% of greenhouse gas emissions (Ellen MacArthur Foundation, 2017).

In the current model, cities have a linear metabolism: they are major consumers of resources that are not produced in the city itself and that, once converted into waste, often end up being managed outside of the cities. Nonetheless, cities have an operating and legal capacity that enables them to implement actions to promote sustainable production and consumption, as well as good waste management. The convergence of citizens, companies, and public authorities in cities enables the development of new business and consumer models, the promotion of services in substitution of products (servitization), the use of inverse logistics, and the design of new durable and repairable products. Cities are, therefore, generators of knowledge, innovation, and disruptive changes. Moreover, the waste-management model adopted by each city determines the quantity of resources that will re-enter the production cycle. For example, the region of Treviso (Italy), home to around half a million people, generates just 55 kg of residual fraction waste per inhabitant per year and has proposed to reach the target of 10 kg by the year 2022 (Contarina Spa, 2018).

CIRCULAR ECONOMY AND ZERO WASTE

In the new definition of waste policy, two concepts are found: the *circular economy and Zero Waste*, which, despite having diverse origins, converge significantly at the point where it is necessary to define decisions, measures, actions, and behaviours to advance towards the same goal. While the circular economy is a more institutional and “technological” concept, Zero Waste is a more social concept linked to practices and initiatives, from citizens and from local and regional organisations alike, that have developed endogenously.

The **circular economy** represents an alternative to the current economic model associated with a linear-economy model that extracts raw materials, transforms them and uses them in the form of products, and subsequently, once their useful life has come to an end, discards them without thinking about the effects on the environment.

This defining behaviour of the linear economy presupposes that natural resources are infinite or ever-replaceable and, at the same time, that nature can act as a storm drain for any kind of waste without suffering any alterations. Historically, the linear conception of economic activity has been focused on cheap access to raw materials and the use of fossil fuels. This has been one of the bases of economic growth and of fast industrial development. But it has also resulted in negative aspects, such as the exhausting of natural re-

sources, environmental pollution, and climate-change effects. The linear economy did not take seriously the fact that it exists on a finite planet until it reached the point of glimpsing its limits.

In order to change course towards a more circular economy, it is necessary to act across the entire product value chain, from design (products should be durable, repairable and recyclable) to waste management (minimising waste wherever possible and recycling materials as a last resort), and to do this requires the contribution and participation of all agents.

The circular economy concept differentiates two types of cycles, the technological and the biological. The biological cycle includes all those materials able to be reincorporated into the biosphere, while the technical cycle refers to all those materials that could be reused or recycled but do not have any possibility of degrading and becoming reintegrated into the biosphere on a human scale.

The circular economy presents environmental benefits (protection of human health and the natural capital, reduction in water consumption, and protection of the air and the climate), economic benefits (associated with savings in raw materials and costs for companies) and social benefits (associated with the creation of jobs).

The three main principles of the circular economy (Korhonen et al., 2018) are:

- Preserving and improving natural capital through the control of finite resources and balancing of the flows of renewable resources.
- Optimising the yields of resources by recirculating products, components and materials with maximum utility in technological cycles.
- Promoting effective systems, avoiding negative externalities and unnecessary limitations.

In order to achieve a circular economy that is efficient and aware of the entropic limits, it is necessary:

- For the volume of what is circulating to be as small as possible, in other words, people should use only what is necessary and stop acting as though resources were infinite.
- For cycles to be short, and for maintenance, reuse and re-manufacturing to be promoted before recycling. For places of consumption to be located close to production or distribution sites. To favour local circuits: the resources used should be produced within the local economy.
- That the speed of circulation of materials is low. The permanence of products in the circular economy should be the longer, the better.

- That materials are free of toxic components so that they can be repaired and recycled without incorporating any toxicity.

The term *Zero Waste* refers to the possibility of preventing waste from being generated by making use of the waste from each process as resources for other processes. We could say that its philosophy integrates the narrative of the circular economy. Zero Waste requires the design of products and processes in order to minimise and avoid waste and materials use, with all resources conserved and recovered in this way. The International Alliance for Zero Waste defines Zero Waste as follows (<https://zerowasteurope.eu/what-is-zero-waste/>):

“Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate natural and sustainable cycles, where all discarded materials are resources for others to use. Zero Waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, conserve and recover all resources and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water or air that may be a threat to planetary, human, plant or animal health.”

Thus, it is a strategy that must enable the availability of resources to be guaranteed for future generations, and, moreover, alleviate the pressure bearing on the planet. At present, in the European Union, there are around 400 cities that have committed to achieving the Zero Waste target. The principles for achieving Zero Waste are prevention, selective collection, reduction of the residual waste fraction and non-incineration (Zero Waste International Alliance, <http://zwia.org/>).

In order to maintain materials in the economy for the maximum time possible, the selective collection of reusable products and components, of recyclable materials, of organic waste and of the residual waste fraction is essential. Thanks to good selective collection strategies, various European municipalities have achieved recycling rates of between 80 and 90%, some of them in Catalonia.

It is necessary, finally, to minimise the residual fraction made up of waste that is not reusable, recyclable or compostable. All products placed in the market have to be designed in such a way that they can once again enter the production cycle, whether through reuse, recycling or composting.

EUROPEAN LEGISLATIVE FRAMEWORK

The Waste Framework Directive 2008/98/EC (European Commission, 2008) is the main regulatory instrument for waste management in the EU. This directive represents an improvement on its predecessor given that, firstly, it incorporates the waste treatment hierarchy, where prevention and reuse are prioritised above recycling and, in the last instance,

incineration and landfill. The Directive also incorporates concepts such as “the polluter pays” and “extended producer responsibility” and obliges member states to make plans for the management and prevention of state and regional waste. For the first time, it also establishes the obligatory nature of the selective collection of various fractions (paper, metal, plastic and glass) and defines a target for recycling and preparation for reuse of 50% by the year 2020. Finally, it also establishes a recycling target of 70% of construction and demolition waste.

Roadmap to a Resource-Efficient Europe and 7th Environmental Action Programme

In the year 2011, within the framework of the European 2020 Strategy, (European Commission, 2010), the Roadmap to a Resource-Efficient Europe was presented. It recognises the importance of considering waste as resources and for these to be returned once again to the economy. The Roadmap also proposes ways of increasing the productivity of resources and disassociating economic growth from the use of resources and the derived impacts.

The main ideas of the Roadmap are developed in the 7th Environmental Action Programme, under the title *Living well, within the limits of our planet* (European Commission, 2014), a programme that contains the goals and the means for transforming the EU into a low-carbon and resource-efficient economy by the year 2020, and presents a longer-term view for the year 2050.

The circular economy package

In December 2015, the European Commission adopted the circular economy package, but it was not until June/July of 2018 that it was definitively approved. The package includes an action plan and specific proposals for modifying the European legislation on waste matters (European Commission, 2015). It plays a key role in the transition towards a circular economy and contributes, at the same time, towards achieving some of the targets marked by the 7th Environmental Action Programme.

The package presents changes in the production and consumption model that should enable better usage of resources. It also takes into consideration waste management and the market for secondary raw materials, in such a way that it covers the whole materials cycle.

The action plan pays attention to five priority sectors: construction and demolition waste, the secondary raw materials market, biowaste, plastics, and food waste. It makes legislative proposals to modify different regulations in the waste area through the Framework Directive on waste, landfill sites, packaging containers, waste electric and electronic devices waste, disused cars and batteries.

The circular economy package defines goals for recycling and preparation for reuse for the coming years and for the first time, limits the amount of waste that can be sent to landfill. It also defines new targets for the upgrading of different types of packaging.

The package also includes the obligatory nature of selective collection of the organic fraction, textiles, oils and hazardous waste. With regard to construction and demolition waste, the Member States have to promote the separation of hazardous substances prior to demolition and maximising reuse and recycling.

In prevention matters, it requires the establishment of qualitative and quantitative prevention targets, although these are not obligatory. Nor does it define obligatory targets in the sphere of reuse, although it does incentivise Member States to establish measures for repair and reuse. It also includes, for the first time, qualitative prevention that limits the presence of hazardous waste in the market and establishes minimum requirements for extended producer responsibility (EPR).

As part of the action plan, in January 2018 the European Commission published the European strategy on plastics within the circular economy (European Commission, 2018a), which tackles recyclability, biodegradability, the presence of hazardous substances in plastics, and marine waste. Especially important is the target that by 2030 all plastics will have to be reusable or recyclable and it has also been announced that a proposal will be published regulating single-use plastics through a specific directive.

WASTE MANAGEMENT IN THE AMB

GENERATION OF WASTE IN THE AMB

The economic crisis of 2008 marked a turning point in municipal waste production. After years of economic growth associated with an increase in waste production, in the year 2004 an all-time record of waste generation was reached with 543 kg/inhabitant. Some years of stabilisation were the prelude to the fall in waste production that took place from 2008 to 2013, when an all-time low of 423 kg/inhabitant was achieved. This fall represented a decrease of 22% from 2004, but since 2013 waste generation has been increasing once more.

In the year 2017, a total of 1,453,839 tons of waste were generated in the AMB, equivalent to 447 kg per inhabitant per year. With this level of waste generation, the AMB was below the average for Catalonia and the average for Europe (509 kg and 483 kg per inhabitant per year, respectively), but even so, an effort needs to be made to further reduce the quantity of waste generated.

The graph below shows the evolution of waste generation (production) distinguishing gross waste collection (GWC), which includes all the waste collected through systems located around the municipalities and assigned to selective collection (SC), from that which is not selectively collected, called the residual waste fragment.

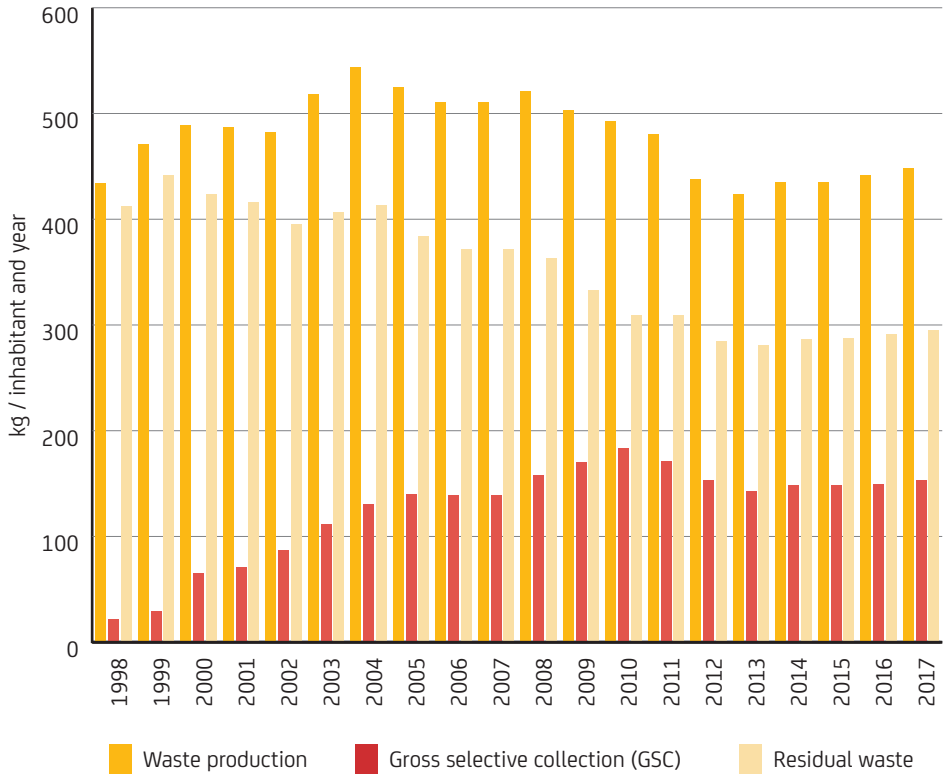


Fig. 1. Evolution of waste generation (production), distinguishing gross waste collection (GWC) and the residual waste fragment. (Compiled by the author based on ACA data).

SELECTIVE COLLECTION OF WASTE IN THE AMB

In the year 2017, there was selective collection of a total of 496,687 tons of municipal solid waste (34% of the waste produced), equivalent to 153 kg per inhabitant. Over the course of the last 10 years, the metropolitan area’s results on selective collection have consistently stood below the Catalan average (39.9% in 2017), both in percentage values and production per capita, and it has never managed to exceed its all-time high of 37.2% corresponding to the year 2010 (data on AMB waste production and management).

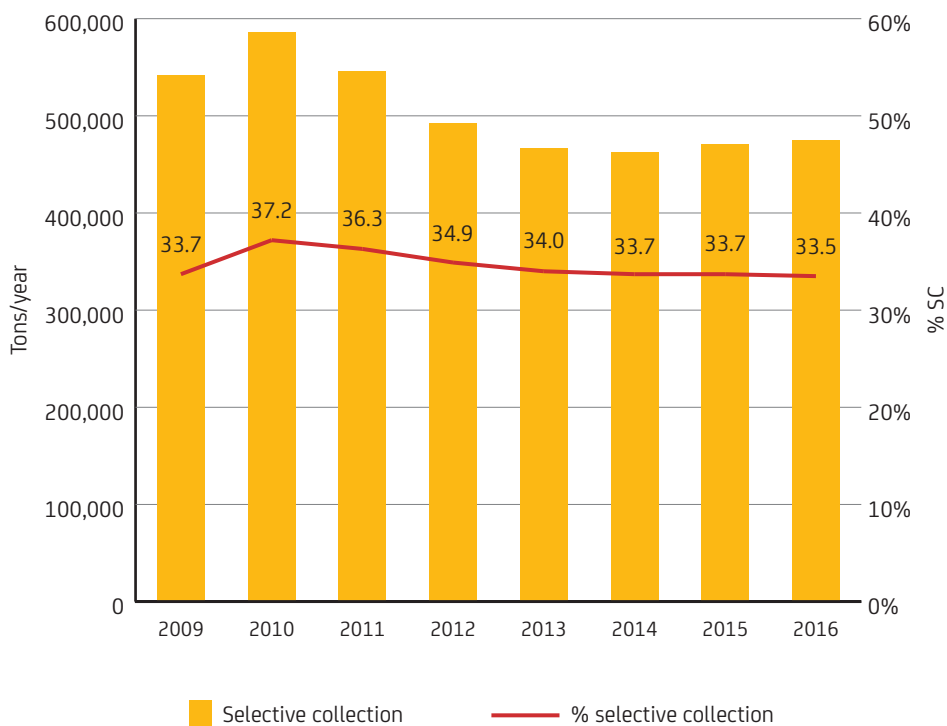


Fig. 2. Evolution of selective collection in the AMB, 2009-2016. *Compiled by the author based on AMB data.*

Selective collection by municipalities

The results for selective collection (SC) present great variability in the different municipalities in the Barcelona metropolitan area, with a minimum of 19% and a maximum of 76% (AMB data on waste production and management, 2017). Within this variability, in the year 2017 there were six municipalities in the metropolitan area that achieved the selective collection targets set in the General Programme for Waste and Resources Prevention and Management 2013-2020 (PRECAT20, Generalitat of Catalonia, 2014): Begues, El Papiol, Castellbisbal, Sant Just Desvern, Tiana and Torrelles de Llobregat. In contrast, the municipalities furthest away from achieving the targets were Santa Coloma de Gramenet, L'Hospitalet de Llobregat, Sant Adrià de Besòs and Cervelló.

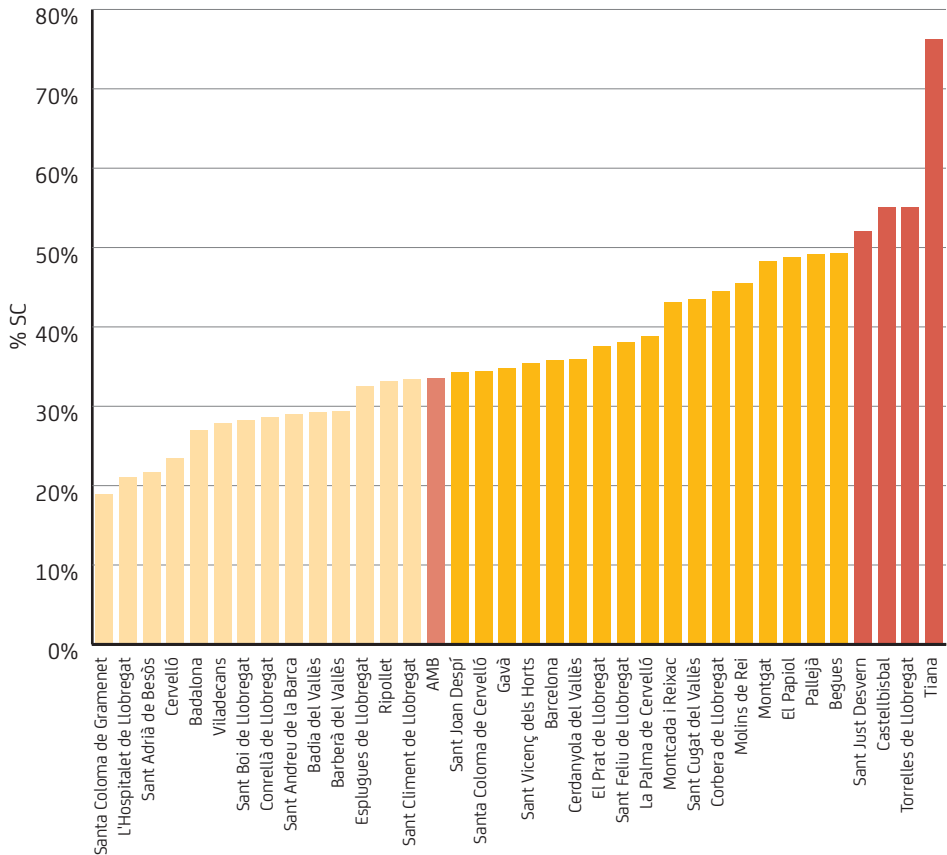


Fig. 3. Level of selective collection (SC) by municipalities in the year 2016. *Compiled by the author based on AMB data.*

Collection by fractions

The fraction with the best collection levels is bulky items, for which it is estimated that close to 65% are collected adequately. This is followed by glass, with 57%, the VFG (vegetable, fruit and garden) fraction with 46%, and paper and cardboard with 38%. The last is textiles, which stands below 15%.

Of the total waste collected selectively, the organic fraction (OFMSW) is the most important fraction, with 32.6% of the total. It is followed by paper and cardboard, with 16.4%, and bulky goods with 14.7%. The rest of the fractions represent a third of the total collected (AMB data on waste production and management, 2017).

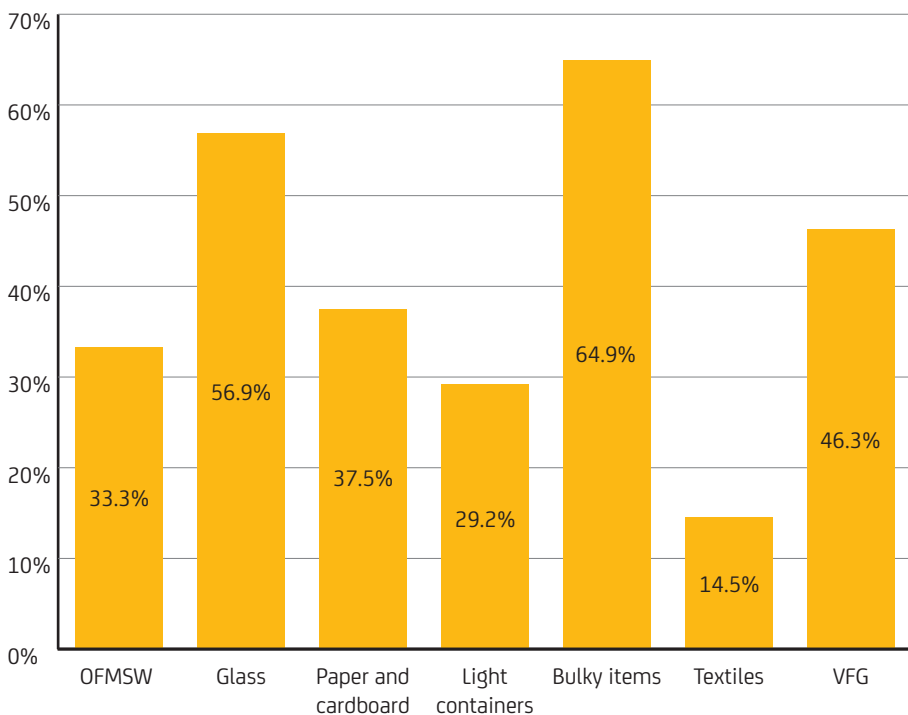


Fig. 4. Level of selective collection (2016) of the main fractions.
Compiled by the author based on AMB data.

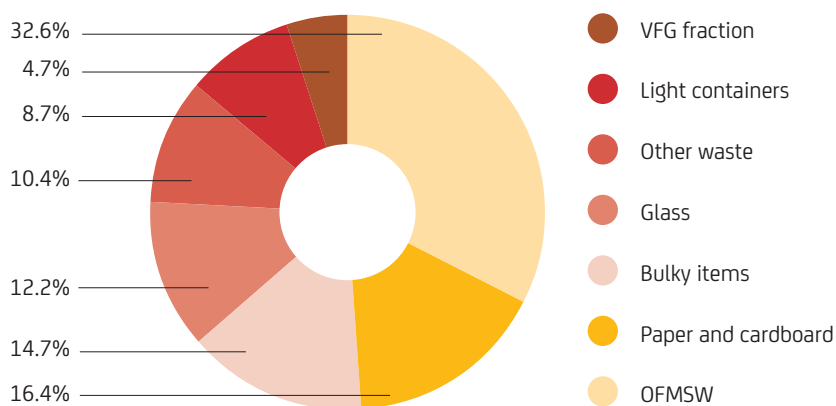


Fig. 5. Distribution by fractions of the selective collection of the main fractions.
Compiled by the author based on AMB data.

The collection of the different fractions has remained stable, except for paper and cardboard which dropped significantly due to theft, and organic waste which stabilised on a downward trend after the mainstreaming of the system in Barcelona in late 2009.

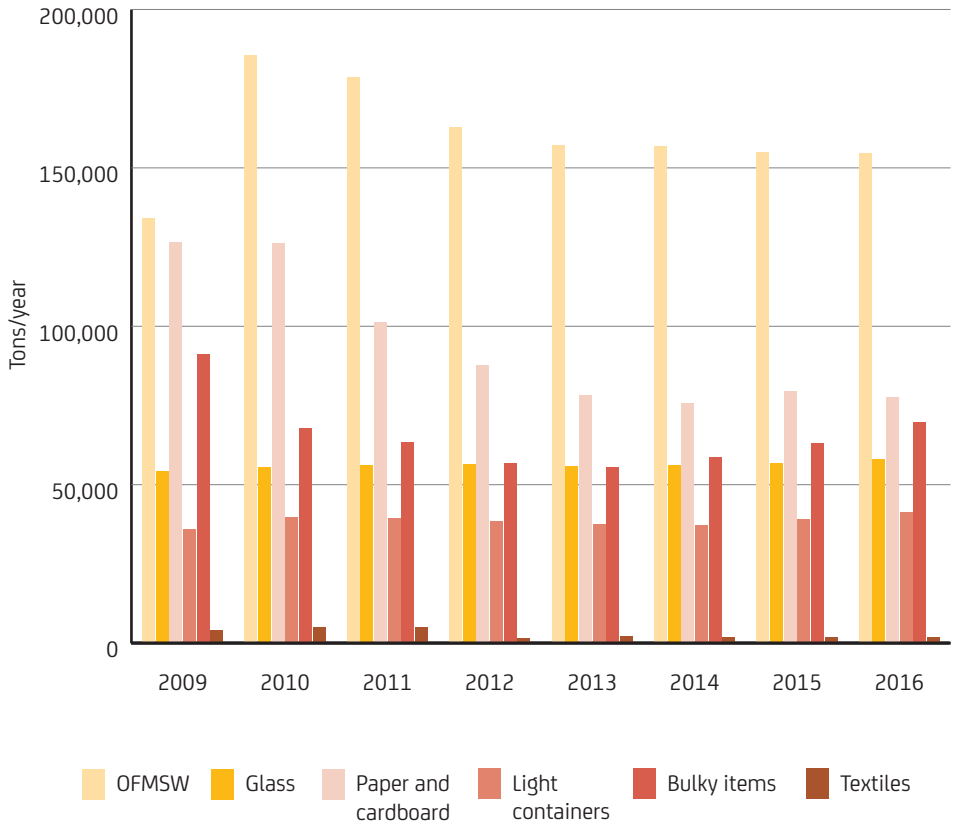


Fig. 6. Evolution of the selective collection of the main fractions.
Compiled by the author based on AMB data.

HOUSEHOLD WASTE COLLECTION IN THE METROPOLITAN AREA

In the last 20 years, the selective collection model has become consolidated based on five fractions (organic, glass, paper/cardboard, light containers, and residual waste fraction), except in minimum-waste municipalities where four fractions are collected separately (organic, paper/cardboard, glass, and inorganic fraction, in other words, residual waste fraction and

light containers). In addition, in all municipalities there is collection of bulky items. In contrast, the rolling out of selective collection of the most minority fractions, such as oils and textiles, has been more irregular.

In parallel to the municipal collection systems, the different extended producer responsibility collection systems (SCRAP), have established a structured collection network for different waste types (mainly batteries, bulbs and small electrical appliances) around points of sale or at municipal rubbish tips.

With regard to the collection system, the most used is the open-lid container (calibrated or not) located on the roadside, although some municipalities also have underground containers or, as in the case of some areas in Barcelona, pneumatic collection points where waste is “vacuumed” away through centralised mechanisms. In metropolitan municipalities there are around 30,000 containers installed for the residual waste fraction, 20,000 for the organic fraction and 9,000 for the other selective fractions (data from the Catalan Waste Agency, 2017).

The exceptions to collection via containers are the municipalities of Tiana and Torrelles de Llobregat, which collect door to door (in the case of Tiana the organic fraction and the residual waste fraction are collected, and in Torrelles de Llobregat, the organic and the inorganic fractions). Door-to-door collection consists of withdrawing waste from the doors of homes on certain days for each fraction. This is one of the systems that achieves the best percentages of selective collection and, moreover, it is associated with lower values of improper waste being mixed with organic waste.

Complementary to the street collection system there is a metropolitan network of rubbish tips, which enables collection of those fractions not covered by a specific selective collection or that, due to the toxicity that they represent, require separate collection.

Management of rubbish tips is shared between the AMB and the municipalities. While the AMB takes care of the logistics management, the municipal councils take charge of the local management of the facilities. The collection of waste at the rubbish tips represents around 5.5% of the municipal solid waste generated. Despite all municipalities having a rubbish tip, only 10% of metropolitan households make use of this service (Ecoinstitut, 2018).

The use made of rubbish tips in the city of Barcelona presents differences with respect to the other municipalities in the metropolitan area due to its commitment to local rubbish tips (neighbourhood green points), of which there are 27. Thus, while Barcelona receives 70% of the total visits, it collects only 22% of the waste in weight terms due to the fact that the main fractions brought by users across the AMB are heavier and include, for example, rubble originating from small building alterations and renovations.



Fig. 7. Barcelona neighbourhood green point. *Xavier Sulé.*

COMMERCIAL WASTE

Commercial waste is waste generated in each municipality by the typical activity of retail and wholesale commerce, hotel and catering establishments, markets, offices and services as detailed in Legislative decree 1/2009, of 21 July, which approves the consolidated text of the Regulatory Law on waste. This waste represents a significant part of the total of municipal solid waste and it is estimated that it accounts for 40% of the total, with differences according to the fractions.

Commercial waste is collected through a public or a private service. In the case of public services, the municipality carries out collection and charges it through the municipal waste collection tax. In the case of private collection, the establishment contracts out a private company and, once accredited, the local council does not charge the establishment the municipal tax or alternatively applies a reduction in the rate.

Currently there are 14 municipalities in the AMB that do not have segregated commercial waste collection, in other words, the commercial waste circuit coincides with that of household waste, and only nine municipalities have organised a special commercial waste system to collect some of the main fractions (organic, glass and containers).

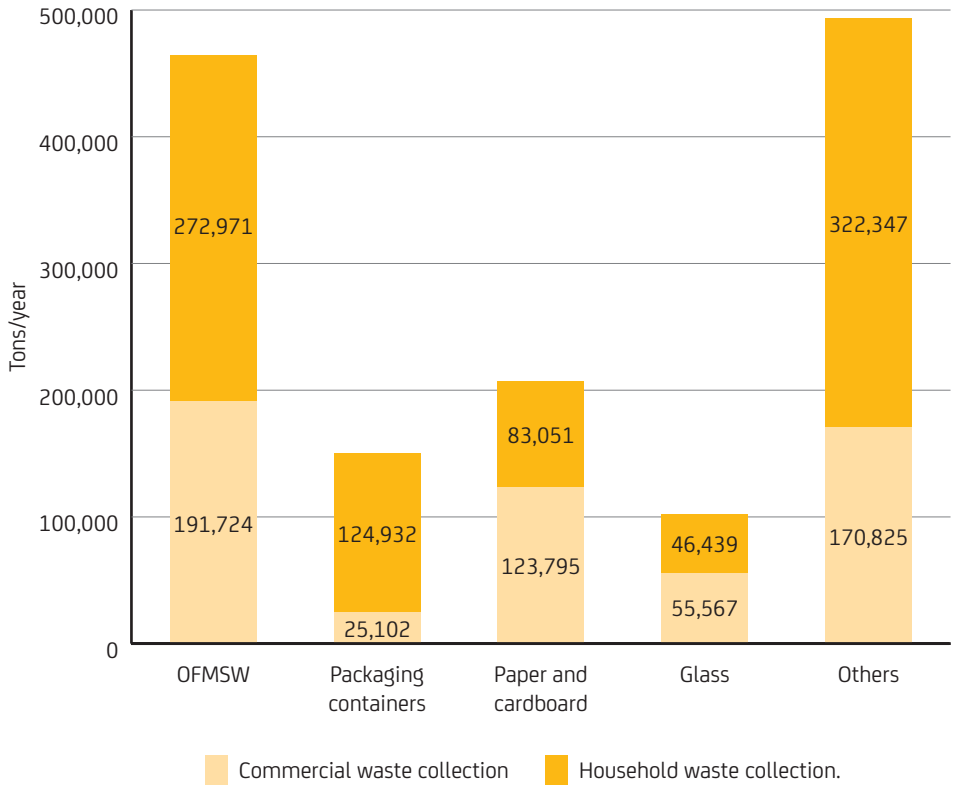


Fig. 8. Proportion of commercial and household waste according to the type of selective collection. *Compiled by the author based on Spora, 2018.*

The generation of waste of commercial origin depends on the degree of intensity of commercial and tourism activity in the municipality. In municipalities such as Barcelona, it is estimated that commercial collection represents 48% of the total municipal waste generated, while in the municipalities of Corbera and Castellbisbal, for example, it represents values of between 12% and 13%, respectively.

DETERMINANTS OF PARTICIPATION IN SELECTIVE COLLECTION

Beyond the individual questions that determine the behaviour of metropolitan inhabitants with regard to selective collection, there are aspects of the design of the collection model via containers that have an important impact on the quantity and quality of the waste that is collected selectively. In the case of the collection of the main five fractions, the three most important are:

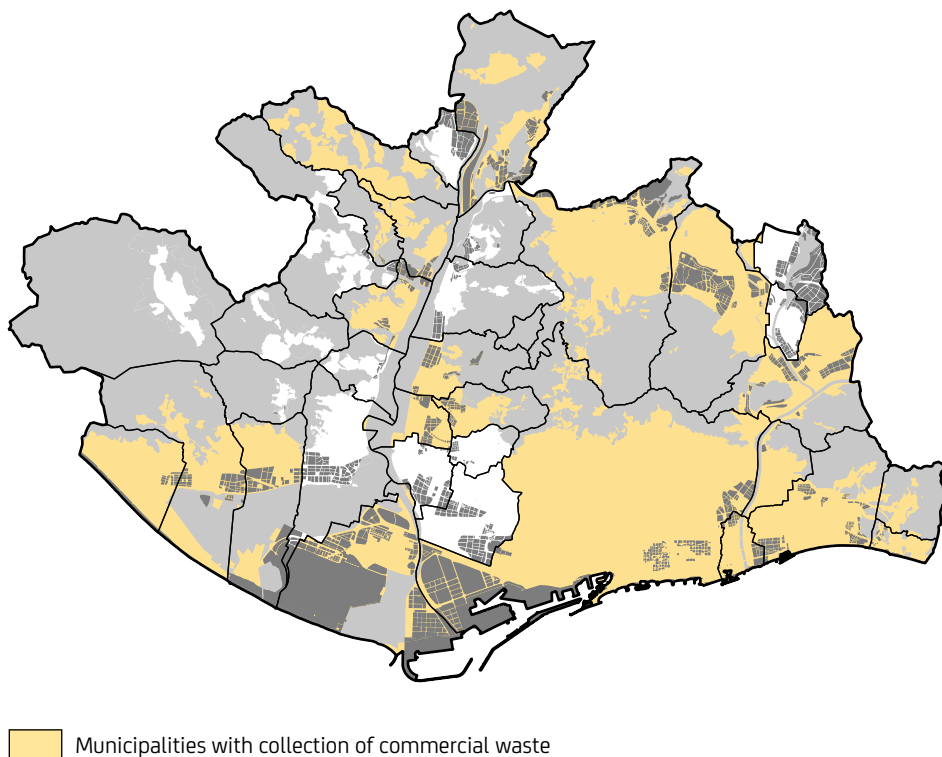


Fig. 9. Municipalities with segregated collection of commercial waste. *Compiled by the author based on Spora, 2018.*

Configuration of collection areas: in the deployment of selective collection in metropolitan municipalities, the three most common configurations are the so-called roadside areas (clusters of waste containers for the selective collection of light containers), bring points for the disposal of the residual waste and organic fractions and, finally, complete disposal areas (with containers for the five main fractions). The complete disposal areas are the configuration that best incentivises selective collection, as it is much more convenient for people who separate all the selective fractions. However, for reasons of occupation of public space, this complete configuration is infrequent in most municipalities and there has been a tendency to group together selective waste containers, on the one hand, and the residual waste and organic fractions, on the other. This configuration has led, in practice, to an increase in collection points for the residual waste fraction, a situation which disincentivizes selective collection. It is important to underline that despite this configuration leading to a greater presence of containers for the organic fraction, no increase in the volume collected has been detected.

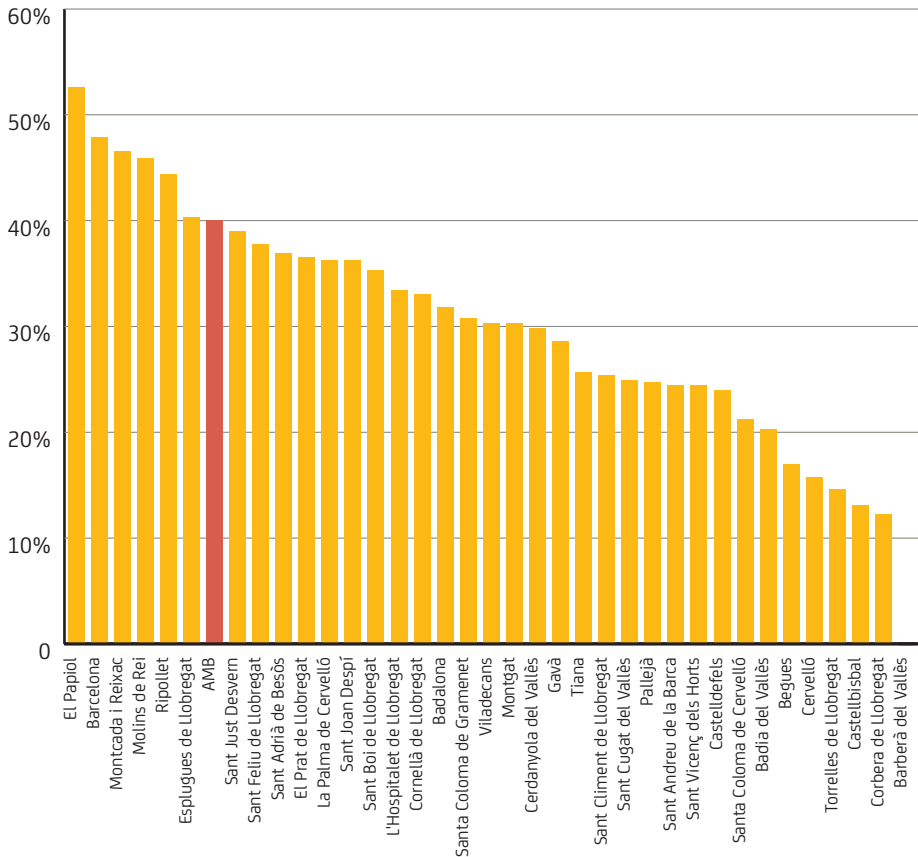


Fig. 10. Collection of commercial waste with respect to total municipal collection. *Compiled by the author based on Spora, 2018.*

Distance to containers: the optimal distance to a selective collection waste container for any of the fractions should not exceed 100 metres. This is complex in many municipalities for the residual waste fraction, but not necessarily for selective collection. The balance between proximity to waste containers and occupation of the public space is one of the weak points of the waste containers collection system. The most adequate way of guaranteeing that this balance does not condition the convenience of selective collection is reducing the number of waste disposal areas but ensuring that they are always of the complete type. The effect of proximity in selective collection levels can be checked with the correlation between inhabitants per container and kilos collected per inhabitant.

Type of opening: besides the amount of waste collected, its quality is also very important, i.e., that it only contains those fractions intended to be collected and not others that can interfere with their treatment. It has been confirmed that adapting the opening of the selective collection container to the type of waste to be collected increases the quality of the materials collected. Nearly all the metropolitan municipalities have containers with calibrated openings for the different selective fractions of packaging containers, but not all of them have these for the collection of organic waste. In this fraction a marked relationship between type of opening and quantity of improper waste can be seen.

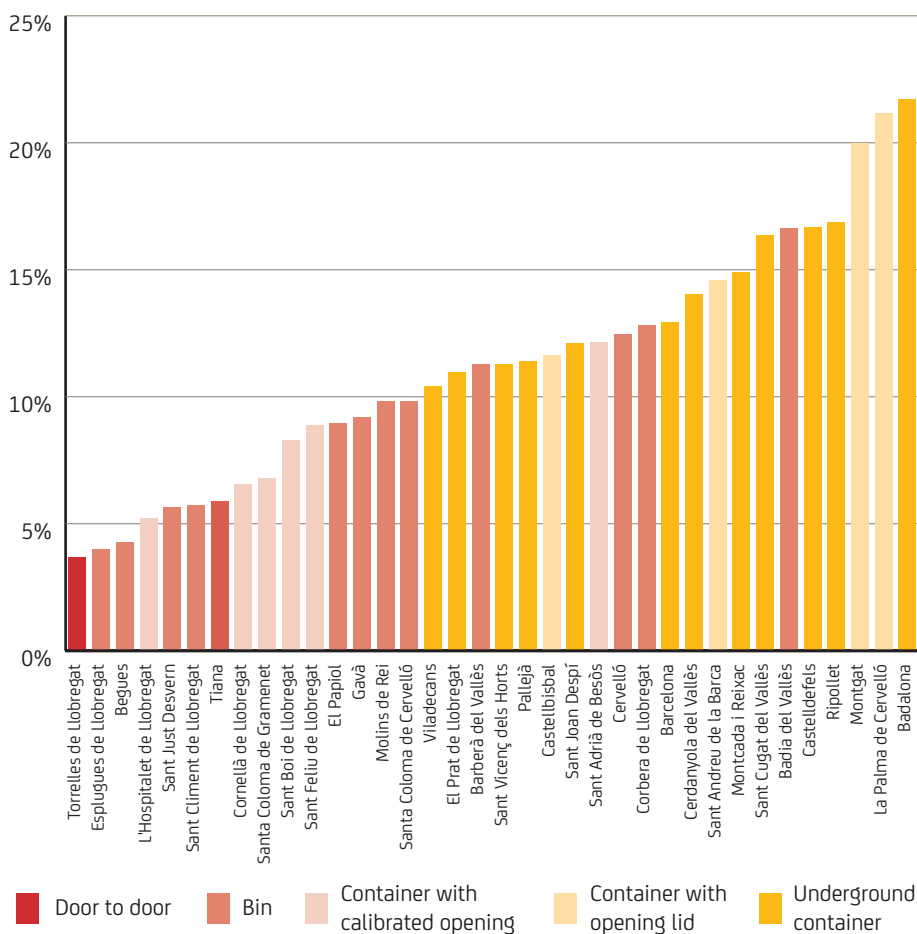


Fig. 11. Amount of improper waste according to type of opening (data 2017). (Compiled by the author).

WASTE TREATMENT INFRASTRUCTURES IN THE AMB

The AMB has access to a series of waste treatment facilities equipped with technologies and capacity for treatment the large part of the waste produced in the metropolitan area.

Specifically, they treat the following fractions: organic fraction of municipal solid waste (OFMSW); inorganic fraction of municipal solid waste (IFMSW); vegetable, fruit and garden (VFG) waste; light containers; bulky items; and residual waste at its own plants, while the other fractions are sent to external managers who take care of their treatment.

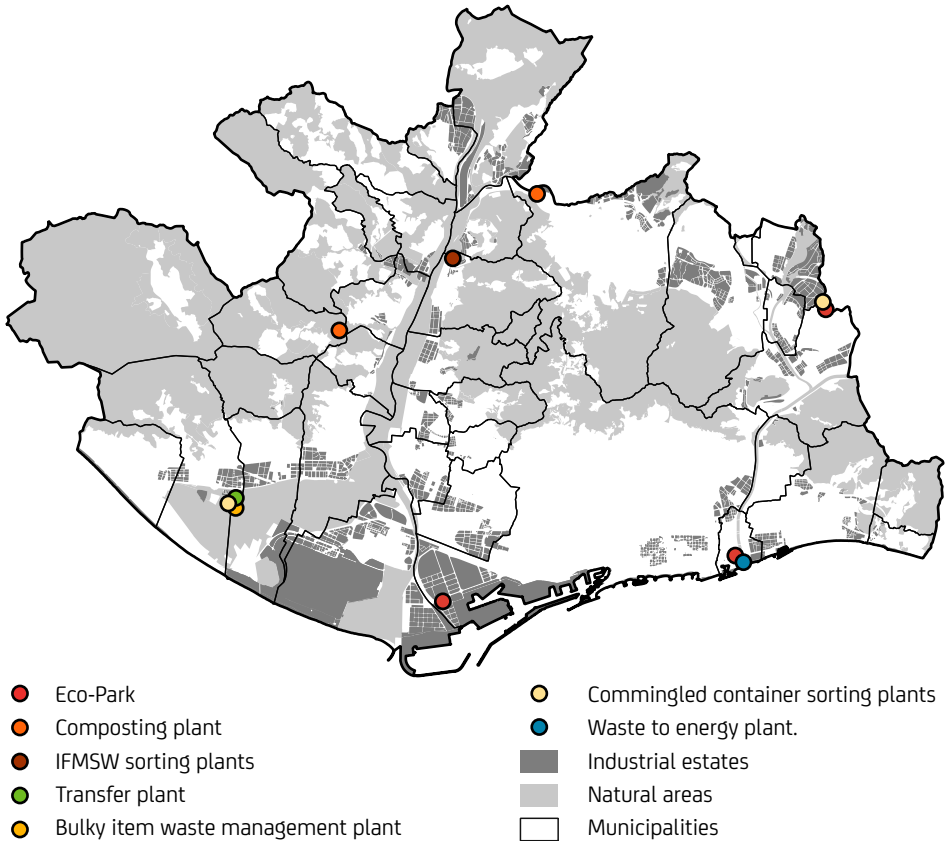


Fig. 12. AMB Waste treatment facilities. *Barcelona Regional.*

For the treatment of these fractions, there are three commingled container sorting plants, two composting plants, a VFG shredder plant, a bulky items plant, four eco-parks and a waste-to-energy plant.

The metropolitan area's waste management model has adapted to the changes that have occurred over the course of time and have implied a transition from the consideration of waste as a problem that it was necessary to solve with technological means to today's consideration that it is a resource that must be preserved and that technology must be an instrument for optimizing the management of selectively collected waste.

Thus, until the late 1980s, waste was managed on a municipal scale and most was taken directly to incineration or to a landfill site, despite some attempts at the sorting of commingled waste at plants such as that of Sant Boi. Following the constitution of the Metropolitan Corporation of Barcelona, in the year 1975, the treatment competences were shared and adopted the current metropolitan dimension made explicit in the Special Plan for the Elimination of Urban Solid Waste, approved in 1981.

Despite incipient initiatives at the start of the 1980s, it was not until the decade of the 1990s – thanks to the different laws that came into force, such as Law 6/1993, on the Regulation of waste (Parliament of Catalonia, 2009), and Law 11/1997, on Packaging and packaging waste – (BOE, 1997) that it started to implement and generalise the selective collection of paper and cardboard, glass, packaging containers and OFMSW. At that point the current AMB treatment facilities also started to be built, the first of which was the composting plant at Torrelles de Llobregat, which opened in 1997 and gave service to the first AMB municipalities that implemented the selective collection of OFMSW: Torrelles de Llobregat and Molins de Rei.

From the year 2000 onwards, and with the goal of stabilising organic matter and recovering reusable materials from the residual waste fraction, plants started to be built offering mechanical and biological treatment and known as eco-parks. Since the opening of Eco-park 1, in 2001, three more have been brought on line and all four incorporate OFMSW treatment lines as well as the residual waste lines.

WASTE PREVENTION IN THE METROPOLITAN AREA

To date, waste prevention in the metropolitan area has been structured around two main pillars: support for the drawing up of local waste prevention plans (PLPRs) and the promotion of direct actions by the AMB.

With regard to the PLPRs, in those municipalities where they have been drawn up, they have been a useful instrument for introducing prevention into the political agenda, defining strategies and obtaining an accurate diagnosis of the waste management situation on a municipal scale. The PLPRs make a very solid diagnosis of the waste prevention status in each of the municipalities and define a list of prevention actions for the different fractions of municipal waste.

There are currently 20 municipalities that have PLPRs, although their implementation status is very varied. There are cases where actions defined in the PLPRs do not always come to be put into practice for different reasons. Examples would be budget and resource restrictions, limitations with regard to the work capacity of council staff or, simply, that waste prevention is not perceived as a political policy.

Furthermore, in a framework where the local authorities have few effective competences in terms of waste prevention, the limitations encountered by the PLPRs are evident and they have not been sufficiently effective from the viewpoint of producing quantifiable results in terms of prevention.

Besides this line of work, the AMB has directly promoted other waste prevention strategies such as the metropolitan household composting network (in accordance with the provisions of PRECAT20 (Generalitat of Catalonia, 2014), household composting became considered as a decentralised waste management activity) which is currently made up of some 5,000 composters in the metropolitan area, especially in those municipalities with horizontal urban planning.

Another line of work promoted by the AMB is the extension of the useful life of products, especially of clothing, textiles, furniture and electrical appliances. In this sense, the Millor Que Nou (Better Than New) space and the product life-extension concept have become metropolitan reference points through the organisation of repair workshops, the availability of a space for exchanging objects permanently or the online tutorials service, among other actions.

There are also some metropolitan rubbish tips that have incorporated this strategy of reuse through repair workshops or the establishment of spaces for exchanges. Approximately half of the rubbish tips in the metropolitan area have a reuse or reuse preparation service. Also, one of the actions that should be promoted in the future is the incorporation of new uses and functions at the existing rubbish tips, including setting up spaces for preparation for reuse, spaces for swapping and a tools or resources bank (loan material). The Ambiteca in Sant Cugat and the rubbish tip of Viladecans are good examples of centres that are carrying out reuse actions.

It is estimated that reuse in the metropolitan area stands at 3.3% and, if only the textile, furniture, and waste electrical and electronic equipment (WEEE) fragments are considered, the result is that 0.33% of municipal waste is being prepared for reuse. This study shows that the potential for waste prevention based on reuse could be 4.4% of the total of municipal solid waste. It is also important to highlight the great potential for waste prevention presented by single-use plastic bags and disposable nappies for babies. Reuse is associated with the creation of jobs. It is estimated that activity in the reuse of WEEE, clothing, and furniture in the AMB generates between 81 and 109 jobs for every 1,000 tons of products reused (Pérez, J.,2018).

CURRENT PLANNING OF THE WASTE SYSTEM IN THE AMB

DISTRIBUTION OF METROPOLITAN COMPETENCES

The AMB's current competences in waste matters include the treatment of municipal waste and waste from works carried out in the metropolitan area, the sorting and selection of packaging containers, the coordination of municipal collection systems and the rubbish tip service in collaboration with the municipalities. In addition, the coordination of the municipal collection systems is a competence explicitly granted to it following the passing of Law 31/2010, of 3 August, on the constitution of the Metropolitan Area of Barcelona, which tasks the AMB with the coordination of municipal collection systems.

The exercising of these competences represents a spend of some €170 M for the AMB, a sum that accounts for almost a quarter of its annual budget. Some 84% of this expenditure allocated to the prevention and management of metropolitan waste is funded through metropolitan taxes for the treatment and disposal of municipal solid waste (MSW), which are paid by citizens and by economic activities in the 36 metropolitan municipalities together with the water bill. In the year 2017, of the total expenditure, some €15.9 M were allocated to the fee for disposal of reject waste.

Competence for the collection and transport of municipal solid waste lies with the municipalities and it is their councils that decide how to do it, the budget that they devote to it and how they fund it. The management of rubbish tips is also a municipal competence. The direct expenditure allocated by metropolitan councils to waste collection and management stands at around €165 M. Normally, the cost of municipal management is funded through the household waste tax that citizens pay to the councils and the tax or public price paid by economic activities. However, in the AMB there are 13 municipalities – making up 84% of the population – that do not have a household waste tax and the corresponding costs are charged to the municipality's general budget. In contrast, there are only three municipalities that do not have a tax or public prices for commercial waste. Income from waste collection taxes or public prices of the metropolitan municipalities totals some €56 M (year 2016).

The rolling out of coordination competences for municipal waste collections in the AMB opens up a pathway for collaboration between the metropolitan authority and the municipal authorities in order to tackle the challenges of social and environmental improvements in waste management with greater guarantees. This metropolitan collaboration also grants the local authorities more capacity for participation and for effective influence when it comes to defining or reviewing the regulations relating to municipal solid waste.

WASTE MANAGEMENT AND THE AMB SUSTAINABILITY PLAN

To achieve the goals of the AMB Sustainability Plan (PSAMB, AMB-Environment Area, 2014), the AMB's governing bodies envisage putting into practice the measures defined in the Sustainability Plan, measures that have been defined for the three levels or areas of action:

- Plan for Environmental Improvement in the AMB territory.
- N2 - Plan for the Promotion of Environmental Services in the AMB municipalities.
- N3 - AMB Management Environmental Quality Plan.

The three levels cover actions that affect waste management. Thus, the Plan for Environmental Improvement proposes strengthening the university/business/administration relationship for the development of R&D projects in waste prevention and product dematerialisation. As for the Plan for the Promotion of Environmental Services in the municipalities, it is proposed to draw up and implement waste management plans for councils (an action that can also be extended to the councils themselves), give technical support to councils for the environmentalization of the municipal waste collection service, and create a working group for the optimisation of segregated waste collection services and to share experiences in the development of municipal taxes that fund the service.

Finally, the Management Environmental Quality Plan covers the need to approve the revision of the Metropolitan Programme for Municipal Waste Management (PMGRM) 2009-2016 (EMSHTR, 2009) and the expansion of the "Better repaired than new" waste prevention programme (AMB-Environment Area, 2018).

WASTE MANAGEMENT AND THE METROPOLITAN ACTION PLAN

The Metropolitan Action Plan (PAM (AMB, 2016)) establishes the following objectives related with waste:

Objective 1

Draw up and develop the new Metropolitan Plan for Municipal Waste Management (PMGRM 2017-2024), within the circular economy concept.

- Draw up the new Metropolitan Plan for Municipal Waste Management (PMGRM) within the framework of continuity of policies based on the 3Rs (reduce, reuse and recycle).
- Achieve treatment of 100% of the municipal waste generated not corresponding to street cleaning and minimise the part of street cleaning that is destined for controlled landfill.

- Guarantee excellence and eco-efficiency in the management of the facilities.
- Increase the commercial value of the compost generated at composting plants with the obtaining of a quality mark.
- Reinforce the presence in the AMB of international and Spanish networks for the exchange of knowledge and experiences in waste management.

Objective 2

Reinforce the current projects and define new actions for waste prevention with regard to meeting the targets set in the European, Spanish and Catalan regulations.

- Implement repair and reuse centres at rubbish tips.
- Extend the “Better repaired than new” project to the metropolitan territory with the aim of making it economically sustainable, to promote the creation of new jobs and enable access by companies from the social economy sphere.
- Promote community composting.
- Establish consumer habits to reduce food waste in households and on the part of big producers.

Objective 3

Reinforce technical collaboration with local councils in waste prevention actions and increased selective collection as part of the Zero Waste strategy.

- Coordinate campaigns with local councils to achieve the targets for prevention, reuse and selective collection defined by the European Union.
- Establish a periodic system for the communication of data and results of waste management, with evaluation and creation of comparative information on best practices for waste collection.
- Promote the use of rubbish tips as the destination of electrical appliances, batteries and special waste in small quantities in order to avoid toxicity in the rest of the waste, and promote the coordination of tips for the collection of waste electrical and electronic equipment (WEEE).
- Create a multidisciplinary group to debate new strategies in waste management and to serve as a participation platform with local councils and social agents.
- Define a roadmap for the incorporation of the majority of the major generators of organic matter into promoting the treatment of such waste at metropolitan plants in a coordinated and direct way, beginning with the municipalities with the largest populations.

- Develop pilot tests for new collection and management systems as a prior step to mainstreaming them.
- Study the feasibility of a deposit and return scheme (DRS) for containers in the metropolitan area.
- Promote a set of measures in order to achieve 45% of selective collection in the year 2019.
- Secure resources to continue developing the Vall de Joan environmental restoration programme.

Objective 4

Achieve the economic sufficiency of the metropolitan waste treatment system.

- Guarantee coverage and progression of the metropolitan waste treatment tax (TMTR) in expenditure on waste management.
- Improve the mechanisms of information and communication to citizens and businesses, increasing transparency.
- Reinforce the link between the TMTR and the more or less significant generation of the residual waste fragment.
- Study the possibility of developing a new joint ordinance on waste collection and treatment.
- Study the feasibility of an integrated management system for the textile sector, both the consumer and the healthcare/sanitary segments, similar to that which exists for glass and containers which incorporates specific income for the management and treatment of this fraction.

SWOT ANALYSIS OF THE AMB WASTE MANAGEMENT SYSTEM

We detail the SWOT analysis of the AMB waste management system that represents a summary of the previous description, in the following points:

STRENGTHS

It has been accepted that committing only to treatment will not enable the future recycling targets to be achieved.

A metropolitan service is available that can implement support services for the local councils to mainstream the collection levels of the more advanced municipalities.

There are metropolitan municipalities that have high levels of selective collection and they can serve as an example.

The legal framework has changed to facilitate the adoption of more ambitious waste management measures.

All the waste produced in the metropolitan area passes through a treatment plant.

WEAKNESSES

The AMB does not have capacity to define the collection models and systems that are used by the municipalities.

The structure of the AMB is very much focused on treatment but not on improving collection.

There are some municipalities that have advanced collection systems and others that have very low rates of selective collection.

The greater part of the waste ends up at end treatment facilities such as the controlled landfill at Hostalets de Pierola and the waste-to-energy plant at Sant Adrià.

Municipal governments do not always manage waste from an environmental perspective, nor does that management always carry enough weight in their agenda.

OPPORTUNITIES

Approval of the Metropolitan Programme for the Prevention and Management of Municipal Resources and Waste 2019-2025 (PREMET25) represents an opportunity to take a leap forward in waste management.

PRECAT20 and the obligation of complying with it is an opportunity for better management of the waste system.

THREATS

Non-compliance with European targets for selective collection and recycling will lead to the arrival of economic sanctions for municipalities.

Low efficiency in resources use leads to competition and tensions on a global scale.

The costs of waste management will grow if a reduction is not achieved in the quantity of waste generated and the level of recycling.





REFLECTION

A resilient vision of the territory for good strategic planning implies assessing the risks and outlining the most necessary strategic policies. The metropolitan context is changing: a housing crisis has emerged, leading this sector to acquire a central preponderance among the concerns of citizens; in light of the recent economic crises, the need has been seen to improve the offering of economic innovation in order to ensure activity; there has been consolidation of the concept of energy poverty which can be extended to other services; a Catalan Law on Citizens' Guaranteed Income has been created that has implications for metropolitan urban cohesion; there has been approval of the Paris Agreement on Climate Change which, in addition to representing an energy transition, brings with it much more demanding environmental requirements; and a new Transparency Law has been passed that has led to the creation of a Transparency and Good Governance Agency.

This entire list of growing needs also represents an increase in resources that must necessarily be associated with better efficacy and efficiency in the organisation of the AMB services available and with a new political strategy in which metropolitan strategic planning is essential.

In this sense, it is necessary to highlight the potential and opportunities offered by the AMB Law, specifically detailed in its Article 14, in which next to the most consolidated areas – urban planning, transport, mobility, environmental services – also prominent, among others, are protection of the environment, health, biodiversity and measures for fighting against climate change.

It is for this reason that the AMB's Strategic Planning Area has developed the DREAM project, which proposes for each Area and Service a Diagnosis (using SWOT methodology), a Reflection, a Strategy and a set of Metropolitan Actions. To specify this, the basis used is the Metropolitan Action Plan (PAM), the reference element for metropolitan policies for each term of office.

This new strategic view seeks to move on from reflection to action and means evolving from a dynamic prone to generating studies towards a view more focused on action that generates resilience in the metropolitan territory in the face of external risks and threats. If we want to push forward with metropolitan strategic policies in a resilient territory, we have to begin with a first narrative for each of the sectoral areas.

This is the aim of this text: to produce an initial DIAGNOSIS organised around the risks, establish a REFLECTION on the metropolitan system, considered as an adaptive complex that requires a territorial and governance positioning and, from there, to establish a STRATEGY to define, subsequently, a set of METROPOLITAN ACTIONS that will need to be implemented.

It is proposed to produce a narrative that is based on a resilient diagnosis of the risks and that helps to configure metropolitan strategies through a series of actions that are already being carried out and will be the basis for defining future strategic policies.

Before the risks such as that of the peak oil effect, and the impact of the materials cycle, the introduction of waste management programmes is essential.

In recent years, the need has become clear to design the urban metabolism of all kinds of settlements, including, of course, that of the metropolitan areas. Only through the analysis of material and energy flows, and by optimising them through design, can we come to talk about cities that are truly geared towards horizons of sustainability and resilience. Waste management is associated with management of the materials cycle.

The peak oil effect is making a reduction in the generation of waste obligatory, especially due to the cost of the energy associated with its collection and treatment. It is necessary to tackle waste reduction, better known as the Zero Waste Strategy.

The future of the AMB's metropolitan waste prevention policy requires providing a metropolitan framework of reference for prevention actions. This has to be done through a metropolitan waste prevention plan (PMPR) which is the central focus of this publication, with the spotlight on increasing waste prevention, extending selective collection, improving waste treatment and developing better governance.

The reference point for this metropolitan policy is the Metropolitan Programme for the Prevention and Management of Municipal Waste and Resources 2019-2025 (PREMET 2025), which defines an action strategy based on a new governance that is committed to reducing municipal waste in order to reach 55% of recycling by the year 2025 and achieve carbon neutrality in the metropolitan waste treatment system.

The authorities, like citizens, have the opportunity of decisively favouring a way of understanding production that encourages sustainability through, first and foremost, a change in consumption patterns. However, in addition, local authorities such as municipal councils and the AMB can – from their position of proximity to citizens and the territory – act as facilitators of change by cooperating, organising, and directing the private sector, given that the implementation of the circular economy is an economically profitable activity and one that makes the materials cycle management processes more resilient.

This volume presents a whole series of examples of this collaboration between public and private agents and also recommends a comprehensive set of actions that can help to develop waste management in the AMB.



STRATEGY

This document must serve as a basis for the definition of the waste management strategy that has been expressed in the Metropolitan Programme for the Prevention and Management of Municipal Waste 2019-2025 (PREMET25, AMB-Environment Area, 2019). Based on the fact that treatment of municipal solid waste is one of the main metropolitan competences, it is proposed to deploy a strategy of coordination of municipal collections and to define modifications to the treatment plants in accordance with the results achieved for collection. This will all be coordinated through the strategy of creating a new system of governance and, as in previous programmes, an action pillar will be maintained with respect to waste prevention.

IMPROVE GOVERNANCE

The transition towards the circular economy has made a powerful entrance into the agendas of the different actors involved in the successive phases of the uses of resources and the management of waste. Both the more global authorities and the more local ones, as well as the set of economic and social agents, are called upon to reconsider many of the ways of acting that are now commonplace. However, as happens in all objectives related with sustainable development, there are various focuses and views regarding the scope and meaning of the circular economy concept, and regarding the implications involved in a transition towards new ways of evaluating and organising the resources economy.

At the same time, the inter-dependence and shared responsibilities that appear when this transition is undertaken require the definition and deployment of governance networks – or multi-level governance – with organisational and relational changes in all of the actors involved. Tackling the challenges facing us with efficiency implies defining new roles and new spaces for inter-relation between social, economic and governmental actions for the different competence levels.

In the metropolitan sphere, the AMB has to lead the definition of a governance that facilitates the diagnosis and shared definition of the same specific objectives in the sphere of the municipal solid waste collection and treatment. This way, a collective response can be given that makes it possible to apply the most adequate actions to achieve the milestones set out. This governance must incorporate instruments that facilitate collective learning based on experiences that already exist, that generate spaces for collaboration between agents and offer sufficient tools for facilitating transparency, accountability and public participation.

Despite the AMB's main competence in waste matters being treatment, the achievement of the objectives established in this programme requires reinforcing institutional harmonisation and joint action between the AMB and the municipalities forming part of it. To make this possible, it is necessary to upgrade the architecture of the metropolitan governance that has existed to date and adapt it to these new needs.

REDUCE WASTE PRODUCTION

From the viewpoint of efficiency in the use of resources, the prevention of the production of waste is the best of strategies, above recycling, as on the one hand it preserves natural resources and, on the other, it avoids the impacts associated with their extraction and production. It is for this reason that waste prevention must be prioritised among the waste management policies, especially at the levels of decision-making that affect the production of waste, but also within the AMB.

There are different strategies that can contribute to waste prevention, the most evident of which is to avoid the production and use of a certain product, but prevention also has other strategies such as reuse, i.e., making use of a reusable element instead of a single-use disposable one, and also repair, refurbishment or other strategies that enable the life of products to be extended.

Another important characteristic of waste prevention policies is the different capacities of the various actors that intervene in a product's life cycle. Unlike recycling – where citizens and local authorities have a strong impact through selective collection – in the case of prevention, the situation is the other way around: the higher one stands in the chain of production and product use, the stronger the capacity to influence it. In other words, businesses have more capacity to make decisions that help waste prevention than local authorities or citizens. Also, the local public authorities have more capacity to influence waste prevention than citizens, so we could talk of a hierarchy in terms of impact on waste prevention.

The transition towards a more efficient society in the use of resources requires a cultural change that affects everything from citizens' consumer patterns to the production and distribution model adopted by businesses. The role of the latter is the most critical, and business models need in-depth changes in order to ensure that products are long-lasting and designed so that they can be repaired and dismantled easily and, thus, be totally or partially reused or, as a last resort, easily recycled.

As mentioned in the Diagnosis section, the waste prevention projects promoted to date have not been sufficient despite the investment of resources and good will. This fact is not without its logic, as the increase in waste production has not, in the main, occurred because citizens or authorities have decided to consume more, but because the model of production, consumption and distribution of products has meant that it is increasingly difficult to opt for consumption patterns that guarantee waste prevention. Without a change in this model, it is not very realistic to pretend that individual changes can solve problems that have their origins in structural aspects.

Therefore, we find that there is a growing reduction in reusable packaging containers, more over-packaging, that clothing is of increasingly poor quality and less long-lasting and, even, that furniture is no longer handed down from generation to generation but that it has an

increasingly short useful life. The same thing is happening with electrical appliances. But the strategy of promoting consumption through programmed obsolescence is no longer exclusive to electronic products; it has become key in the production models of many other products. The result is that producing waste is much easier than avoiding doing so.

INCLUDE MORE MATERIALS IN SELECTIVE COLLECTION

The main challenge of waste management in the metropolitan area is making a break with the situation of stagnation in selective collection and reaching 50% of recycling by the year 2020 and 55% by 2025. Increasing selective collection is key to achieving quality recycling levels and, therefore, more efficient waste management. A conclusion from the deployment of the model based on eco-parks is that separation at origin enables more and better-quality materials to be recycled than the mechanical separation of waste once commingled. Furthermore, the correct separation of products that contain toxic elements facilitates the closure of the materials cycle and the ultimate management of the waste.

Moreover, although waste prevention is the main aim from the viewpoint of the hierarchy of waste management, it is in the development of selective collection where local organisations have access to more instruments and more capacity for influence. It is local organisations that have the competence of municipal collection and the capacity to decide which separation model and which collection system they want to apply according to urban size, density or characteristics.

It is important to underline that, according to the Catalan Waste Law, the systems chosen must guarantee material recovery (recycling), have maximum efficiency and be suited to the characteristics of the municipal territory. In fact, the Waste Law establishes that: “With the aim of encouraging the recycling and material recovery of municipal waste, all municipalities must provide a service for the selective collection of the various waste fractions. The municipalities must provide the selective collection service by using the separation and collection systems that have proven to be most efficient and that are suited to the characteristics of their territorial area”.

The current collection results show that the model based on the anonymous and voluntary disposal of waste in containers available 24 hours a day has a ceiling. It is for this reason that it is necessary to incorporate collection individualisation mechanisms if the aim is to achieve the recycling targets set by Europe. In this sense, it would be necessary to guarantee that by the year 2025, organic and residual waste fractions are collected door to door or using smart containers.

The change of collection systems must be accompanied by the commitment of citizens, businesses and, especially, commercial outlets to participating in selective collection.

To incentivise participation among all actors it will be necessary to establish economic incentives and specific communication and environmental education campaigns. The approval of a waste collection tax in all those municipalities that do not yet have one – and that represent more than 80% of the total population of the area – is a necessary prior step to be able to activate mechanisms of reductions and penalisation according to the population's behaviour.

Commercial waste derived from economic activities, commercial outlets, and services constitutes some 40% of the total municipal waste generated in the metropolitan area. According to a study on commercial collections (http://residus.gencat.cat/es/consultes_i_tramits_nou/normativa/normativa_catalana_en_materia_de_residus), better segregation for commercial collection could lead to an improvement in the AMB's selective collection of between 7 and 12 percentage points and contribute between 100,000 and 160,000 tons more of waste selectively collected and guarantee, or contribute very decisively to, the fulfilment of the selective collection targets.

RECOVER MORE MATERIALS AND INNOVATE IN WASTE TREATMENT

The AMB is the authority tasked with the treatment of waste of municipal origin – or equivalent – generated in the metropolitan territory. Besides adequately managing selective fractions in order to guarantee their subsequent use as a resource, the treatment of the residual waste fraction is fundamental for recovering usable materials from it and reducing the environmental impact of biodegradable waste, while complying at the same time with the landfill sites directive.

The model of waste management in the metropolitan area has been determined by changes in the legislative framework that have occurred in recent years, changes that have meant an evolution from considering waste as a problem that had to be resolved through technological media to the current consideration that waste is a resource which needs to be made use of and that technology has to be an instrument for optimising selective waste collection management.

This change in concept has led to the need to constantly improve the functioning of the plants and to promote technological innovations to incorporate them into the metropolitan waste treatment system.

Within the framework of the transition towards a waste-collection model with higher recovery rates, the metropolitan waste treatment system will have to adapt to a reduction in the need for treatment of the residual waste fraction and an increase in the need for finding an outlet for materials selectively collected, especially the organic fraction.





METROPOLITAN ACTIONS

IMPROVE GOVERNANCE

The challenges of the circular economy require action on many scales of government, from the most global to the most local. The main lines of action and the main objectives are accepted on supra-national scales, but many of the challenges have to be transformed into action programmes and specific measures that need to be developed at lower territory levels, especially regional and local levels.

The inter-relation between the challenges and the actions to tackle them necessarily imply participation of all government levels through new forms of governance that facilitate the transition towards the circular economy and that incorporate all the relevant actors. Taking into account this need, different actions are defined that are necessary to achieve the targets established on a European scale.

ACTION 1. COORDINATION AND MUNICIPAL SUPPORT

Achieving the objectives established in the metropolitan waste management programme requires reinforcement of institutional harmonisation and joint action between the AMB and the municipalities forming part of it, as well as the other authorities with competences in waste matters and that act in the metropolitan territory, especially the Barcelona Provincial Council and the Catalan Waste Agency.

The municipal waste collection systems and their results are important conditioning factors with respect to type of treatment and, therefore, the objectives established in the metropolitan programme will not be achieved if emphasis is not placed on improving the efficiency of the collection systems. The separation of competences that currently exists between municipal waste collections (the responsibility of the municipalities) and the treatment of this waste (the responsibility of the AMB) leads to operative dissemination whereas it is necessary to consider a combined joint effort.

To respond to this situation, it is necessary to define a series of measures addressed at promoting coordination between municipalities and the AMB, as well as incorporating support measures for those municipalities on the road to transforming their collection systems, in order to achieve better results for recovery and recycling.

The main instrument from which this new role for the AMB is structured is the Metropolitan Zero Waste Agreement, according to which metropolitan local councils commit to deploying a series of basic measures to guarantee that by the year 2025, the organic and residual waste fractions will be collected in an individualised manner and that there will be economic instruments for incentivizing participation in selective collection. The rolling out of these commitments in a coordinated way between the different municipalities will facilitate management on a municipal scale, inject coherence into the metropolitan waste collection sys-

tem and favour acceptance by the general public. To make this agreement possible it will be necessary to roll out a series of measures involving technical, economic and political support on the part of the AMB and the higher authorities such as Barcelona Provincial Council and the Catalan Waste Agency.

An important action has been rolled out to support municipalities and to optimise municipal selective collections through a line of subsidies to the value of 3,800,000 euros established for the 2017-2018 period. The subsidies granted are aimed at the design, application, development and evaluation of projects that enable a reduction in waste generation and an improvement in the efficiency of collections. This support action should continue to be maintained while useful in the process of change, and the first review of its results will take place at the close of the 2020 financial year.

It would also be necessary to give coverage to actions by the municipalities and the AMB itself by developing lines of action of a sectoral type in those areas considered necessary: major waste generators, management of bulky items, textiles, etc.

In the prevention area, municipal initiatives are articulated through local waste prevention plans (PLPRs). In order to influence the coordination and municipal support for the PLPRs, it will be necessary to have a Metropolitan Waste Prevention Plan that establishes a reference framework for actions and measures that the AMB must undertake. This plan would at the same time permit coverage to be given to municipal initiatives regarding local prevention actions, especially to those municipalities that do not have their own local plan.

Another aspect that must be taken into account when giving support to municipalities is the creation of work groups enabling sharing of the different technical and operating aspects that present themselves in the process of change of waste collection systems, and where a space is made for information and experiences that are useful for the future, on the pathway towards achieving effective results from the collection and recovery of municipal waste. It is worth mentioning that there has been a reactivation of the environmental seminars, which are information and debate sessions around projects of common interest that are carried out from the AMB or by metropolitan municipalities.

ACTION 2. GOVERNABILITY OF THE ECONOMIC SPHERE

To continue advancing in governance on the economic side it will be necessary to determine the costs of the different processes for the collection and treatment of the different fractions or products. This way, three milestones could be achieved: the first, having appropriate management instruments adapted to each of these processes in order to help decision-making; the second, having access to data that permit favouring a fairer distribution of economic responsibilities between the different social agents and production sectors; and the third, an advancement in transparency and public accountability.

To improve the distribution of economic responsibilities, some metropolitan municipalities are considering incorporating systems of payment for waste generation, according to the waste produced, or of discounts, according to the level of participation by citizens. Achieving a fairer distribution of the costs of waste management is a measure that favours an improvement in recovery results. Within the framework of the metropolitan agreement, it will be necessary to harmonise the respective collection taxes with the metropolitan waste treatment tax, as well as economic incentives linked to both systems of taxes in order to favour this objective.

ACTION 3. EXTENDED PRODUCER RESPONSIBILITY

Extended producer responsibility (EPR) is a very useful principle for waste management policy because, through the assuming of direct management or funding of waste collection and treatment systems, it enables producers to be incorporated into waste management as actors for their own products. It also thus enables producers to become aware of the options for the treatment of their products at the end of their useful lives and, therefore, to undertake more appropriate actions to favour their reuse, repair or recycling (ecodesign, changes in distribution methods, etc.).

The circular economy package of the European Union places the emphasis on these systems, modifies the Directive on waste and packaging (European Parliament, 1994), proposes a Directive on single-use plastic products (European Commission, 2018b) and opens the door to the creation of new collective extended producer responsibility systems (SCRAP) for determined products. These modifications will lead to changes in the management framework that will affect metropolitan management.

It is for this reason that from the AMB it will be necessary to urge the higher authorities regarding the establishment of new SCRAPs for the textile, furniture, mattresses and health-care/sanitary textile fractions. Until there is regulation through new SCRAPs, the AMB will have to promote the establishing of voluntary agreements to tackle the problem of the collection and treatment of these fractions.

Finally, although the general system for the selective collection and treatment of waste is useful for tackling the generic problem of management of the main waste fragments, it is possible that, for determined products, voluntary selective collection will not give a response to all the problems associated with their consumption. Therefore, complementary deposit and return schemes could be a good solution.

One example would be products that appear abandoned in public or natural spaces, such as drinks containers, but also others that can easily pass through waste management systems without being adequately collected and treated, such as products that are too small like coffee capsules, products with high toxicity such as batteries, or certain containers of chemical products, or products with small quantities of minerals considered strategic, such as

small electrical devices. For these products it may be suitable to establish economic incentive systems for collection such as deposit and return schemes, and the AMB should give support to these.

ACTION 4. REINFORCEMENT OF COMMUNICATION

The direct relationship between the AMB and citizens is acquiring increasing importance, with regard to information and communication about the services provided and also the need to adequately communicate the results of waste management and the achievement of targets.

It is for this reason that it would be necessary to have a specific communication plan for waste that disseminates the goals, actions and results of the AMB and the metropolitan municipalities with regard to the management and treatment of municipal solid waste. This plan would have to be aligned with the environmental education programme “We share a future” and with measures that are derived from the environmental education pillar. In this sense, the communication plan should also have the objective of increasing knowledge regarding the circular economy and its relationship with waste management.

The communication plan would have to reinforce both governance actions and those from other action pillars, make use of new media, and have a presence in media of general and local scope.

With the aim of improving communication it would be necessary to report on an annual basis the carbon footprint of waste management and improve the visibility of the metropolitan waste treatment tax (TMTR). In this sense there has already been a redesign of the tax invoice in order to segregate concepts that refer to water management and consumption from those relating to waste treatment. At the same time, the AMB will periodically report to citizens regarding the situation of their municipality with regard to waste generation and collection, the cost that its management represents, as well as the repercussion of treatment fees.

Finally, the collaboration agreements signed between the public authorities and the production sectors through the SCRAPs envisage joint communication actions to promote selective collection and recovery. The Metropolitan Area of Barcelona is already coordinating some of these actions in collaboration with metropolitan local councils. The metropolitan administration will continue carrying out this task, which will be extended insofar as the new agreements maintain this communicative collaboration space.

It is necessary to ensure that these campaigns are adapted to the goals proposed by the new context of transition towards a circular economy, overcoming the phase in which communication campaigns were only aimed at the improvement of selective collection without any impact on waste prevention.

Also, there will be emphasis on the implementation of specific campaigns to promote the selective collection of the organic fraction together with the municipalities and, preferably,

with the participation of the Catalan Waste Agency, as the organic fraction is the main component of municipal waste and that which, in most of the municipalities, presents the lowest levels of selective collection.

ACTION 5. CREATION AND MANAGEMENT OF KNOWLEDGE

The AMB has extensive experience in waste treatment and management. Knowledge about the processes through which the different waste fractions selectively collected and disposed of at each of the treatment facilities and the knowledge of the results derived from this – as well as knowledge about markets for the recovery and reuse of materials and products – constitute an asset that must be exploited in relation to the goals proposed.

The adaptation of the different collection models and systems to the reality of each municipality means that, in the metropolitan area, diverse models coexist. The AMB proposes to begin work with the municipalities in order to look in-depth at knowledge of municipal waste collection and management systems and to establish a regular system of obtaining information and analysis of the results of the collection systems in order to favour the continuous improvement of their management.

The aim of waste treatment is to recover the maximum of materials and make use of the best technologies available in order to minimise environmental impacts. Within the framework of the circular economy, a new function of waste management appears, consisting of knowing about and defining the incompatibilities of the different products or materials to be reintroduced into production cycles. Experience in waste management and treatment thus acquires a new dimension geared towards new economic and environmental goals. This new role will also mean analysis of the behaviour of the different products when they become waste and are collected and treated in the metropolitan system. This will not only be based on materials but also on products in order to facilitate the establishment of producer responsibility systems.

In this sense, waste management also requires the incorporation of traceability systems that enable waste to be traced from the point where it leaves the municipalities until it is once more incorporated into the system, whether in the form of product, sub-product or resource, or until final disposal, whether through waste-to-energy schemes or at controlled landfill sites.

In parallel with the measures announced, knowledge management capacity will be reinforced with the creation of a unit for the management and analysis of data that has to provide support for both municipal collection services and AMB waste management and treatment services for the purpose, among others, of facilitating the establishment of pay-per-use systems for municipal and metropolitan services.

ACTION 6. LEADERSHIP IN THE REGULATORY FRAMEWORK

The emergence of the circular-economy model on a European scale has led to the modification of various directives, the appearance of new regulations and the establishment of waste management and efficiency in the use of resources.

From now until 2020, there will be a process of transposal that will give rise to important changes within the regulatory framework on the Catalan and Spanish scales that will have implications for local waste management.

The AMB has to become an actor in this process and identify the forums where it has to participate, contributing knowledge and useful criteria to the process of producing regulations. Especially important is the role that it can exercise in identifying barriers that hinder waste recovery and making proposals to overcome them.

The AMB's Environmental Sustainability Plan 2014-2020 (AMB-Environment Area, 2014) established as one of its objectives the promotion of responsible public procurement through the introduction of sustainability criteria. It is for that reason that the environmentalization of conditions and green procurement now form part of metropolitan governance and that of its local councils, but the criteria and measures currently in force should be reviewed in the light of all the pillars of action that are formulated.

REDUCE WASTE PRODUCTION

The future of the metropolitan waste prevention policy requires a metropolitan framework of reference to be given to actions for prevention through a metropolitan waste prevention plan – giving continuity to those actions that have functioned well and incorporating new proposals according to the following criteria:

- They should function by default, i.e., without requiring excess effort by the receiving population.
- They should be aimed at the public in general, not only at people who are already aware or convinced.
- They should be economically viable.
- They should be long-lasting in time and represent permanent changes.
- They should be able to be physically measured.
- They should help towards consolidating a change in habits.

ACTION 7. METROPOLITAN WASTE PREVENTION PLAN (PMPR)

Only 20 of the AMB's 36 municipalities currently have a Local Waste Prevention Plan (PLPR) specifying the prevention goals established in the PMGRM 09-16 (<http://www.amb.cat/web/medi-ambient/residus/planificacio>).

The Metropolitan Waste Prevention Plan (PMPR) will give coherence to the actions promoted and will enable municipalities to share a joint vision and actions. The actions will be carried out in a coordinated way and will be directly managed by the AMB in those municipalities lacking technical capacity, economic capacity or political leaderships.

The Plan will take into consideration the prevention actions already being promoted by the AMB and will incorporate them into its planning. It will also give coverage to all those municipalities that do not have a PLPR and that do not envisage drawing one up and, at the same time, it will allow other municipalities to adhere to those actions that complement or make effective their own PLPRs. This will mean compliance with the need to have a PLPR as specified in the PRECAT20, with the priority intention of guaranteeing that there is compliance with the PRECAT20 goal that all municipalities have a PLPR that includes, and gives a metropolitan dimension to, the actions that may be included in already existing PLPRs.

ACTION 8. FOOD WASTAGE

The fight against food wastage has made a powerful entrance into political agendas in recent years as is demonstrated, for example, by the milestone set in the United Nations Sustainable Development Goals of achieving a reduction in food wastage to half by the year 2030 (https://ec.europa.eu/food/safety/food_waste/eu_actions_en).

The AMB should contribute to this goal by promoting simple actions that are reproducible in those metropolitan municipalities that have not yet taken any actions in this direction.

ACTION 9. METROPOLITAN STRATEGY ON SINGLE-USE PLASTIC

The production of plastics has increased exponentially since the 1950s and currently in Europe around 60 million tons are being generated. The single-use containers sector is the main consumer of plastics.

Beyond the need to prevent their production, like that of any other type of product or waste, plastic products present an environmental problem and a specific management one. From the perspective of management, the first challenge is to capture plastic waste through selective collection, but the great variety of formats, the existence of many different plastics with diverse compositions, and the mixture of different types of plastics or of plastics with other materials make both sorting and subsequent recycling difficult.

A metropolitan strategy on plastics is necessary that includes especially the public sphere and those spheres where the public authorities have the capacity to make an impact. The strategy should include six actions to prioritise the substitution of single-use plastics by reusable elements:

- The use of reusable glasses for cold drinks.
- The use of reusable glasses and cups for hot drinks.
- The use of reusable tableware and cutlery.
- Promotion of the consumption of tap water.
- Reduction in the use of single-use plastic trays.
- Reduction in the use of disposable nappies.

ACTION 10. EXTENSION OF THE USEFUL LIFE OF PRODUCTS

One of the most consolidated lines of action with regard to metropolitan waste prevention is “Better Than New” (<http://www.millorquenou.cat/>), which consists of extending the useful life of products, especially clothing, furniture and electrical appliances, through repair or exchange.

The metropolitan reference is the “Better Than New” space located on Carrer Sepúlveda in Barcelona. This line of action will be maintained and, furthermore, new strategies will be incorporated such as practices of sharing products through tool banks or the decentralisation of the activities of repair workshops. The production of a virtual common catalogue of reusable items that reach rubbish tips could also be considered.



Fig. 13. Better Than New. *Metropolitan Area of Barcelona.*

ACTION 11. RESEARCH AND INNOVATION

Another action that has given good results is the line for the creation of knowledge and innovation linked to waste prevention. In this sense, it is necessary to give continuity to the conducting of specific studies and to university research grants and a communication strategy should be established to disseminate the results of this strategic line.

INCLUDE MORE MATERIALS IN SELECTIVE COLLECTION

High-quality selective collection is determined by getting the metropolitan area to progress from being a core nucleus for the consumption of material resources to become a supplier of resources within the framework of the circular economy. This reflection includes a proposal for action to tackle the challenges in selective waste collection management in the metropolitan area.

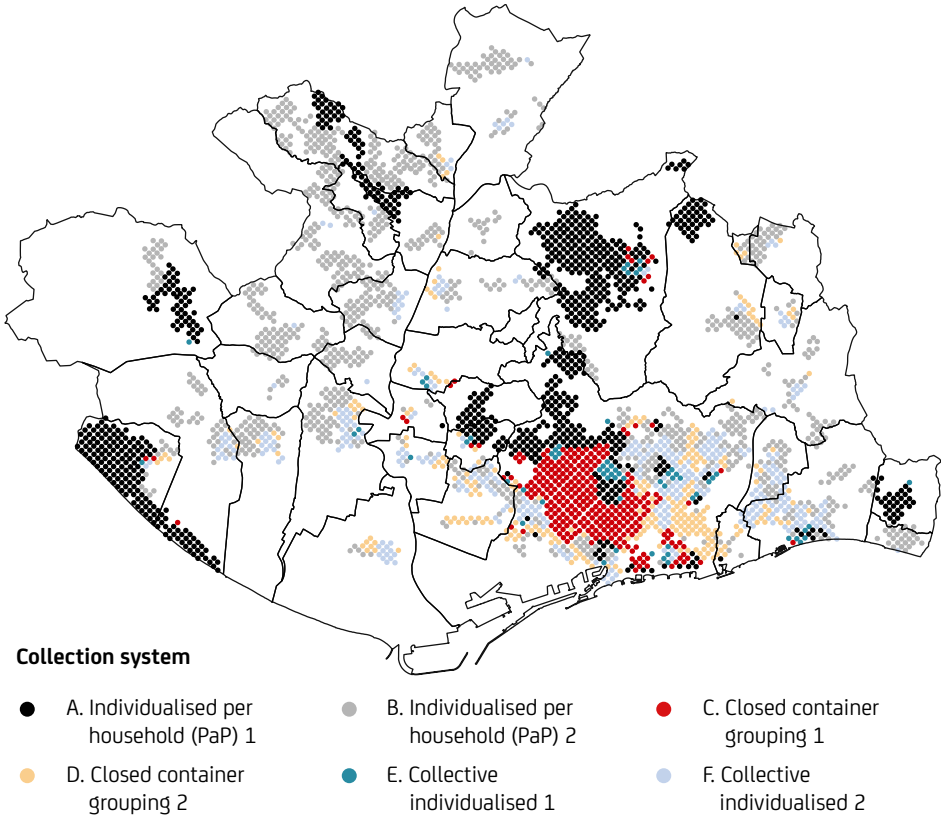


Fig. 14. Potential more favourable collection systems according to building typology and income level. AMB-Strategic Planning Area (2017). Waste Prevention and Management Services Josep Mercadé, 2017.

The proposal for action tackles the improvement of the selective collection of the main fractions (organic, paper and cardboard, plastic, metal, and glass) and of the minority fractions that have specific collections or that are carried out via the metropolitan network of rubbish tips.

The main challenge on the metropolitan scale is the improvement of selective collection of the organic fraction, both because of the weight it represents in the global amount of waste generated and the distortion that its presence represents in the channels of selective collection of inorganic materials, as well as the potential environmental impact if it is not adequately treated. Moreover, it is the only fraction for which it is not possible to establish producer responsibility mechanisms, because it constitutes almost 40% of the total of municipal waste and presents very low levels of collection.

A basic element of the proposal is the need to make a change in the collection model, which means breaking with anonymity and encouraging selective collection by incorporating pay-per-use or discount systems, making taxes and public prices much lower for those users who better manage their own waste.

The proposal for action refers to household and commercial collection alike, and its aim is to increase levels of selective collection to 60% by the year 2020. The achievement of these goals requires the implication of the municipalities and the promotion of mainstream actions in homes, shops, restaurants, schools and businesses.

ACTION 12. PROMOTE SYSTEMS THAT IMPROVE THE SELECTIVE COLLECTION OF ORGANIC MATTER

The organic fraction of municipal solid waste is the most important and represents some 40% in weight of the total municipal waste generated; 60% of this fraction is produced in homes, while the remaining 40% comes from the commercial sector, especially from the catering and food sales segments.

To promote the collection of this fraction, by the year 2025 all metropolitan municipalities will have to have implemented systems that enable the application of discounts to the collection of the organic fraction, depending on whether it is of domestic or commercial origin.

The system most used to improve the quantity and quality of organic matter collected is door-to-door collection. Municipalities with door-to-door collection collect an average of 105 kg/inhab./year, more than double those with roadside container collection (<https://www.slideshare.net/residuscat/situaci-de-la-recollida-selectiva-a-catalunya-en-el-nou-context-catal-i-europeu>). According to the metropolitan agreement, in those cases where it is not feasible to implement door-to-door collection or a commercial collection service, systems should be used that enable collection to be individualised and discounts applied to it, such as user identification systems through cards or electronic devices.

It would be necessary to promote pilot projects that enable evaluation of the viability of establishing other collection systems, such as communal door-to-door collection in dense areas and, temporarily, the introduction of modifications to containers to guarantee that the organic waste collected is of the highest quality possible.

ACTION 13. PROMOTE SYSTEMS THAT IMPROVE THE SELECTIVE COLLECTION OF THE MAIN INORGANIC FRACTIONS

In parallel with organic fraction collection discount systems, systems that incentivize participation in the selective collection of inorganic fractions should also be rolled out. In this sense, the limitation of access to the collection of residual waste is key and, as established in the metropolitan agreement, it will be necessary for municipalities to disincentivise use through the individualisation of collection. This already happens naturally in door-to-door collection and it is necessary that with collection via containers, the use of the residual waste container is disincentivized through opening with an identification card and/or limitation of opening to certain days.

Moreover, in many metropolitan municipalities, the residual waste container still continues to be more available than the selective collection containers. The municipalities will have to advance towards establishing complete bring areas and the reduction of the presence of residual waste containers separated from those of selective collection.

Some metropolitan municipalities are considering opening their recycling bins for packaging containers up to plastic or metal products that are not containers, which would enable the system's reach to be expanded and improve the collection and recycling of plastic and metallic materials. It is foreseeable that this system will become mainstream and ultimately substitute the ordinary yellow container. It is also necessary to evaluate whether it would be possible to add to this recycling bin the collection of other fractions that do not have a sufficiently wide-reaching selective collection such as textile waste or small waste electrical and electronic equipment.

As for light containers, one instrument for increasing their selective collection is the deposit and return scheme (DRS) (ENT, 2017). Despite the AMB not having the competence to introduce it, this system would make a very positive contribution towards achieving selective collection targets and towards maintaining public spaces in a good state of upkeep, for which reason it should give it support and urge the higher authorities to implement it.

ACTION 14. DESIGN A SYSTEM OF COLLECTION AND MONITORING THAT ENABLES REWARDS ACCORDING TO RESULTS.

One of the challenges that must be tackled is that users be made aware of the economic impacts of their participation or not in selective collection and that there are economic incentives for them to separate their waste.

Municipalities should gradually incorporate systems of payment for the use of the collection service and a framework will need to be established for collaboration between the AMB and the municipalities to be able to modulate their TMTRs also on an individual scale, according to selective collection behaviour. In the case of municipalities that do not have a waste collection tax for households, they should implement, at least, a tax that enables discount systems to be established that in the case of good separation could reduce charges to zero. This tax could be managed from the AMB.

Independently of the options that each municipality chooses for improving selective collection, from the AMB there will be advancement towards a system that enables collection results to be territorialised, which means that responsibility can be taken for individual behaviours in the achievement of collective targets and their transparency and communication facilitated.

It is for this reason that waste collection and treatment services must enable data to be obtained on a scale smaller than the municipal scale, such as, for example, the neighbourhood or district scale. In this way, when it is not possible to reward individual behaviours, it will be possible to reward people's behaviour collectively.

The deployment of commercial collection systems with user identification in those zones where the municipality has not deployed a specific door-to-door collection system will also permit progress towards apportioning responsibility and rewarding favourable behaviours from the viewpoint of selective collection.

ACTION 15. IMPROVE THE COLLECTION OF MINORITY NON-ORGANIC FRACTIONS

Despite the majority fractions representing over three quarters of the total of waste produced, it is necessary to continue paying attention to the minority fractions. Improvements will be promoted in the collection of the following fractions: furniture, batteries, oils, waste electrical and electronic equipment (WEEE), and, especially, that of textiles, given that it has a growing presence and is relevant from the viewpoint of the consumption of resources and pollution potential.

The collection of small WEEE is far from achieving desirable collection levels (in 2015 selective collection stood at around 25% according to data supplied by the Catalan Waste Agency, 2018). In order to tackle this, the AMB will participate in information campaigns about the environmental, economic and social benefits represented by taking WEEE to bring collection points and at the same time will inform about the different collection channels available.

The selective collection of textiles is estimated to stand at about 14.5% and, despite there being no defined objective, the AMB will contribute towards improving the collection of this fraction together with organisations, local councils and the other competent authorities. It will also promote projects to increase their selective collection and will work with organisations and management companies in order to achieve good traceability of their destination.

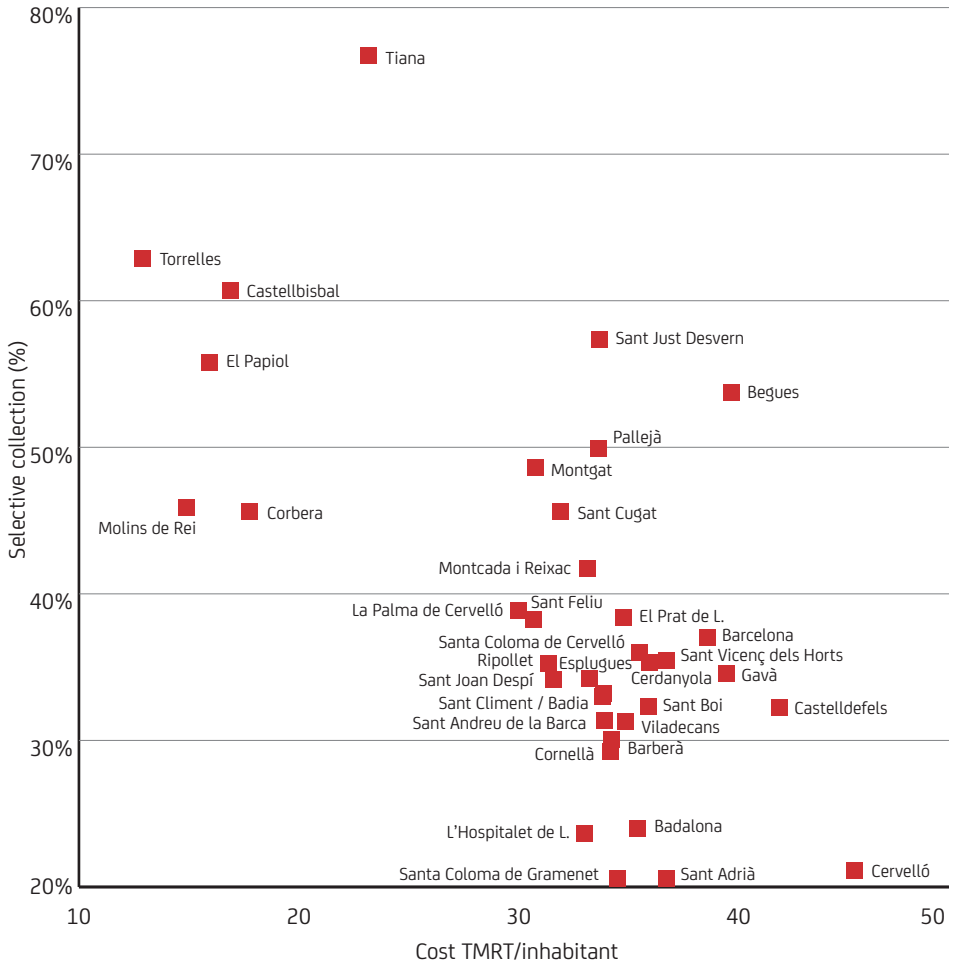


Fig. 15. Relationship between selective collection level (%) and metropolitan waste treatment tax (TMTR) amount, by municipalities. *AMB-Strategic Planning Area (2017). Waste Prevention and Management Services. Josep Mercadé, 2017.*

In addition, it will tackle specific projects to improve the selective collection of furniture and mattresses and encourage their reuse.

In order to improve the management of these fractions it will be necessary to create new SCRAPs for those that do not yet have them, but until that becomes a reality, voluntary agreements will be promoted by the AMB and in collaboration with other authorities, in order to carry out pilot projects for improved collection, reuse and recycling of this type of waste.

ACTION 16. PROMOTE A REGULATORY FRAMEWORK THAT FAVOURS WASTE PREVENTION AND SELECTIVE COLLECTION

A complementary goal is to ensure that by 2025, all metropolitan municipalities have a municipal ordinance that regulates waste collection and establishes discounts and fiscal incentive measures for household and commercial waste collection alike. It will be necessary to also guarantee that municipalities have a waste collection tax to which discounts and economic incentives can be applied.

As for metropolitan competences, there will be an in-depth review of the metropolitan tax for waste treatment in order to incorporate systems of discounts for both domestic and non-domestic users as the individualisation systems are rolled out.

ACTION 17. ADAPT THE RUBBISH TIPS NETWORK TO THE NEEDS FOR CHANGE OF COLLECTION SYSTEMS

A new definition of the rubbish tip concept is required, and these installations need to be adapted to the new challenges and objectives defined by the metropolitan waste management policy. On the one hand, it is necessary to encourage people to bring waste that has no specific collection service to rubbish tips and, on the other, rubbish tips have to become centres for the promotion of new activities such as the repair and reuse of certain products.

In order to increase the waste brought by private individuals, it will be necessary to promote the rubbish tips user card – or even to make it obligatory – through more incentives and new uses associated with it such as access to containers or emergency areas in door-to-door collection.

In a complementary way, it will be necessary to define and promote a local rubbish-tip model that brings these collection points closer to the everyday spaces used by citizens.

Moreover, it is necessary to improve the facilities at rubbish tips, especially those where it is aimed to promote preparation activities for reuse or exchange spaces, which will enable a certain specialisation of the rubbish tips network in such a way that there are some focused on one or more activities.

In the case of determined products, above all those that present a certain toxicity, it will also be necessary to consider the possibility of their return to the point of sale and take advantage thus of a network offering greater proximity than that of the rubbish tips.

RECOVER MORE MATERIALS AND INNOVATE IN WASTE TREATMENT

Within the framework of transition towards a more circular economy, it is necessary to reduce the dependency of end-point treatment facilities – landfill sites and incinerators – and the impacts associated with this activity

With the metropolitan waste-treatment model, input into end-point facilities are made up mainly of reject waste from other facilities such as light container sorting plants or composting plants.

To be able to reduce this current dependency it is proposed, firstly, to increase selective collection in order to minimise the quantity of waste not selectively collected (residual waste fraction), which will have to be treated at the eco-parks and, secondly, to increase the quality of selective collection and recover globally the plants system by incorporating innovative elements. In parallel with this objective, it is important to guarantee sufficient capacity for the treatment of waste produced in the metropolitan sphere through the transformation of those plants that already exist or the construction of new ones if necessary. This treatment must permit optimisation of the recovery of materials and energy vectors by using the best technological solutions.

ACTION 18. ADAPT WASTE TREATMENT PLANTS TO THE NEW FLOWS

In the future, according to the projects and scenarios proposed, an increase is planned in the selective collection of the different fractions and a reduction in the percentage of collection of the residual waste fraction. To tackle these changes, the plants will have to adapt progressively according to the behaviour of the different fractions.

The PREMETS will have a facilities plan that includes the possibility of carrying out these changes or constructing new plants according to the following criteria:

- Flexibility in the reception of materials. Construct plants capable of adapting to changes in the composition of input flows.
- Balance in territorial distribution and proximity to the point of waste generation.
- Adaptation of the existing plants to receive other flows if the generation of the different fractions permits this.
- Generation of new recoverable products and strengthening of R&D lines.

According to the type of fraction, the facility plan proposes certain actions:

OFMSW

Meeting the targets for selective collection will mean that one of the fractions for which collection will most increase is that of OFMSW. Currently, OFMSW is treated at the composting plants in Torrelles de Llobregat and Sant Cugat del Vallès and at Eco-parks 1 and 2.

The current operating capacity (COC) for OFMSW treatment is approximately 256,000 tons, while in 2016 a total of 154,651 tons were treated.

The facilities plan will have to consider various options to increase the capacity for treatment of this fraction. These options will be implemented according to how it behaves over the coming years and one will be chosen that, at a given time, fulfils the criteria of the facilities plan as explained above.

Light containers and IFMSW

Currently, the operating capacity for the treatment of waste containers is 49,000 tons (light containers) and 20,000 tons of IFMSW. In 2016, a total of 38,631 tons of PPW and 16,611 tons of IFMSW were treated (data from the AMB, 2018).

At present, the capacity for treatment of packaging containers is now starting to become insufficient and, therefore, it is necessary to start introducing modifications into the plants or they will not have sufficient capacity to treat the increase in packaging containers that is forecast.

Also, it is possible that it is necessary to make adaptations at plants once the current light container waste containers admit non-packaging plastic or metal. This type of collection is starting to be implemented in some municipalities in the metropolitan area and it is foreseeable that it will be extended to others, as it is included as one of the measures that have to be implemented in the collections pillar.

Bulky items

The current operating capacity for the treatment of bulky items has already reached its limit and some municipalities in the northern zone of the AMB are taking them to the inter-comarcial plant in Sabadell with which they have established a contract to make use of its facilities for the treatment of this fraction.

To tackle the increase in tons of this fraction and in order for them to be treated at metropolitan plants, the construction is planned of a new plant with a capacity similar to the existing plant. It should be sited in the northern zone of the metropolitan area to provide services to the municipalities that are currently taking bulky waste to the plant in Sabadell.

VFG fraction

There is currently no metropolitan plant for the shredding of vegetable, fruit and garden (VFG) waste. The shredding plant in Castelldefels is under private management and the AMB has a contract with it for the management of this fraction.

So that management is metropolitan and able to give the correct treatment to VFG waste, it would be necessary to plan the construction of a new facility.

Residual waste

According to the forecasts, in the coming years there will be a considerable increase in selective collection which will mean that the tons of residual waste treated will decrease. With the current facilities, it is planned to tackle the treatment of this fraction in the future.

ACTION 19. CONTINUOUS IMPROVEMENT OF PROCESSES

One of the priority lines of the Facilities Plan is the continuous improvement of processes that are carried out at treatment plants to recover material of value or to treat the reject material from the plants.

The efficiency of the eco-parks with respect to the recovery of reusable materials stands at about 8 to 10% (AMB data, 2018). Recovering materials from the residual waste fraction is a costly process and not a very efficient one due to the poor quality of the recyclable materials recovered due to the high presence of organic material. In contrast, plants that treat waste collected selectively enable the recovery of much better-quality material which, therefore, has a much bigger market and higher economic value.

In coming years there will be greater commitment to the treatment of organic material through anaerobic digestion for the production of biogas. This treatment brings with it a reduction in the smell produced and biogas is used for self-consumption of energy by the plants themselves.

It is also important to highlight that the Torrelles plant has obtained the ecolabel and that the processes at the Sant Cugat composting plant will be improved in order to obtain the best quality possible.

In parallel with the management of compost at metropolitan plants, it is planned to continue promoting the network of household composters.

In order to increase the quality of recyclable material bales, it is necessary to continue optimising plant technologies in order to be able to separate plastic mono-materials and reduce to the maximum improper waste in the output bales sent to the recyclers.

Although the main objectives of the programme focus on the increase in the selective collection of organic matter to avoid it ending up in the residual waste fraction, it is foreseeable that there will always be a part that cannot be selectively collected. The programme, through the Facilities Plan, proposes a series of improvements in the process of treatment of this residual organic matter (ROM), which is the cause of the main problems that the treatment plants have to tackle.

ACTION 20. INNOVATION AND CREATION OF KNOWLEDGE

The creation of knowledge generated based on innovation in the management of urban solid waste is an area that requires continued promotion.

Currently, the AMB is collaborating on different projects:

Res Urbis (Resources from urban bio-waste) 2017-2020 (<http://www.resurbis.eu/>)

This project enables the transformation of the flow of organic material into useful products with a high real market value and a positive impact on the environment, the economy and employment. The main objective of the project is to transform urban solid waste into bioplastics.

These bioplastics can be used to pack products; for the manufacture of chasses or cases for computers, tablets, and telephones; and for the remediation (restoration of a contaminated environment) of underground water.

MethaMORPHOSIS (2015-2019) (<http://www.life-methamorphosis.eu/en/home>)

The aim of the project is the recovery of energy through the obtaining of biomethane originating from municipal waste.

The project proposes to demonstrate on an industrial scale two innovative systems for waste treatment: the UMBRELLA prototype, at the Eco-park in Montcada i Reixac, and the METHAGRO prototype, at the agri-food plant Porgaporcs de Vila-sana (Pla d'Urgell) owned by Ecobiogas.

One of the main objectives of the UMBRELLA prototype is the obtaining of biomethane from the anaerobic digestion of organic matter and its use as a fuel for vehicles, specifically for the trucks that carry out the selective collection.

At the same time there are other methods under study for obtaining products of high economic value, such as methanol or synthetic diesel from plastic film and the plastic mix, or the production of pellets for the waste-to-energy conversion of ROM.

Besides the AMB's participation in these two studies, it is proposed to continue working on RDI by:

- Participating in new European projects.
- Testing new technologies.
- Opening up grant lines for studies.
- Carrying out studies to analyse the barriers that exist for the recovery of certain types of products.
- Incorporating treatment codes at all the plant exits, increasing traceability of the waste.
- Incorporating QR codes into all selection circuits to have access to specific information on each circuit.
- Including innovation criteria in the terms and conditions of invitations to tender for the management of treatment plants.
- Creating a waste laboratory that would take charge of conducting RDI in order to find the best treatments for obtaining recyclable materials that can be recirculated.



REFERENCES

- AMB (2016). *Pla d'actuació metropolitana (Metropolitan Action Plan)*.
<https://pam.amb.cat/home>
- AMB-Environment Area (2014). *Pla de sostenibilitat ambiental de l'Àrea Metropolitana de Barcelona (AMB Environmental Sustainability Plan). PSAMB 2014-2020*. Department of Environmental Services and Regional Barcelona. January 2014.
<http://www.amb.cat/web/medi-ambient/actualitat/publicacions/detall/-/publicacio/memoria-del-pla-de-sostenibilitat-de-l-area-metropolitana-de-barcelona/636033/11818>
- AMB-Environment Area (2018). *Millor que nou. Guia 2018 ("Better Than New. Guide 2018")*.
<http://www.amb.cat/en/web/medi-ambient/actualitat/publicacions/detall/-/publicacio/millor-que-nou--guia-2018/568079/11818>
- AMB-Environment Area (2019). *PREMET25. Programa Metropolità de Prevenció i Gestió de Recursos i Residus Municipals/2019-2025 (Metropolitan Programme for Municipal Resources and Waste Prevention and Management/2019-2025)*.
<https://www.premet25.cat>
- BOE (1997). *Llei 11/1997, d'envasos i residus d'envasos (Law 11/1997 on packaging and packaging waste)*.
https://www.boe.es/boe_catalan/dias/1997/12/31/pdfs/A00053-00060.pdf
- Contarina Spa (2018). *Integrated Waste Management*.
<http://www.contarina.it/files/en/ppt.pdf>
- Ecoinstitut (2018). *La xarxa metropolitana de deixalleries. Diagnosi i propostes de futur 2025 (The metropolitan rubbish tips network. Diagnosis and proposals for the future 2025)*. https://www.premet25.cat/wp-content/uploads/2019/02/EB_07_Deixalleries.pdf
- Ellen MacArthur Foundation (2017). *Cities in The Circular Economy: An Initial Exploration*.
<https://www.ellenmacarthurfoundation.org/publications/cities-in-the-circular-economy-an-initial-exploration>
- EMSHTR (2009). *Programa Metropolità de Gestió de Residus Municipals 2009/2016 (Metropolitan Programme for Municipal Waste Management 2008/2016)*.
- Ent (2017). *Estudi sobre la viabilitat tècnica, ambiental i econòmica de la implantació d'un sistema de dipòsit, devolució i retorn (SDDR) per als envasos d'un sol ús a Catalunya*.
http://residus.gencat.cat/web/.content/home/ambits_dactuacio/tipus_de_residu/envasos/gestio_denvasos/eines_de_gestio_especificades_a_la_normativa_sig-sddr/170725-SDDR-Catalunya-ARCFg.pdf
- European Commission (2008). *Framework Directive on Waste 2008/98/EC*
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098>

- European Commission (2010). *Europe 2020. A European strategy for smart, sustainable and inclusive growth*
<http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf>
- European Commission (2014). *The new General Union Environment Action Programme to 2020: Living well, within the limits of our planet*
<http://ec.europa.eu/environment/pubs/pdf/factsheets/7eap/en.pdf>
- European Commission (2015). *Circular Economy. Closing the Loop. An Ambitious EU Circular Economy Package* http://ec.europa.eu/environment/circular-economy/index_en.htm
- European Commission (2018a). *A European Strategy for Plastics in a Circular Economy*
<http://ec.europa.eu/environment/circular-economy/pdf/plastics-strategy.pdf>
- European Commission (2018b). *Directive of the European Parliament and of the Council on the reduction of the impact of certain plastic products on the environment.*
http://ec.europa.eu/environment/circular-economy/pdf/single-use_plastics_proposal.pdf
- European Parliament (1994). *European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste*
<https://eur-lex.europa.eu/eli/dir/1994/62/2015-05-26>
- Generalitat of Catalonia (2014). *PRECAT20. Programa general de prevenció i gestió de residus i recursos de Catalunya 2020. Catalan Waste Agency (General Programme for Resources and Waste Prevention and Management in Catalonia 2020).*
http://residus.gencat.cat/web/.content/home/ambits_dactuacio/planificacio/precat20/docs/PRECAT20_doc_principal.pdf
- Korhonen et al. (2018). *Circular Economy: The Concept and its Limitations. Ecological Economics*, volume 143, January 2018, pp. 37-46.
<https://www.sciencedirect.com/science/article/pii/S0921800916300325>
- Parliament of Catalonia (2009). *Llei 6/1993, reguladora de residus (Law 6/1993, on waste regulation).* <https://www.parlament.cat/document/cataleg/48096.pdf>
- Pérez, J. (2019). *Estudi sobre el potencial de creació de llocs de treball directes i indirectes derivats dels PMGRM.* (Study on the potential for creating direct and indirect jobs derived from the PMGRMs).
- Raworth, K. (2017) *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist.* Chelsea Green Publishing

- Spora (2018). *Estudi d'anàlisi de la situació actual de la recollida i generació comercial/singular a l'àrea metropolitana de Barcelona* (Analysis study of the current status of commercial/singular waste collection and generation in the Barcelona metropolitan area). https://www.premet25.cat/wp-content/uploads/2019/02/EB_08_Recollida_comercial.pdf
- United Nations (2015). *Transforming our world: the 2030 Agenda for sustainable development*. <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>

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03 Waste management in the Barcelona metropolitan area

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