"Good Practices in collection and closed-loop glass recycling in Europe"

Report prepared by the Association of Cities and Regions for Recycling and sustainable Resource management (ACR+) in partnership with the European Container Glass Federation (FEVE)

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Glossary

Bottle bank:

a large container into which the public may throw glass bottles for recycling

Source: Collins English Dictionary (http://www.thefreedictionary.com/bottle+bank)

Civic Amenity Centre / Site:

A guarded, fenced-off area where local residents can dispose of and sort their recyclable, hazardous or bulky waste. Civic Amenity Centres can take both flat and containers glass waste. However for the purpose of this study when we refer to glass diposed in a Civic Amenity Centre we mean container glass waste.

Source: Suez Environnement

Contamination:

The addition of the result of the addition, or presence of a material or materials to, or in, another substance to such a degree as to render it unfit for its intended purpose.

Source: ARC21

Container Deposit scheme:

Container-deposit legislation is any law that requires collection of a monetary deposit on soft-drink, juice, milk, water, alcoholic-beverage, and/or other containers at the point of sale. When the container is returned to an authorized redemption center, or to the original seller in some jurisdictions, the deposit is partly or fully refunded to the redeemer (presumed to be the original purchaser). The deposit schemes can serve for recycling or reuse (refill).

Source: Wikipedia

Closed loop recycling:

Means the glass is recycled back into the same product type.

Source: WRAP

Door-to-door:

Waste packaging collected from one house to the next.

Source: Collins English Dictionary

Glass Cullet:

Scraps of broken or waste glass gathered for remelting, especially with new material.
Source: http://www.thefreedictionary.com/cullet

Household Waste:

Means waste from households as well as other waste, which because of its nature or composition, is similar to waste from households.

Source: OECD/Eurostat Joint Questionnaire on Waste

Municipal Solid Waste:

Waste originating from households, commerce and trade, small businesses, office buidlings, institutions and from selected municipal services, (waste from parks and garden maintenance and street cleaning services); collected by or on behalf of municipalities.

Source: Eurostat

One – way packaging container:

One way glass packaging: Packaging such as bottles, jars, flasks, etc. that cannot be refilled after use.

Source: http://www.ara.at/

Selective Collection (of glass waste):

It is the separation of materials intended for recycling. It means that recyclable materials should not be disposed together with residual waste. It can be an initiative of a single citizen or organized in communities : apartment buildings, companies, schools, clubs, cities, etc.

Source: http://www.natureba.com.br/nature/selective-collection.htm

Separation at source:

Actions taken by a household to keep certain materials separate from others.

Source: VNG International

Underground bottle bank:

It is a bottle bank whereby the waste is then sucked through underground pipes by a fan syste to a central bulking point where it is stored in airtight, containers, which can then be sent on for further reprocessing by the waste contractor.

Source: www.letsrecycle.com

Waste generation:

The weight or volume of materials and products that enter the waste stream before recycling, composting, landfilling, or combustion takes place. Also can represent the amount of waste generated by a given source or category of sources.

Source: EPA US

Executive Summary

Objectives and content of the study

An efficient glass collection and recycling scheme is an important driver to move towards a circular economy where waste is not dumped but become the essential raw materials used to manufacture new products.

In this study the aim is to identify good practices in selective collection and closed-loop recycling of glass packaging waste from Municipal Solid Waste (MSW) across European regional and local authorities. ACR+ on behalf of the European Container Glass Federation (FEVE) conducted this research to identify good practices on glass packaging waste recycling and highlight some key results. The strategic objective established for this project is to increase awareness and disseminate information on good practices of glass recycling with the aim to increase the quantity and quality of the cullet available.

Operational Objectives

The following objectives were identified for this project:

- What are the different types of glass recycling collection schemes operating across Europe?
- Which factors affect the success of an effective glass collection scheme?
- Evaluate the performance of the different glass collection schemes
- Identify best practices for glass collection schemes leading to closed loop recycling (bottle to bottle)

The methodology of selective collection; quantity and quality of the glass waste ensuring closed – loop recycling were amongst the most important criteria to select the good practices. The case studies were selected via different means such as: desk- based research, dissemination of case study template among ACR+ members, electronic questionnaires and literature reviews.

Eight case studies were selected for the purpose of this study. The Authorities chosen were: Intradel – Liège Province (Belgium), Municipality of Graz (Austria), LIPOR, Greater Porto Intermunicipal Waste Company (Portugal),Municipality of Maastricht (Netherlands), Municipality of Lippe (Germany), Canton of Geneva (Switzerland), City of Grand Besançon (France), Municipality of Odense (Denmark).

For each case study, the following aspects were analysed based on the available information:

- Legal context and responsibilities.
- Geographical content (urban, semi-urban, rural, touristic and / or historical centres).
- Financial context and incentives.
- Identification of the statistical methodologies and indicators used to assess the recycling performances
- Efficient collection schemes (kerbside, bottle banks, deposit schemes and other types of schemes) including sectorial differences for glass collection (commercial, household) and/or colour-separate glass collection vs mixed glass collection.
- Innovation in glass collection schemes and processes.
- Costs and funding
- Quality criteria for glass waste sent to recycling (contamination levels).
- Value chain from glass waste collection to recycling process (interaction between collectors, EPR schemes and recyclers)
- Communication: Education, raising awareness amongst households and other targets

Glass recycling in Europe

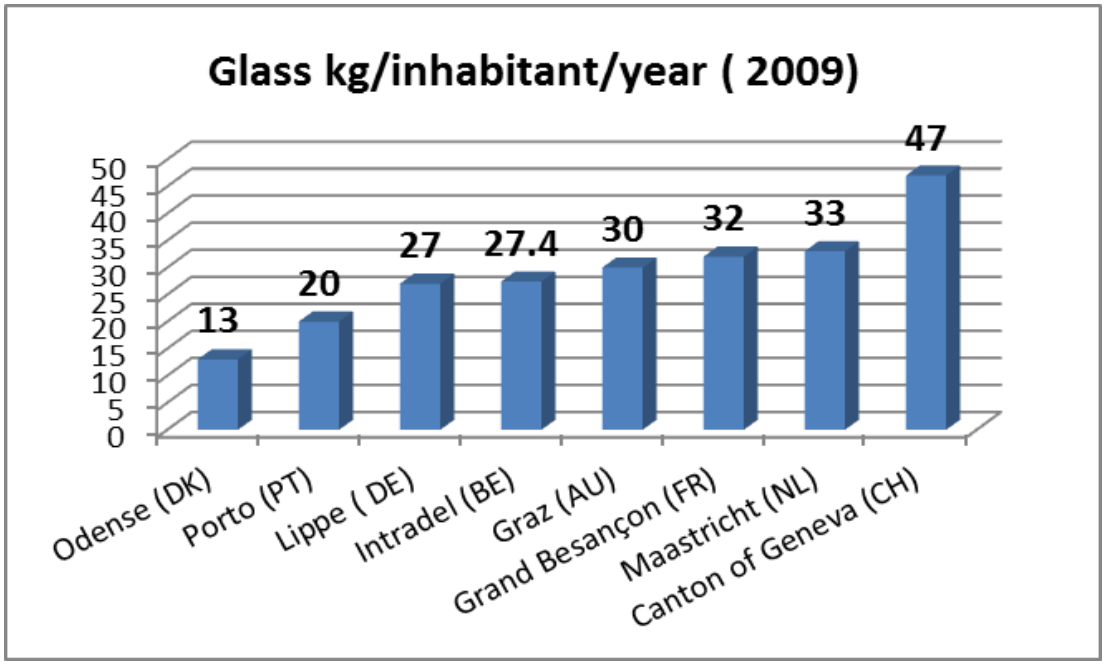
Within the framework of the EU Strategy 'Europe as a Recycling Society' each Member state is mandated to follow the Waste Framework Directive and meet the statutory recycling target of 50% of municipal solid waste. Also as part of the Packaging Waste Directive, each member state should meet separate packaging waste targets. For glass packaging waste, the recycling target is 60%.

According to the latest glass packaging recycling estimates more than 67% of glass bottles and jars were collected for recycling in the European Union in 2009. The figures released by FEVE, the EU Container Glass Federation, translate into about 11 million tonnes or 25 billion glass bottles and jars being collected throughout the European Union, confirming the steady and positive trend of the last years (66% in 2008). According to our 8 case studies the average recycling rate for glass containers reaches: 81%.

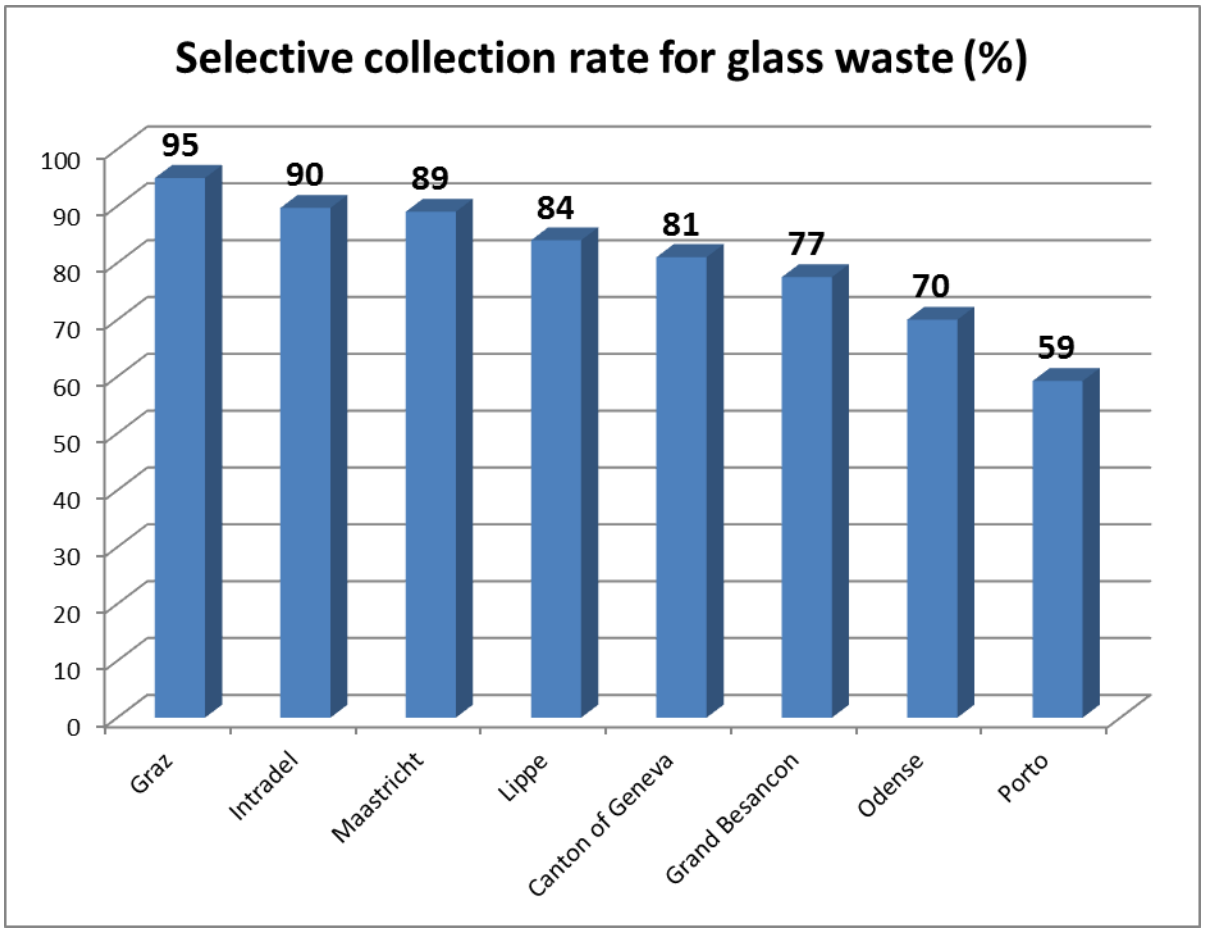
The selected case studies are based on the quality outputs i.e. the glass packaging waste originating from the selective collection systems that is of sufficient quality to be easily recycled and not on the volume of inputs i.e. the total amount of glass recovered. The research demonstrates that by sorting glass packaging waste from other waste flows, generally provides a high quantity and quality material for recycling and these cases were prioritised in this study. In the study, the glass waste

selectively collected varies from case to case: 13 kg/inhabitant/ year (in Porto) – 47 kg/inhabitant/year (in Canton of Geneva), underlying the differences not only in performance but also in glass packaging use as well as the existence of deposit schemes competing with municipal collection.

The following graph provides a summary benchmark of the amount of glass waste selectively collected per inhabitant in 2009 for each of the eight municipalities (some low values may be due to the existence of deposit schemes):



Whereas the graph below represents the glass waste recycling rate (%) in each case study. The selective collection for glass waste ranges from 59% to 95% for the selected case studies. The local glass recycling rate figures have been calculated by dividing the amount of glass waste selectively collected by the amount of glass waste generated in each region or city selected (based on tonnes). The latter figure is however not always available or difficult to estimate. Transboundary imports and exports not registered (e.g. consumers bringing back in one country bottles bought in another country) may also influence the result.



The selective collection methods vary across Europe

The study identified 4 main selective collection schemes: door-to-door, bottle banks, civic amenity centers and glass deposit schemes. Additionally, for marginal quantities mainly from hospitality sector, some collection on request schemes were identified.

The collection is either separated by colour or mixed. A sample of this variety is shown in the 3 following examples.

In Porto, glass collections commenced in 1980 and today the inter-municipality provides a selection of ways for residents to recycle their glass packaging, through: door-to-door, bring banks or 'Ecopontos', Civic Amenity centres and glass on request. In 2010, around 1,148.48 tonnes of glass were collected on request (for non-household origin).

The municipality of Lippe in Germany which started glass collection in the early 1980's operates a '3 tier' colour-sorted waste glass system for: amber, clear, green is effectively applied, whereby bottles

banks are available for each colour type of glass bottle. Lippe reaches a glass selective collection of 27 kg per inhabitant per year.

The Canton of Geneva in Switzerland operates a glass recycling scheme since 1986 and today it provides 567 bottle banks located in the 45 communes (1 bottle bank/ 820 inhabitants). Glass selective collection reaches 47 kg per inhabitant per year. The total amount of glass packaging collected in 2009 was 20,935 tonnes from both the commercial and household premises. The type of glass collection is dual for: clear and coloured glass.

In Denmark, on average glass bottles are collected mixed as the glass is separated by colour mechanically at the treatment plants. The Danish government and the municipalities believe this is more cost-efficient and economically viable solution.

Container Deposit schemes across Europe

There are two types of container deposit schemes existing in Europe:

a) Refillable container deposit scheme (on reusable drink container)

A refillable deposit scheme is a scheme whereby the glass container , once emptied is returned to an authorised shop or deposited in a container, that will be then be sanitised and refilled to be placed back again in the market.

In Denmark, Germany and Sweden, refillable glass drink containers represent a significant share of the glass drink container market with: Denmark at 80%, Germany at 51%, and Sweden at 47% in 2006.[1]

b) Recycling container deposit scheme (on one-way containers)

[1,5,6] Ernst & Young Study for ADEME ' *Assessment of Results in the reuse and recycling of packaging in Europe*'. March 2009

Recycling deposit schemes cover only a minority of container tonnage, the highest being Germany at 3% until recently.[2] The share of these schemes in the overall packaging recycling rate varies from 1% (in the Netherlands, where the system is recent) to almost 5% (in Sweden).

During this study we identified 3 different container deposit schemes in:

- Lippe (DE):

A compulsory deposit scheme is in operation for different types of bottles. Once put through the deposit system, the consumer receives directly 8 or 15 cents per bottle (0.08 or 0.15 Euro).

- Maastricht (NL):

Deposit systems are in use for beer bottles, drink containers in Maastricht. The price of bottled beers and soft drinks includes a small deposit that is refundable on returning the empty containers (0.10 Euro).

- Odense (DK):

In Denmark, the container deposit refund for the consumer is[3]:

• Cans, glass and plastic bottles under 1 litre (Pant A) : 13 cents (DKK 1.00)
• Plastic bottles of 0.5 litres (Pant B):20 cents (DKK 1.50)
• Cans, glass and plastic bottles of 1 litre and over (Pant C): 40 cents (DKK 3.00)

The take back is mainly organised by reverse vending machines, except in the smaller outlets. Machines also accept labeled packaging even if the shop in which it is located does not itself sell the product.

[3] http://www.pro-e.org/Denmark

Funding & Finance: The collections costs and their coverage are key parameters

The financing of glass waste collection systems varies from one country to another and plays a key role in glass waste recycling performance, generally with the support of Extended Producer Responsibility (EPR) schemes.

For example the Belgian EPR system for packaging is coordinated by Fost Plus which is a private organisation that promotesand finances the selective collection, sorting, and recycling of household packaging waste in Belgium including glass. Fost Plus, has the legal obligation to cover the full costs incurred by the municipalities for packaging collection including:

- Cost for glass collection – value of the material
- Cost for follow up by inter-municipalities
- Cost for communication material

In Portugal the EPR System is coordinated by Sociedade Ponto Verde, S.A., an organisation responsible for the collection and recycling of household, commercial and industrial packaging waste. All glass received by LIPOR is sent for recycling by Ponto Verde;

In the case of Odense in Denmark, the Extended Producer Responsibility is not applied as it has not been adopted by national legislation.

Across all good practice case studies, the glass selective collection costs vary from 51 euro (Intradel) to 125 euro (Canton of Geneva) per tonne and this is due to different parameters taken into consideration when calculating those costs: The collection costs for the municipality includes administrative (including communications), collection/handling and transportation of glass packaging waste to the recycling facility.

Permanent innovation for glass selective collection

Though glass waste was one the first waste flows to be selectively collected already in the 80's, there have been major improvements and innovation in order to improve the quantity and quality of the glass waste collected as well as increase the comfort of citizens-sorters. Innovation plays a key role to ensure high levels of selectively collected glass packaging waste.

In Belgium and Austria the underground bottle banks located in parks, near shopping centres, by residential establishments have shown to increase the quantity and quality of glass waste collected. In the UK, new technologies have been developed in the hospitality sector (restaurants, hotels, bars and pubs) such as glass crushers in order to reduce the volume of waste glass being generated due to lack of space in the premises. One solution to the storage problem is to compact the glass on site (using a glass compactor unit). This reduces the amount of space required to store the empty bottles and/or the frequency of collections required.

Cultural habits must be taken into account when analysing results as they play a key role in the performance of glass waste collections. Germany and Austria have historically higher consumption levels of both coloured and clear glass: colour-coded sorting at source was implemented to enable the production of a sufficient quantity of white cullet.

Glass waste selective collection can count on original and efficient communication at local level

Communication material act as a catalyst for the effectiveness of the glass selective collection schemes and additional illustrations and photos on guides and brochures ensure for better quality of the glass waste collected on a local level. The municipalities have also been focusing on communicating the importance of glass recycling to schools (i.e. '*Bottle Recycling Heroes'* in Austria) and community groups.

European container glass manufacturers – through FEVE – support "Friends of Glass" – a self-fed European consumer community of more than 20,000 people that supports and promotes consumers' rights to be able to choose food and drink products in glass packaging. A number of enticing tools are available on the multi-language website **www.friendsofglass.com** – like Hank the Singing Bottle, the Bottle Bank Test and the Pass the Bottle Facebook game. They have the objective to increase consumer awareness on the fact that glass is 100%, infinitely and locally recyclable in a 'bottle-to-bottle' system, and that glass recycling is therefore sustainably sound. Friends of Glass was initiated in 2009 in response to a pan-European survey commissioned by FEVE to the research institute InSites, which found that 74% of European consumers prefer glass packaging for their food and drinks.

Low contamination rates and involvement of recyclers

From a technical and market perspective, glass manufacturers set up key criteria for glass waste with either the municipality or the glass packaging association and waste contractors to ensure higher efficiencies which effectively adds more pressure to the regional and local authorities to ensure a high quality of glass waste is achieved. In most of the cases, it is strongly advised that ceramic, stone (heat-resistant glass), light bulbs and other types of glass are strictly not disposed in the bottle banks as they have a higher melting point than glass containers.

Throughout the study it has been noticed that the traceability of the glass packaging waste can be difficult as the glass waste collected from the municipalities gets delivered to the glass manufacturer (sometimes via transit stations) in bulk. Thus, to obtain information about potential origins of contamination from specific loads of glass waste can be limited.

Based on the study, it is evident that the following factors are encouraging a higher glass selective collection rate:

Parameters
Accessibility and high number of bottle banks (e.g. Maastricht)
Cleanliness and maintenance of bottle banks (e.g. Intradel)
Information, clear and simple messages to residents (e.g. Graz)
Frequent collection by the Municipality and avoidance of over filling of bottle banks (e.g. Canton of Geneva)
Separate glass collection by colour type (e.g. Lippe) or implementation of state-of-the-art technology to separate colours after collection
Glass bottle banks placed/located in 'popular' central areas (e.g. Porto)
Better handling of glass bottles at collection point, will secure higher quality of glass waste (e.g. Odense)
LRAs to introduce advanced systems: underground street bottle banks (e.g. Intradel)

Conclusions

The study confirms that glass collected separately from other materials provides the highest quality feedstock. Colour separation at source or implementation of of state-of-the-art technology to separate colours after collection are the best options to achieve the required standards ready for recycling by a glass maker. New technology also exists which allows for colour separation after collection..

The collection system varies from region to region and the study calls on all relevant stakeholders to work closely together to develop guidelines that will assist the municipalities, waste contractors and glass manufacturers to achieve a better quality cullet, so as to reduce the amount of virgin raw materials used in glass making.

1. Introduction

In 2005, the EU formulated a vision “Europe as a Recycling Society” in the framework of the EU Strategy for waste prevention and recycling. This was an ambitious but necessary vision aiming towards a more sustainable society with less use of virgin material, less use of energy and reduced GHG emissions as well as less polluting emissions to soil, water and air.

The Packaging waste Directive (1994/62/EC) sets up a minimum target of 15% recycling rate for all packaging waste. This directive was modified by the directive 2004/12 which has introduced differenciated targets par material and especially a recycling target of 60% for glass packaging by 31 december 2008. Following the adoption of the new Waste Framework Directive (2008/98/EC), all EU27 are obliged to recycle 50 of some “ municipal waste” by 2020 and, to adopt , if appropriate, a separate collection for at least paper, metal, plastic, glass by 2015.

Glass waste is conceptually 100% and infinitely recyclable when properly collected (color separation), sorted and treated thus reducing the use of virgin material to produce new glass bottles or others products. The European glass packaging industry is committed to sustainable packaging and the reduction of their environmental impact is one of their major priorities

According to the latest glass recycling estimates more than 67% of glass bottles and jars were collected for recycling in the European Union in 2009. The figures released by FEVE, the EU Container Glass Federation, translate into about 11 million tonnes or 25 billion glass bottles and jars being collected throughout the European Union.

Under this context, ACR+ and FEVE agreed to carry out a joint research project in 2011 to identify best practices in collection and closed-loop recycling of glass from Municipal Solid Waste (MSW) across European Regional/ Local Authorities. The methodology of selective collection, quantity and quality of the glass waste ensuring closed –loop recycling are of the most important criteria to select the best practices.

2. Objectives

The strategic objective established for this project is to increase awareness and dissemination of information on good practices of glass recycling with the aim to increase the quantity and quality of the cullet available.

The operational objectives include:

- Identification of the different types of glass recycling collection schemes operating across Europe
- The type of factors affecting the success of an effective glass collection scheme
- Evaluation of the performance of the different glass collection schemes
- Identification and description of best practices for glass selective schemes leading to closed loop recycling
- Dissemination of information on the identified best practices

The cases studies have been selected based on a range of criteria that were agreed between ACR+ and FEVE, which can be found below.

Good Practice examples based on the following agreed criteria:

- Quality of the glass collected for recycling
- Total costs for society
- Areas achieving high recycling rate, mainly among ACR+ members.
- Efficient collection schemes (kerbside, bottle banks, deposit)
- Sectorial differences for glass collection (commercial, household).
- Legal context and responsibilities.
- Geographical content (urban, semi-urban, rural etc).
- Financial context and incentives.
- Colour-separate glass collection vs mixed glass collection.
- Innovation in glass collection schemes and processes.
- Communication: Education, awareness raising and other targets.

3. Methodology

Following the project agreement between FEVE and ACR+, ACR+ with the vast experience on waste management and the participation of some ACR+ members, commenced the research for the project. In summary the following steps were conducted:

- Desk based research on data collection at all levels:
  Various reports and documents by: FEVE, EUROSTAT, ACR+ members and national bodies (UK, DK, FR and other) were examined to gain background knowledge and information. Some of which include:
    - Analysis of Municipal Waste Management Practices in Europe: An image of some of the best performing cities/regions (ACR+ publication, 2006).
    - Europe as a Recycling Society (European Environment Agency, 2011)
    - Assessment of the Danish Market and Environmental Impacts of Recycling Glass Bottles (2000)
    - The WRAP case studies on UK glass recycling: colour separate or mixed (2008)

- Preparation and dissemination of a 'case study template' to the Regions/Cities which included questions and information on:
    - ❑ National context
    - ❑ Data on local demographics and key local features
    - ❑ Quantities of glass collected
    - ❑ Methodology for selective collection and key actors
    - ❑ Funding & Cost for municipality
    - ❑ Communication material

  (NOTE: The 'case study template' can be found under Appendix 1)

- A 'Call of interest' was sent to the ACR+ members to respond with good practices on glass selective collection schemes.
- A series of email questionnaires/survey and phone conversation with targeted local authorities, including non ACR+ member
- A selection of appropriate cases against the agreed criteria
- The elaboration of factsheets for each Regional/Local Authority
- Various contacts/survey with Glass Recycling Companies and FEVE members
- Drafting conclusions /recommendations

The case studies presented in this report have been selected via several different methods. The ACR+ team launched a call to its contacts to attract good practices of glass selective collection. Also they conducted a literature review to identify 'good performers'. The selection process was based on the criteria established in the contract (as mentioned in the Objectives).

4. Current Legislation - European Policy

4.1. The Landfill Directive (1999/31/EC)

The Landfill Directive seeks to reduce the volumes of waste going to landfill and imposes controls on the nature and types of wastes disposed of and the manner in which they can be disposed.

4.2. The Packaging waste Directive 2004/12/EC

The Packaging waste Directive 2004/12/EC, adopted in early 2004, formally amended the 1994 Packaging Directive by establishing[4]:

- A global recovery targets of minimum 60% by weight of all packaged wastes including an overall recycling target by 31 December 2008, between 55 and 80% by weight of all packaging waste;
- The following recycling targets for materials contained in packaging waste:
    - 60 % by weight for glass,
    - 60 % by weight for paper and board,
    - 50% by weight for metals,
    - 22.5 % by weight for plastics, and
    - 15 % by weight for wood;
- Specific deadline for the new EU member states

The individual Packaging waste Directive targets will need to be met by 2015 as set by the European Commission.

[4] http://www.epa.gov/oswer/international/factsheets/200610-packaging-directives.htm

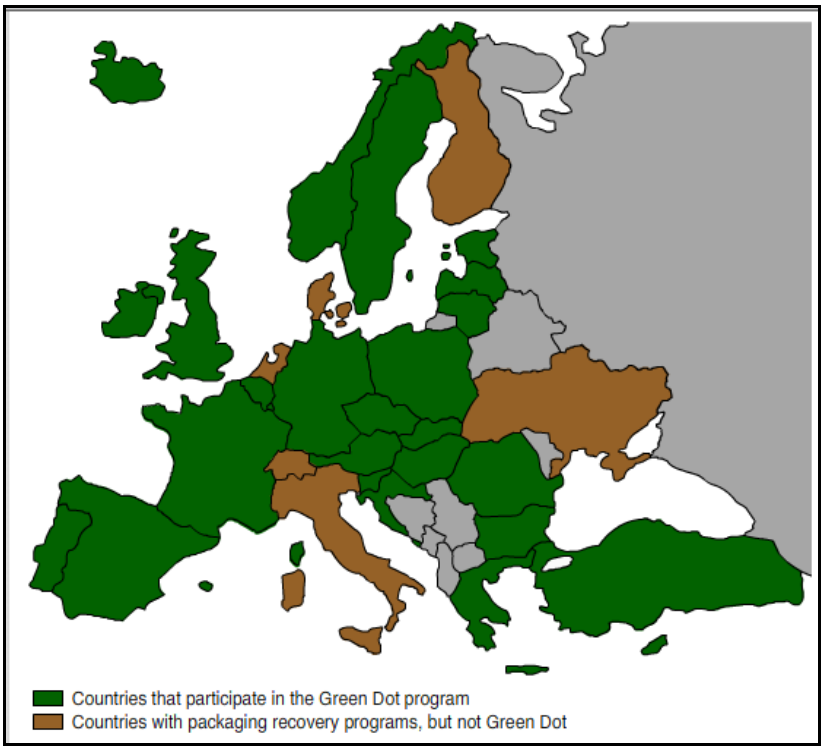
4.3. Waste Framework Directive (WFD 2008/98/EC)

The EU Waste Framework Directive (WFD 2008/98/EC) requires Member States to adopt a waste management hierarchy with 5 levels: prevention, preparation for reuse, recycling, others forms of recovery and disposal. The Waste Directive requires also Member States to take appropriate measures to achieve ''the recovery of waste and the use of recovered material as raw materials'' so as to conserve natural resources''. A statutory target of 50% of recycling of some municipal solid waste has been established. And there is a need to develop selective collection for some materials including glass by 2015.

4.4. Packaging Compliance Organisations (across the EU)

The goal of the adoption of the ''Packaging and Packaging Waste Directive - 94/62/EC'' was to provide a high level of environmental protection and ensure the functioning of the internal market. In order to implement properly the provisions of the directive, national producer responsibility systems were created in the different EU countries such as: Duales System Deutschland GmbH (Germany), Eco-Emballages S.A. (France), FOST Plus (Belgium) and ARA Altstoff Recycling Austria AG.

Later, more countries formed their own national organizations. Today, in total, more than 30 countries have national packaging compliance organisations which are involved in packaging recovery programs. Three countries: Denmark, The Netherlands and Ukraine do not offer the Green Dot® program.



Source: Green Dot System (http://www.greendotcompliance.eu/)

5. Container deposit schemes

A Container-deposit legislation[5] is any law that requires collection of a monetary deposit on soft-drink, juice, milk, water, alcoholic-beverage, and/or other containers at the point of sale. When the container is returned to an authorized redemption center, or to the original seller in some jurisdictions, the deposit is partly or fully refunded to the redeemer (presumed to be the original purchaser)[6].

There are two types of container deposit schemes existing in Europe:

a) Refillable container deposit scheme (on reusable drink container)

b) Recycling container deposit scheme (on one-way containers)

[5] http://en.wikipedia.org/wiki/Container_deposit_legislation

[6] « Assessment of : Results on the reuse & recycling of packaging in Europe », ADEME Report,March 2009

a) Refillable container deposit scheme

A refillable deposit scheme is a scheme whereby the glass container , once emptied is returned to an authorised shop or deposited in a container, that will be then be sanitised and refilled to be placed back again in the market.

In Denmark, Germany and Sweden, refillable glass drink containers represent a significant share of the glass drink container market with: Denmark at 80%, Germany at 51%, and Sweden at 47% in 2006.[7] The deposit scheme in general has fewer restrictions in terms of the type of drinks and containers –except in the Netherlands, where only glass bottles (and plastic bottles) with a capacity of over 0.5L containing beer, water and soft drinks have a reuse deposit and in Sweden where only glass bottles with a capacity of less than 0.5 L have a reuse deposit. Milk and wine based drinks are generally excluded from reuse systems[8].

b) Recycling Container Deposit Scheme

Recycling deposit schemes cover only a minority of container tonnage, the highest being Germany at 3% until recently.[9] The share of these schemes in the overall packaging recycling rate varies from 1% (in the Netherlands, where the system is recent) to almost 5% (in Sweden).

There is no overall assessment of the specific impact of deposit schemes on recycling performance, and the comparable effectiveness of recycling deposit schemes and selective collection is widely debated. Thus in Germany, the recycling deposit scheme has been challenged because it allegedly costs three times more than selective collection, with a result in terms of impact on the recycling rate equivalent to that of the Austrian system, which has no recycling deposit scheme. The majority of drink manufacturers therefore believe that it would be better to extend sorting schemes to households in order to improve recycling rates, considering that this would increase the type of waste treated by

[7,5,6] Ernst & Young Study for ADEME ' *Assessment of Results in the reuse and recycling of packaging in Europe*'. March 2009

eco-organisations and use existing infrastructure, thus providing economies of scale, rather than investing in new infrastructures and organisations.

During this study we identified 3 different types of container deposit schemes in the selected case studies:

- Lippe (DE): *Pfand* or *Einwegpfand* (single-use deposit):
  0.25 Euro per beer, mineral water bottle

- Maastricht (NL):
  0.10 Euro deposit for each glass beer bottle

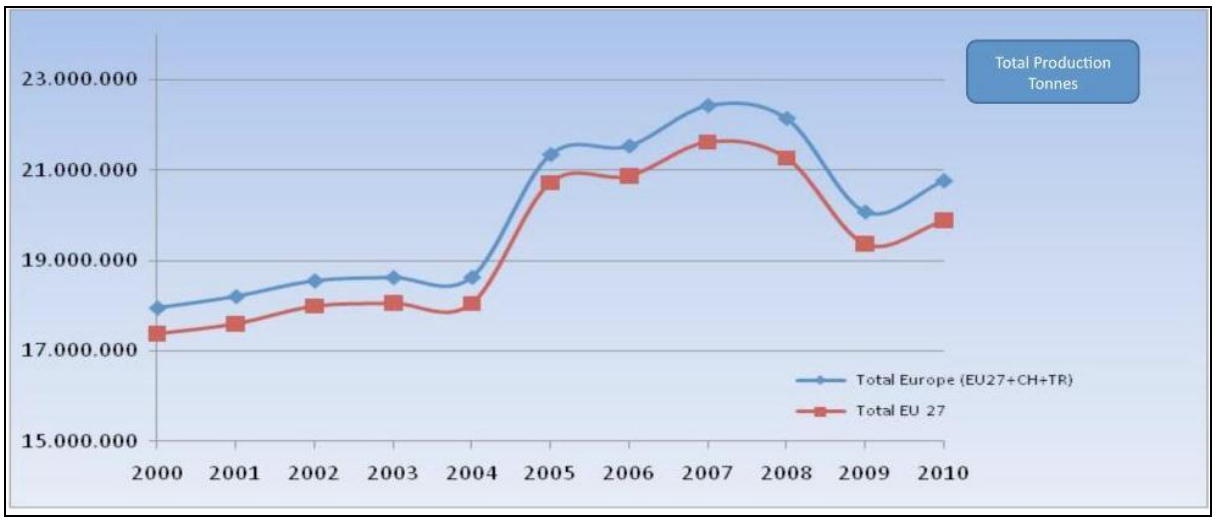
- Odense (DK):
  The deposit refund for the consumer:
  - Cans, glass and plastic bottles under 1 litre (Pant A) - **13 cents (DKK 1.00)**
  - Plastic bottles of 0.5 litres (Pant B) – **20 cents (DKK 1.50)**
  - Cans, glass and plastic bottles of 1 litre and over (Pant C) – **40 cents (DKK 3.00)**

These examples will be presented in more detail later in the report.

6. Glass current performance

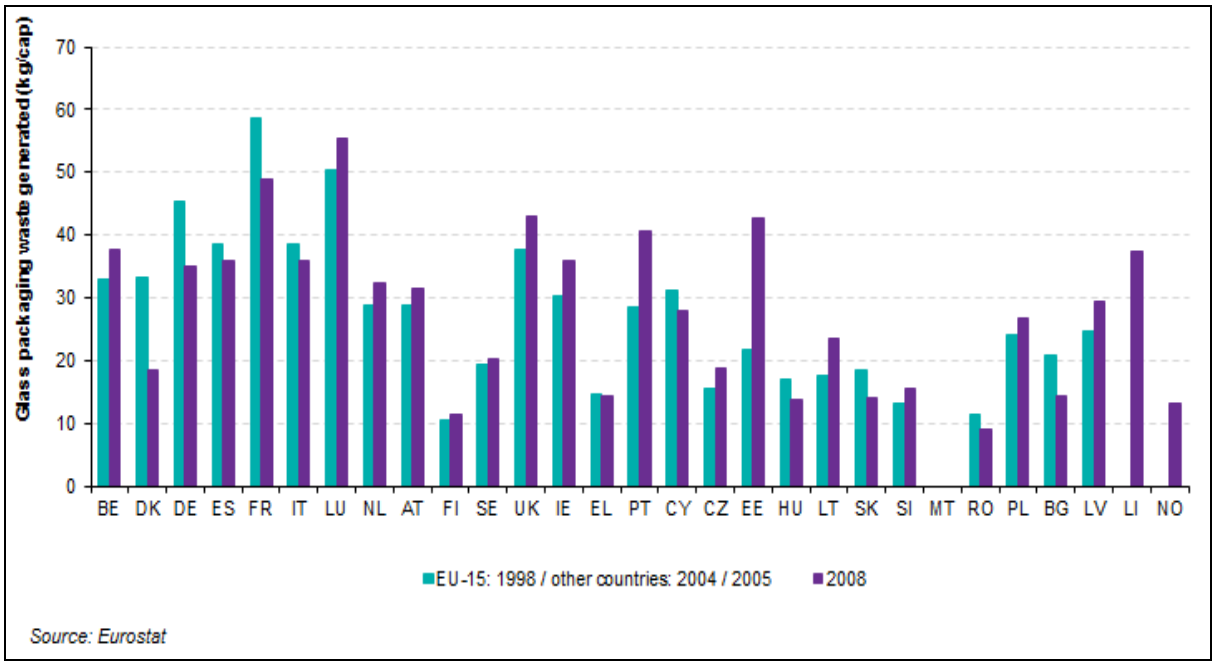
6.1. Results in the EU

According to FEVE, the packaging glass generation, mainly of bottles, flacons, jars for food and beverages has increased from 17,379,507 (2000) to 19,901,925 (2010) million tonnes across the EU27 with some great fluctuations in 2009 due to the financial market crisis.



Source: FEVE: http://www.feve.org/index.php?option=com_content&view=article&id=10&Itemid=11

Based on EUROSTAT's statistical data, the glass packaging waste generation per inhabitant has steadily increased since 1998. In the EU-15, the glass packaging waste generated was 37 kg per inhabitant in 2008 whereas in the 12 Member States which joined the EU after 2004 it amounted to only 19 kg per inhabitant. The gap between the countries is rather wide. Finland has the smallest amount within the EU-15 with 11 kg per inhabitant. As the table below shows, the glass packaging generated in the case of Romania amounts to only 9 kg per capita for 2008 while Luxembourg and France have the highest level of glass packaging generated with 55 kg per capita and 49 kg per capita respectively.

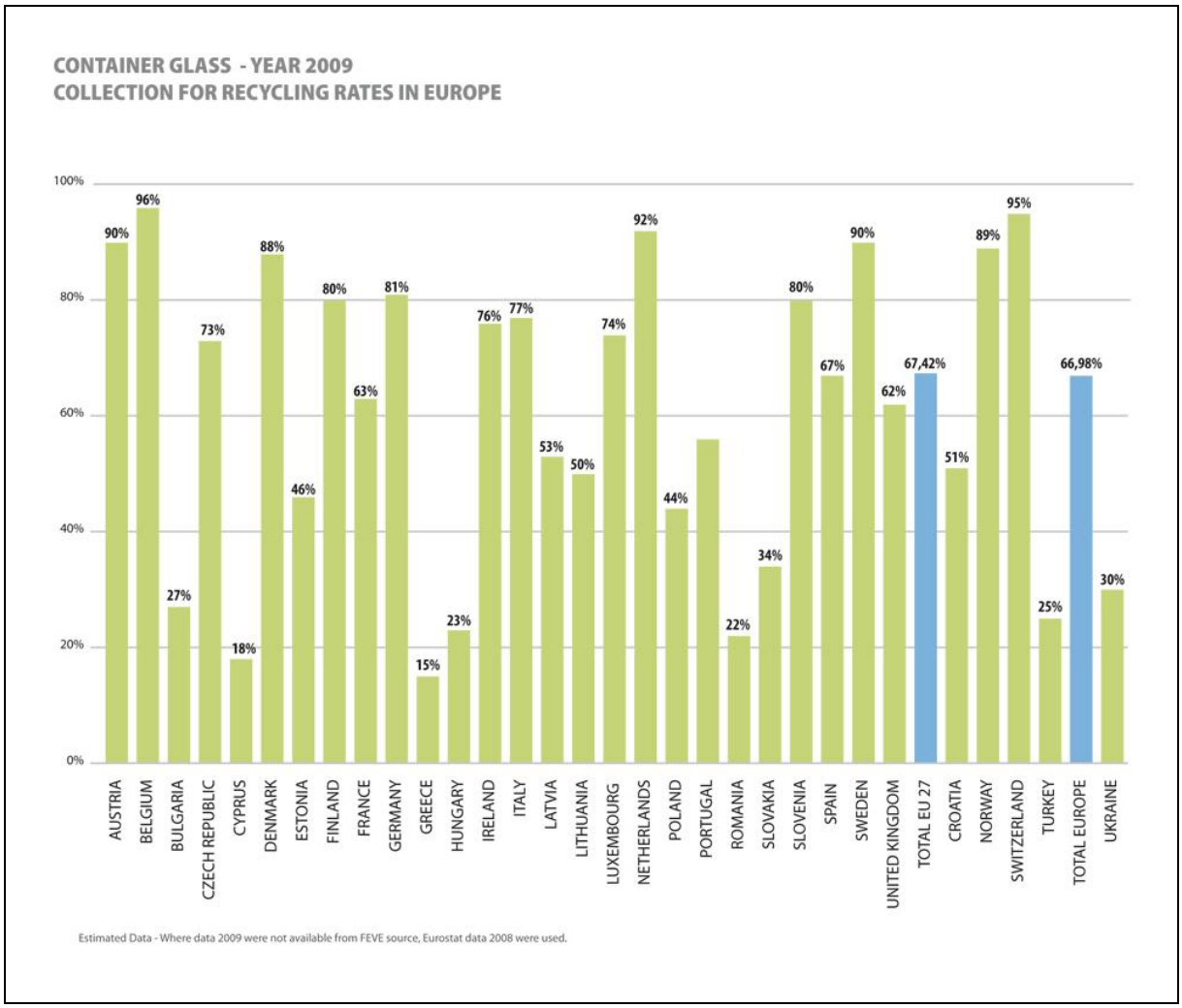


Source : Eurostat[10]

There is a very wide range of quantity of packaging glass generated between the various Member States. The development over time is also very different. Some countries such as Belgium, the United Kingdom, Slovenia or Poland experience an increase whereas other countries such as Denmark, France or Bulgaria see a decline.

In 2009, according to FEVE, the average glass selective collection rate for the EU27 reached 67.4% and nearly 11.5 million tonnes of glass packaging were collected all over Europe (including Norway, Switzerland and Turkey). The following image shows the glass selective collection rate per country within Europe.

[10] Eurostat : http://epp.eurostat.ec.europa.eu/statistics_explained/index.php?title=File:Per_capita_volume_of_packaging_glass_waste_generated_1998_and_2008.PNG&filetimestamp=20110913080909



Source: http://www.feve.org/index.php?option=com_content&view=article&id=10&Itemid=11

In this chapter it is interesting to demonstrate the price of glass cullet sold in the market over a period of 10 years (2000 – 2010). The price of secondary materials (such as glass cullet) is highly influenced by the price of raw materials and thus by the overall economic development. The revenues from secondary materials pay for a substantial part of the waste management schemes.

The table below presents the specific prices (Euro/tonne) over the total volume of glass cullet. It is evident that the price of glass cullet has increased over the years as the amount put on the market has also increased. The average price of glass cullet over the years is 42.6 Euro/tonne.

PERIOD	Average €/tonne	tonnes
2000	36.2	2,653,057
2001	35.8	3,083,692
2002	37.8	2,969,065
2003	37.0	3,191,781
2004	47.4	3,220,523
2005	46.1	3,213,687
2006	46.8	3,294,839
2007	42.8	4,294,690

2008	48.3	4,365,816
2009	48.0	4,254,798
2010	48.0	4,198,716

Source: http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/wastemanagement/recycling

For the other materials such as paper and plastic the average price of these secondary materials are much higher. For more detailed information you can visit the EUROSTAT website.

6.2. Study on choosing and improving glass collection services

Following a study carried out by WRAP on "Choosing and improving your glass collection service"[11] in 2008, it is highlighted that:

- Collecting glass colour separated will deliver the quality of glass required by the remelt industry
- If a Local Authority is already colour –sorting –should avoid changing the method of collection
- If a Local Authority is unable to collect glass completely colour separated, it should keep clear glass separate from other streams.

In the UK, approximately 2.7 million tonnes of glass waste gets collected each year, with an increased proportion collected as mixed-colour. For a Local Authority to choose which collection methodology to introduce, various factors need to be taken into account: including financial benefits, ease of collection, environmental and reputational benefits. Also, the services a Local Authority has in place and the location of relevant end markets.

Good practice glass collection requires an understanding of the various collection options and their associated costs and benefits.

[11] http://www.wrap.org.uk/downloads/Final_version_-_Glass_best_prac_-_May_2008.483bbc08.5715.pdf

The following types of collections for glass waste have been identified and assessed by WRAP:

Dedicated collection rounds	Fully colour sorted	Kerbside sorted dry recycling (incl. fully colour sorted glass)	Kerbside sorted dry recycling – two streams (clear-colour)	Colour mixed glass collections	Fully co-mingled recyclables	Household Waste Recycling Centres (HWRCs) and bring sites
Easy of collection	3	3	3	4	5	4
Quality of recyclate	5	5	4	3	1	5
Environmental performance	5	5	4	3	2	4
Cost and service	high	med	med	med	low	low

(1: lowest performance 5: highest performance)

Most local authority recycling services have evolved over time, being influenced by the local or regional reprocessing infrastructure and outlets available. To ensure residents participation authorities should provide sufficient container capacity, appropriate collection frequency and clear instructions on how to take part.

When introducing, changing or promoting a glass collection service, clear, timely and relevant communications are the key to maximizing performance. A well planned, well delivered communications campaign lets residents know how, where and when to use their service.

A guide to planning a local authority communications campaign is available from WRAP[12] providing – in depth guidance on linking communications in with operational issues; defining target audiences; settling timelines and budgets; and detailing the strengths and weaknesses of common communication methods.

12

http://www.wrap.org.uk/downloads/2011_03_01_Increasing_recycling_through_effective_communications_WEB.60cc1623.2732.pdf

7. Case Studies - Glass selective collection

The eight case studies that have been selected as part of this research project are:

Case Study 1: Intradel – Liège (Belgium)
Case Study 2: Municipality of Graz (Austria)
Case Study 3: LIPOR, Greater Porto Intermunicipal Waste Company (Portugal)
Case Study 4: Municipality of Maastricht (Netherlands)
Case Study 5: Municipality of Lippe (Germany)
Case Study 6: Canton of Geneva (Switzerland)
Case Study 7: Grand Besançon (France)
Case Study 8: Municipality of Odense (Denmark)

The following table summarises the performance of each of the eight Regional/ Local Authority against the main key indicators which are set out by ACR+ and FEVE.

Summary of key indicators of the selected 8 case studies:

	Intradel (BE)	**Graz (AU)**	**Porto (PT)**	**Maastricht (NL)**	**Lippe (DE)**	**Canton Geneva (CH)**	**Grand Besançon (FR)**	**Odense (DK)**
Population	998,009	291,890	984,047	118,523	352,234	464,412	176,627	167,615
Overall Selective collection rate[13] (%)	64	56.5	20	65	75	43	49	66
Amount of glass selectively collected (tonnes)	27,361	8,422	19,448	4,538	9,524	20,935	5,660	2,460
Glass selectively collected kg/inh/yr	27.4	30	20	33	27	47	32	13[14]

[13] All materials

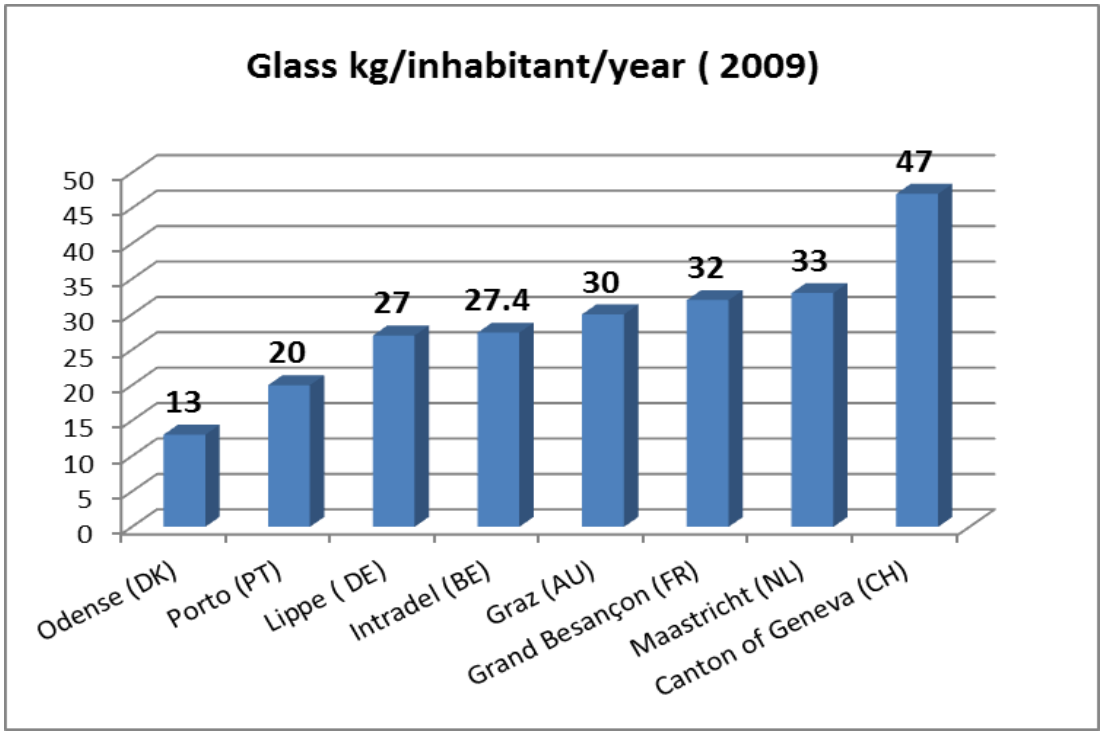
[14] This figure (13 kg/inh/year) is low due to the fact that Denmark runs a refillable container deposit scheme. Thus the amount of glass selectively collected for recycling is much lower.

	Intradel (BE)	**Graz (AU)**	**Porto (PT)**	**Maastricht**	**Lippe (DE)**	**Canton Geneva (CH)**	**Grand Besançon (FR)**	**Odense (DK)**
Glass waste recycling rate (%)[15]	90	95	59	89	84	81	77	70
Type of collection scheme	a)Bottle banks b)CA site	a) Kerbside b) bottle bank c) CA site	a)Kerbside b) bottle bank c) CA site d) Collection on request	a)Bottle banks b)CA site	a)Bottle banks b)CA site	a)Bottle banks b)CA site	a)Bottle banks b)CA site	a)Bottle banks b)CA site
Type of glass collection	Dual system: -Clear -Colour	Dual system: -Clear Colour	Mixed glass	Dual system: -Clear -Colour	'3 tier' system: -Amber -Clear -Green	Dual system: -Clear -Colour	Mixed glass	Mixed glass
Number of inhabitants per bottle bank	442	N/A	285	N/A	443	819	291	1117
Target	Mainly household and small businesses	Mainly household and small businesses	Mainly household and small businesses	Only household	Mainly household and small businesses	Mainly household and small businesses	Mainly household and small businesses	Mainly household and small businesses
Glass recycling company	Maltha GlasRecycling Netherlands	Vetropack (AU)	Various	Various	Various	Vetro recycling	Saint Gobain	Marius Pedersen A/S (Ltd.)
Cost of glass waste per tonne[16]	50. 6	87	35 – 65	56	20 – 25[17]	120 - 130	64	103

[15] Glass waste recycling rate (%)= glass waste selectively collected / glass waste generated

[16] Note : The cost per tonne in each case is calculated in a different way. The calculations could include: EPR intervention, subsidies, local market or typology, collection cost, collection and transportation.

The following graph provides a benchmark of the amount of glass waste selectively collected per inhabitant in 2009 for each of the eight municipalities. However it's important to note here that some municipalities either use deposit schemes or consume less glass bottles, factors that are not taken into account on this graph.



The research demonstrates that by sorting glass packaging waste from other waste flows, such as single stream separation, it overall provides a high quantity and quality material for recycling. In the study, the glass waste selectively collected varies from case to case: 13 kg/inhabitant/ year (in Porto) – 47 kg/inhabitant/year (in Canton of Geneva), underlying the differences not only in performance but also in glass packaging use as well as the existence of deposit schemes competing with municipal collection.

Whereas the graph below represents the glass waste recycling rate (%) in each case study.
The selective collection rate for glass waste ranges from 59% to 95% for the 8 case studies. The glass selective collection rate has been calculated by dividing the amount of glass waste selectively collected by the estimated amount of glass waste generated in each region or city selected.

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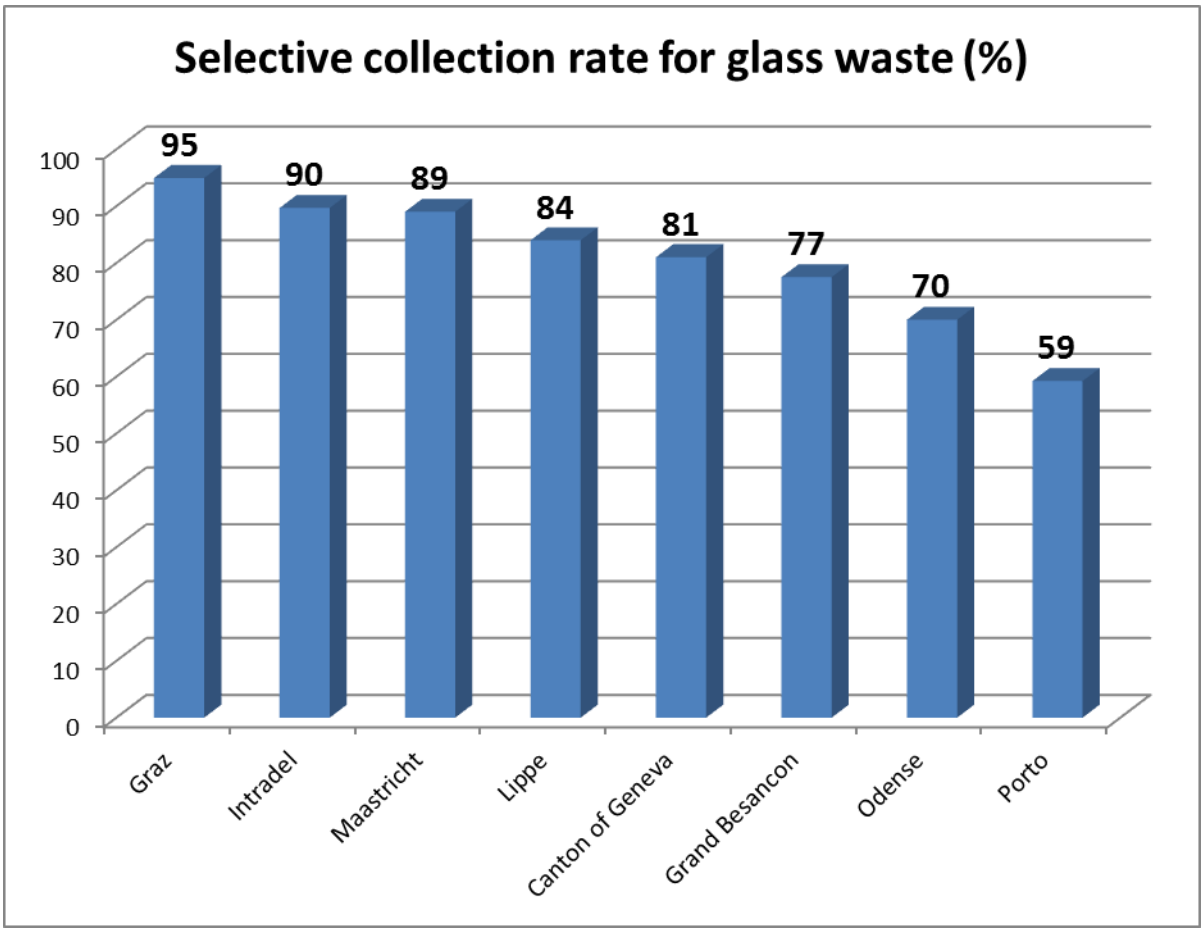
[17]Includes administrative and sorting costs but NOT collection costs



The following table demonstrates the cost of packaging glass waste selectively collected in 2009 for each of the seven municipalities:

	Cost / per tonne (€)	Cost for collection	Cost for transportation	Cost for supervision	Cost for comms
Canton of Geneva (CH)	120-130	X	X	X	
Odense (DK)	103	X (and handling)	X		
Graz (AU)	85	X	X		
Porto (PT)	35-65			X	X
Grand Besancon (FR)	64	X (and handling)	X		
Maastricht (NL)	56	X	X	X	
Intradel(BE)	51	X	X	X	X
Lippe (DE)	25				

A range of different costs per tonne can be observed in the above graph. These variances are mainly due to the different parameters taken by each municipality. For example in the case of the municipality of Lippe the pure treatment costs in the sorting including the administrating costs are approximately 25 Euros. However, the costs of collection is not included as it is covered by the German Green Dot system.

7.1. Belgium

Extended Producer Responsibility Scheme for Glass

In Belgium, the Green Dot® program is coordinated by Fost Plus since 1994 with 5,235 members registered (2010). Fost Plus is a private organisation which promotes, coordinates, and finances the selective collection, sorting, and recycling of household packaging waste in Belgium. Fost Plus is a certified organization and its work is controlled by the environmental authorities of the 3 Belgian Regions in the framework of the so-called Interregional Cooperation Agreement for Packaging.

The recycling rate for glass in Belgium reached 111% (334,935 tonnes) under Fost Plus membership and 105,4% on estimated Belgian market. On average, in Belgium for 2010, the amount collected per inhabitant per year was 30 kg. The recycling rate for household glass is the ratio between the glass put on the Belgian market declared to Fost Plus and the glass actually collected by Fost Plus. For the collected glass, Fost Plus receives information of the quantities collected by the inter-municipalities. It is important to note that the glass recycling percentage is higher than 100% because not all producers are Fost+ members and because of parallel imports (transboundary purchases). In the case of glass, the impact of parallel imports is estimated at 30 KT.

It is important to note that 80 % of the collected glass goes to recycling facilities in Belgium.

In Belgium, 78 % of the glass is collected via bottle banks and 6 % is collected via container parks (civic amenity centres), the remaining originates from other sources (private contractors, kerbside…). Some inter-municipalities collect also glass door to door. The amounts of glass collected at Horeca by private operators for which the operator can prove the recycling destination (by means of a recycling attestation) are taken into account in the recycling figures.

In Belgium, it is mandatory to organise glass selective collection with colour separation. In average, glass collected is composed of 45% white glass and 55% colored glass.

The municipalities (organised in inter-municipal companies) are responsible for the collection operations and receive full financial compensation from Fost Plus. Fost Plus is responsible for the

coordination and provides guidance to improve the efficiency of glass collection and recycling. The following operations have to take place in the context of glass collection via bottle banks:
emptying of the bottle banks
cleaning of the bottle banks sites
cleaning and maintenance of the bottle banks
Those may be carried out by the inter-municipality itself or by a private subcontractor chosen by the inter-municipality.

Technical aspects

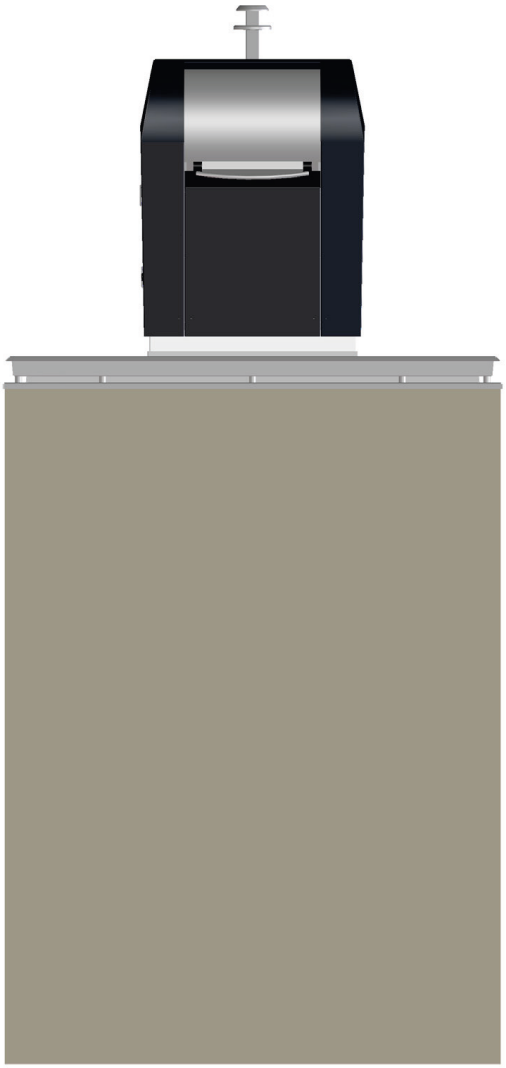
There are about 14.000 bottle banks on some 8.000 sites around the country. The collection in bottle bank is always separated by colour in Belgium.
The distribution of bottle banks is regulated in the following way:

- One bottle bank site per 700 inhabitants
- One bottle bank site per 400 inhabitants in inter-municipalities with a population density of less than 200 inhabitants/km².

Remark: there are about 2% 'underground bottle banks' in Belgium. This remains under initiative of intermunicipalities or their municipalities. It can be financed via the 0.10 €/inhab. that Fost Plus provides to sustain initiatives to promote the glass collection. The following images display the underground bottle banks (*Ondergrondse containers*), than can be found in the cities of Belgium:

Source :http://www.engelslogistics.be/content/user/File/downloads/NL/Milieuzorg_Stalen_afvalcontainers_Apyra.pdf

The underground bottle banks come in different sizes (volumes) with recording systems to obtain the weight of the bottle banks containing glass bottles. Also the dimensions of a typical underground bottle bank are the following: W: 1820 x 1820 mm, H (total): 3900 mm, H (underground): 2100 mm:



Following Fost Plus guidelines, bottle banks have to be emptied when they reach ¾ full. The frequency of emptying the bottle banks is dependent on the expertise and knowledge of the bottle bank network.

- Bottle banks have to be always maintained in good condition. Bottle banks are cleaned at least 4 times a year in order to maintain them in good condition. Defects have to be repaired as soon as possible with a maximum delay of 1 week after notification.
- Bottle bank sites have to be cleaned once a week and within 24 hours after notification.

- Fost Plus finances also the reinforcement of the ground beneath the bottle bank if necessary. It facilitates its maintenance and its attractiveness for users.

The maintenance and performance of the bottle bank sites are the responsibility of the inter-municipalities. However, Fost Plus and its contractual control organisation are also performing continuous controls of the bottle bank sites. The network of each intermunicipality is controlled 4 times a year (once every three month). This represents 40% of the bottle bank sites on a yearly base. Reports of those controls are sent to the related inter-municipality (and, where appropriate, its subcontractors) within the 24 hours. Penalties can be applied when the initial observed non-conformities are not solved within the contractual agreed period (normally one week).

To encourage self-assessment of the bottle bank sites by all the concerned partners, Fost Plus has developed a Methodological Tool[18] to assess the cleanliness of the bottle bank sites.

In order to ensure high quality cullet, specifications for the purity of the glass have been defined by Fost Plus. This is controlled by an independent control organism who analyzes frequently samples at the delivery point of collected glass.

These include:

- Ceramic, stone, porcelain (CSP) and heat-resistant glass (i.e. pottery jugs, plates):
  - greater than 60 mm less than 9000 g / tonne
  - 10 to 60 mm less than 1,500 g / tonne
  - smaller than 10 mm less than 150 g / tonne
- Non-ferrous / non-magnetic: less than 9,000 g / tonne
- Ferrous / Magnetic: less than 11,000 g / tonne
- Paper: less than 12,000 g / tonne
- Plastics and synthetic materials: less than 12,000 g / tonne
- Organic matter: less than 9,000 g / tonne (except the residual content packaging)
- Rest: less than 3,000 g / tonne

[18] www.fostplus.be

Financial aspects

The Belgian Green Dot system is controlled by the 3 regional authorities which are exclusively competent for waste policy. Fost Plus has the legal obligation to cover the full costs including:

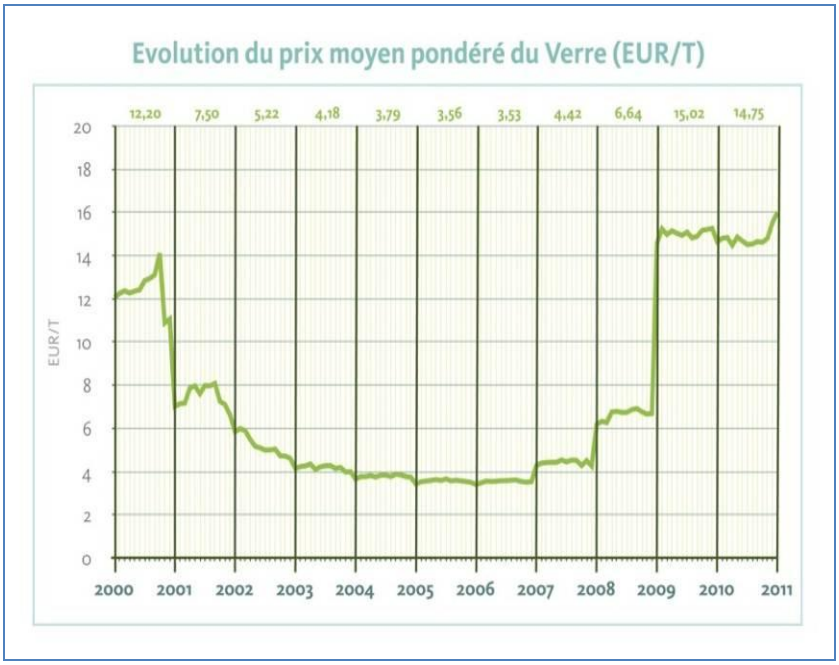
- Cost for collection – value of the material
- Cost for follow up by inter-municipalities
- Cost for communication material

The average cost (administrational/communication, collection and transportational costs) for glass selective collection amounts 49.33 Euros/tonne in 2010.
See graph below for the evolution in time.

Source: Fost Plus (www.fostplus.be)

Fost Plus also supports financially the installation of underground bottle banks by the municipalities, on their initiative. Fost Plus intervenes with a contribution of 0.10 EUR/inh. The main objective is to reduce illegal deposits around the bottle banks, reduce space occupation and noise, improve the visual integration in the city landscape.

Fost Plus launches regular tenders for selecting the recycling companies for the different packaging flows and for the different inter-municipalities. The sale price to the recycling companies varies over the time and is currently between 15 and 16 Euros/tonne, equivalent to 0,015 / kg.
The graph below indicates the evolution of price in time.



Source: Fost Plus (www.fostplus.be)

Communications

Fost Plus is also responsible and supports the communication and dissemination of marketing material about packaging recycling including glass recycling. To view the full guide, please see Appendix 2.

Case Study 1

Intradel –Liège Province in Belgium

HIGHLIGHTS

- ✓ High recycling rate for glass
- ✓ Vast territory comprising contrasted urban and rural areas
- ✓ Detailed monitoring of costs
- ✓ 100 % costs coverage by Green Dot scheme
- ✓ Colour separation and high cullet quality
- ✓ PAYT scheme for citizens

INTRODUCTION

Intradel is the inter-municipality for the management of Municipal Solid Waste serving 72 municipalities in the Liège Province and it covers an area of 2643 km^2 with a population of 998.009[19] inhabitants. Liège is the easternmost province of Belgium and belongs to the Walloon Region. Liège, the capital city of the Province, counts 190.200 inhabitants.

Its territory presents a variety of situations in terms of housing and density, from very urban to very rural:

45% > 1000 inh/ km^2

30% > 250 and <1000 inh/ km^2

25% < 250 inh/ km^2

The strategic objective for Intradel is to reach an overall 60% recycling rate of municipal waste. It currently exceeds its target by reaching a selective collection rate of 67%.

The amount of household glass packaging collected in 2010 was 27,361 tonnes estimating 27,4 kg per inhabitant per year. The glass recycling rate reaches: 90%

Intradel focuses on the household sector and manages a number of waste management sites and plants:

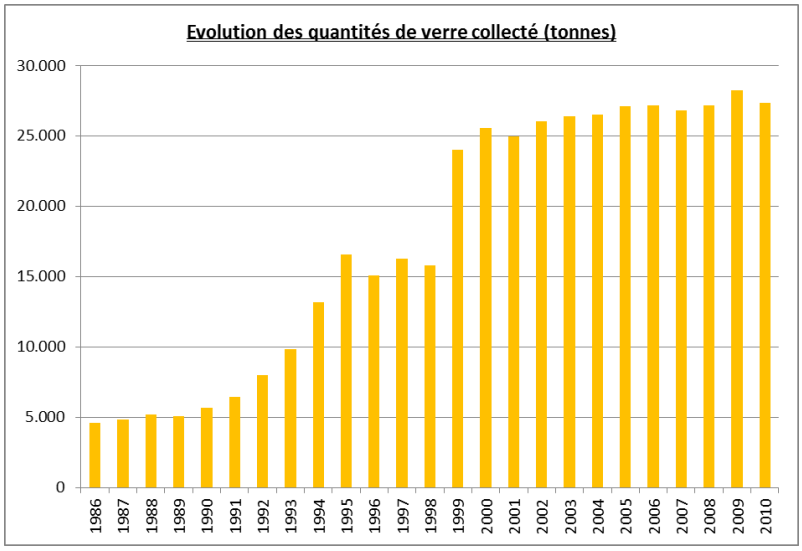
- The incineration plant in Herstal
- The composting centre in Seneffe

[19] Source: Intradel Data: 2010

- The sorting centre for dry recyclables
- The landfill of Hallembaye (Oupeye)
- 48 park containers

Intradel offers to residents a door-to-door waste and recycling collection for: residual waste, organic waste and dry recyclables (container 1: paper/cardboard; container 2: plastic bottles, metal cans and drink cartons). A 'pay as you throw'[20] principle is established for the collection of residual waste (pay –per – bag scheme).

The inter-municipality started collecting glass separately for recycling in 1987, and the first bottle banks were introduced in 2001 serving 70% of the population. The following graph shows the evolution of selectively collected glass quantities.



Source: Fost Plus

The glass selective collection scheme:

In the Intradel zone, glass waste is being collected from either:

[20] Pay-as-you-throw: is a usage-pricing model for disposing of municipal solid waste. Users are charged a rate based on how much waste they present for collection to the municipality or local authority.

a) Bottle banks – 2256 bottle banks (1128 sites)

b) 48 Container parks

Intradel, provides separate colour containers for the collection of glass waste bottles: i) containers for clear glass and ii) colored glass (mainly green and brown). Once the bottle banks reach ¾ full, they get emptied by the waste contractors.

The trend is now to install systematically underground bottle banks mainly in urban centres, like the City of Liège, where it is already the case for 68 of the 227 sites. This is upon initiative and with financial investment of the municipalities) and, as mentioned in the introduction,
Fost Plus intervenes with a contribution of 0.10 €/inh. The main objective is to reduce illegal deposits around the bottle banks, reduce space occupation and noise, improve the visual integration in the city landscape.

It is important to note that, like in most cases, the bottle banks are not only collecting households, as they are used by professional sources as well (for example, restaurants or offices).

The glass waste is collected by various private waste management companies operating in the Intradel region. The glass containers once collected from municipal sources get delivered by barge to Maltha GlasRecycling Netherlands B.V.[21] .

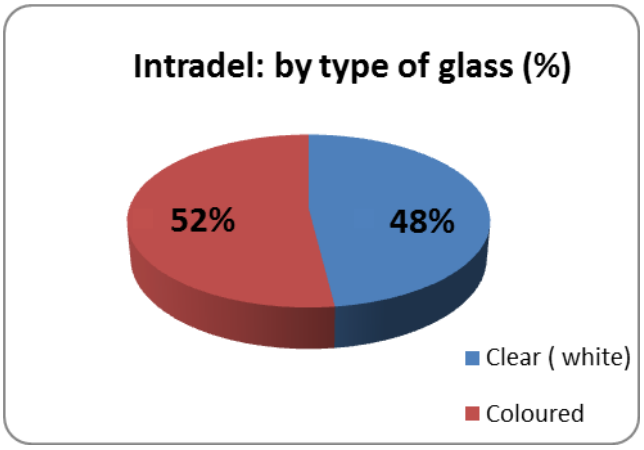
RESULTS & KEY DATA

In Intradel, the total amount of municipal solid waste produced in the region reached 483,401 tonnes in 2010. This means 484 kg of municipal waste are generated per inhabitant per year.

In Intradel, a total of 27,361 tonnes of household glass were collected in 2010 from both bottle banks and container parks estimating that the regional collected amount of glass was 27, 42 kg per inhabitant per year (2010).

Specifically:
24,762 tonnes of glass were collected through bottle banks
2,598 tonnes of glass through container parks (civic amenity sites)

The pie chart below demonstrates the percentage of glass selectively collected by colour in the inter-municipality:



[21] Recycling company currently under contract. Maltha is specialised in the recycling of container glass (jars and bottles) and plate glass (windowpanels, mirrors, etc.).

Colored Glass	14,175,540 tonnes
Clear (white) glass	13,185,350 tonnes

In Belgium on average, the collected glass from bottle banks is composed of 45% clear glass and 55% colored glass. In order for Intradel to ensure high quality cullet, specifications for the purity of the glass have been defined by Fost Plus (Green Dot systems). These include:

• Ceramic, stone, porcelain (CPS) and heat-resistant glass (i.e. pottery jugs) plates):

- greater than 60 mm less than 9000 g / tonne
- 10 to 60 mm less than 1,500 g / tonne
- smaller than 10 mm less than 150 g / tonne

• Non-ferrous / non-magnetic: less than 9,000 g / tonne

• Ferrous / Magnetic: less than 11,000 g / tonne

• Paper: less than 12,000 g / tonne

• Plastics and synthetic materials: less than 12,000 g / tonne

• Organic matter: less than 9,000 g / tonne

(except the residual content packaging)

• Rest: less than 3,000 g / tonne

Based on waste composition analyses, an estimated quantity of around 3,5 kg of glass waste is not captured by the selective collection schemes and remains in the residual waste.

<u>FUNDING AND COST:</u>

As noted earlier in the report, packaging household waste collection including glass waste in Belgium is funded by the Green Dot® program and coordinated by Fost Plus. Under the legal regulation for packaging in Belgium, Fost Plus has the obligation to cover:

- Cost for collection – value of the material
- Cost for follow up by inter-municipalities
- Cost for communication material

In Intradel, in 2010, the overall cost for running a selective collection scheme is estimated at: **€ 1.384.693**, equating to **€ 1.39 per inhabitant, or 50.6 €/tonne**. The average value price of glass sold to the glass recycling companies in 2010 is calculated at €14.57 per tonne.

COMMUNICATION

The main communication tools are elaborated by Fost Plus. They are put at the disposal of the intermunicipalities which add their own logo. The communication campaigns are carried out by the intermunicipality and additional communication efforts can be done by the municipalities themselves.

The main communication efforts concerning glass waste aim at ensuring a good separation by colour and a reduced contamination rate, especially ceramic, porcelain, stone (CPS) and heat-resistant glass (i.e. pottery jugs, plates). The communication material is to be found in Appendix 2.

FUTURE DEVELOPMENT

Glass waste selective collection is considered mature by Intradel.

Only marginal innovation is envisaged, like improving the monitoring and statistics concerning the bottle banks through geo-information systems, the cleanliness around the bottle banks and the installation of underground bottle banks.

Quantitatively, the remaining glass fraction contained in the residual waste (3,16 kg) is considered as acceptable.

Qualitatively, with the separation by colour and quality controls systems, the quality of the glass waste sent to recycling is considered as optimal.

Financially, the full collection cost is covered by Fost Plus and is at a very reasonable level, thus not an issue either.

7.2. Austria

In Austria, the Packaging Ordinance which came into force in 1993 requires companies to take back and recycle packaging materials. The Ordinance applies to companies that put packaging, products that are directly processed into packaging, or packed goods on the Austrian market. Furthermore, it obliges companies to recover both domestic and commercial packaging.

In Austria, the Green Dot® program is coordinated by ARA Altstroff Recycling Austria AG [22] who organises and finances the collection and recycling for packaging waste throughout Austria. Altstoff Recycling Austria AG (ARA) is Austria's leading collection and recovery system for packaging. It offers a full compliance service to all domestic and foreign manufacturers, importers, packers, fillers, wholesalers and retailers of packaging who are subject to the Austrian Packaging Ordinance. By entering a compliance and license agreement with ARA AG, these companies transfer to ARA AG the legal obligations they have under the ordinance. ARA have acquired so far 15,000 license partners.

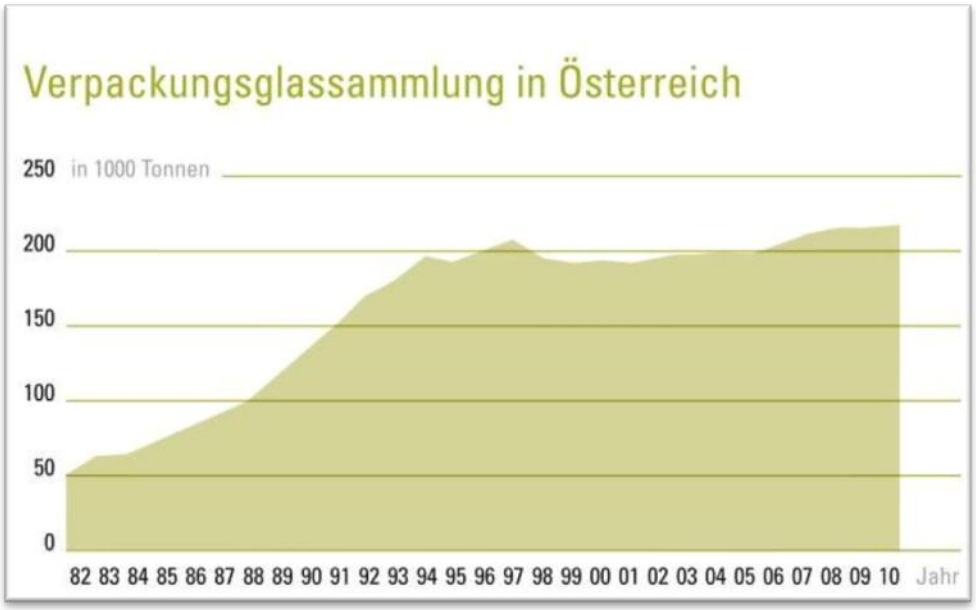
ARA AG and **Austria Glas Recycling (AGR)**[23] together provide compliance services for glass packaging. AGR is responsible for organising the collection and recovery of glass packaging within ARA system. AGR is also working with different stakeholders as it forms part of a network consisting of municipalities, private and municipal waste-collection companies, research institutions and the glass industry.

AGR collects packaging glass (bottles and jars). Other sorts of glass (windows, mirrors, dishes, lamps etc.) have to be delivered to waste collecting or recycling stations by the citizens.

In Austria glass bottles have been collected since the 1970's. In the 1980's the amount of glass collected for recycling increased steadily. Since 1993 it has increased only a 10% , which is more than 80 % of glass bottles in circulation in Austria. The following graph illustrates the evolution of glass waste packaging collection in Austria.

[22] www.ara.at

[23] www.agr.at



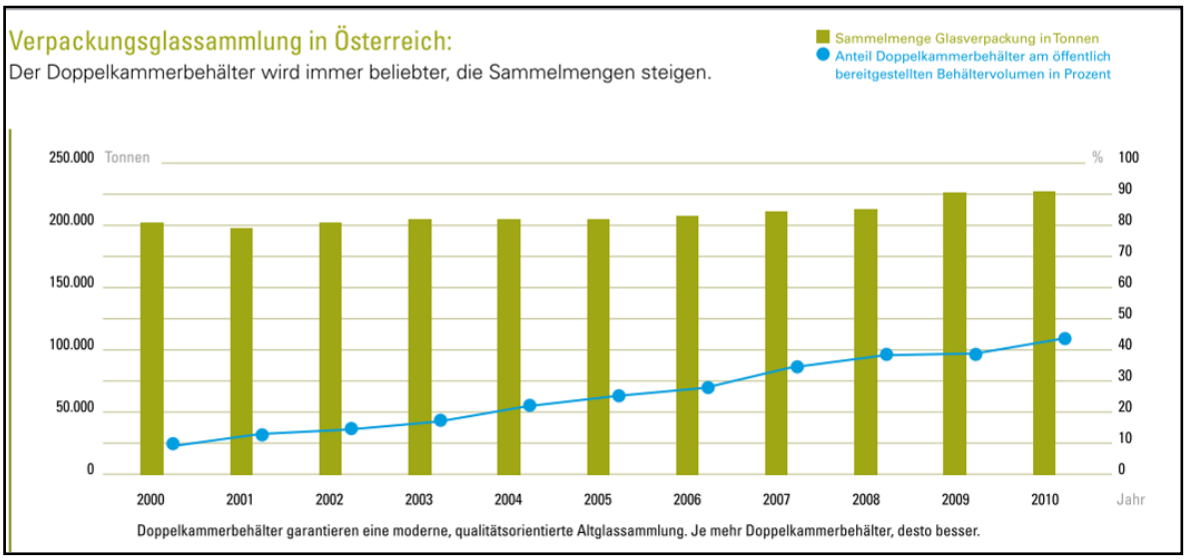
Source: http://www.agr.at/uploads/tx_pdforder/AGR-Nachhaltigkeitsbericht_2011.pdf

There are cases reported by the Austrian Glass Recycling (AGR), where glass collection is higher in rural areas (97%) in comparison to urban areas (92%) due to a number of factors as indicated by AGR such as: less bottle banks, bottle banks not always walking distance from the residential blocks. However, in the majority of the cases across Europe and due to the fact that these are densely populated areas with a high number of visitors, we observed that on average the amount of glass waste collected in urban areas is higher than in rural areas.

In 2010, AGR collected a total of 216,138 tonnes of glass packaging and delivered it to glass plants for recycling. This figure includes around 9,000 tonnes of commercial and industrial glass packaging that were collected through the household system. The graph below demonstrates the breakdown (in tonnes) of packaging waste captured in Austria in 2010, including a 26% of the total glass waste.

Source:http://www.ara.at/fileadmin/user_upload/ENGLISH/Downloads/2011/ARA_Leistungsreport2010_ENG.pdf

The glass packaging collection in Austria shows an increase in time and the bottle banks with a dual system (clear vs coloured glass) are becoming more popular, increasing the quantities collected.

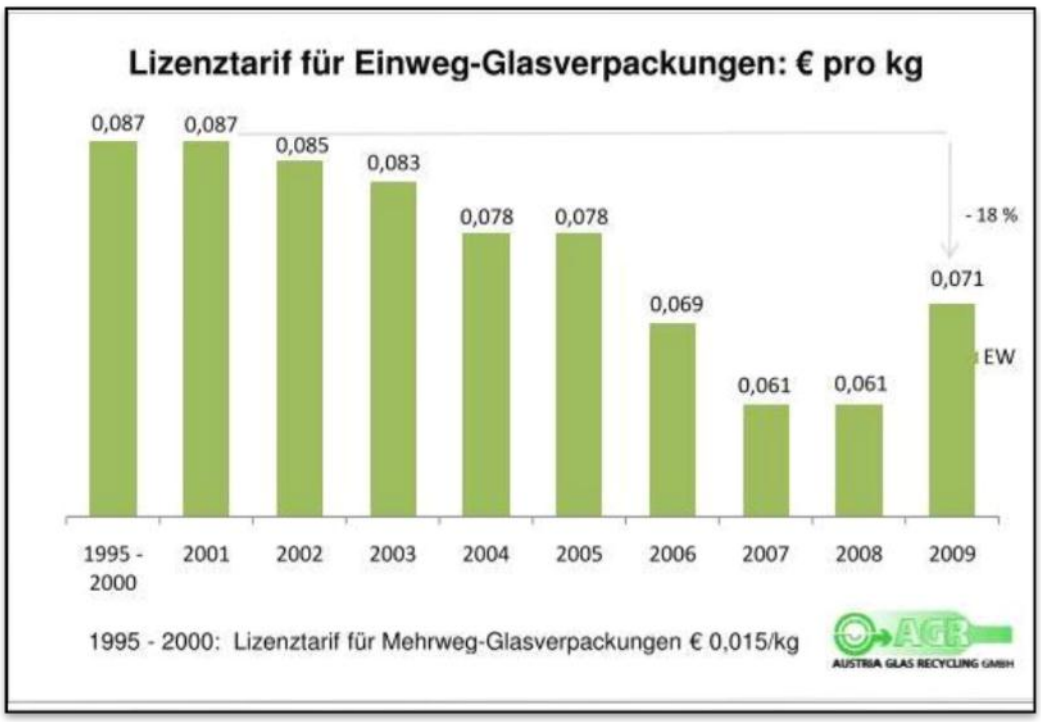


Source: http://www.agr.at/uploads/tx_pdforder/AGR-Nachhaltigkeitsbericht_2011.pdf

Financial aspects

ARA AG is coordinating the tariff (fee) level for all packaging including glass waste.

In Austria, the cost of participation in the collection and recovery of glass packaging waste is **71 € / per tonne** and it has remained stable since 2009. The following graph indicates the evolution in time and a decrease of 18% in price since 1995.



Source: http://www.agr.at/fileadmin/redakteure/Grafiken/Lizenztarif_Glasverpackungen_1995_-_2009.pdf
http://www.pro-e.org/files/Participation-Costs-2011_4%20February%202011.pdf

Technical aspects

ARA AG, through its commercial waste service, manages 140 bring sites throughout Austria where customers can take licensed packaging waste free of charge, including glass packaging waste. Approximately 80,600 glass bottle banks are available for the collection of glass waste. They have a total volume of around 80,000 m³ and come in different modules and sizes. Glass bottles are collected through bottle banks (1 chamber: see photo) that have a dual system:

b) Clear glass

c) Coloured glass (green/ brown)

The collection frequency depends on the optimum collection volume and on regional needs: While it is up to 53 times per year in urban areas, it is usually once per month in rural areas, and 15 times per

year on average in Austria. The disposal volume is calculated from the total container volume multiplied by the collection frequency. It is around 1,300,000 m³ in Austria.[24]

The glass waste collected by AGR is melted and made into new glass products. 209,904 tonnes of glass packaging were recycled in 2010 (2009: 208,621 tonnes).

Source: http://www.agr.at/service-presse/presse-fotos-grafiken.html

More than 80 % of the collected glass packaging is recycled domestically by Vetropack Austria GmbH (in Pöchlarn, Lower Austria, and Kremsmünster, Upper Austria) and Stölzle Oberglas GmbH (in Köflach, Styria); the remaining waste glass is exported to glass plants in Germany, Italy and the Czech Republic.

Austria has not set up a recycling deposit scheme for drink containers.

Communications:

AGR have assisted in the coordination of a number of communication strategies and activities throughout the country. The most well-known glass recycling campaigns that are also very common in schools are: the ***Bottle Recycling Heroes*** and ***Bobby*** that were introduced in 2001 explaining to the younger generations the importance of glass recycling in an environmentally friendly approach

[24] http://www.agr.at/: Sustainability Report; Performance Report 2010

Case Study 2

Municipality of Graz – Austria

HIGHLIGHTS

Provides a kerbside glass selective collection

- ✓ High glass recycling rate: 95%
- ✓ Offers a 3 'tier' system (door-to-door, bottle bank, Civic Amenity Site)

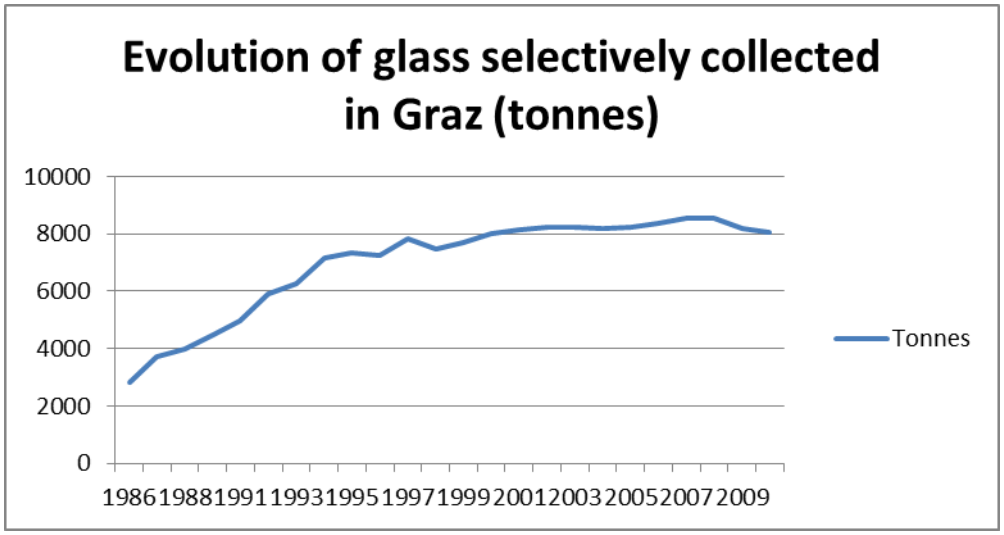
INTRODUCTION

Graz is the second-largest city in Austria after Vienna and the capital of the federal state of Styria with a population of 291,890 inhabitants. The municipality of Graz covers an area of 127.56 km^2 and is situated on the Mur River in the southeast of Austria.

The strategic objective for Graz is to reach an overall 50% recycling rate of municipal waste.

The amount of household glass packaging collected in 2010 was 8,422 tonnes estimating 29 kg per inhabitant per year. The glass recycling rate reaches: 95%

The municipality of Graz begun household glass collections before 1986, and today it targets both household and small commercial companies that are eligible to use the glass collection points. The following graph demonstrates the evolution of glass selectively collected:



Glass packaging waste is currently collected through:

Kerbside bins for flats **Bring Banks** **AEVG: 2 Civic Amenity Centres**

Kerbside collection: Graz offers a kerbside collection (photo 1) for apartments buildings for: residual waste (grey lid) paper & cardboard (red lid), clear and colored glass ('dual system'), plastic packaging (yellow lid), metal (blue lid) and biowaste (bag).

Bottle Banks: Graz also provides bottle banks (part of Brink Banks, photo 2) across the municipality. Graz aims to deliver high quality cullet to their recyclers and therefore it provides to residents and small businesses colour separated containers for the collection of glass packaging waste:

- Container 1 (green lid): clear (white) glass
- Container 2 (brown lid): Colored glass

Civic Amenity Centres: 2 Civic Amenity Centres are available where glass can be disposed safely. (photo above). The Civic Amenity Centre can also accept: hazardous waste, WEEE and green waste.

For more detailed information about what can/cannot be accepted see the leaflet currently provided to all residents (Appendix 3).

Remark: no separate figures (kg) of glass collected from the different schemes are currently available.

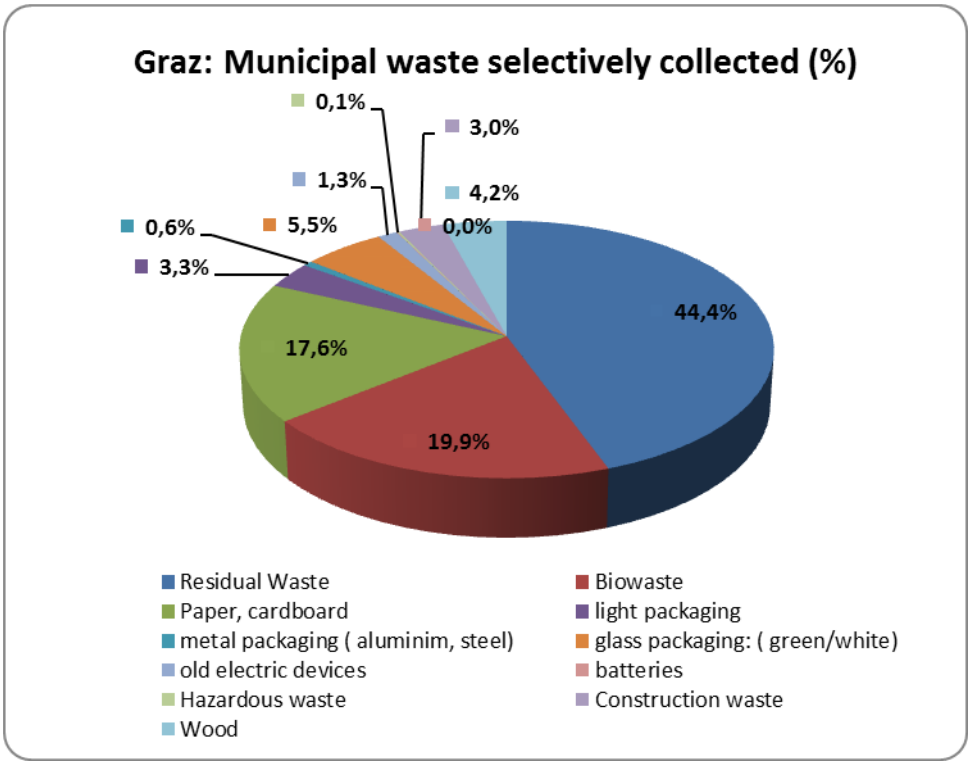
In Graz, the municipal packaging waste including glass is currently managed by a private waste management company that subcontracts Servus ABFALL, to collect glass waste from all the glass recycling points (kerbside, bottle banks, Civic Amenity Centre). Servus ABFALL has a contract agreement with Austria Glass Recycling Gmbh (AGR) to collect, sort and transport the glass to Vetropack Austria. The collection frequencies vary from weekly to fortnightly, depending on the District.

Following a waste composition analysis provided by Graz, glass represents 5 % of the total amount of waste generated under municipal sources. For further details, view Appendix 4.

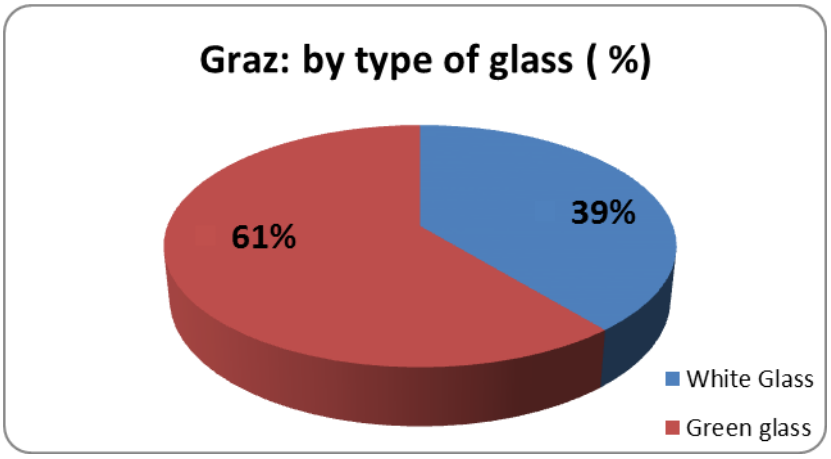
RESULTS & KEY DATA:

In Graz, in 2009 the total amount of municipal solid waste produced in the city reached 149,567 tonnes. Thus, it can be estimated that 512 kg of municipal waste are generated per inhabitant per year. The global selective collection rate reaches 56.5 % for municipal waste.

Specifically, **8,084 tonnes of glass waste** were collected in 2009 which equates to 5.5 % of the total municipal waste collected in the municipality. Approximately 29 kg of glass per inhabitant per year is collected in Graz. The graph below displays the percentage of glass waste selectively collected in Graz in comparison to the other waste material (based on weight):



The pie chart below demonstrates the percentage of glass selectively collected by colour in the inter-municipality:



The contamination rate of glass waste in Graz, when calculated in 2010 was less than 5%.

FUNDING & COST

ARA AG and Austria Glass Recycling Gmbh (AGR) together provide compliance services for glass packaging. AGR is responsible for organising the collection and recovery of glass packaging within ARA System.

AGR is constantly working on optimising the separate collection of post-consumer glass packaging to make the scheme more convenient and user-friendly on the one hand, and on the other hand to reduce the need for sorting at glass plants.

The cost for the municipality of Graz for glass collection, and transportation is € 87 per tonne.
No further information was provided by either the municipality of Graz and glass manufacturer regarding the price of glass waste sold to in the market.
ARA AG relies exclusively on the revenues from license fees paid by its customers to finance the collection, sorting, and recovery of packaging waste. On a national level, the cost of participation (license tariff) for the producers (ARA AG customers) in the collection and recovery of glass packaging waste is **71 € / per tonne** and it has remained stable since 2009.

ARA AG financial statement (2010) cover:

- License Fees revenue (179,808 million euros)
- Revenues from secondary raw material sales (27,914 million euros)
- Expenses for collecting, capturing, sorting and recovering waste (145,189 million euros)

COMMUNICATION

The municipality of Graz provides leaflets and electronic information about glass recycling and recycling activities to the community (Appendix 3). In addition to a wide range of electronic media, direct contact is made through environmental street fairs and other awareness raising events every year in the municipality to increase visibility about recycling.

7.3. Portugal

In Portugal the Green Dot System is coordinated by Sociedade Ponto Verde, S.A., (SPV) an organisation responsible for the collection and recycling of household, commercial and industrial packaging waste. It was founded in 1998 and today it reaches 10,008 members and covers 308 municipalities.

SOCIEDADE PONTO VERDE (SPV), is a non-profit-making company with the mission to promote the selective collection, take-back and recycling of packaging waste in Portugal, in order to guarantee the achievement of the recycling and recovery targets defined in the packaging Portuguese Law.

The mission of SPV is, on behalf of packers, fillers, importers, manufacturers of packaging and packaging materials and distributors, to organise and manage the take-back and recovery of packaging through the integrated system for the management of packaging waste (SIGRE), also known as the Green Dot system. The SIGRE is based on the articulation of responsibilities and processes among a number of partners. It is designed to recover and recycle packaging waste and help reduce the volume of waste disposed in landfills.

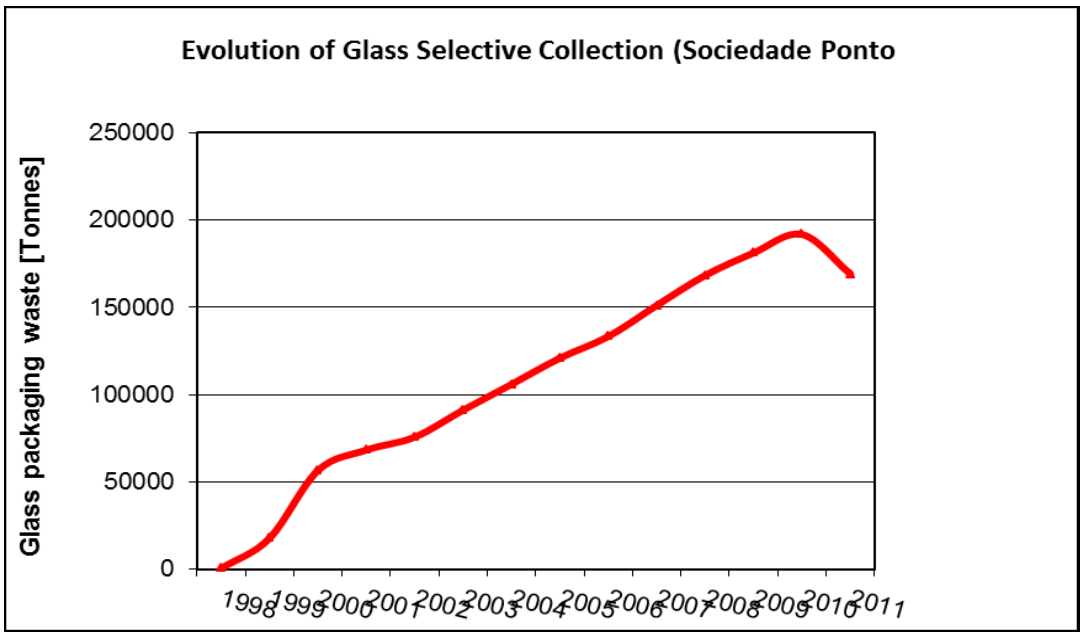
SPV represents all types of activities involved in the so-called packaging chain and covers presently six specific packaging materials: paper/cardboard, glass, plastic, steel, aluminium and wood.

SIGRE's main activities involve:

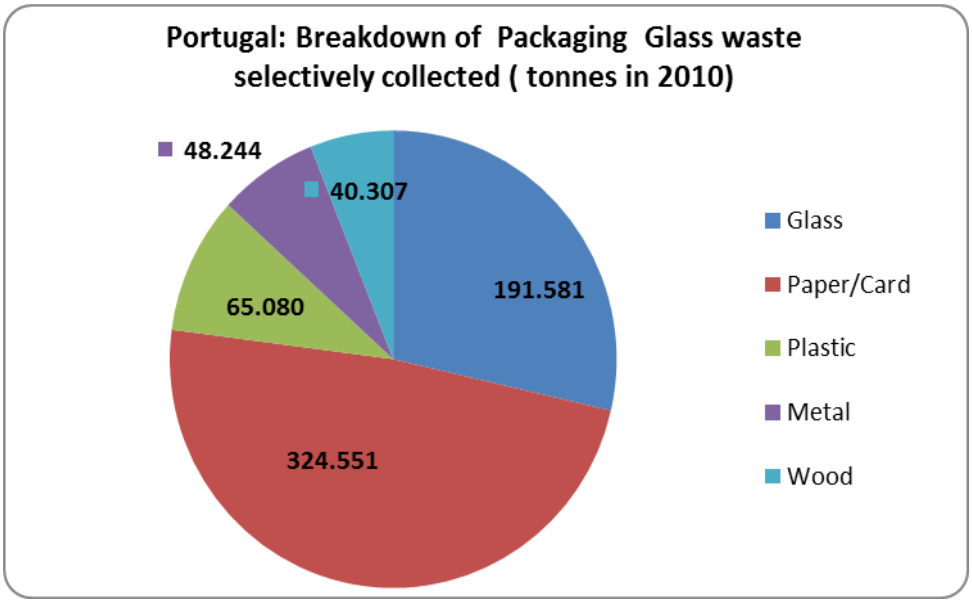
- To support local authorities in the selective collection and non-reusable packaging waste sorting programmes;
- To guarantee the take-back, recovery and recycling of sorted waste under its contracts with manufacturers of packaging and packaging waste (paper and cardboard, glass, plastic, wood, and steel and aluminium);
- To manage the final disposal of non-reusable packaging placed on the Portuguese market by packers, fillers and importers, after consumption;
- To guarantee to distributors that their non-reusable packaging is covered by an Integrated System for Packaging Waste Management (SIGRE);
- To promote consumer awareness and environmental education;

- To support research programmes fostering the development of the market for recycled products and materials

Packaging glass waste commenced just before 1998 in Portugal. The evolution of packaging glass selectively collected in Portugal can be examined below :



In 2010, packaging glass waste selectively collected represented 28% of the total packaging waste as reported by SPV.

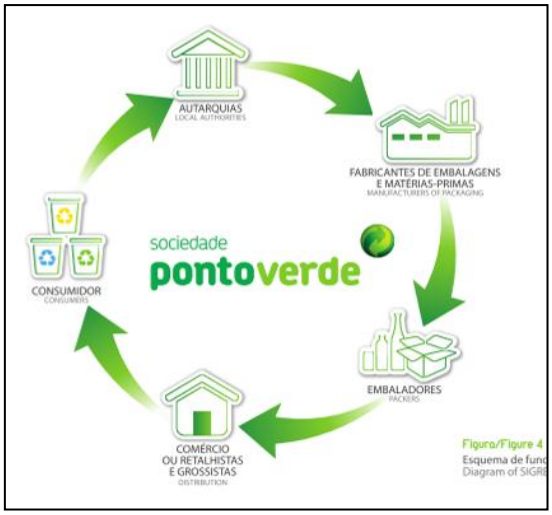


Source: www.pontoverde.pt

Technical Aspects

Waste management at Sociedade Ponto Verde is based on two management models, one for household packaging waste and the other for trade and industry packaging waste (extra urbano).

Where household packaging waste is concerned, Sociedade Ponto Verde forms partnerships with municipalities or their respective waste management contractors (SMAUT), who are responsible for selective collection and sorting of packaging waste separated by the public in their area of intervention.



Glass packaging waste from selective collection comes from recycling drop-off-containers, door-to-door collection and/or Civic Amenity Centres and needs the public's cooperation to ensure success. The 'drop-off-containers' are green.

Waste from selective collection is managed directly by Sociedade Ponto Verde in the market for this waste. The municipalities or waste management contractors (SMAUT) receive the corresponding financial support for each tonne of packaging waste material (see the Ponto Verde Fee below, under financial aspects).

The SMAUT receive the complementary report fee (CRF) for each tonne of complementary flow waste sent for recycling. Sociedade Ponto Verde is not directly involved in the management of this waste, which is done by the SMAUT, i.e. they sell this waste directly to entities licensed to treat and recycle it and then send this information to Sociedade Ponto Verde.

Financial Aspects

Using both door-to-door collection schemes and specific containers for a bring system, the Portuguese municipalities take over the multi-material collection and sorting of household packaging waste including glass waste and are reimbursed by SPV for the additional cost incurred as a result of these operations. In addition, they are also entitled to receive financial and technical support from SPV for PR campaigns undertaken to gain or increase public acceptance for the selective collection programmes implemented by them. Finally, the packaging manufacturers and raw material producers are responsible for recovery and recycling of the collected packaging waste, thus closing the loop.

The system is financed throughout the payments made by Fillers/ Importers in a clear adoption of the polluter-pays principle. The license fees are calculated according to the weight of the respective packaging material put into the Portuguese market.

Below is the framework of the amount paid to the SMAUT per tonne of household glass packaging waste material from selective collection from recycling drop-off containers and door-to-door collection. It is an amount appropriate for mainland Portugal and the autonomous regions approved in accordance with the license to pay the costs of collection and/or sorting of packaging waste, minus the avoided costs of undifferentiated collection and disposal in landfills.

	Kg/inhabitant			€/tonne			
	X1	X2	X3	P1	P2	P3	P4
Glass	<14,3	<24,5	<40,8	35,00	48,00	60,00	35,00
Paper	<8	<10	<15	135,00	151,00	166,00	135,00
Ecal	<0,3	<1,8	<3	770,00	823,00	876,00	770,00
Plastic	<2,1	<3,6	<15,3	770,00	823,00	876,00	770,00
Mixed plastic	-	-	-	500,00	530,00	620,00	500,00
Steel	<0,4	<0,7	<4,1	600,00	644,00	688,00	600,00
Aluminium	<0,02	<0,04	<0,86	766,00	1.016,00	1.283,00	766,00
Wood	-	-	-	15,87	15,87	15,87	15,87

Source: www.pontoverde.pt (P1,P2,P3,P4 –represent the different range in the price of glass)

During the year, the financial support changes on the basis of quantities of materials per inhabitant (by material) delivered for take back by each SMAUT.

The tariff applied by the Extended Producer Responsibility Scheme (Green Dot) to the glass packaging waste is 18 € / per tonne.

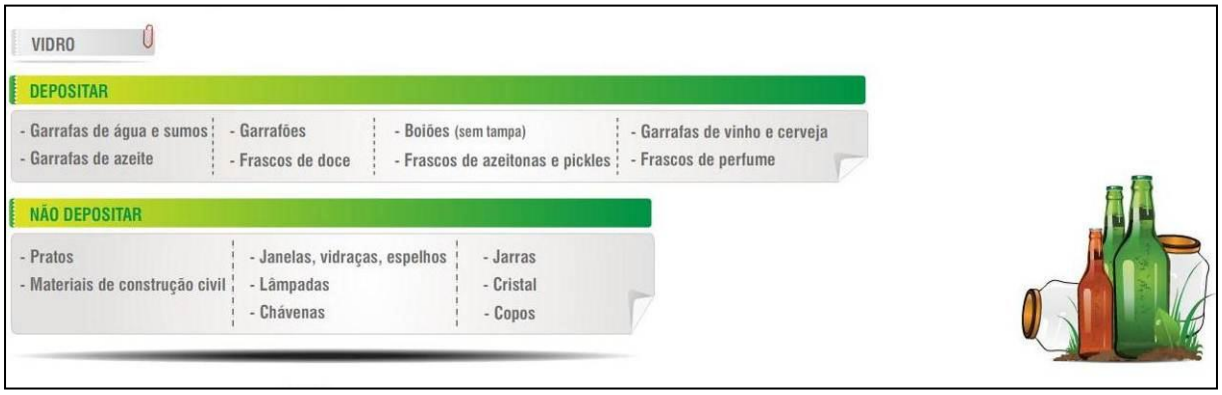
In return for the fee collected, SPV grants the Fillers/ Importers permission to mark their packaging with the "Green Dot". This symbol together with a certificate issued by SPV, confirms that the companies belong to the Integrated System and have transferred their recovery obligations to an officially recognized system-operating organisation.

SPV fully allocates its annual overall revenue towards the budget expenditure to cover the additional costs of municipalities with regards to multi material collection and sorting represents the biggest part of the revenues. The remaining part is allocated to budgets meant for communication and environmental education as well as research & development projects.

Communications:

The following messages are communicated to residents across Portugal in order to provide clear guidance as to how glass packaging waste is collected for recycling.

Message: ***"It is enough to remember that practically all glass containers – bottles and jars – produced are made partially or totally from recycled glass. "***



Source: http://www.pontoverde.pt/

Other National advertising campaigns include:

Case Study 3

LIPOR, Greater Porto Intermunicipal Waste Company, Portugal

HIGHLIGHTS

- ✓ One of the highest performers (PORTO) in Portugal in glass selective collection
- ✓ A combination of collection systems (4)
- ✓ Remarkable progress in glass selective collection the last 10 years
- ✓ Still important margin for performance increase

INTRODUCTION

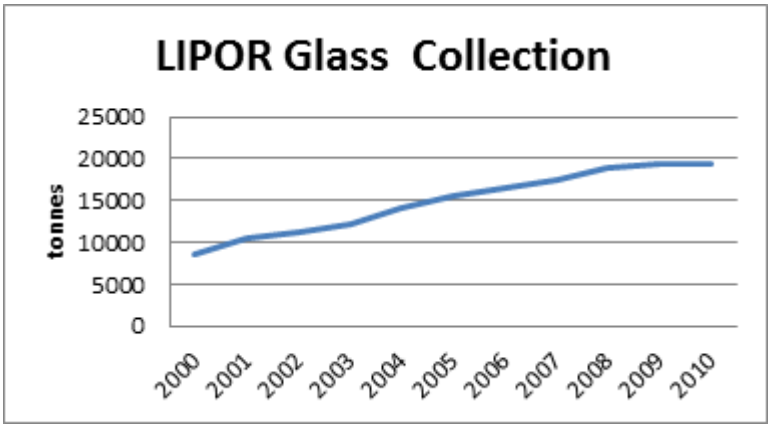
Porto is the second largest city in Portugal and one of the major urban areas in the Iberian Peninsula with a population of 984.047 inhabitants. The region of Porto covers an area of 648 km^2. Located along the Douro river estuary in Nothern Portugal, Porto is one of the oldest European Centers.

Lipor is the inter-municipal Waste Management company of the Greater Porto area, and is established as an Association of eight Municipalities: Espinho, Gondomar, Maia, Matosinhos, Porto, Póvoa de Varzim, Valongo e Vila do Conde.

The strategic objective for LIPOR is to reach the commitments defined in LIPOR Strategic Sustainable Waste Management Plan 2007 – 2016. At the end of 2011 the targets will be reviewed on the basis of the new guidelines contained in the new National Strategic Waste Management Plan currently under review.

The amount of glass packaging collected in 2010 was 19.448,44 tonnes estimating 20 kg per inhabitant per year. The glass recycling rate reaches: 59%

The glass collection system in Porto started in the early 80's and it doubled the last ten years.



The inter-municipality Lipor collects from both the household and commercial sectors (mainly small /medium businesses, service buildings) and currently runs:

- A sorting centre which can process up to 35,000 tonnes of paper, cardboard, plastic, metal in a year.
- A composting plant with a capacity of 60,000 tonnes per year for both kitchen and green waste.
- An incineration plant with a waste processing capacity of 1000 tonnes per day.
- A Landfill for reception of the rejected and waste previously prepared.

The Scheme:

In Porto, the inter-municipality provides a selection of ways for residents to recycle their glass packaging. More specifically:

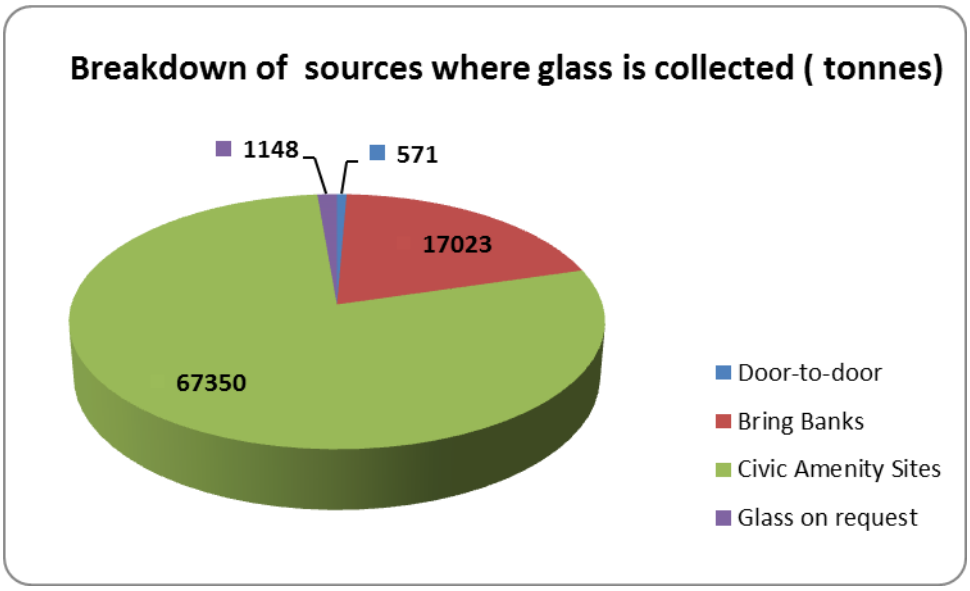
- **Door to door:** Dedicated glass containers or green plastic bags (for glass) are provided to single homes and in some large buildings blocks which have the allocated space to receive the containers. The glass from those containers is collected during well-defined days. In 2010: 570,5 tonnes of glass waste containers were collected (mixed colour).

- **Bring Banks:** 3456 Bring Banks are allocated across Porto Region (named: *Ecopontos*).

  The ratio calculated is: 1 Ecoponto for 281 inhabitants (2010). In 2010: 17,023 tonnes of glass were collected.

- **Civic Amenity Sites:** There are 21 Civic Amenity sites across the region. In 2010: 673,50 tonnes of container glass waste were collected .

- **Glass on Request:** Glass collections on request are common in the Lipor area. In 2010, around 1,148 tonnes of container glass waste were collected on request (from non-household origin).



The frequency of glass collections vary depending on the type of container, building block and neighbourhood. Glass collections normally take place every week or every two weeks. Lipor is responsible for the waste management and delivery of glass to the Sociedade Ponto Verde, S.A (part of the Green Dot System).

The glass is not colour sorted through Lipor's system, therefore it gets collected mixed in the containers.

Private companies can use the infrastructures of selective collection of glass available in public streets (green container), civic amenity sites, door-to-door or collection on request.

RESULTS & KEY DATA

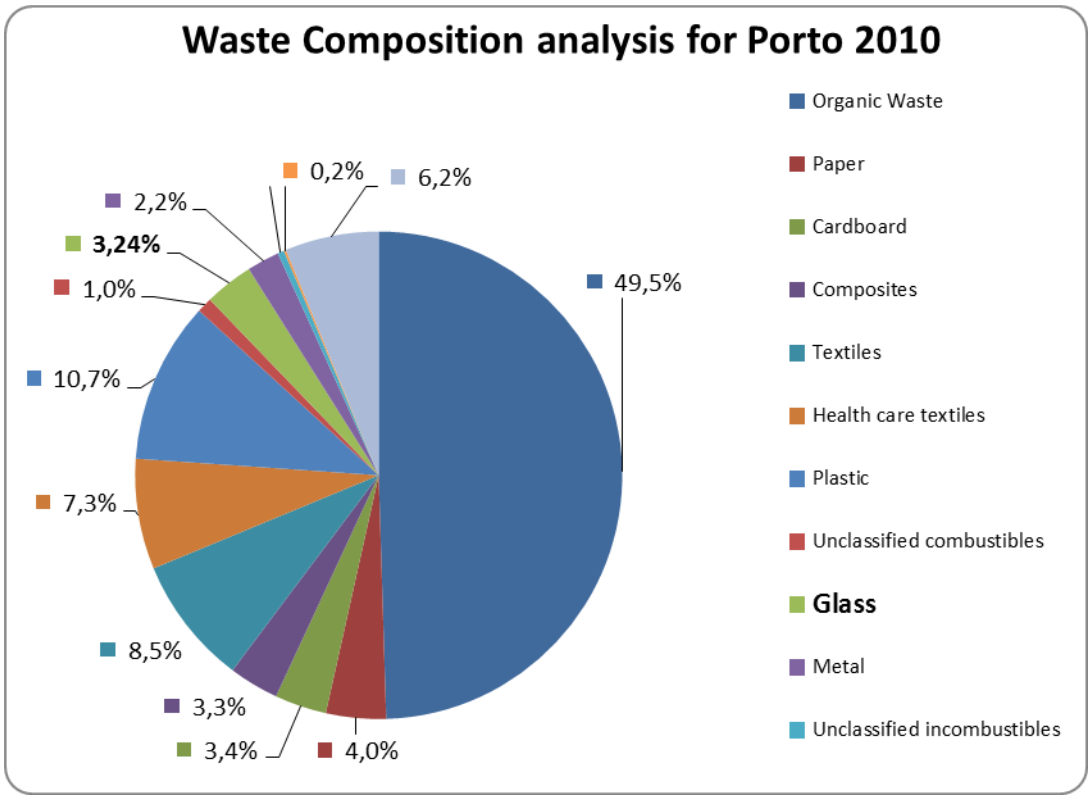
The total amount of municipal solid waste produced in the region reached 519,000 tonnes in 2010, which corresponds to 535 kg of waste generated per inhabitant per year.

The total amount of municipal waste recycled in the region was 106,000 tonnes for 2010 reaching a 20% selective collection rate overall.

The amount of glass selectively collected in 2010 was 19.5 tonnes.

Waste composition analysis indicate a 3.24% of glass found in a typical residual bin (see graph below). This means that there is still an important potential to increase the quantities of glass

selectively collected (13,000 tonnes which is around 13 kg/inh.). Lipor intends to increase its performance, namely by possible PAYT schemes (variable charging for waste collection).



LIPOR collects glass packaging and the glass is send to only one management entity (Green Dot system), which sends the glass to recycling companies.

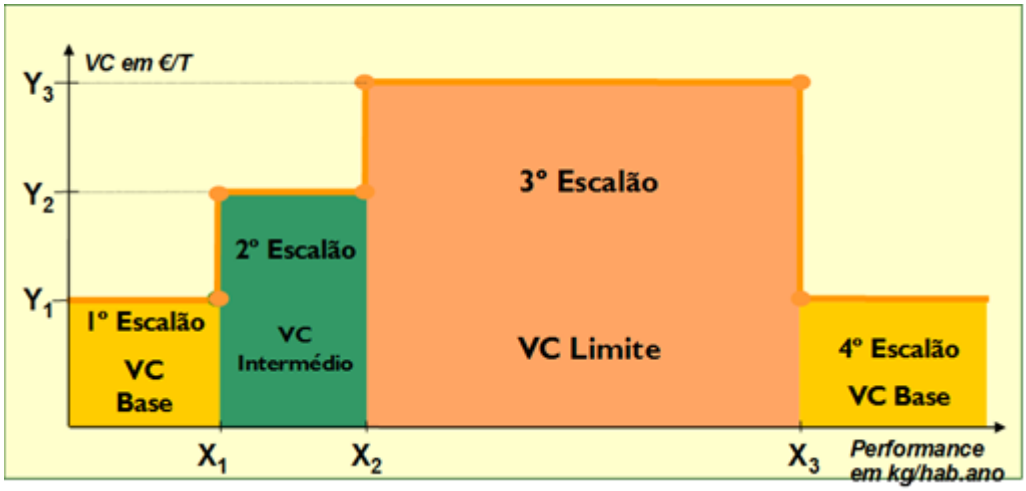
The main quality requirement from the Green Dot scheme is to remove the infusible materials (material that does not melt at the same temperature that glass packaging - rocks, ceramics, glasses - windows, etc). LIPOR makes a visual control to glass loads (in the reception of material) which ensures to keep the number of registers of not conformity to a marginal level.

FUNDING & COST

In Portugal the Green Dot System is coordinated by Sociedade Ponto Verde, S.A., an organisation responsible for the collection and recycling of household, commercial and industrial packaging waste.

All glass received by LIPOR is sent for recycling by Ponto Verde.

The selling values of these materials -Value of Counterpart (VC), is defined by Law, in accordance with a referential kg/inh./year of material sent for recycling (for each platform is establish a VC specific, defined by this way):



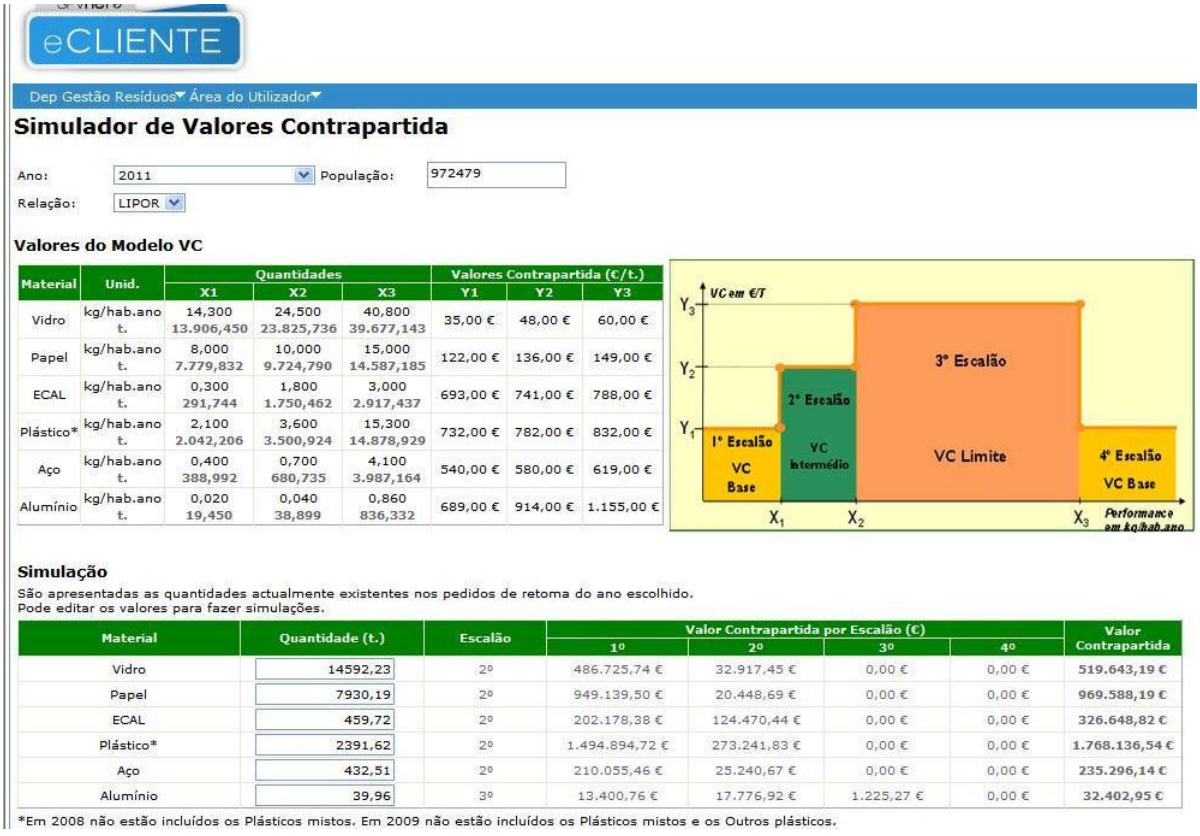
VC currently in vigor for the material Glass is the following ones:

1º Platform Step = 35 €/ ton.

2º Platform Step = 48 €/ ton.

3º Platform Step = 60 €/ ton.

The values for quantities are calculated according to the number of inhabitants, as shown in the picture below.



eCLIENTE

Dep Gestão Resíduos Área do Utilizador

Simulador de Valores Contrapartida

Ano: 2011 População: 972479

Relação: LIPOR

Valores do Modelo VC

Material	Unid.	Quantidades X1	Quantidades X2	Quantidades X3	Valores Contrapartida (€/t.) Y1	Valores Contrapartida (€/t.) Y2	Valores Contrapartida (€/t.) Y3
Vidro	kg/hab.ano t.	14,300 13.906,450	24,500 23.825,736	40,800 39.677,143	35,00 €	48,00 €	60,00 €
Papel	kg/hab.ano t.	8,000 7.779,832	10,000 9.724,790	15,000 14.587,185	122,00 €	136,00 €	149,00 €
ECAL	kg/hab.ano t.	0,300 291,744	1,800 1.750,462	3,000 2.917,437	693,00 €	741,00 €	788,00 €
Plástico*	kg/hab.ano t.	2,100 2.042,206	3,600 3.500,924	15,300 14.878,929	732,00 €	782,00 €	832,00 €
Aço	kg/hab.ano t.	0,400 388,992	0,700 680,735	4,100 3.987,164	540,00 €	580,00 €	619,00 €
Alumínio	kg/hab.ano t.	0,020 19,450	0,040 38,899	0,860 836,332	689,00 €	914,00 €	1.155,00 €

VC em €/T
Y3
Y2
Y1
1º Escalão
VC Base
2º Escalão
VC Intermédio
3º Escalão
VC Limite
4º Escalão
VC Base
X1
X2
X3
Performance em kg/hab.ano

Simulação

São apresentadas as quantidades actualmente existentes nos pedidos de retoma do ano escolhido.
Pode editar os valores para fazer simulações.

Material	Quantidade (t.)	Escalão	Valor Contrapartida por Escalão (€) 1º	2º	3º	4º	Valor Contrapartida
Vidro	14592,23	2º	486.725,74 €	32.917,45 €	0,00 €	0,00 €	519.643,19 €
Papel	7930,19	2º	949.139,50 €	20.448,69 €	0,00 €	0,00 €	969.588,19 €
ECAL	459,72	2º	202.178,38 €	124.470,44 €	0,00 €	0,00 €	326.648,82 €
Plástico*	2391,62	2º	1.494.894,72 €	273.241,83 €	0,00 €	0,00 €	1.768.136,54 €
Aço	432,51	2º	210.055,46 €	25.240,67 €	0,00 €	0,00 €	235.296,14 €
Alumínio	39,96	3º	13.400,76 €	17.776,92 €	1.225,27 €	0,00 €	32.402,95 €

*Em 2008 não estão incluídos os Plásticos mistos. Em 2009 não estão incluídos os Plásticos mistos e os Outros plásticos.

In August 2011, the average sale price for glass waste was 35.94 €/tonne (green dot system).

Overall the glass waste collection is under the responsibility of the municipalities rather than LIPOR. Transportation of glass to the recycling industries is responsibility of recycling industries/ companies.

COMMUNICATION

LIPOR greatly focuses to improve the communication about recycling with citizens, schools, companies, services and commercial establishments, with a strong accent on environmental benefits and reduction of greenhouse gas emissions[25]. Lipor also communicates, every month, on their website (in Reciclómetro) the waste amounts (by stream) that was collected selectively.

FUTURE STRATEGY

LIPOR currently examines the way to improve glass selective collection, as there is still room for improvement and to take into account the effect of the economic crisis on selective collection schemes.

[25] Lipor has elaborated its own carbon balance and monitoring tool for its waste management activities

Lipor is working on this important issue and debating with Municipalities and others partners.

To increase glass recycling; LIPOR is working on strategies that include:

In theory:

- Sharing experiences with similar companies
- To adapt projects and initiatives to the culture reality (National /Regional /Local)
- To establish and strength relations with Partners
- To invest in Innovation
- By Communication, information and education

In practice:

- To involve new targets in the selective collection of materials
- To define an including strategy that considers the services sector
- To consider systems of incentives
- To bet on the Social Economy and Inclusive Business
- To intensify the debate with different public.

At the moment, Lipor is also piloting a PAYT Project in Maia Municipality which if successful could be also trialed in Porto municipality.

7.4. Netherlands

The Netherlands do not participate in the Green Dot® program, but have a different packaging recovery organization called Nedvang[26], founded in 2005 in order to comply with the Packaging Waste Directive and meet their targets. Nedvang covers 443 municipalities across the countries and is responsible for the recovery of both commercial and household packaging waste.

Nedvang, a non for profit organisation was set up by producers and importers as a way of collectively implementing the Dutch Packaging Decree[27]. Nedvang, acts as mediator between producers, importers and distributors and waste disposal and waste processing/recycling companies, municipalities and the national government.

The most important target in the Decree is to recycle 70% of the approximately 3 million tonnes of used packaging generated every year. With regards to glass packaging, the Dutch Ministry has set up a target of 90% recycling rate.

Technical aspects:

All municipalities, by law have to operate a separate selective collection of packaging waste. The Netherlands commenced recycling packaging glass waste in the late '80s in line with the EU Packaging Directive and embedded it within their national environmental policy. It is a statutory requirement that each district council is responsible for the collection of glass for recycling. At the beginning there were only bottle banks located across the country, available for use in central key points of the cities and later on in the 90's the municipalities introduced bottle banks next to apartment blocks so that the residents can access more easily.

In the Netherlands, all glass packaging waste is collected in two different types of bottle banks:

[26] www.nedvang.nl

[27] Packaging and Packaging Waste Decree in the Netherlands : http://wetten.overheid.nl/zoeken/

clear and colour, which are available both overground and underground, estimated at about 1 container per 1000 inhabitants.

In 2009, 495,000 tonnes of glass container waste were selectively collected, 91% of the glass packaging waste was recycled . Every Dutch person uses approximately 30 kg of glass per year. Municipalities collect on average 23 kg per inhabitant per year however the collection rates vary from 16 kg / inh /yr up to 34 kg /inh /yr.

Maltha Glass Recycling is responsible for the recycling of glass containers in the Netherlands and through its marketing strategy communicates with consumers the importance to dispose good quality glass waste (see communications section). During the last 5 years, increased contamination of plastic bags, ceramics, stone and porcelain has been reported in the glass bottle banks. From the glass waste that comes in, each containing 1,000 kg of glass waste, on average 35 grams of contamination is recorded.

Maltha Glass Recycling uses advanced laser technology to remove pieces of ceramic, stone and porcelain from the flow of glass waste. However, due to the strong blow of glass waste that occurs during the removal process of any non-glass items some loss of good quality glass occurs.

Thus, it is strongly advised (as we will also see below under the communication section) that ceramic, stone (heat-resistant glass), light bulbs and other types of glass are strictly not disposed in the bottle banks as they have a higher melting point than glass containers.

Financial aspects:

From 2008, companies that bring more than 15 tonnes of packaging onto the Dutch market have to pay a tax.

By means of a packaging tax, producers, importers and distributors of packages products pay for the collection, sorting/processing and recycling of packaging waste. An annual total amount of € 115 million is reserved in a waste fund. From this fund, municipalities are paid for the collection. The money received has to be invested in local waste policies.

The tax tariffs have been calculated based on the environmental impact of the material. The tariffs are (in € / kg):

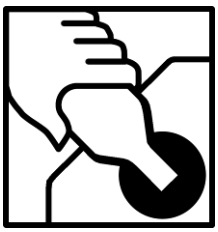
Material	**Primary packaging** (€/kg) (Consumer packaging)	**Secondary/Tertiary packaging** (€/kg) (Secondary: packaging that holds products together Tertiary: Packaging used to transport packaging)
Glass	0,0456	0,0160
Aluminum	0,5731	0,2011
Plastics	0,3554	0,1247
Paper/ Cardboard	0,0641	0,0225

Source : ProEurope (www.pro-e.org)

Additionally, Nedvang assesses the packaging waste chain, calculates the recycling percentages and advises the waste fund about the allocation of the total budget.

Container deposit scheme:

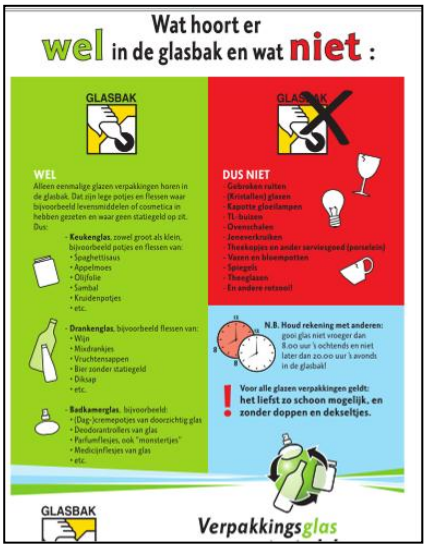
The Netherlands operate a container deposit legislation whereby empty glass bottles of some locally filled products, such as Heineken, have a 10 cent deposit on each of them; the consumer gets 10 cents (0.10 euro) by returning each empty bottle to the supermarket collection point. This glass will then be cleaned, terilized and used again. The return rate is reportedly well over 90%.



COMMUNICATION:

On disposable glass packaging, the bottle bank logo appears on the bottle container. It means that the package belongs in the bottle bank and can be recycled. The following images below appear as part of the communication material[28] published by Nedvang about glass recycling in the Netherlands.

[28] Source: http://www.duurzaamglas.nl/consument/infomateriaal-



In summary the following key instructions are provided to residents to ensure high quality glass recycling:

Separation Guide Glass

Place in the bottle bank:

- bottles of wine, juices, beer without deposit
- jars of peanut butter, jelly, spaghetti sauce, herbs
- perfume and medicine bottles

Non acceptable in the bottle bank:

- ovenware, coffee pots and other heat-resistant glass
- drinking glasses
- tea cups, flower pots and other porcelain
- pottery and other stone products
- mirrors, windows, fluorescent and fluorescent lamps

Case Study 4

Municipality of Maastricht – Netherlands

HIGHLIGHTS

- ✓ high glass selective collection: 33 kg / inh/year (average in NL: 23 kg/inh/yr)
- ✓ High glass recycling rate: 89%
- ✓ underground glass containers (bottle banks)
- ✓ high frequency of emptying glass containers: 2-3 times per week

INTRODUCTION

Maastricht is situated on both sides of the Meuse river (Dutch: *Maas*) in the south-eastern part of the Netherlands, on the Belgian border and near the German border. It is located in the Southern part of the Dutch province of Limburg. The population in Maastricht is 118,523 inhabitants and the area covered is 60.06 km^2

The City is a popular tourist destination and the type of housing varies: 60% detached single homes, 40% flats.

The strategic objective for Maastricht is to reach a 50% recycling rate of household waste, similar to its national and European target.

The amount of glass packaging collected in 2010 was 3,911 tonnes estimating 33 kg per inhabitant per year. The glass recycling rate reaches: 89%

The Scheme:

The glass collection system in Maastricht started in the late 1980's. However the data available by the Municipality of Maastricht starts from the year 2000.

Bottle Banks

7 ecycling parks are available in the region and each park contains 2 types of bottle banks (size: 4m^3), one is for coloured (green/ amber) and the second one is for clear glass. These glass containers are underground containers. Maastricht operates underground street facilities for the collection of empty glass bottles (including other packaging material such as: paper, plastics, metal).

Underground waste facility:

Bottle banks can also be found next to supermarkets for better access to residents.

The bottles banks are emptied 2 or 3 times a week by the municipality container trucks and the glass waste gets transferred to a recycling depot. From there it gets delivered to Maltha's Glass recycling plant.

Civic Amenity Centre

There are 3 Civic Amenity centres in Maastricht that provide glass containers to residents for recycling. The collection frequency depends on the site and its usage.

Other collection sources

With regards to the separate collection of other types of waste, most households have two waste bins that are emptied on alternate weeks: a green one for biodegradable waste, and a grey one for other household waste. Paper is collected fortnightly, and a van collects small hazardous waste such as light bulbs, batteries, and harmful cleaning products.

Return/ Deposit Scheme

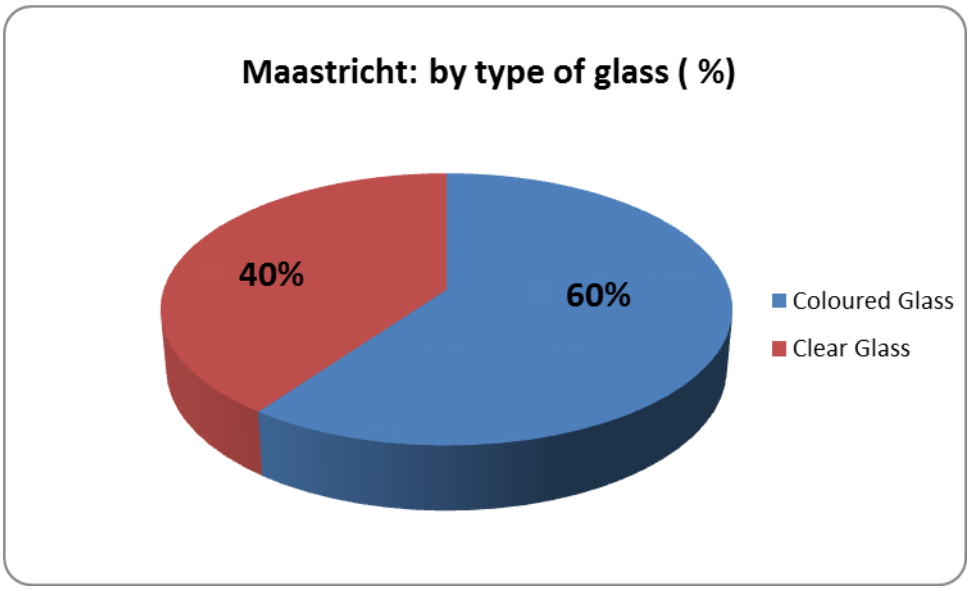
A glass recycling deposit scheme is available across the Netherlands therefore the financial incentive for the consumer drives glass recycling in Maastricht relatively high. Deposit systems are in use for beer bottles, drink containers nationwide including in Maastricht. The price of bottled beers and soft drinks includes a small deposit that is refundable on returning the empty containers.

RESULTS & KEY DATA

Maastricht reaches an overall selective collection rate of 65% and an impressive 90% glass selective collection rate (2010).

The total amount of municipal waste generated in the area reached 60,549 tonnes in 2010. Out of the total waste generation, 3,911 tonnes of glass were selectively collected and recycled. This equates to 33 kg of glass per inhabitant per year, approximately 10 kg/inh/yr higher than the average national glass figure which remains at 23 kg/inh/yr. The achieved high rate could be due to a number of factors, like for example due to the effectiveness of communication of glass recycling campaigns.

The Municipality collects the glass in colour separated containers. The pie chart below demonstrates the percentage of glass selectively collected by colour in the inter-municipality: 60% coloured (1,911 tonnes) and 40% clear glass (2,000 tonnes).



With regards to the waste glass quality specifications as outlined on a national level and communicated by Maltha Glass Recycling, only container glass is accepted and any other form of glass waste is strictly prohibited by the glass manufacturers. Thus, no window glass, mirrors, ceramic, porcelain and stone glass are accepted as it lowers the value of glass entering the manufacturing stream. Specifically ceramic and porcelain type of glass are heat resistant and have a higher melting point than glass containers.

The maximum contamination level for glass is 5% and according to the municipality of Maastricht is never exceeded.

FUNDING AND COST

In the Netherlands the packaging recovery organization, Nedvang, is responsible for the coordination of the recycling of packaging waste and has a contract with Maastricht. This contract frames the rules of separation and acceptance, the monitoring system and prices per waste stream, in our case, glass waste.

The cost of glass collection is 56 euros per tonne and the collection cost per inhabitant is 1.8 euros. By this, the municipality takes into account: collection, transportation, administrative costs, administrative overhead, charges on fixed assets (for example the costs of the containers, trucks). These costs determine the collection costs.

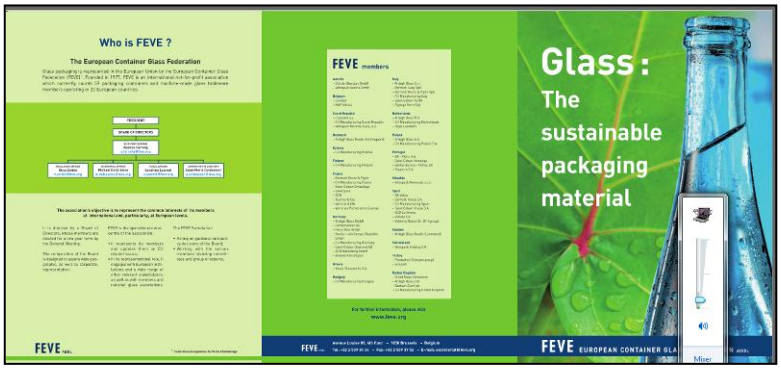
Glass beer bottles carry a 10 cent (0.10 Euro) deposit with a further 1.50 Euro deposit for the plastic crate. The return rate for deposit glass bottles is around 90% (2,160 million in 2009).

COMMUNICATIONS

The municipality of Maastricht utilises various national communication material for glass recycling and it also has developed several local communication campaigns to encourage residents to recycle more glass and improve the quality and efficiency of the collection scheme.

The illustration below is one example, which forms part of a Recycling Guide available for residents:

They also use the following glass recycling guide published by FEVE, translated in Dutch:



7.5. Germany

The German Packaging Ordinance which came into force on June 12, 1991 was the Environment Ministry's reaction to a steady drop in landfill capacity combined with a high volume of household waste. Its objective: To prevent, reduce, reuse and/or recycle packaging waste and, consequently, to return it to the production loop. Since then, a couple of amendments to the German packaging ordinance came into effect so that the system was further improved.

On 1 January 2009, the 5th Amendment to the German Packaging Ordinance came into force. Today manufacturers and distributors of secondary and sales packaging are obliged to take back and recycle packaging waste outside the boundaries of the public waste disposal system. The Packaging Ordinance rules out incineration with energy recovery as an option. The Packaging Ordinance specifies collection and sorting targets, which are used as the basis for calculating the recycling targets.

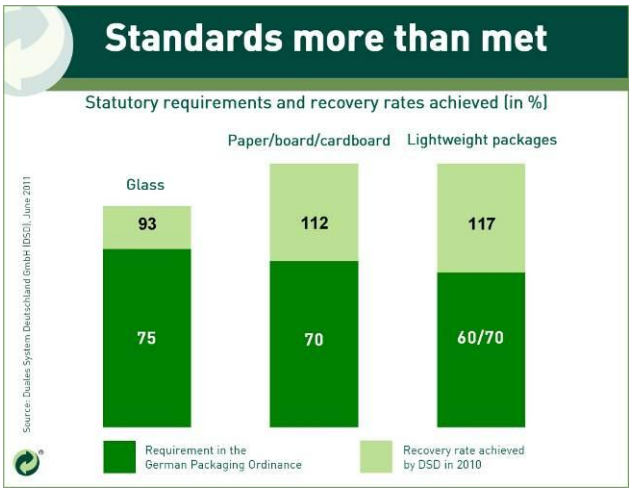
For all obligated companies, there is compulsory membership of a dual system (compliance scheme), which ensures that used sales packaging is regularly collected from private households and other locations throughout Germany such as small local businesses (restaurants, bars, hotels, offices etc.) . Companies are free to choose which dual system they join and there is no requirement to display the Green Dot or any other dual system membership symbol, on sales packaging.

Technical aspects

The “Der Grüne Punkt - Duales System Deutschland GmbH (DSD)” was founded in September 1990 as a private enterprise. As the umbrella organisation for the recycling of sales packaging in accordance with the provisions of the Packaging Ordinance, the company neither owns nor operates any sorting or recycling plants. Rather DSD organises the collection, sorting and recycling of packaging waste in Germany with the support of 724 waste management partners.
Also, DSD offers comprehensive waste management solutions for transport packaging and industrial waste. The recovery through DSD reached 104% in 2010[29]. Advanced technology in sorting and recovery operations enables progressively higher yields to be achieved in the recycling process – this ensures high recovery rates.

[29] http://www.gruener-punkt.de/en/corporate/sustainability/environmental-balance.html

The German Packaging Ordinance's requirements for the recovery of used packages was 75% for glass and through the DSD, the glass recovery rate reached 93%.



Glass selective collection in Germany reaches 81% one of the highest in Europe.

The collection of glass takes place very carefully to ensure the '3 tier' colour-sorted waste glass is not mixed together again in the truck. Practically, there are three separate chambers inside the truck. This means that the clear, brown and green glass are kept separate from each other.

Financial aspects

The DSD finances its activities by a fee which has to be paid for the participation in the dual system for packaging recycling.

In compliance with the user-pays principle, the license fees for the Green Dot are calculated on the basis of the material used, the weight and the number of items sold. They also take account of the different costs incurred for collecting and sorting the packaging materials. The companies pay only

for those items of packaging they put on to the German market. The fees for the trademark are shown in the following:

Material	€/tonne
Glass	1.00
Paper/cardboard	3.00
Plastic	17.00
Composites	13.00
Tinplate	5.00
Aluminium	13.00

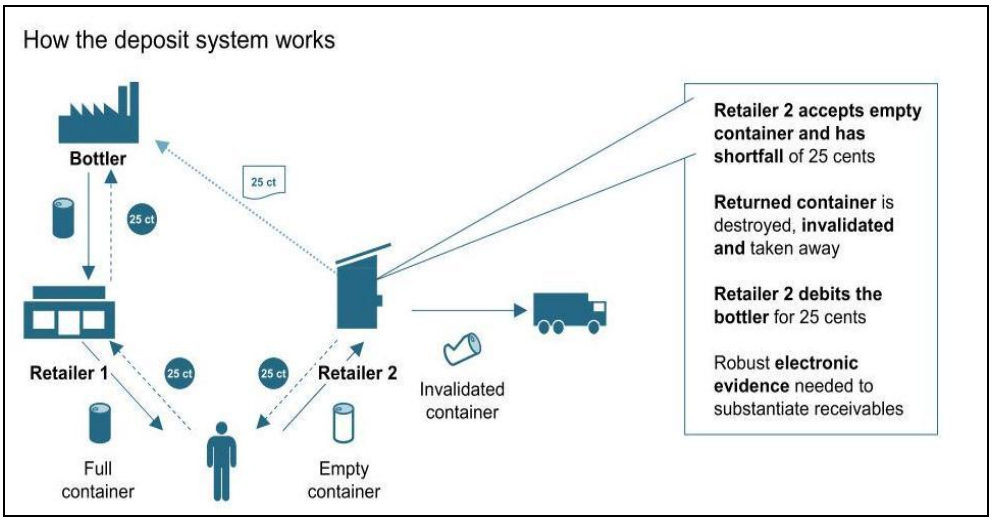
Deposit Scheme

In Germany the container deposit legislation, known as *Pfand* or *Einwegpfand* (single-use deposit), was agreed in 2002, and was adopted on 1 January 2003.

It is important to note that there is a compulsory deposit scheme in operation in Germany for drinks containers such as one-way glass bottles (including one-way PET bottles and beverage cans) from 0.1 litres to 3 litres. The deposit is at 25 cents regardless of the type of drink or size of the container[30]. This includes all beer, mineral water and carbonated and non-carbonated soft drinks and alcoholic mixed drinks (i.e. alcopops).

The deposit applies to packaging materials such as: glass, metal and plastics. The deposit is levied initially by the bottler and then passed down through every link in the retail chain. Consumers pay the deposit when the buy the product. Retailers must take back empty packaging in return for the deposit free of charge in the vicinity of the place of sale. This is a national scheme that also applies in the Municipality of Lippe.

[30] The consequences of a deposit system for disposable packaging based on the German example, AGVU – Roland Berger, June 2007



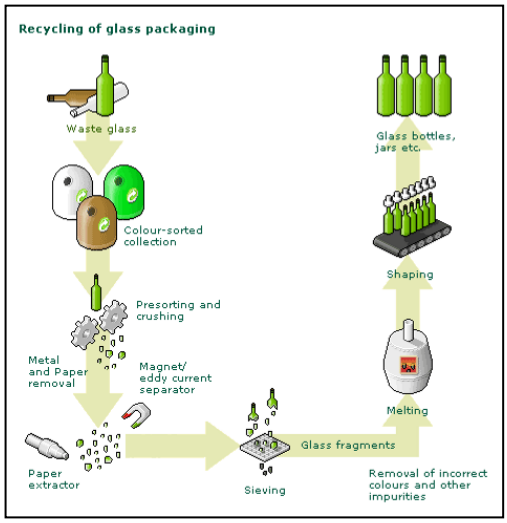
Source: 'The consequences of a deposit system …', AGVU –Roland Berger, June 2007

The contribution of recycling deposit scheme to recycled tonnage of packaging in Germany reaches 3%, no separate data for recycled tonnage of glass have been obtained.

Packaging for juices, milk and wine glass bottles as well as drink cartons, polyethylene tubular bags and stand-up bags remain exempt from deposit but are still subject to the recycling obligations under the Packaging Ordinance.

Communications

The following images are available at the German Green Dot (Der Grüne Punkt) website[31] referring to closed loop glass recycling and material that are strictly prohibited from entering the bottle banks in Germany:



[31] http://www.gruener-punkt.de/en/

Case Study 5

Kreis Lippe – Germany

HIGHLIGHTS

- ✓ '3 tier' system for glass recycling: Clear/ Green / Amber coloured bottle banks
- ✓ Collection of municipal glass waste by private waste companies
- ✓ Deposit scheme in operation (single use deposit)

INTRODUCTION

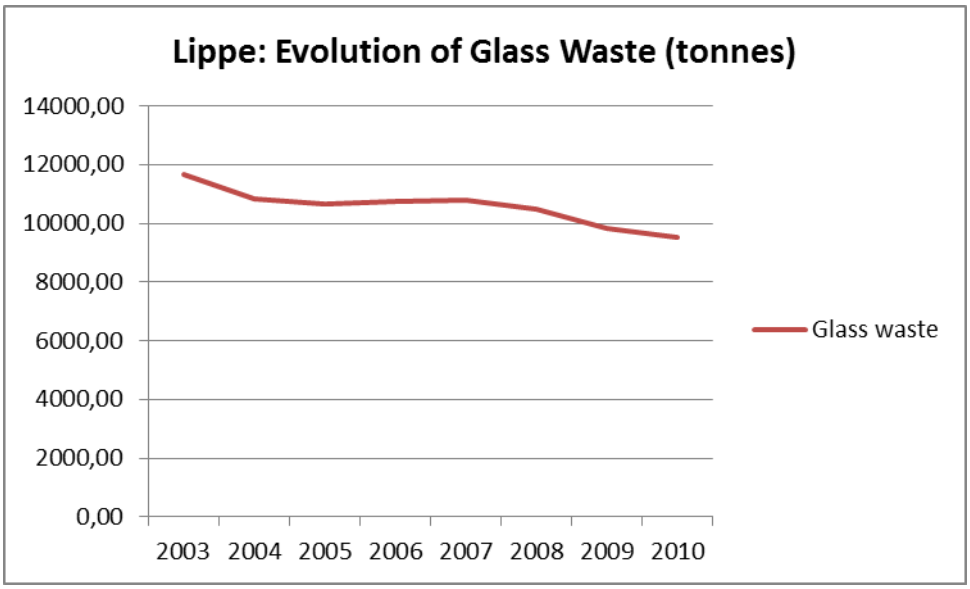
Lippe is a Kreis (district) in the east of North Rhine - Westphalia, Germany with a population of 352,234 inhabitants (2010). It covers an area of 1246, 38 km^2 and consists of 16 communities.

The strategic objective for Lippe is to reach a 65% recycling rate of household waste, similar to its national target. A recycling rate of 65 % for household waste is the goal of the Recycling Act "Kreislaufwirtschaftsgesetz" that has not been adopted yet.

The amount of glass packaging collected in 2010 was 9524 tonnes estimating 27 kg per inhabitant per year. The glass recycling rate reaches: 84%

The scheme:

Lippe started collecting glass for recycling in the early 1980's. However the data received from Lippe starts in 2000 and it is apparent from the graph below that there is a decrease of glass waste collected (since 2000).



Lippe operates a 'a dual recycling system' similar to the rest of Germany. One system is for residual waste collected by Lippe's Waste Management Association and the second system is for recycling waste collected by Tönsmeier, private waste management company. Tonsmeier has a contract with the Municipality of Lippe for the disposal of waste.

Lippe provides the following waste / recycling household scheme:

- Grey bin – for residual waste (disposal nappies, sweepings, foam plastic, ashes, mirrors, treated wood)
- Green bin – for all compostable waste
- Yellow bag – for all packaging except paper and glass: plastic, metal cans, lids and aluminium foil, tetrapacks.
- Blue box – for paper and cardboard
- Bottle banks – for empty glass bottles and jars
- Hazardous waste: there are special collecting dates where the residents can bring their waste
- Civic Amenity centre

Bottle Banks

There are 796 bottle banks across the municipality and the objective is to have 1 bottle bank for 500 inhabitants. The glass is collected in all parts of the municipality however the distribution of the glass containers can vary as normally there are more containers located in urban areas. The '3 tier'colour-sorted waste glass is effectively applied in Lippe.

There are bottles banks for each colour and also multi-chamber container, as seen from the pictures below.

Civic Amenity Centre

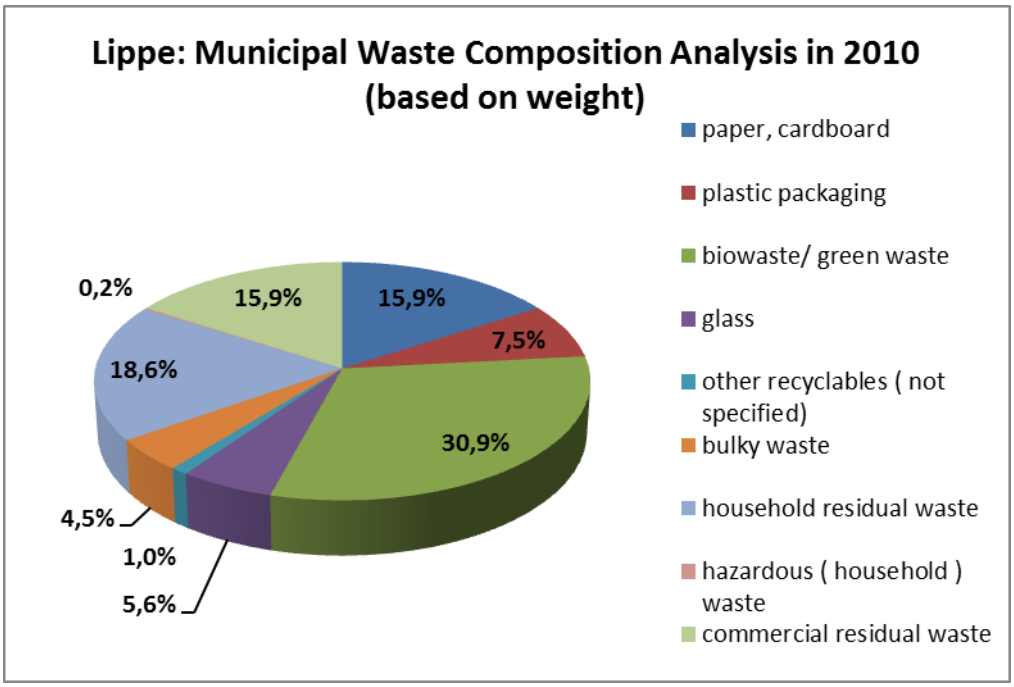
Glass bottles are also collected via the Civic Amenity Centres available to all residents in each community (16 communities in total).

The glass bottles, once collected by Tönsmeier waste management company, get delivered to different glass remanufacturers.

RESULTS & KEY DATA

Lippe generated 170,029 tonnes of municipal waste out of which 142, 693 tonnes of household waste. It currently exceeds its target by reaching an overall selective collection rate of 75%.

The graph below demonstrates the percentage of the breakdown of all municipal waste types generated in Lippe through different sources:

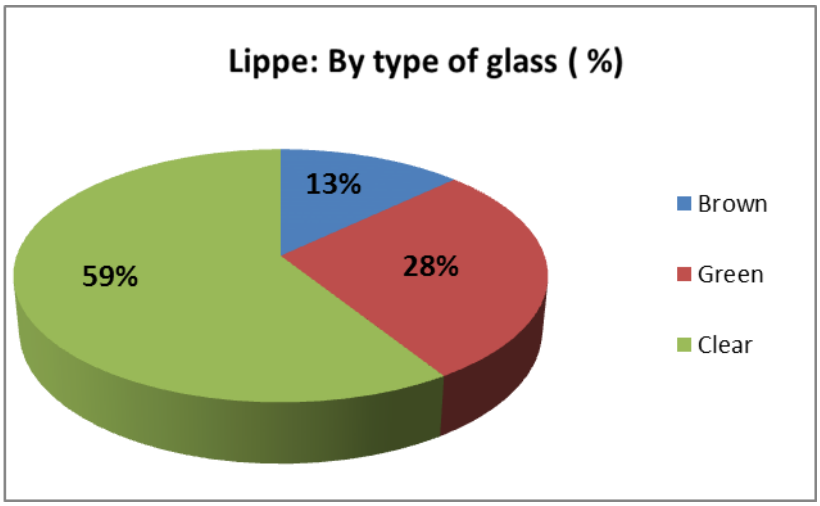


The Municipality of Lippe selectively collects 9,524 tonnes of glass waste overall.

In more detail, the different amounts of separate colour glass can be found below:

- White glass: 5,617.08 tonnes
- Green glass: 2,678.76 tonnes
- Brown glass: 1,228.30 tonnes

The pie chart below demonstrates the percentage of glass selectively collected by colour in the municipality:



As seen in the other cases, the municipality of Lippe has also similar strict rules as to what type of glass waste can be accepted in the bottle banks. The following types are not accepted in the bottle banks: window glass, mirrors, stone ware, light bulbs and fluorescent tubes.

To avoid mixing of different colours of glass waste, blue and black glass waste has to be collected together with green glass.

The current contamination rate as reported by the municipality reaches 3% of non-glass waste found in the glass containers when discharged at the glass remanufacturer.

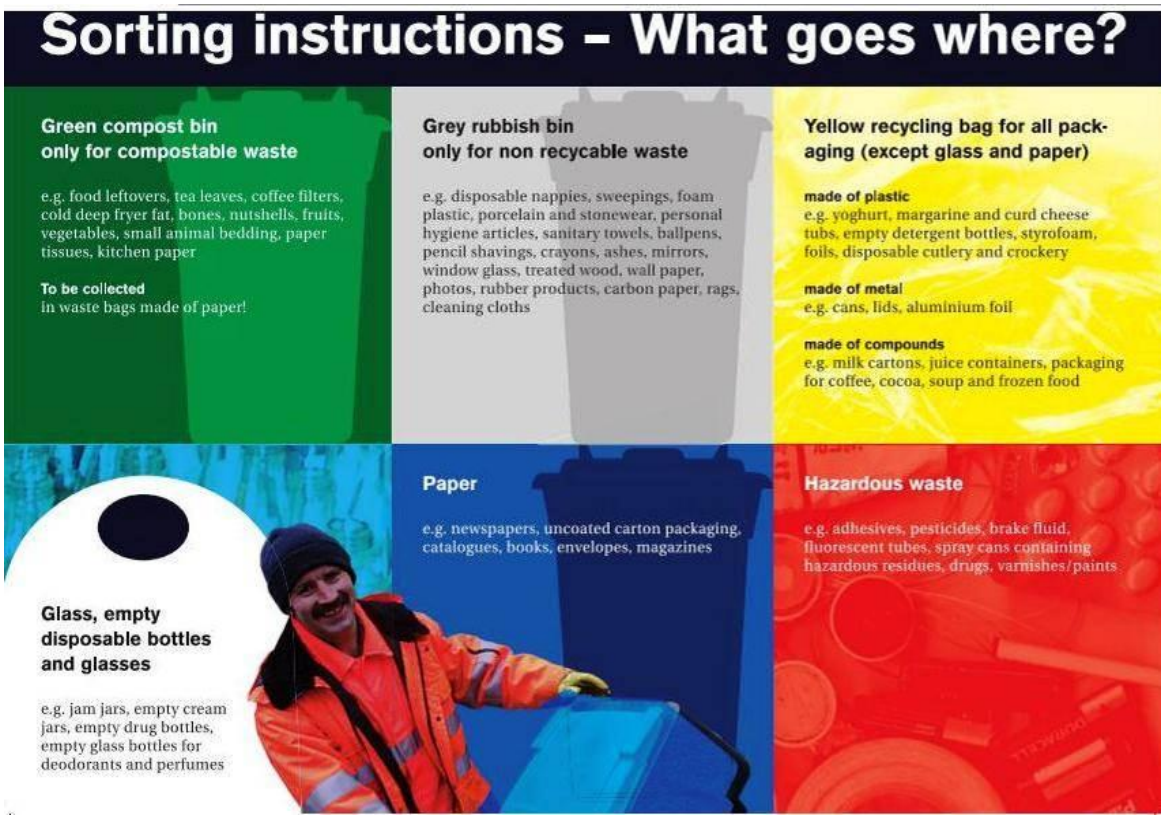
FUNDING & COST

There is a fee imposed on all packages price before they are placed on sale. The fee included in the purchase price of the packages depends on the size and the weight of the glass packaging. The amount of the fee for all packaging in 2010 was 11.04 Euros per inhabitant in Germany.

The pure treatment costs in the sorting including the administrating costs are about 20 - 25 Euros per tonne. The costs of collection are not included.No information was provided by the municipality on the cost of collection and transportation of glass for recycling. The price of glass waste sold to the market was not provided due to confidentiality.

COMMUNICATION

The communication illustration, originally published in German language but also translated in other languages, is available across the municipality to all residents.



7.6. Switzerland

Switzerland is not a member of the EU and is therefore not bound by the EU Packaging and Packaging Waste Directive.

Swiss Law – unlike in the EU – does not aim to encompass all packaging: no general ordinance on packaging exists and none is planned for the future. Nevertheless, prescriptions concerning specific types of packaging, or their characteristics, do exist in the Beverage Containers Ordinance (2000). That only concerns beverage containers, excluding milk products. It regulates the sale and recovery of beverages packaging, with the aim of reducing the amount of beverage containers in the municipal waste stream, by reducing the number of one-way containers.

With regards to glass packaging waste the national legislation refers particularly to:

• A 75% minimum recycling target for glass (similar target for PET and aluminium)

•The organisation of a marking, deposit or taxation system, depending on the material concerned

Rules are complemented by the application of the "polluter pays" principle, which requires that those responsible for commercial and industrial waste should bear the costs linked to their disposal.

It lays out in particular that:

- Glass bottles are subject to a prepaid disposal fee (PDF) defined in a separate ordinance
- Reusable packaging is subject to a deposit fee and an obligatory marking
- The amounts of beverages and packaging are subject to mandatory declaration

Compliance organisations and financing

The entire collection, treatment and recovery of paper, cardboard, glass, PET beverage bottles, tin and aluminium cans, is carried out by municipal services and private organisations. Other packaging waste (plastic films, drink cartons, and composite materials) are disposed of with unsorted municipal waste, and incinerated.

As far as financing is concerned:

- For mixed solid waste, the burden is directly put on consumers with taxes levied on rubbish bags.

- For recyclable elements, a prepaid disposal fee (PDF) is mandatory. For packaging waste, the only legal PDF currently in force is on glass bottles.

Technical aspects:

Switzerland has one of the highest glass recycling rates in Europe at approximately 95%. In 2010, Switzerland collected 345,443 tonnes of waste glass, an increase of 4.2% over the previous year. The amount collected per capita on a national level was 0,0439 tonnes (43.9 kg.).

Glass is a popular waste packaging in Switzerland, and this is shown by the increase in the consumption of glass packaging. 2010 consumption increased by 4.7% nationally to 367,000 tonnes of glass against 350,000 tonnes in 2009.

30% of the collection of glass waste in Switzerland is organized by Vetrorecycling (110,371 tonnes collected glass in 2010). The glass is treated and recovered in the glass industry as a feedstock for the manufacture of new glass containers. Vetrorecycling Ltd. is a division of Vetropack, one of the leading companies in the packaging industry with production sites in Switzerland of glass (Saint-Prex) and in Austria, Czech Republic, Slovakia, Croatia and Ukraine.

Financial aspect:

The Ordinance on Beverage Containers[32] regulates[33]:

a) the supply and take-back of beverage containers used within Switzerland

b) the financing of the disposal of beverage containers made from glass

With regards to labeling, manufacturers, distributors and importers who supply beverages to consumers must:

a. mark refillable containers as such; this does not apply to restaurant businesses;

b. indicate the amount of the deposit charged on deposit-bearing beverage containers;

[32] http://www.admin.ch/ch/e/rs/8/814.621.en.pdf

[33] It applies to containers of all beverages except for containers for milk and milk products

EPR system(Prepaid Disposal Fee) for Glass Beverage Containers - Obligation to pay a fee

Manufacturers who supply empty glass beverage containers for use within Switzerland and importers who import such containers must pay in respect of these a disposal fee to an organisation such as Vetrorecycling appointed by the Federal Office for the Environment (the FOEN). The obligation to pay a fee also applies to importers who import filled glass beverage containers.

Use of the fee

The Fee Organisation must use the fee for the following activities:

a. the collection and transport of used glass;

b. the cleaning and sorting of intact glass container

c. the cleaning and preparation of cullet for the manufacture of containers and other products;

d. information, particularly to promote the reuse and the recycling of glass beverage containers; no more than 10% of the annual income from the fee may be used for information activities;

e. refunding the fee therefore producers have to pay (Art. 14);

f. its own activities in accordance with the mandate of the FOEN.

- An advance disposal fee (TEA) is included in the selling price of each bottle (0.02 to 0.06 Euro per bottle depending on size)/ 25 ml: 0.02 CHF (0.016 Euro)
- 50ml: 0.04 CHF (0.03 Euro)
- 75ml: 0.06 CHF (0.05 Euro)

Case Study 6

Canton of Geneva

HIGHLIGHTS

- ✓ 47 kg/inh/yr were selectively collected in Canton of Geneva
- ✓ Glass waste managed by the private waste management companies, less authority to the communes on the management apart from communication and supervising bottle banks
- ✓ Prepaid Disposal Fee

INTRODUCTION

The Republic and Canton of Geneva is the French speaking westernmost canton or state of Switzerland. The canton of Geneva is located in the southwestern corner of Switzerland; and is considered one of the most cosmopolitan areas of the country.

The area of the canton of Geneva is 282 km^2 (108.9 m^2) and its population reaches 464,412 inhabitants. The Canton of Geneva consists of 45 communes.

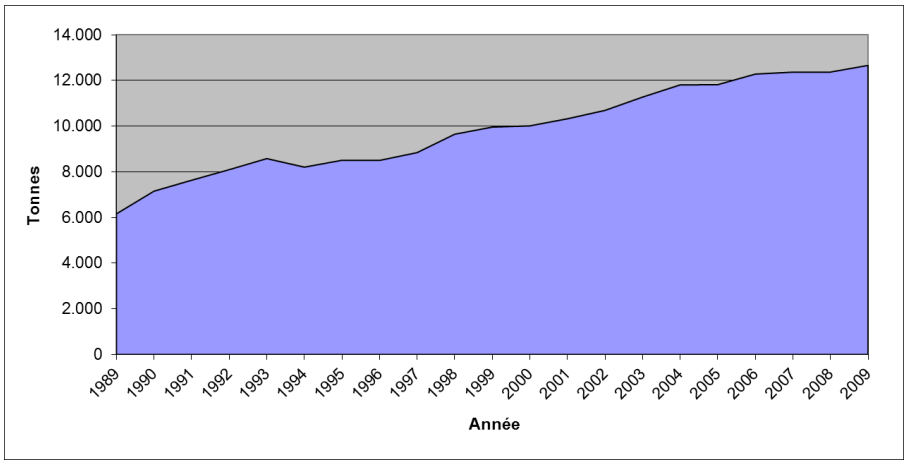
The strategic objective for Canton of Geneva is to reach a (global) 50% selective collection rate of household waste, similar to its national targets and also reach 70% for the commercial sector.

In 2010, Canton of Geneva reached overall a recycling rate of 44.6% of municipal waste an increase of 43.1 % in 2009).

The total amount of glass packaging collected in 2009 was 20,935 tonnes including both the commercial and household sectors, estimating 47 kg per inhabitant per year. The glass recycling rate reaches : 81%

<u>The scheme</u>

The separate glass collection in Canton of Geneva commenced in 1986 and the graph below demonstrates the collection of glass from household sources (12,662 tonnes in 2010).



Bottle Banks:

The Canton does not offer a door-to-door collection for glass but instead provides 567 bottle banks located in the 45 communes, with a ratio of 820 inhabitants per bottle bank.

The glass waste is collected into 2 different types of bottle banks:

a) White glass
b) Coloured glass (Green / Brown)

Ecole de Belle-Cour - 155 Rte du Grand-Lancy

There are several recycling bring banks, which contain glass bottle banks, located in Geneva's neighborhoods and communes, where residents can recycle: glass bottles divided into white and brown/green, PET bottles, home-use batteries, aluminum and plastic coffee pods. Paper and cardboard, is collected on a door-to-door or street collection service.

All glass is collected by private waste management companies on behalf of the communes and is shipped by train to Vetrorecycling for treatment (60 km away from Canton of Geneva).

Civic Amenity Centre

There are 3 Civic Amenity sites spread in the Canton that also offer a glass collection service. Depending on the commune the frequency of collection varies from 1 to 3 times a week.

Civic Amenity Centre: Commune of Russin

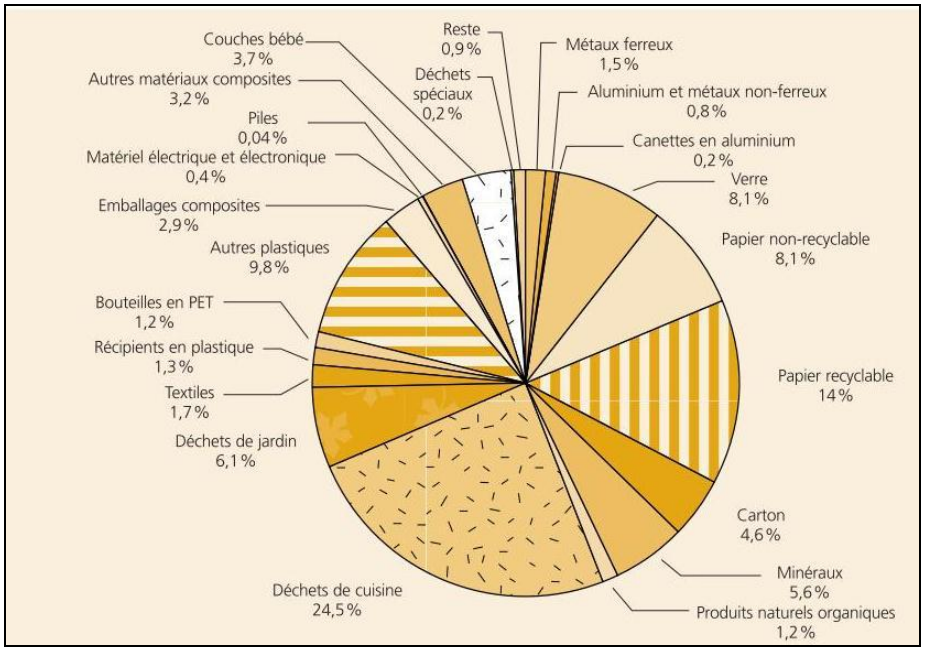
The collection, awareness raising and transportation of glass takes place by the private waste contractors, managed by the communes and appointed by and in partnership with Canton of Geneva.

RESULTS & KEY DATA

The Canton of Geneva generated 2,7 million tonnes of municipal waste[34] (including construction and demolition and hazardous wastes) and 291,452 tonnes of household waste reaching an annual (global) recycling rate of 43% in 2009.

Following a waste composition analysis that was carried out in 2002, 8.1% of glass was measured to be found in an average residual bin. The Canton of Geneva is now in the process of conducting a more up to date Waste Composition analysis which is estimating that glass in the waste bin has now dropped down to 4-6%. The graph below illustrates the glass generation:

Caption: Municipal Waste composition analysis of Canton of Geneva (2002)



[34] http://etat.geneve.ch/dt/SilverpeasWebFileServer/

The total amount of glass packaging collected in 2009 was 20,935 tonnes from both the commercial and household premises estimating an average of 47 kg per inhabitant per year. The household glass waste reached 12,662 tonnes in 2009.

A strong increase in the amount of glass recycled was observed in 2006 and 2007 (Appendix 3). 6,000 tonnes of bottles were recovered in 2007 through the introduction of vending machines[35] for glass. The glass bottles were placed back on sale after being sorted, recycled and made into new glass bottles.

The Canton of Geneva receives no separate data per type of glass (clear or coloured). It is down to the waste collection companies to provide those figures as they are in direct arrangements with the communes in the Canton.

FUNDING & COST

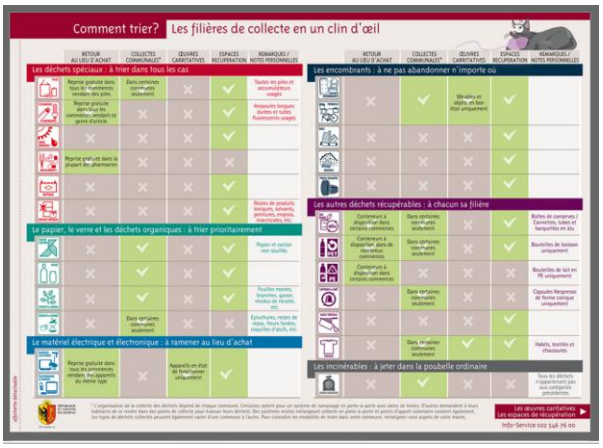
Information regarding funding for the glass waste selectively collected was only given on a national level.

Canton of Geneva provided the following information about the cost of collection:

The cost is approximately € 120-130 per tonne. This amount represents mainly the cost billed by the waste management company, the cleaning of the collection point and the global supervision.

COMMUNICATION

The following recycling guide has been developed by Canton of Geneva and is available for residents to use[36]



[35] Vending machine: A machine that accepts glass containers

[36] http://etat.geneve.ch/dt/dechets/actualite-nouveau_guide_dechets_menagers-12218.html

7.7. FRANCE

The Extended Producer Responsibility in France is coordinated by ECO-EMBALLAGES S.A. which is a non for profit organisation based in Paris, founded in 1992**.** Eco-emballages is a private company accredited by the French public authorities to introduce, organise and optimise sorting and selective collection of household packaging. In 2007, 47,000 companies (with 22,197 licensees' contracts) were recorded to be members of Eco-Emballages S.A.

Eco-Emballages provides financial and technical support to the local authorities who undertake the selective collection and valorisation of household packaging waste. Eco-Emballages also provides a guaranteed recovery for all the secondary materials adapted to the contractual quality standards.

Technical aspect:

In 2010, France recycled 64.3% of packaging waste. Both door-to-door and bottle bank systems are in place for the collection of household glass. In 2010, an average of 80% of glass waste was selectively collected according to the Eco-Emballages Annual Report (2010)[37].

Approximately 91% of glass waste is collected via private waste management companies whereas only 9% is collected directly by the public authorities. There are 134,000 bottle banks located across France and it is estimated that there is 1 bottle bank per 435 inhabitants ranging from:

- 1 bottle bank per 230 inhabitants in rural areas
- 1 bottle bank per 810 inhabitants in urban areas

The different types of collection schemes in operation in France are as follows:

- Separate collection of glass through bottle banks
- Separate door-to-door collection of glass only in specific containers. Containers are provided to individual households while in other schemes a designated collection

[37] http://www.ecoemballages.fr/mediatheque/rapports-annuels/

container is provided for several households. Glass is not colour separated in these schemes.

- Door-to-door collection schemes with the glass comingled with other materials in the collection bin.
- Civic amenity sites (déchetteries) also provide householders with the opportunity to separate and recycle glass

On average in France, 45 kg of domestic packaging waste is sorted a year, but the performance varies according to the type of area:

- urban: 30 kg a year
- semi-urban: 43 kg a year
- semi-rural: 52 kg a year
- rural: 56 kg a year

The volume of domestic packaging reaches 3,012 million tonnes. The recycling performance by material (as a percentage of the total volume) can be seen below (based on Eco-Emballages data, 2010):

- Steel: 116.3%
- Glass: 80 %
- Paper/ Carton: 57.1%
- Plastic: 51%
- Aluminium: 36.3%

No recycling deposit scheme has been developed for France.

Financial aspect:

Eco-Emballages helps local authorities to set up and optimize selective waste collections programmes by providing finance for the extra cost incurred by this type of collection and in operating sorting centres (the amount is based on the weight of separated material).

Since 1993, most pack participating in Eco-Emballages have been paying 0.15 € cent irrespective of the material or weight. From year 2000, the principles of the new fee structure provide for a fee by weight of each material + a fee per pack, taking into account packaging waste prevention

The license fees are paid as follows:

Fee by weight of material €/kg (2011)

Steel	0.0302
Aluminium	0.6060
Paper/Card	0.1633
Plastics	0.2378
Glass	0.0048
Other	0.1633

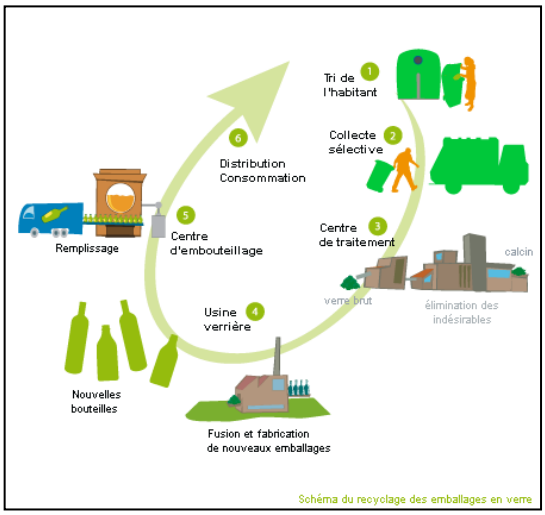
The fee for each piece of packaging is calculated on the basis of the material and weight plus a unit fee, i.e. a fee capped at 0.0015 Euros per pack.

The system is financed mainly by fillers, distributors and importers of household products who pay a license fee for the use of the Green Dot trademark.

Communication:

Eco Emballages[38] has developed specific guidelines and communication material for glass recycling (including other packaging material). More communication material is available on the eco-Emballages website.

[38] Source: http://www.ecoemballages.fr/fileadmin/contribution/pdf/instit/brochures/collecte-selective-performances-et-innovations-2009.pdf



Case Study 7

Grand Besançon - France

HIGHLIGHTS

- ✓ Mixed glass but only collection through bottle banks – high collection efficiency
- ✓ Best national performer

INTRODUCTION

Besançon, is the capital and principal city of the Franche-Comté region in eastern France. Located close to the border with Switzerland, it is the capital of the department of Doubs. Besançon is located in the north-east quarter of France on the Doubs River about 325 km (215 mi) east of the national

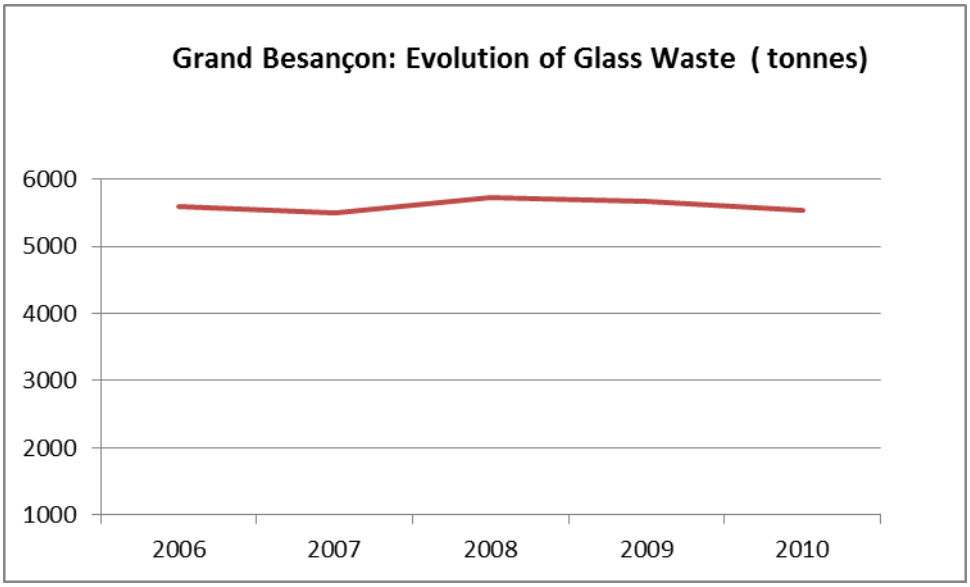
capital of Paris. Grand Besançon **covers an area of 432 km^2** with 11 municipalities and has a population of 176 627 inhabitants.

The strategic objective for Grand Besançon is to reach a 50% selective collection rate of household waste, similar to its national and European target.

The total amount of glass packaging collected in 2009 was 5660 tonnes from municipal sources estimating 32 kg per inhabitant per year. The glass recycling rate reaches: 77%

The scheme

Separate glass waste collections commenced in Grand Besançon in 1999, however, the municipality started in-house[39] collections of glass waste in 2006. The graph below indicates the evolution of glass since 2006:



The collection method for residents to dispose their glass waste is through the use of bottles banks which are located across the municipality. There were 605 bottle banks available in the Municipality in 2010, meaning that on average 300 inhabitants per bottle bank. Glass waste is collected mixed

[39] In-house: collected by the municipality itself.

Grand Besançon has developed some communication material in order for the residents to respect the municipality rules and dispose their glass only between the following hours: 07h00 - 22h00, as any activity outside those hours will cause nuisance to the neighborhood.

The following flyer demonstrates the types of glass waste that can be accepted in the bottle banks and also the type of other glass waste such as ceramic, mirrors, light bulbs that are forbidden for glass recycling through the bottle bank containers.

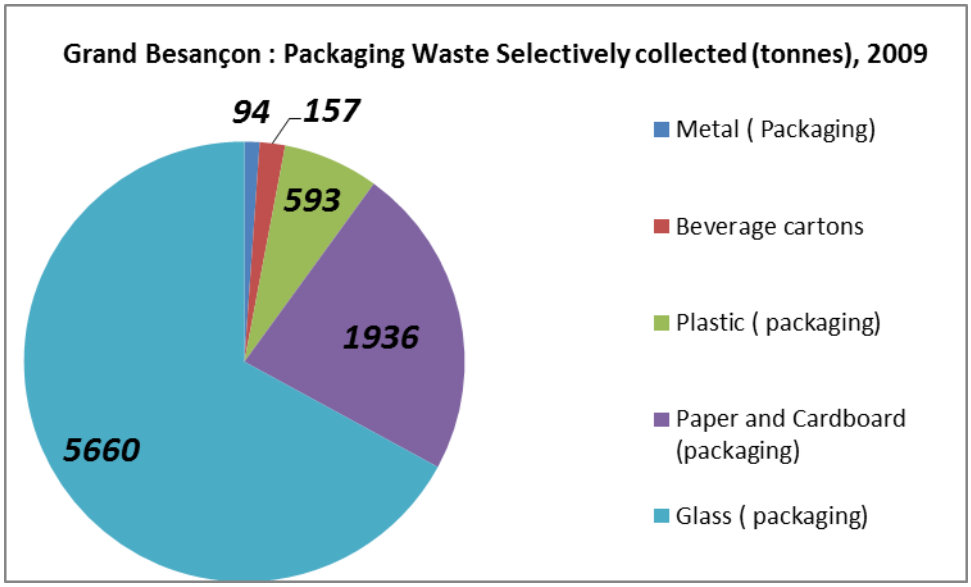
The bottle banks are emptied twice per month and the glass waste is collected by two different waste management companies: COVED and Solover, both which are responsible for the collection, handling and transportation to the glass company Saint Gobain.

RESULTS AND DATA

Grand Besançon generated approximately 170,000 tonnes of municipal waste out of which 84,919 tonnes of waste in 2009, which consisted of household waste and other similar waste (i.e. waste

originating from schools, commercial premises and other), leading to a production of 480 kg per inhabitant per year.

The selective collection rate for packaging that the municipality reached in 2009 was 49%. The glass waste selectively collected reached 5,660 tonnes, equivalent to 32 kg per inhabitant per year**.** The following graph demonstrates the selective collection rate for packaging and biowaste in the municipality:



The amounts in tonnes for each individual waste stream shown on the above graph can be found in Appendix 5.

FUNDING & COST

During this survey, Grand Besançon reported that 366.684 Euros are spent per year in order to cover collection/handling and transportation costs for the selective collection of glass waste, this equates approximately to approximately 64 Euros per tonne.

The level of intervention of Eco Emballages to Grand Besançon is: € 1,447,807 (2010).
However it is important to note that the above amount is Eco Emballages contribution for all packaging and not only glass.

COMMUNICATION

Various communication material have been developed at a local level. Some examples can be found on page 99 (section: The scheme).

7.8. Denmark

In Denmark, waste legislation is gathered in Statutory Order N° 619 (June 2000) which implements various provisions of a number of EC waste directives, including the Packaging and Packaging Waste Directive and amends the responsibilities placed on local authorities.

There is no producer-responsibility scheme in Denmark. It is the only Member State that has opted for the internalisation of packaging waste management costs rather than setting up an industry-run funding system like other countries in the EU.

Therefore, Denmark does not participate in the Green Dot® program. There is no national program and the responsibility for collection of household packaging recovery falls upon the municipalities. Bottles of glass are collected in two parallel collection schemes, i.e. bottle banks and a container at the civic amenity sites. The municipal collection (and treatment) is financed by a separate waste fee, i.e. not over the general taxes.

•The management (collection and treatment) of commercial packaging waste falls under the responsibility of private operators,

•A deposit-return system operates for one-way beverage container packaging (plastic and metals) and refillable bottles (glass).

Packaging tax

In order to make packaging lighter and less material consuming the Danish State has imposed a packaging tax on all **new** packages produced in or imported to Denmark. The tax is charged per unit of packaging, and at a rate that depends on the size of the container and the material it is made of.

Deposit-return system for one-way packaging

The Danish deposit and return system operates within the legal framework established by the '*Statutory Order on Deposits and Collection etc. of Packaging for Beer and certain Soft Drinks'* [40]

[40] http://scp.eionet.europa.eu/facts/factsheets_waste/2006_edition/Denmark

amended in 2007. The deposit-return system for beverage containers has been in force in Denmark since 1984.

Deposits apply to both one-way packaging and refillable bottles that contain beer, carbonated soft drinks, energy drinks, mineral water, iced tea, ready-to-drink beverages and cider products sold in Denmark. It does not however cover fruit squash, juice, cocoa, wine and spirits.

How does the system work?

Importers and producers must be registered with Dansk Retursystem if they wish to sell drink products that are included in the deposit and return system. Both domestic and external companies have to pay the fees for the system. In 2007 the annual registration fee amounted to 2,000 DKK.

Only the companies who have registered can affix the deposit logo to their beverage packaging. Each type of one-way packaging is identified by a label indicating to which category the packaging belongs. The cash values of the refunds are laid down by the Danish Ministry of Environment.

On top of the registration fee, for beverage containers sold by the retail/convenience sector, DRS levies a **collection and logistic fee** to be paid by importer/producer.

The deposit refund for the consumer is[41]:

- Cans, glass and plastic bottles under 1 litre (Pant A) 13 cents (DKK 1.00)
- Plastic bottles of 0.5 litres (Pant B) 20 cents (DKK 1.50)
- Cans, glass and plastic bottles of 1 litre and over (Pant C) 40 cents (DKK 3.00)

The take back is mainly organised by reverse vending machines, except in the smaller outlets. Machines also accept labelled packaging even if the shop in which it is located does not itself sell the product.

[41] http://www.pro-e.org/Denmark

One could say that the deposits are a flow of money moving between shops and consumers.

Statistically, the cleansed and refilled bottles for beer and soft drinks are “invisible”. They do not appear in the waste statistics until they break and are collected for remelting for new bottles. Then they form part of the municipal selective collection statistics.

Case Study 8

Odense - Denmark

HIGHLIGHTS

- ✓ **Glass waste collection system: for recycling and for reuse (refill)**
- ✓ **Deposit scheme for glass: for recycling and for reuse**
- ✓ **High glass collection costs: 103 Euros per tonne**

INTRODUCTION

The city of Odense is the third largest city in Denmark and it is located in the Southern part of the country. The Municipality of Odense Municipality with a population of 190,245 (as of January 2011). The land area of Odense is 304 km^2, with a population density of 611 per km^2

The strategic objective for Odense is to reach a 50% selective collection rate of municipal waste, similar to its national and European target and a 60% selective collection rate for glass waste.

The total amount of glass packaging collected in 2009 was 2494 tonnes from municipal sources estimating 13 kg per inhabitant per year. The glass recycling rate reaches: 70%

The Scheme

The evolution of collected glass can be viewed in the table below (tonnes):

	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
Civic Amenity Site	1346	1310	1373	1265	1235	1268	1282	959	1043	1015
Bottle Banks	1114	1184	1235	1238	1230	1256	1313	830	1125	1065
In total	2460	2494	2608	2503	2465	2524	2595	1789	2168	2080

Except for 2003, the general picture shows a stable increase in the collection of glass waste. It is not possible to see a link to the economic development in society in the same period.

The target sector is mainly household including some commercial premises, schools, administrative buildings, churches and other municipal buildings.

The glass waste is currently collected through two different methods:

a) Bottle Banks -1,114 tonnes are collected annually (2009)

b) Civic Amenity centre – 1,310 tonnes are collected annually (2009)

The bottle banks which are located in different parts of the municipality are collected on a weekly basis and in some case even more frequent. There are 150 bottle banks placed across the city of Odense. The glass waste is not separated by colour, therefore it gets collected mixed in the bottle bank containers. In Denmark, glass bottles are collected mixed as the glass is separated by colour mechanically at the treatment plants. The Danish government and the municipalities believe this is more cost-efficient and economical.

The glass waste is currently collected by Odense Waste Management Company Ltd who has a contract agreement with the municipality of Odense to collect/ handle and transport the waste to different recycling facilities. The current contract holder for reprocessing Odense's glass waste is Marius Pedersen A/S (Ltd.).

The target for one-way packaging is 95% and this needs to be met by 2013[42].

[42] Information from Dansk Retursystem's website:

Return % for one-way drink packaging distributed on materials	2010	2009	2008	2007
Metals	86 %	85 %	84 %	84 %
Plastics	92 %	90 %	93 %	93 %
Glass	90 %	92 %	93 %	91 %
Total average	89 %	88 %	88 %	87 %

The return percentage for refillable glass bottles was 106% in 2010. This is possible, because more bottles were returned than sold that year. Refillable glass bottles are collected by the Danish breweries.

RESULTS & KEY DATA

Odense reaches an overall recycling rate of almost 100% and a selective collection rate of 66%. In 2009, it generated 146,515 tonnes of municipal waste (household and similar waste) out of which 48, 724 tonnes were residual household waste.

A total of 2,460 tonnes of glass packaging waste were selectively collected in the Municipality and sent for recycling.

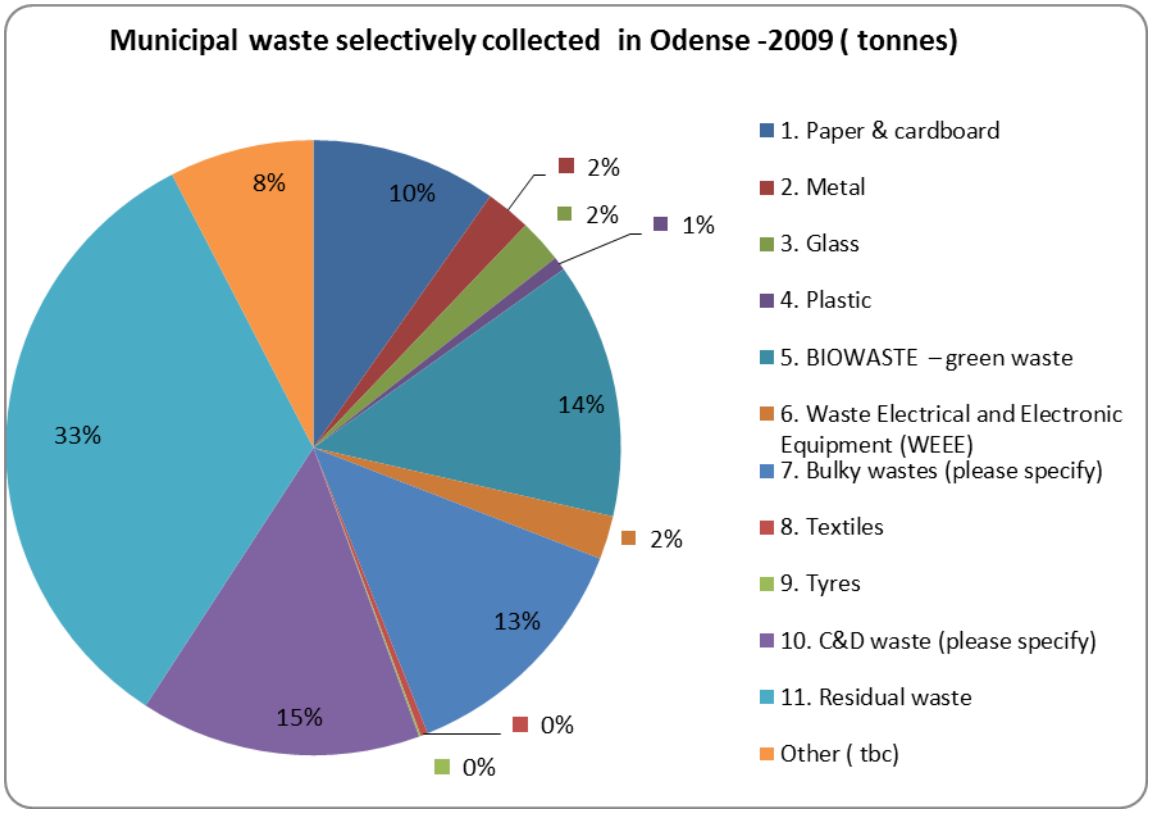
Based on the above figures 13 kg of glass waste per inhabitant per year are collected in the municipality. At first sight, 13kg per inh/year seems low compared to other cases in Europe, but this is due to the existence of deposit schemes in Denmark , therefore glass waste is not only collected from the bottle banks and civic amenity centres but also from the deposit systems.

The total amount of glass waste collected, 2,460 tonnes , includes some glass from the deposit schemes but only the worn-out or broken bottles not the whole bottles. The municipality cannot identify the amount of glass waste collected from the deposit scheme.

The following figures demonstrate the percentage of household packaging selectively collected in Odense (2009), whereby glass packaging waste represents 29% of the total:

- Glass: 2,494 tonnes
- Cardboard: 1,680 tonnes (clean paper is normally not packaging waste)
- Metal: 174 tonnes (estimated 5% of 3,474 t metal in total)
- Plastic: 1,062 tonnes (this is mainly plastic bags and other foils and a little bit of hard plastic packaging)

The following graph demonstrates the municipal waste selectively collected in Odense, whereby total glass (packaging and non –packaging) represents 2% of municipal waste.



The contamination rate is not known by the municipality of Odense, it is in the hands of the glass manufacturers.

FUNDING & COST

The Extended Producer Responsibility is not applied in Odense as it has not been adopted by national legislation. Deposit schemes for recycling bottles are very common in Denmark.

In Odense, the cost of glass only collected from bottle banks arise to 254.413 Euros. This cost covers the collection/ handling, transportation of glass packaging waste to the recycling facility (and not the treatment of glass). This equates to 103 Euros per tonne, 1.34 Euros per inhabitant.

The packaging tax on new wine and spirits bottles of glass was 1.60 DKK per unit. Last year the Danish government lowered the tax to 0.11 Euro (0. 80 DKK) per unit. This fiscal amendment made it much less attractive to try to save as many entire second-hand bottles through the collection system.

No further information on glass waste specification has been outlined by the glass manufacturer to the municipality.

Refillable bottles:[43]

There is no valid statistical data on the number of refillable bottles. Therefore the analysis is made on the basis of the products using the refillable bottles, e.g. how many bottles of beer were sold each year. Furthermore it is estimated how many times a refillable bottle circulates during a year. To this is added a buffer amount of 20%.

Material	Type	Product	Number of bottles sold per year	Number of physical bottles in circulation	Annual amount of glass in tons (if one-way)
Glass	Flasker	Beer	944.880.000	188.976.000	283.460
Glass	Flasker	Soft drinks	288.300.000	57.660.000	57.660
Plastic	Flasker	Soft drinks/beer	297.600.000	59.520.000	19.340

Source: Municipality of Odense: Figures are from 2005

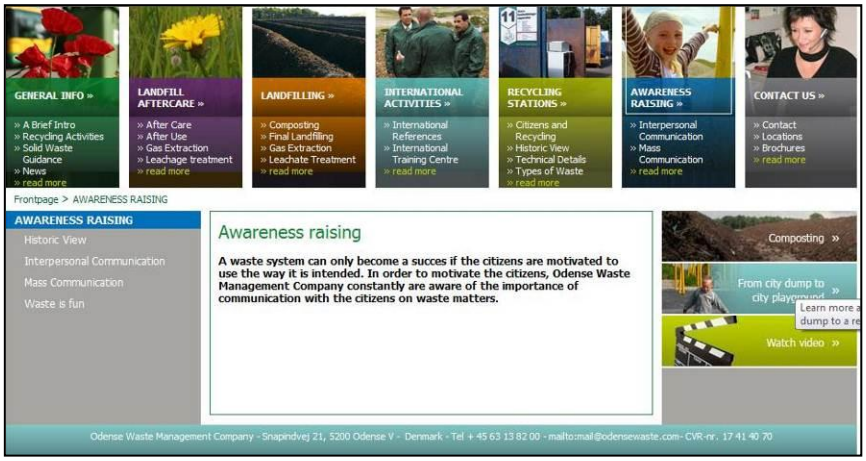
If all the bottles were one-way packaging (meaning non-refillable), the total waste amount would be approximately 360,000 tonnes as a one-way glass bottle weighs approximately 100 gr less than a refillable bottle.

It is uncertain for Odense how many bottles leave the circulation each year, and consequently how many new bottles are put into circulation.

COMMUNICATION

Every year a handbook of waste management in Odense is delivered to all household in Odense Municipality. The booklet explains all about how to hand in all different types of waste from the household. The handbook is highly appreciated by the citizens and gets good ratings in our annually costumer surveys.

[43] Extract from a report from the Danish EPA (Report No. 1231, 2008)



When the right occation occurs, Odense also use television broadcast to communicate a change in legislation or a new service to their citizens.

Press releases are sent to the local newspapers whenever a good story needs telling or a change in the waste management system requires the citizens cooperation.

Future strategy:

Currently there is no specific strategy to be adopted specifically for glass but the municipality is aiming to increase the glass waste selectively collected in the following years and identify different methodologies to obtain more accurate statistical data.

8. Conclusions

An efficient glass collection and recycling scheme is an important driver to move towards a circular economy where waste is not dumped but become the essential raw materials used to manufacture new products.

The Packaging waste Directive 94/62/EC, modified by the Directive 2004/12, has been the main driver to push glass selective collection at 67% in Europe. All European Member States ought to meet the individual 60% glass waste recycling target (by weight) by 2015 and based on the Waste Framework Directive (2008/98/EC)achieve a 50% recycling rate of municipal waste by 2020. For the majority of the municipalities and regions examined in this study, glass selective collection schemes, were introduced in the late 1980's and since then, have seen a stable increase of the amount of glass collected up to today. A few fluctuations have been observed in the glass selectively collected in 2008-09, due to the instability in the market for all sorts of materials including glass.

In relation to the variability of schemes across the different municipalities in Europe, there are many types of collection methods such as:

- Door –to – door
- Bottle bank
- Civic Amenity Centre
- Collection on request (this applies mainly for the commercial sector)
- Deposit schemes (one - way packaging or for reuse/ refill)

Quantitatively, the majority of glass waste is selectively collected through bottle banks followed by door-to-door. In some countries, like the Netherlands, Germany or Denmark, deposit schemes are attracting most of the glass bottles (especially in Denmark).

In the majority of the cases and due to the fact that these are densely populated areas with a high number of visitors, we observed that on average the amount of glass waste collected in urban areas is higher than in rural areas. However there are cases reported in Austria by the Austrian Glass Recycling (AGR), where glass collection is higher in rural areas (97%) in comparison to urban areas (92%) due to a number of factors as indicated by AGR such as: less bottle banks, bottle banks not always walking distance from the residential blocks.

The glass waste selectively collected varies from case to case: 13 kg/inh/ year (in Odense) – 47 kg/inh/year (in Canton of Geneva), underlying the differences in performance. When calculating the overall glass recycling rate for all the selected cases we can observe a range from 59% (Porto) to 95%

(Graz) taking into consideration the amount of glass waste selectively collected out of the total amount of glass generated in each case. The average glass recycling rate for containers for the 8 cases is at 81%.

However, those figures also depends upon the existence of deposit systems and the consumption patterns, as in particular consumer habits and national markets can affect the recycling results for glass waste and public policies implemented. Thus, the existence of high duties on alcohol in countries such as Germany and Denmark lead to cross border flow of goods, in our case glass bottles, that are difficult to quantify, partly explaining the particularly high glass recycling rates. Also, the source of glass waste, such as glass collected from the households, hospitality , business and small retail sectors , is another possible reason for the difference in performances.

Cultural habits must also be taken into account when analysing results. For example historical consumption of wine in France means that a colour –separate sorting scheme was not initially required. On the other hand, Germany and Austria have historically higher consumption levels of coloured and transparent glass: colour-separate sorting at source was implemented to enable the production of a sufficient quantity of white cullet. Today, new technologies allow for further colour-separation after collection.

Targets for refillable or for one-way container deposit schemes set by some EU countries vary in nature which makes it difficult to compare actual performances. Germany, Denmark, Sweden and the Netherlands have deposit schemes, which affect their respective recycling rates and all three countries have high glass selective collection rates. However, the comparable effectiveness of recycling deposit schemes and selective collection remains subject to debate.

The glass selective collection costs vary from 51 Euro (Intradel) to 125 Euro (Canton of Geneva) per tonne and this is due to different parameters taken into consideration when calculating those costs: The collection costs for the municipality includes administrative (including communications), collection/handling and transportation of glass packaging waste to the recycling facility.

Further variation could be observed if the above costs included the intervention of the Extended Producer Responsibility scheme each country has set up (if any).

Based on the case studies we presented in this report, the following factors are encouraging a higher glass selective collection rate:

- Accessibility and high number of bottle banks (e.g. Maastricht)

- Cleanliness and maintenance of bottle banks (e.g. Intradel)
- Information, clear and simple messages to residents (e.g. Graz)
- Frequent collection by the Municipality and avoidance of over filling of bottle banks (e.g. Canton of Geneva)
- Separate glass collection by colour type (e.g. Lippe)
- Use of underground bottle banks (e.g. Brussels)
- Better handling of glass bottles at collection point, will secure higher quality of glass waste (e.g. Odense)
- Local/Regional Authorities to introduce advanced systems: underground street bottle banks (e.g. Intradel)

In general, the challenges for the local authorities are to further expand the existing network and to find suitable and acceptable locations for new bottle banks. Door-to-door systems will always be attractive to households for recycling materials in general. The use of innovative bin systems, such as underground or deep storage bins, should be examined as alternatives to the traditional ground bottle banks.

Depending on the colour of the glass being processed a limited level of contaminants is accepted in the final specification. For example for clear glass the acceptable level of contaminants is typically less than <1%, for green or amber it is higher ranging from 3-5%. Glass collected in a colour separate form provide high quality feedstock and can be processed quickly at a cullet facility to the required standards. Glass collected in a mixed manner require additional processing compared to colour source separated product from bottle banks.

Acceptance quality criteria for the input stream are applied on an individual basis depending on the type and source of the glass waste and in function of the process capability of the recycling plant. Although most glass recyclers would prefer to implement a stricter quality for the incoming glass waste, they are not able to do so because the quality criteria are imposed by the contractor (Green Dot organisation, municipality, region) and differ from country to country.

Another issue is the difficulty to ensure traceability of cullet throughout the supply chain. When glass waste arrives in bulk in the recycling plant, it is limiting to identify the origins of glass waste making harder in some cases to reduce contamination and increase the quality of glass.

As noted in each of the selected case studies, the communication material has played a key role in the effectiveness of the glass selective collection schemes and additional illustrations and photos on guides and brochures ensure for better quality of the glass waste collected on a local level. The municipalities have also been focusing on communicating the importance of glass recycling to schools (i.e. '*Bottle Recycling Heroes'* in Austria) and community groups.

Another interesting initiative is the '***Friends of Glass'*** initiative: it is a European consumer community of more than 20,000 people that supports and promotes consumers'rights to be able to choose food and drink products in glass packaging. A number of tools are available on the multi-language website **www.friendsofglass.com** – like Hank the Singing Bottle, the Bottle Bank Test and the Pass the Bottle Facebook game. They have – amongst others - the objective to increase consumer awareness on the fact that glass is 100%, infinitely and locally recyclable in a 'bottle-to-bottle' system, and that glass recycling is therefore sustainably sound.

Friends of Glass was initiated in 2009 in response to a pan-European survey commissioned by FEVE to the research institute InSites, which found that 74% of European consumers prefer glass packaging for their food and drinks.

In conclusion, all relevant stakeholders must work closely together to develop guidelines that will assist the municipalities, waste contractors and glass manufacturers to achieve better quality cullet, higher quantities of glass waste and a more efficient glass selective collection system in order to meet the EU glass packaging targets, reduce the amount of raw materials used in this process and take advantage of the new technological innovation in the world of glass recycling.

The exchange of good (or evolving) practices between public responsible authorities for glass waste management should be developed.

9. Appendices

Appendix 1:

ACR+/ FEVE CASE STUDY TEMPLATE under the Efficient closed loop glass recycling research project

INTRODUCTION	**Country**	
	Region/City	
	Population (inhabitants):	
	Density (inhabitants/km2):	
	Area (km2):	
	Type of housing (single home , small building (2-5 families), large building (>5 families):	
	Annual Recycling and/or selective collection rate for Region/City (%)	
	Glass recycling and/or selective collection rate (%)	
	Amount of municipal waste produced in the region/city (tonnes)	
	Waste composition (please provide data if available)	
	Glass percentage (%) by type	
	Amount of household waste (tonnes)	
ACTORS AND ROLES	**Waste management company**	

	Regional/Local Authority/ies	
	Recycling Facility/Company	
OBJECTIVES (official quantitative target)		
STRATEGY		
CHARACTERISTICS	**Collection scheme** • **Door-to-door** • **Bring Bank** • **Civic Amenity site** • **Other – please specify**	
	Collection frequency and time (if applicable)	
	Funding source for separate collection (through EPR, tax, fee, sale of materials, subsidy)	
	Collection: **Separate –colour / Mixed**	
	Comments	
	Cullet quality **(i.e. colour separated, purity of glass)**	
	Incentives (for the household) **-Deposit schemes** **-Other –please specify**	
	Cost for glass recycling selective collection (€) **Cost for glass recycling**	

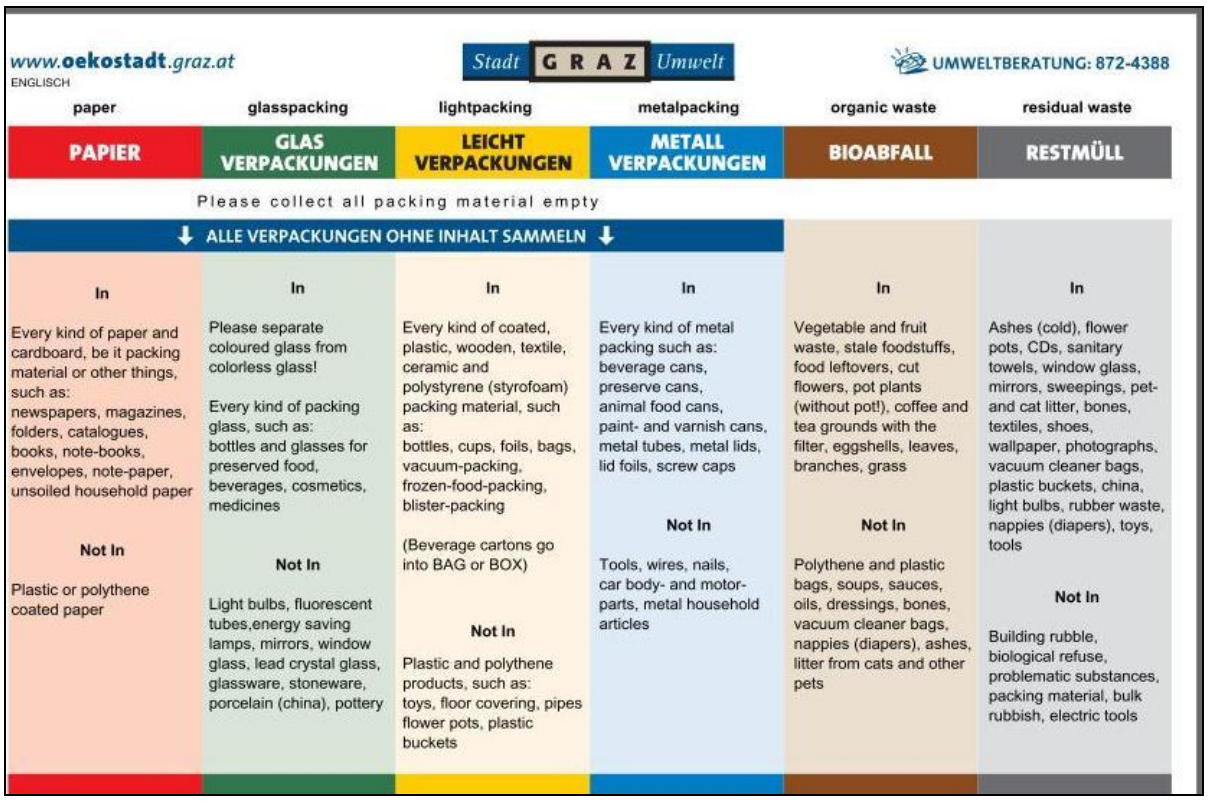
	selective collection per inhabitant (€)	
	Cost of glass recycling per tonne	
	Targeted Sector (household/commercial)	

RESULTS	**Amount of total glass recycling and/or selective collection (tonnes/year)**	
	Amount of glass recycling and/or selective collection per colour (tonnes)	
	CO_2 savings (tonnes), please provide calculation method (if applicable)	
	Participation rate (%) (is the level of usage by the households or Local Authorities for that specific service or scheme designed to accept the glass material.	
	Contamination rate (%) (is the percentage of waste that is not glass, found in the glass container)	
LIMITATIONS		
FUTURE PLANS		
COMMUNICATIONS: ***Please provide us with photos, press releases/clippings, information on promotional actions, awards, quotes, etc.***		

Appendix 2:

Sorting guidelines published on the collecting calendars are distributed to the households

APPENDIX 3: Municipality of Graz: household packaging waste collection –page 1



www.oekostadt.graz.at
ENGLISCH

Stadt GRAZ Umwelt

UMWELTBERATUNG: 872-4388

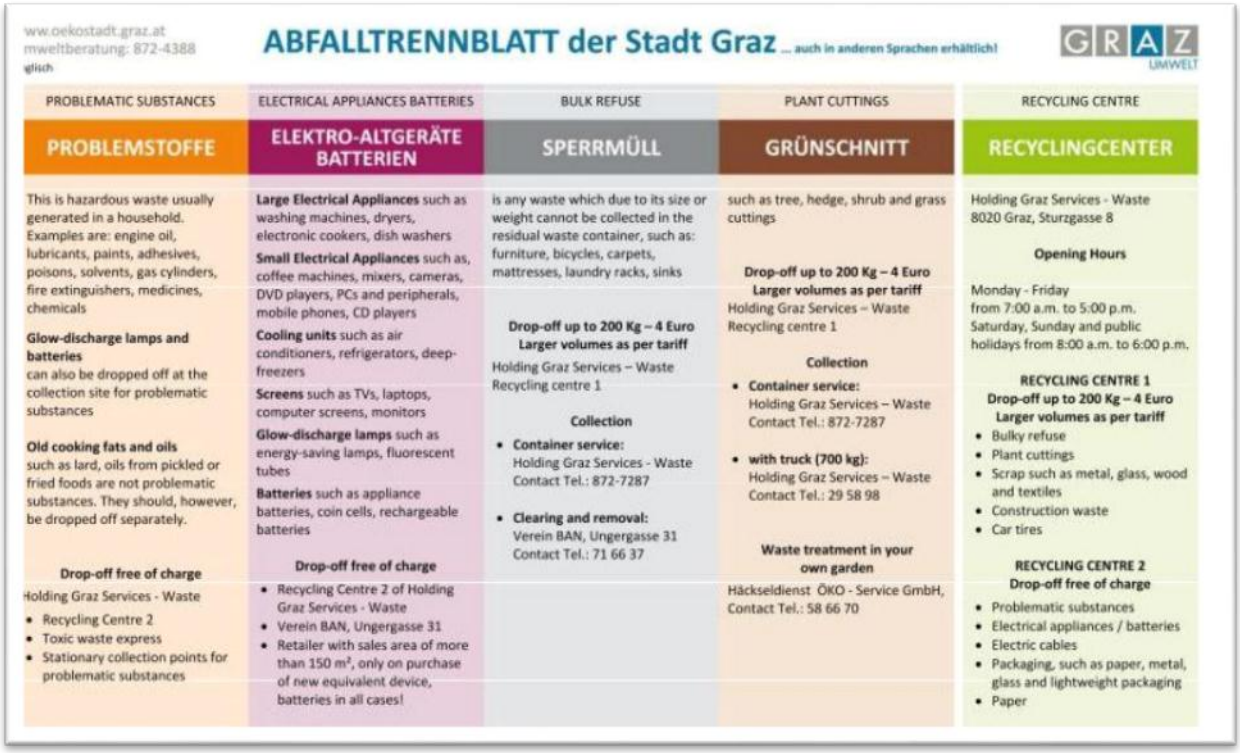
paper	glasspacking	lightpacking	metalpacking	organic waste	residual waste
PAPIER	GLAS VERPACKUNGEN	LEICHT VERPACKUNGEN	METALL VERPACKUNGEN	BIOABFALL	RESTMÜLL

Please collect all packing material empty

ALLE VERPACKUNGEN OHNE INHALT SAMMELN

paper	glasspacking	lightpacking	metalpacking	organic waste	residual waste
In Every kind of paper and cardboard, be it packing material or other things, such as: newspapers, magazines, folders, catalogues, books, note-books, envelopes, note-paper, unsoiled household paper **Not In** Plastic or polythene coated paper	**In** Please separate coloured glass from colorless glass! Every kind of packing glass, such as: bottles and glasses for preserved food, beverages, cosmetics, medicines **Not In** Light bulbs, fluorescent tubes,energy saving lamps, mirrors, window glass, lead crystal glass, glassware, stoneware, porcelain (china), pottery	**In** Every kind of coated, plastic, wooden, textile, ceramic and polystyrene (styrofoam) packing material, such as: bottles, cups, foils, bags, vacuum-packing, frozen-food-packing, blister-packing (Beverage cartons go into BAG or BOX) **Not In** Plastic and polythene products, such as: toys, floor covering, pipes flower pots, plastic buckets	**In** Every kind of metal packing such as: beverage cans, preserve cans, animal food cans, paint- and varnish cans, metal tubes, metal lids, lid foils, screw caps **Not In** Tools, wires, nails, car body- and motor-parts, metal household articles	**In** Vegetable and fruit waste, stale foodstuffs, food leftovers, cut flowers, pot plants (without pot!), coffee and tea grounds with the filter, eggshells, leaves, branches, grass **Not In** Polythene and plastic bags, soups, sauces, oils, dressings, bones, vacuum cleaner bags, nappies (diapers), ashes, litter from cats and other pets	**In** Ashes (cold), flower pots, CDs, sanitary towels, window glass, mirrors, sweepings, pet- and cat litter, bones, textiles, shoes, wallpaper, photographs, vacuum cleaner bags, plastic buckets, china, light bulbs, rubber waste, nappies (diapers), toys, tools **Not In** Building rubble, biological refuse, problematic substances, packing material, bulk rubbish, electric tools

APPENDIX 2: Municipality of Graz: household packaging waste collection –page 2



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mweltberatung: 872-4388
glisch

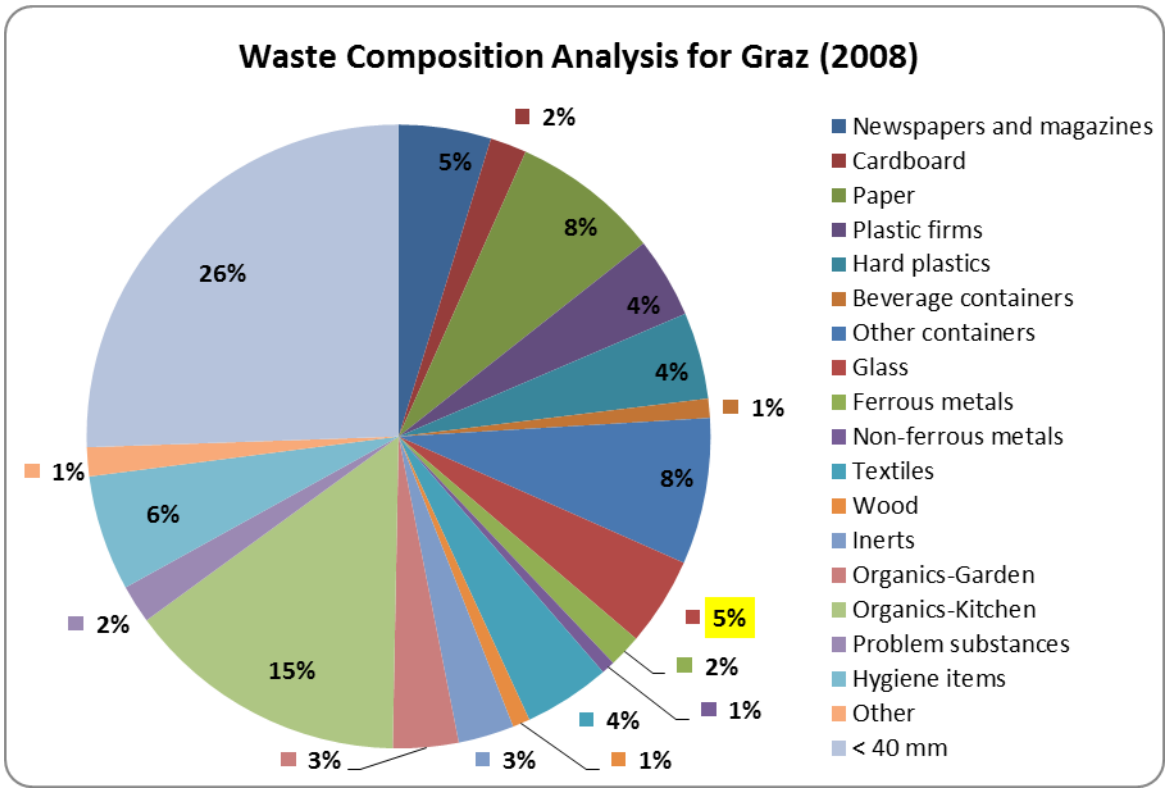
ABFALLTRENNBLATT der Stadt Graz ... auch in anderen Sprachen erhältlich!

GRAZ UMWELT

PROBLEMATIC SUBSTANCES	ELECTRICAL APPLIANCES BATTERIES	BULK REFUSE	PLANT CUTTINGS	RECYCLING CENTRE
PROBLEMSTOFFE	ELEKTRO-ALTGERÄTE BATTERIEN	SPERRMÜLL	GRÜNSCHNITT	RECYCLINGCENTER
This is hazardous waste usually generated in a household. Examples are: engine oil, lubricants, paints, adhesives, poisons, solvents, gas cylinders, fire extinguishers, medicines, chemicals **Glow-discharge lamps and batteries** can also be dropped off at the collection site for problematic substances **Old cooking fats and oils** such as lard, oils from pickled or fried foods are not problematic substances. They should, however, be dropped off separately. **Drop-off free of charge** Holding Graz Services - Waste • Recycling Centre 2 • Toxic waste express • Stationary collection points for problematic substances	**Large Electrical Appliances** such as washing machines, dryers, electronic cookers, dish washers **Small Electrical Appliances** such as, coffee machines, mixers, cameras, DVD players, PCs and peripherals, mobile phones, CD players **Cooling units** such as air conditioners, refrigerators, deep-freezers **Screens** such as TVs, laptops, computer screens, monitors **Glow-discharge lamps** such as energy-saving lamps, fluorescent tubes **Batteries** such as appliance batteries, coin cells, rechargeable batteries **Drop-off free of charge** • Recycling Centre 2 of Holding Graz Services - Waste • Verein BAN, Ungergasse 31 • Retailer with sales area of more than 150 m², only on purchase of new equivalent device, batteries in all cases!	is any waste which due to its size or weight cannot be collected in the residual waste container, such as: furniture, bicycles, carpets, mattresses, laundry racks, sinks **Drop-off up to 200 Kg – 4 Euro** **Larger volumes as per tariff** Holding Graz Services – Waste Recycling centre 1 **Collection** • **Container service:** Holding Graz Services - Waste Contact Tel.: 872-7287 • **Clearing and removal:** Verein BAN, Ungergasse 31 Contact Tel.: 71 66 37	such as tree, hedge, shrub and grass cuttings **Drop-off up to 200 Kg – 4 Euro** **Larger volumes as per tariff** Holding Graz Services – Waste Recycling centre 1 **Collection** • **Container service:** Holding Graz Services – Waste Contact Tel.: 872-7287 • **with truck (700 kg):** Holding Graz Services – Waste Contact Tel.: 29 58 98 **Waste treatment in your own garden** Häckseldienst ÖKO - Service GmbH, Contact Tel.: 58 66 70	Holding Graz Services - Waste 8020 Graz, Sturzgasse 8 **Opening Hours** Monday - Friday from 7:00 a.m. to 5:00 p.m. Saturday, Sunday and public holidays from 8:00 a.m. to 6:00 p.m. **RECYCLING CENTRE 1** **Drop-off up to 200 Kg – 4 Euro** **Larger volumes as per tariff** • Bulky refuse • Plant cuttings • Scrap such as metal, glass, wood and textiles • Construction waste • Car tires **RECYCLING CENTRE 2** **Drop-off free of charge** • Problematic substances • Electrical appliances / batteries • Electric cables • Packaging, such as paper, metal, glass and lightweight packaging • Paper

Source: http://www.oekostadt.graz.at/cms/beitrag/10088482/1598402/?a~Abfall

APPENDIX 4: Waste Composition Analysis for Graz (2008)



APPENDIX 5: Grand Besancon: Selective collection in tonnes

Material	**tonnes**
Paper and Cardboard (packaging)	1936
Metal (packaging)	94
3. Glass (packaging)	5660
4. Plastic (packaging)	593
5. Beverage cartons	157
6. BIOWASTE – green waste	8756