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URBAN-WASTE – 690452 – D2.7

URBAN-WASTE

Urban strategies for Waste Management in Tourist Cities

D2.7 – Compendium of waste management practices in pilot cities and best practices in touristic cities

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Editors:	Gruber Iris Obersteiner Gudrun		
Contributing Authors:	BJØRN OLSEN Trine, DE LUCA Claudia, ERIKSSON Mattias, GROßE Juliane, GRUBER Iris, KAZERONI Marie, KOVÁCS Erneszt, MAYERHOFER Johannes, OBERSTEINER Gudrun, RAMUSCH Roland, ROMEIN Arie, ZAPATA ARANDA Pilar		

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Abstract

This report (Deliverable D2.7) refers to URBANWASTE Work Package 2, Task 2.8. Under this Task the current waste prevention and management practices in the URBANWASTE pilot cases are investigated and best practices coming from the EU context (focussing on touristic processes) are identified. This document shall support the selection of innovative strategies to be carried out within Work Package WP 4.
A comparative policy review of national waste management strategies and targets in the European Union (EU) showed that there is no separate field of policies and instruments for waste generated by tourism neither on European level nor on the national level of EU member states.

The identified waste prevention and management strategies already existing in the URBANWASTE pilot cities as well as international best practice examples can be allocated to well-known policy instruments mainly based on information and awareness building as well as provision of infrastructure (e.g. bins for separate collection of food waste). But also regulatory instruments (e.g. ban of plastic bags), economic instruments and voluntary agreements (e.g. use of returnable containers) could be identified.

Both, existing waste management and prevention practices in pilot cities as well as international best practices focus on nutrition of tourists. Most measures deal with food waste prevention as well as food waste management. The low-waste organisation of events and the promotion of re-use activities were also identified to be promising topics to reduce tourist waste generation. The promotion of resource consciousness in procurement amongst tourist accommodation establishments as well as food and beverage providers for tourists is another positive example identified.

Most identified international best practice examples connected to tourist waste management refer to eco labelling and connected guidelines. The hotel industry can considerably reduce their waste generation by implementing and following a waste management system. One interesting knowledge gained from international best practice examples is the recommendation to elaborate an extended inventory of waste types and sources as first step for waste prevention measures.

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Contributing Authors

NAME	COMPANY	CONTRIBUTIONS INCLUDE
Iris GRUBER Johannes MAYERHOFER Gudrun OBERSTEINER Roland Ramusch	Universität für Bodenkultur Wien (BOKU)	Chapters 1, 2, 4, 4.9, 4.11, 5
Arie Romein	Technische Universiteit Delft (Delft University of Technology)	Chapters 3 and 4.5
Mattias Eriksson	Sveriges Lantbruksuniversitet – Swedish University of Agricultural Sciences	Chapter 4.7
Juliane Große	University of Copenhagen	Chapter 4.9
Gisela MC. Nascimento	Fundo Regional para a Ciência e Tecnologia- FRCT	Chapter 4.8
Trine Bjørn Olsen	Aarhus University - AU Herning	Chapter 4.1
Claudia de Luca	CE - CONSULTA EUROPA PROJECTS AND INNOVATION SL	Chapter 4.3
Pilar Zapata Aranda	Bioazul	Contributing to chapters 4.9 and 4.11
Marie Kazeroni	ORDIF - Paris Region Waste Observatory	Chapters 4.4, 4.6 and 4.10
Erneszt Kovács	ACR+ - ASSOCIATION DES CITES ET DES REGIONS POUR LE RECYCLAGE ET LA GESTION DURABLE DES RESSOURCES	Chapter 4.2

The **data** on waste generation and management, socio-economic data and tourism data used for all the assessments performed within Work Package 2 and presented in this report **was provided by the URBANWASTE pilot cases**.

Contributors from the URBANWASTE pilot cases to Work Package 2 (data provision)

PILOT CASE	CONTRIBUTORS
Copenhagen	**City of Copenhagen**: Line Kai-Sørensen Brogaard, Susanne Lindeneg
Dubrovnik-Neretva County	**DUNEA**: Iva Pozniak, Ivana Prce
Florence	**Regione Toscana:** Lorella Lentucci, Renata Laura Caselli **Alia Servizi Ambientali S.p.A.:** Angelo Fazio
Kavala	**Municipality of Kavala:** Alexis Michail **DIAAMATH:** Paraskevi Giourka, Fotios Tsagas
Lisbon	**Câmara Municipal de Lisboa - Lisbon City Council:** Celeste Oliveira, Maria Barata, Catarina Dao, Isabel Goncalves, Carla Tamagnini
Métropole Nice Côte d'Azur (MNCA)	**Métropole Nice Côte d'Azur (MNCA):** Yoann Billon
Nicosia	**Nicosia Municipality:** Michalis Lagos, Sotiroula Thoma, Maria Thiseos

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PILOT CASE	CONTRIBUTORS
Ponta Delgada	**Fundo Regional para a Ciência e Tecnologia (FRCT):** Gisela Nascimento, Fábio Vieira **Municipality Council of Ponta Delgada:** Vânia Pimentel
Santander	**Ayuntamiento de Santander:** Celia Gilsanz Gomez, Juan Echevarria Cuenca
Syracuse	**Syracuse Municipality:** Giuseppe Di Guardo, Emma Schembari, Rita Savasta, Nunzio Marino, Sandro Randazzo
Tenerife (Municipalities Adeje, Arona, Puerto de la Cruz)	**Cabildo Insular de Tenerife:** Antonio Jesús Mayor Morell, Gerardo González, Alejandro Molowny López-Peñalver, Arturo J Arévalo Morales, Victor Manuel García Díaz

List of abbreviations

WMP	Waste Management Plan
MSW	Municipal solid waste
GPP	Green Public Procurement

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Summary

This report (**Deliverable D2.7**) refers to URBANWASTE **Work Package 2**, **Task 2.8**. Under this Task, project partners investigated the **current waste prevention and management practices** in the URBANWASTE pilot cases as well as identified **best practices** in these cities as well as from the broader European and international context. The information about best practices will be used during WP 4 (strategy development) to select those best practices (strategies) which are most suitable for adaptation and replication in tourist cities. It will be made available for associated partners and potential stakeholders as well.

A **Comparative Policy Review of National Waste Management Strategies and Targets in the European Union (EU)** was performed to serve as background for future waste management and prevention activities in pilot cities. There is no separate field of policies and instruments for waste generated by tourism neither on EU level nor on the national level of EU member states. On the everyday level of implementation, specific practices to manage tourist waste, if existing at all, are usually designed and implemented at city or even local level and are linked to features of the local societal and geographical context. The comparative review of national waste policies and performances of the countries of the URBANWASTE pilot cases, which is presented in Chapter 3, is therefore based on national data about policies and performances regarding the management of the undivided stream of municipal waste. Nevertheless, European waste policy is the overarching framework for waste management in Europe. It is used as baseline to assess member states' national strategies, policies and targets in a comparative way.

Current Waste Prevention and Management Practices in the URBANWASTE Pilot Cities were investigated to figure out transferable best practice activities to other regions that are suitable to solve problems resulting from tourist activities. Additionally, **international best practice activities** in waste prevention and management were screened according to their relevance for the URBANWASTE goals.

Besides describing briefly some general characteristics of the pilot case areas, the description focusses on waste prevention activities that currently exist in the pilot cases as well on the municipal solid waste management. Attention was further paid on the organisation of waste collection from tourist establishments and touristic ships.

Waste prevention and management strategies can be designed and implemented by using one or a combination of various policy instruments and measures. During analysing the waste prevention activities that currently exist in the URBAN WASTE pilot cases in order to identify the strategies behind, several examples for the following categories of instruments were found:

- **Information** instruments
- **Regulatory** instruments
- **Economic** instruments
- **Voluntary agreements**
- **Provision of infrastructure**
- [PM]

Through analysing the waste prevention activities and waste management systems in the eleven URBAN WASTE pilot cases, the following **waste prevention strategies** have been identified:

- **Changing waste behaviour of citizens**

Focusing on the waste behaviour of tourists, awareness campaigns can inform about what they can do to prevent waste (e.g. use public drinking water fountains to refill empty plastic bottles, use reusable bags). Awareness campaigns aimed at changing waste behaviour of tourists need to be implemented at municipality level, but the distribution of information can be carried out mainly via tourist accommodation establishments or other tourist information points.

- **Composting activities at the point of waste generation**

On-site composting could be implemented at hotel level and for other establishments providing food and beverage to tourists to catch the organic waste produced by tourists. Information campaigns on composting as well as the provision of technical composters could be targeted mainly to bigger accommodation establishments where the compost later can be used on the hotel garden as fertiliser.

- **Eco-events**

The "green" organisation of events may affect the total amount of waste produced by tourists. Waste of bigger events like sport or music events attracting thousands of tourists can be highly influenced by green events, but also small events, even meetings, can be oriented according the green event concept. Bigger Green Events could be implemented at municipal level, while conferences or seminars can be organised as green event on hotel level.

- **Promotion of re-use activities**

Activities aiming at re-using, which potentially could be implemented in URBAN WASTE, could include: Swap facilities for products the majority of tourists might only need temporarily such as travel guidebooks, city maps, bathing and beach gear such as air mattresses, snorkelling gear, etc. but also the use of reusable dishes in tourist establishments instead of one way dishes and the donation of reusable equipment like furniture, TV, minibar or computers from hotels to people in need or social organisations could be allocated to this category. Depending on the specific activity, the implementation level would be either the municipality or the hotel area.

- **Promotion of tap water for drinking**

Through the installation of public drinking water fountains (and accompanying information measures) tourists could be encouraged to refill their empty plastic drinking bottles, thus, reducing PET-bottles waste. Responsibility of implementation level lays at the municipality,

- **Reduction of food waste**

Reducing food waste resulting from tourist activities is useful as food and beverage provision to tourists was identified to be one of the main hotspots for waste generation by touristic processes. The provision of doggy bag systems as well as the reduction of food waste in the kitchen can be emphasised. Measures aiming at reducing food waste from tourism are likely to be implemented at restaurants, hotels etc. The organisation of information and guidelines for the food service sector at municipality level assists the implementation of food waste prevention.

- **Resource consciousness in procurement**

Within the scope of URBANWASTE it seems possible to promote resource consciousness in procurement amongst tourist accommodation establishments as well as food and beverage providers for tourists. Partially this could be reached by promoting environmental certification labels/schemes.

In the URBAN WASTE pilot cases the following **waste management strategies** have been identified to be suitable strategies to solve problems resulting from tourist activities. Waste management activities will mainly to be implemented at municipality level.

- **Awareness-raising to change waste separation behaviour (of citizens)**

Information on correct waste separation could be adapted to create an easily understandable "waste guide" for tourists.

Level of implementation: "Waste guides" for tourists etc. could be part of the information package tourists receive in their accommodation establishment.

- **Biogas from organic waste**

The separate collection of organic waste/food waste from establishments providing food and drink to tourists (restaurants, hotels, …) to use it for biogas production could be an option to deal with organic/food waste from tourism.

- **Increase waste separation in the business community**

Especially information about multifunctional waste solutions could be a support for hotels that are not concerned with waste management issues so far. Information campaigns could be targeted for example to all tourist establishments in a given area. Legal regulations regarding waste management or incentive schemes could have the same target group/area.

- **Provision of better waste separation options for citizens**

Having many public bins for different waste fractions available and visible might be an incentive also for tourists to do proper waste separation. Such measures would have to be implemented on municipality level, but the idea of designing an "attractive" and "easy to understand" waste collection system could also be adopted for hotels as well. Especially separate collection of food waste can be implemented easily at least at the hotel and restaurant level

- Additional to conventional waste management and prevention issues **Eco-labels and similar environmental certifications**

have been identified to be useful to solve the problem resulting from tourist waste generation. Eco-labels provide minimum standards for sustainability in hotel establishments including indicators for waste management performance like reusable dinnerware and cutlery, refillable toiletry dispensers or on-site composting or composting

Also **international best practice** examples focus on Eco-tourism certification scheme and labelling. A summary of several sustainability standards and eco-tourism labels of European countries is given in the report focussing on included waste management requirements like facilitating waste separation by guests, separate collection of waste, avoiding of disposable products and single-dose food packaging.

The hotel industry can considerably reduce their waste generation by implementing and following a waste management system that is designed by the concepts of reduce, reuse and recycle (Greenhotelier, 2004). Styles et al. (2013) identified that "a relevant starting point for waste prevention, **sorting and recycling is to record on-site waste generation** by category and source". In addition, it may be useful to consider local reuse and recycling

options, or rather seek opportunities for product reuse before waste is sent for recycling. Concrete examples of best practices for waste management in the hotels are given in this section.

A universally transferable best practice model of municipal or regional waste management could not be identified, because each area is dependent of its own characteristic limitations. Two specific best practice examples can be highlighted: The European project **SCOW** "**Selective collection of organic waste for recycling in tourist areas"**, aims to develop low cost, technically simple and high quality bio-waste collection and recycling models in territories with touristic areas and agricultural activity in Mediterranean zones. Another opportunity, to selectively grade incurring wastes, is the **separation** of useful organic fractions such as **cooking oils, fats and grease** before organic waste is send to anaerobic digestion or composting.

According to the International Tourism Partnership (2008) and the Travel Foundation (2016) the first step for waste prevention measures in accommodations and touristic destinations is to elaborate an inventory of waste types and sources. This should help to locate avoidance potentials of waste generation in different departments. An overview of items to prevent, items to select and actions to avoid waste in accommodation is given.

The **Waste Mapping Guidance for Hotels** in Cyprus developed by the Cyprus Tourism Organisation, Cyprus Sustainable Tourism Initiatives and The Travel Foundation (2013) addresses hotel operators and other organisations working in the Cypriot tourism industry to highlight the financial and environmental benefits of undertaking waste mapping as part of their on-going business operations.

United Against Waste (UAW) was launched in 2014 in Austria in form of a cross-border cooperation platform. Companies from the food service market as well as the federal government, the provinces, science and NGOs are pursuing an ambitious goal: reduction of avoidable food waste in kitchens by half by 2020.

The main objective of the **Fair Hotel project** is to reduce the production of waste packaging in the hotels and enhance the hotel offer in an environment friendly way.

"**Menu Dose Certa**" or Right Serving Menu a pioneering project in the city of Espinho, part of greater Porto, aims to support restaurants in creating menus that avoid food waste.

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Glossary

Litter	**Litter** means small pieces of rubbish (e.g. cans, paper, plastic bottles) that have been left lying on the ground in public places. Source: Cambridge Dictionary
Metropolitan area	A **metropolitan area** covers the core city / municipal area as well as the surroundings.
Municipal solid waste (MSW)	**All types of solid waste that are collected by municipalities or by order of them.** They include waste originating from households and similar establishments (e.g. commercial activities, office buildings, institutions such as schools and government buildings and small businesses) that produce waste similar (quantity and quality) to household waste and dispose of waste at the same facilities used for municipally collected waste. They also include similar waste from rural areas, even if they are disposed by the generator. The definition goes on to include: similar wastes generated by the same sources that are collected or purchased for recycling, even if the material does not enter the same waste stream (including separately collected fractions); white goods, bulky waste; street sweepings and the content of litter containers, if managed as solid waste. Source: EEA Report
Similar establishments	**Similar establishments** are non-household waste producers producing waste similar (in quantity and quality) to household waste (e.g. commercial activities, office buildings, institutions such as schools and government buildings and small businesses).
Street sweeping waste	**Street sweeping waste** refers to waste that accumulates from street sweeping when cleaning large areas (sometimes including the contents of public waste bins). Street-sweepings consist mostly of materials such as grit, dust, salt, and de-icing products, abraded particles of the roadbed, interspersed with organic components of soil, roadside greenery, leaves, etc., as well as harmful substances related to motor vehicles, such as abraded particles from tyres and brake linings, heavy metals from exhaust fumes, and the residue from car leaks, as well as waste from collection containers along the roadside and in parks and public squares. Source: Austrian Federal Waste Management Plan 2006
Tourist establishments	**Tourist Establishments** are hotels and similar accommodation (e.g. hostels, Bed&Breakfast), restaurants, camping sites, marinas, public structures such as museums, other tourist establishments
Touristic ships:	The term "**Touristic ships**" embraces all types of ships of different size that come from somewhere else and bring tourists to the pilot case area (e.g. cruise ships). Small boats that only offer sightseeing cruises on local rivers, channels or along local coast lines (e.g. "boat sightseeing" such as Gondola rides in Venice) are not included.

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1. Introduction

The impacts of tourism are manifold. On the one hand, tourism is one of the most important industries worldwide and a driver for socio-economic development in many regions. Around 10% of the world's GDP are directly and indirectly generated by and one out of eleven jobs is related to tourism. On the other hand, the total number of 1.1 billion tourists every year causes a range of negative externalities, including emissions from transport and touristic activities, high levels of unsustainable resource consumption (renewable and non-renewable, incl. water resources) and waste production.

Solid waste generation is considered being one of the most relevant environmental aspects related to tourism activities. In comparison with other cities, tourist cities have to face additional challenges related to waste prevention and management due to their geographical and climatic conditions, the seasonality of tourism flows and the specificity of tourism industry and of tourists as waste producers. One major objective of the URBANWASTE project is to support policy makers in answering these challenges and in developing strategies that aim at reducing the amount of municipal waste production and at further support the re-use, recycle, collection and disposal of waste in tourist cities.

The main aim of **Work Package 2** is to provide background data and to assess waste related impacts of tourism using a Life Cycle approach. To meet this objective, Work Package WP 2 is composed of **three procedural steps**. The first procedural step is the **development of a proper methodology (Task 2.2) and the adjustment and definition of data requirements**. A **database** including each pilot city will provide the information necessary for linking touristic processes to resource consumption and waste generation, prevention, recycling, treatment and disposal activities in order to analyse how tourism is responsible for positive and negative impacts considering the three pillars of sustainability (environment, society and economy). In a second step, a **baseline assessment** will be carried out (Task 2.6), applying MFA and LCA to assess the current situation in selected URBANWASTE pilot cases. The third procedural step within WP 2 to meet the project's objectives will be to gather information on **existing technologies** for innovative waste management and **best practices** in waste prevention and management strategies related to touristic activities (Task 2.8).

This report (**Deliverable D2.7**) refers to URBAN WASTE **Work Package 2**, **Task 2.8**. Under this Task, project partners investigated the **current waste prevention and management practices** in the URBANWASTE pilot cases based on a **Policy Review** of National Waste Management Strategies and Targets in the European Union. **Best practices** within the pilot cities as well as examples coming from the European and the international context are identified. The information about best practices will further be used during WP 4 (strategy development) to select those best practices (strategies) which are most suitable for adaptation and replication in tourist cities.

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2. Approach

The comparative review of national waste policies and performances of the countries of the URBANWASTE pilot cases is based on national data about policies and performances regarding the management of the undivided stream of municipal waste.

The description of the current waste prevention and management practices in the 11 URBANWASTE pilot cases is mainly based on information provided by the URBANWASTE pilot case partners.

These descriptions follow the following structure:

- Brief description of the URBANWASTE pilot case area
- Description of waste prevention activities
- Description of municipal solid waste collection
- Collection of waste from tourist establishments
- Description of waste from touristic ships (if relevant for the specific pilot case)

Additional information (mainly on existing waste prevention activities and environmental certifications for hotels) was retrieved through an internet search.

The findings from this report shall be fed into Work Package WP 4. Within this Work Package, waste prevention and management strategies that subsequently shall be implemented in the URBANWASTE pilot cases will be developed. In order to provide the kind of input that is necessary for the tasks of WP 4, the waste prevention and management practices currently existing in the pilot cases were analysed according to the:

- Waste prevention and management strategies they belong to as well as the
- Type of policy instruments these activities represent.

Further, it is briefly discussed if the identified strategies can be considered suitable for URBANWASTE in terms of feasibility in tourism context either at hotel or on municipality level.

In order to find best practice examples for waste prevention and management in tourist cities a comprehensive web-based search was carried out. The following general criteria (adopted from Vittuari et al., 2015) were used as orientation for identifying best practices:

- **targeted**: practices that have a strong waste prevention focus, clearly distinct from other waste management strategies or broad environmental goals;
- **effective**: practices based on guidelines, protocols, standards, reports, or preferred practice patterns that have been proven to lead to effective food waste prevention/reduction practices;
- **measurable**: practices that have an evaluation plan in place to measure program outcomes, even if they do not yet have evaluation data available to demonstrate the effectiveness of positive outcomes;
- **innovative:** practices that use original or resourceful techniques for waste prevention;
- **replicable:** practices that can be easily reproduced and are similarly relevant in regions across Europe;
- **visible:** only measures that are reported either in scientific literature or at other reports or web-pages could be taken into account

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3. Comparative Policy Review of National Waste Management Strategies and Targets in the European Union (EU)

Arie ROMEIN

3.1 Introduction: Why drawing attention to EU waste policies?

Tourism contributes by far most to the particular stream of municipal waste. The specific part of this stream amounts to around 10% in the whole of the EU. There is no separate field of policies and instruments for waste generated by tourism neither on the EU nor the national level. Whereas policies, policy instrument and targets to manage municipal waste at large fit within national legislation and policy making - the more the country's government system is centralised. On the everyday level of implementation, specific practices to manage tourist waste, if existing at all, are usually designed and implemented at city or even local level and are linked to features of the local societal and geographical context. Furthermore, there was no rapidly to find data available in order to explore the performance of cities on tourism-generated waste only. Hence, the comparative review of national waste policies and performances of the countries of the URBANWASTE pilot cases, which is presented in this chapter, is based on national data about policies and performances regarding the management of the hardly divided stream of municipal waste.

Regarding national policies, municipal waste policies including, it is mandatory for EU member states to transpose EU waste legislation into national policy practices. Broadly speaking, the EU issues four types of legislative documents with different legislative 'power'. In a descending order, these are Regulations, Directives, Decisions and Preparatory Acts (COM, JOIN, SEC and SWD documents). A Regulation becomes immediately enforceable as law in all member states, supersedes national laws dealing with the same subject, and subsequent national laws must be made in the light of it. At the other end, COM Documents have no direct impact on national laws: they are proposals and other acts to be adopted in legislative procedures of the EU, such as Communications, Recommendations, and White and Green Papers. The EU waste policy that is relevant for member states' legislation is mainly included in Directives: legislative acts that are not directly applicable to national laws but need to be transposed into these. In order to implement Directives correctly, member states usually have to adjust laws accordingly (Fusions, 2015: 14). So, EU waste policy is an overarching framework to assess member states' national strategies, policies and targets in a comparative way. Therefore, this framework is briefly analysed first.

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3.2 EU waste policy framework

3.2.1 Changed approach to waste and waste policy

Due to both steadily growing quantities of waste and occasional scandals with seriously polluting or hazardous types of waste, increasing importance has been attached on a European level to environmental policy since the days of the then EEC in the 1970s. In the past few decades, the EU waste policy apparatus has been gradually expanded by launching new or revised policy documents and legislative acts to keep a grip on generation and management of growing volumes and new types of waste. The first versions of the Waste Framework Directive and the Hazardous Waste Directive that both date back to 1975 have been repetitively amended later on. Concomitant to this expansion, the 'concept' of waste has altered from merely an unwanted burden - "a problem, a cost, a pollutant" (EC, 2005: 6) - towards a valued resource that is worth to be exploited (EC, 2010; EEA, 2015). Hence, the progress of solid waste management systems has been driven by concerns about environmental protection (including GHG emissions by landfilling of food waste), public health and landscape deterioration (Cailean & Teodosiu, 2016; Cecere & Corrocher, 2016) but also by sustainable use of resources, i.e. re-use and recycling of valued materials from waste.

In 2005, the EC commented that "the common set of general principles and control procedures necessary to ensure a high level of protection of the environment and human health across the Community [EU] has now been established" (EC, 2005: 10). Notwithstanding, the Commission has seen itself forced to further expand the legal framework in the decade since then. First and foremost, progress achieved on a number of waste fronts is persistently set off by the gradual increase in the generated volumes of waste. The total EU waste generation that amounted to 2.5 billion tonnes in 2010 (http://ec.europa.eu/environment/waste/index.htm) grew further to 2.6 billion tonnes in 2014 (http://ec.europa.eu/environment/green-growth/waste-prevention-and-management/...). Furthermore, practices of prevention and treatment of waste in several member states were, and still are far from environmentally optimal and need to be tackled by amended or new policies. Too much waste, for instance, still goes to incineration or to the landfill instead of recycling or recovery facilities. "Currently, only 36% is being recycled while the rest was either burned or landfilled, of which some 600 million tonnes could be reused or recycled. For household waste alone, some 40% is reused or recycled, and in some countries more than 80% still goes to the landfill" (http://ec.europa.eu /environment/waste/index.htm). Many member states do still prefer the seemingly cheapest options such as incineration or landfilling and disregard the actual environmental and economic benefits of re-use and recycling.

Use and transformation of resources build up capital stocks and are "the backbone of every economy" (http://ec.europa/environment/archives/natres/index.htm). However, the current non-sustainable use of resources in various member states is both harmful to the ecological environment and economically dissipating. Hence, the challenge faced today by EU waste policy is to achieve integration of environmental sustainability with economic benefits. Key in this is the objective to tackle the continuing growth of waste streams by 'decoupling' them from growth of economic production. Next, the ambition is to take a further step by placing the objective of decoupling into the framework of the pursuit of a circular economy with the aim to re-use resources and stimulate industrial symbiosis – turning one industry's by-products into another industry's raw material (http://ec.europa/environment/circular-economy/index_en.htm) - but also to create jobs. EU waste policy has to be gradually embedded in a broadening framework of strategies and policies to address environmental, economic and social challenges of the future, with the ultimate objective to transform the EU into a competitive sustainable recycling economy.

3.2.2 Strategies, policies, key policy documents and targets

With the development of the post-war mass-consumption society, particularly in the western part of Europe, the amounts of municipal waste have grown together with both population and economic growth. As the EEA (2016, 3-4) states, "wealthier countries generate more municipal waste per person". More recent trends that contribute to the growth of the EU municipal waste mountain are the increasing share of one-person households – a type that tends to produce more waste per capita than family households - and the design of consumer goods for ever shorter lifespans (EC, 2010: 2). Between 1995 and 2003, both GDP and municipal waste grew by 19% in the EU. For an important component of municipal waste, food waste, the EC predicts a "rise to about 126 million tonnes a year by 2020 from a baseline of 89 million tonnes in 2006, unless action is taken to halt this trend" (http://ec.europa/environment/archives/eussd/food/htm). No doubt that increasing volumes of tourism have added to these trends: it is an economic sector that has proven to continue growing worldwide in spite of the recent economic downturn (Croti & Mishrahi, 2015).

On the lowest level of enforceability into national laws, main examples of Communications that present general principles of the EU waste policy with implications for municipal waste management are the Thematic Strategy on Prevention and Recycling of Waste (2005), the Roadmap to a Resource Efficiency of Europe (2011) and the Circular Economy Package (2015). The Thematic Strategy, for example, sets long-term goals for the EU to become a recycling society that seeks to avoid waste and use waste as a resource. It plays an important role in EU waste policy development by identifying seven general key actions. Prevention of waste production is prioritized over recycling, but for waste recycling policy itself this strategy developed minimum standards. Furthermore, it introduced life-cycle thinking into the waste management policy (EC, 2011).

To some extent, the Thematic Strategy has been a basis for the latest revision of the Waste Framework Directive in 2008 and some waste-specific Directives. The actual version of the Waste Framework Directive "is meant to be the cornerstone of the current EU waste policy" (EC, 2010).

In order to comply with the objectives of this Directive and to move towards a European recycling society with a high level of resource efficiency, Member States are legally obliged to adopt waste prevention programmes (by December 2013) and to take the necessary measures regarding "the preparing for re-use and the recycling of waste materials such as at least paper, metal, plastic and glass from households and possibly from other origins as far as these waste streams are similar to waste from households" (EEA, 2015; EC,2008: 13). To achieve these objectives, the Waste Framework Directive makes it mandatory for member states to draw up Waste Management Programmes and Plans in line with the Directive's targets and cover their entire geographical territory. Furthermore, unlike the Thematic Strategy, this Directive presents quantified targets for EU waste policy. An important one is to achieve "a minimum of overall 50% recycling and preparing for re-use by weight by 2020". In 2015, the EC proposed new targets for municipal waste of 60% by 2025 and 65% by 2030. The Circular Economy Package (2015) proposes to further increase the recycling rate for packaging waste to 75% in 2030.

In addition to these general acts, the EU waste policy apparatus also includes a number of thematically specific legislative documents, mostly Directives, that focus on either a specific type of waste stream or a stage in the waste hierarchy. Quite a few of these documents were issued before 2008 but some have been revised on the basis of the Waste Framework Directive. As to the number of Directives, EU waste management policies with major implications for municipal waste are first and foremost laid down in waste stream specific directives. There are now Directives on various types of toxic and hazardous materials (either gaseous, liquid or solid), on solid

non-hazardous materials and on biodegradables. Biodegradables include garden and park waste, and kitchen and food waste from households, retail, hotels, restaurants and food processing plants.

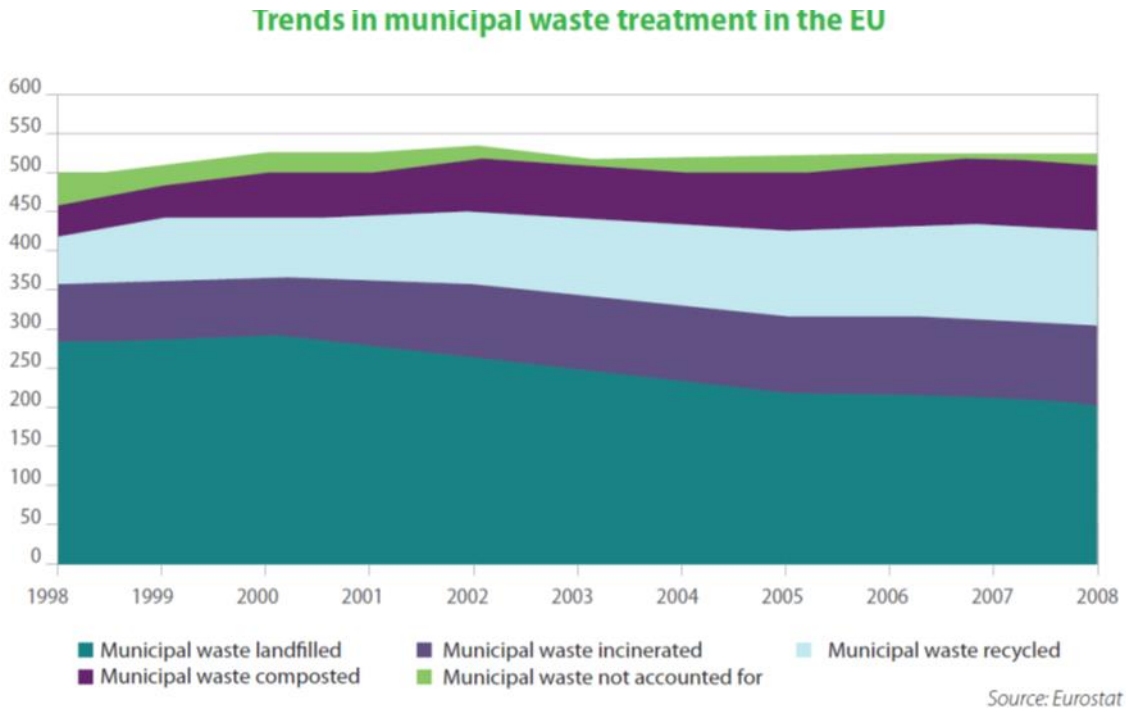

Figure 1: Trends in municipal waste treatment in the EU, 1998-2008 (EC, 2010)

By and large, waste hierarchy related directives attempt to achieve moves up in the hierarchy. Important are those on Landfill (1999) and Waste Incineration (2000) that aim to reduce amounts of municipal waste to be either landfilled and incinerated. Figure 1 shows a reduction of landfilling and an increase of recycling between 1998 and 2008. The limitation of landfill, for example, is mainly motivated by its detrimental impacts on both ecological environment and public health by decomposition of biodegradable waste, most in particular food waste. Particularly in the case of insufficiently closed installations, decomposition lead to contamination of soil and groundwater by sludge, and emissions of the GHG methane. Member States had to reduce the amount of biodegradable municipal waste that they landfilled by 2006 to 75% of the total amount generated in 1995. This proportion had to be further reduced to 50% by 2009 and to 35% by 2016. However, it was recognized that these targets were increasingly difficult to realise by countries with a very high share of landfilling. Therefore, countries that landfilled still over 80% of their municipal waste in 1995 were given the opportunity to request a derogation period, usually of four years, to achieve these successive targets. The Circular Economy Package further reduces the landfilling target to a maximum of 10% of municipal waste by 2030 and bans it completely for separately collected waste.

A broader perspective on the transposition of EU regulations into national waste policies in the Member States includes the following principles:

- Protection of ecological environment and human health by preventing or reducing the adverse impacts of generation and management of waste.
- Implementation of the waste hierarchy as management instruments with prevention and recycling as highest priorities.
- Improvement of resource use efficiency performance.
- Integration of sustainable resource use and waste treatment policy by means of a life cycle that involves all 'operators': producers, distributors, end-users (consumers) and waste treatment agencies.

3.2.3 Significance of EU waste policy for national legislation on solid tourism-related waste

There is no explicit legislative act in EU policies and strategies on waste exclusively produced by the tourist industry. This industry's waste streams pertain to some more general legislative acts, or specific articles in acts, either on waste streams or on stages of the waste hierarchy, in particular related to landfill, incineration and recycling. By far, most waste generated by the tourist industry ends up in municipal waste. This waste (amongst others) covers: food waste; packaging waste of food, drinks, detergents and other cleaning materials; and solid waste from hotel offices and reception desks, bars and restaurants like paper, plastic, glass and batteries. Also waste from Waste of Electrical and Electronic Equipment from rooms like TV or hair dryers as well as bedlinens and towels may be allocated to tourist activities. These specific types of waste are covered under EU Directives on biodegradables, on packaging & packaging waste, on plastics and on batteries, on WEEE but separating these materials at source or from the municipal solid waste stream is required for the directives to become effective.

Referring to the waste hierarchy, most types of municipal waste generated by the tourist industry may end up at any level of the hierarchy. This may sound least likely for re-use of food waste, but the comparative study of EU Member States' by Bio by Deloitte (2014), following a call by the European Economic and Social Committee, makes clear that food that is considered waste due to regulations on durability, date marketing and hygiene standards still can be donated to food banks and other charities for consumption.

3.3 Country summaries of municipal waste policies

3.3.1 Introduction

This section presents a comparative analysis of waste management in the countries of the URBANWASTE pilot cases on their way from diverting municipal waste from being landfilled and moving towards more recycling. The liability to transpose EU Directives into national laws is no guarantee that each country has done so both rapidly and to a maximum degree. And if transposed, this does not imply that all targets are already met, or will be met in their target year. To explore the questions if, how and to what extent these countries' municipal waste management has moved up the waste hierarchy, the comparison consists of two parts: national waste policies

and introduced policy instruments against the background of EU legislation, and quantitative trends in waste generation, recycling and landfilling as indicators of waste management performance. The national policies and policy instruments are presented first because they contribute to the explanation of the trends in quantitative and qualitative performances of the countries. It has to be taken into account however, that other factors also contribute to these trends, like level of wealth, environmental awareness of the population, and specific features of how waste management legislation, policies and instruments are implemented (EEA, 2016). Inferred from this comparative analysis, finally, the countries' challenges in the near future to meet EU targets are indicated.

The comparison contains 14 countries: the eight countries of the URBANWASTE pilot cases and, as a reference group, the six best performing countries of the 32 member countries of the European Environment Agency (EEA) – the EU-27 and 5 non-member states. These six had already achieved in 2014 a recycling rate of municipal waste above the Waste Framework Directive 2020 target of 50 percent. In contrast to the countries in the best performance reference group, the recycling rate of municipal waste of all eight countries of URBANWASTE pilot cases was lower than 50% in 2014. Nevertheless, these can be further divided into two groups: one with rates less than 20% and one with rates between 30 and 50%. Hence, the fourteen countries presented in this comparative analysis consist of three groups. Group I contains Croatia (16%), Cyprus (18%) and Greece (19%); Group II Portugal (30%), Spain (33%), France (39%), Italy (42%) and Denmark (44%); and the Reference Group Sweden (50%), the Netherlands (51%), Switzerland (54%), Belgium (55%), Austria (59%) and Germany (64%).

Both the description of national municipal waste policies and policy instruments and of trends in generation, recycling and landfilling are based on the 'Country Fact Sheets' published by the EEA in October (EEA, 2016a-n). The Fact Sheets present highly identical, hence rather comparable information on policies and quantitative performance data of each country, mainly for the period 2001 – 2014. Regarding policies, the EEA overviews reflect some main policy instruments of national waste management but are far from exhaustive. Furthermore, explicit distinction between streams of waste paper, plastic, glass and food – the major types generated by tourism – are not being made in these Fact Sheets. Nevertheless, the two large flows that are distinguished in these documents - material and organic waste - include in most countries respectively paper, plastic and glass waste, and food waste. To avoid a large number of repetitions, references to these Fact Sheets as sources will not be made below.

3.3.2 Waste and waste management policies

Table 1 presents an overview of municipal waste management policies across the 14 selected countries (EEA, 2016). The first and second column display data about the development of Waste Management Plans (WMPs) since 2001 - the legal framework for policy instruments as required by the EU Waste Framework Directive.

The next six columns refer to selected policy instruments: a selection that is far from exhaustive but does reflect the primary policy aim to divert waste from landfilling and move upward in the waste hierarchy: banning and taxation of landfilling, taxation of incineration, separate collection of bio-waste and pay-as-you- throw (PAYT) systems as instruments to stimulate recycling, respectively after collection and by households before 'throwing' and collection. The threshold of € 30/tonne of landfill tax is included as an indicator for effectiveness of the instrument of landfill tax: EU countries that either ban landfilling of biodegradable or mixed municipal waste, or implement a ban combined with a landfill tax of at least EUR 30/tonne have a landfill rate well below the EU-28 average of 28% (EEA, 2016).

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Table 1: Municipal solid waste management and selected policy instruments in 14 European countries (2001-2015) (EEA, 2016)

Country	≥ 2 national WMPs: 2001 - 2015	Only regional WMPs	Landfill tax increased by > 50 % : 2001 - 2015	Landfill tax ≥ €30/ tonne at 2015	Incinera-tion tax	Landfill ban on organic or non-pretreated waste	Mandatory separate collection of bio-waste	PAYT or other economic incentives for recycling
Group I								
Croatia	×		No tax	No tax				
Cyprus	×							
Greece #	×		No tax	No tax				(×)
Group II								
Portugal	×		×		×			
Spain	×		(x)		(×)	(×)	(×)	(×)
France		×	×	×	×	×		(×)
Italy		×					(×)	(×)
Denmark	×			×	×	×		(×)
Reference group								
Sweden	×		×	×	(x)	×		×
Netherlands	×		(×)			×	×	(×)
Switzerland		×				×		×
Belgium		×	(×)	×	×	×		(×)
Austria	×		(×)	(x)	×	×	×	×
Germany		×	No tax	No tax		×	×	×

(×): the instrument in the country is not mandatory, is implemented only in some regions or municipalities, or has been abolished again.

#: For Greece 2013 instead of 2014 data are used.

Please note: The original table contains information about 32 countries (EEA, 2016).

The Table indicates for each instrument if it had been introduced or not. It clearly shows that the difference between countries in the number of policy instruments introduced in 2014 is large. Nevertheless, this says little about efficiency, because the same policy instruments can be designed and implemented in many different ways. A similar conclusion is drawn by Weißenbacher and Seyring (2016) in their assessment of 45 WMPs in 18 different EU member states: there are "major discrepancies in the proper implementation of the Waste Framework Directive as regards the drafting of Waste Management Plans". Three WMPs provide a thorough analysis and achieve a good quality of waste management planning while eighteen fail to properly address mandatory elements in the WFD in some way or another and are rated as 'substandard' (op. cit.: 58, 59). Overall, Plans differ on elaborating in detail on specific instruments, indicating clearly whether policy instruments are already in place, or on providing information about schedule and responsibilities for the implementation of instruments. An exhaustive description of differences in design and implementation is far beyond the scope of this section but a few qualitative details will be presented here, as a background for some understanding of the countries' different performances in the next section.

3.3.2.1 Group I

Each country in Group I introduced its first WMP after 2001 and has revised that Plan once since the introduction. Croatia is an EU member state only since 2013 but its first WMP dates back to 2007. It covered the period to 2015 and was succeeded by a revised version for 2016-2022. In Cyprus and Greece, revision of the first WMP was not a smooth process. Revision in Cyprus has been under consultation between 2012 and 2016, and in Greece it was the intention to revise WMPs every 5 years but the second edition (2014-2020) became effective 12 years after the first, in 2015.

Furthermore, in spite of these WMPs, the three countries in this Group hardly introduced any of the policy instruments selected in Table 1. The only exceptions are (1) landfill taxes in Cyprus that are both very low - between € 5 and € 10/tonne waste - and introduced in two cities - Nicosia and Limmasol – rather than country-wide, and (2) a non-mandatory PAYT system in Greece. It is not surprising, then, that still many landfill sites are in operation in Group I countries - 109 in Greece in 2011 and 147 in Croatia in 2014. Due to the predominantly private companies in waste business, diverting waste from these sites is problematic because they require minimum amounts of waste to be commercially viable.

3.3.2.2 Group II

Unlike the Group I countries, the first WMP of Denmark, Portugal and Spain in Group II dates further back than 2001, to respectively 1993, 1997 and 2000. Denmark has revised its national WMP already three times, Portugal twice and Spain once. But in spite of its intentions to comply with EU legislation and targets, approximately 60% of municipal waste was still landfilled in Portugal during the first decade of this century and the country has not yet succeeded to substantially reduce the number of open dumps. Instead of national WMPs, Italy has regional Plans and France only municipal Plans. Italian regions hold responsibility for drawing up WMPs but implementation is decentralised to provinces and municipalities. In fact, Spain is an intermediate case between countries with national and with regional WMPs: its second Plan (2008-2015) is national but based on Plans for its 17 autonomous regions.

The number of the six selected policy instruments introduced in Group II varies between three in Portugal, four in Italy, five in Denmark and France, and all six in Spain. For landfill, Spain, France and Denmark introduced a ban at the end of the 1990s on respectively recyclable materials, untreated waste and combustible waste. Further, all five countries in this Group levy a tax on landfill: Italy and France since the 1990s and Denmark even since 1987. The tax rate in these countries has increased by over 50% since the turn of the century, although not in all

Italian regions. Actually, that increase varied considerably between these regions. On the Iberian Peninsula, landfill tax was introduced more recently – in Spain in 2004 and in Portugal in 2007. But this introduction in Spain was limited to one autonomous region, Catalonia, followed only eight years later, in 2012, by Castilla y León. The current Spanish third WMP (2016-2020) proposes a country-wide landfill tax for the first time. As to the level of the tax rate, € 30 or more is levied only in Denmark (€ 63.30 in 1999 that increased again in 2010) and France (€ 30 in 2014 and € 40 in 2015), but in France tax reductions are given on many types of waste. Portugal on the other hand has one of the lowest in Europe: € 4.28, raised with 50% in case of recyclable waste.

To reduce waste incineration, an incineration tax is being levied in all Group II countries except Italy. But since incineration is preferred over landfilling, its rate is considerably lower than the landfill tax. The Portuguese third WMP (2014-2020) sets it on 25% of the landfill tax. In France this proportion is a bit higher, about one-third, but it is lower in the other countries in this group. In Denmark, the proportion can no longer be determined since the tax rate is calculated in energy content instead of weight.

Finally, the two instruments to stimulate recycling, mandatory separate collection of bio-waste and a PAYT system, also exist in most Group II countries. However, their application is either non- mandatory, takes place only in some regions, or is still a pilot project. Separate collection of bio-waste was introduced in Spain in 1998, but only in Catalonia and in municipalities with more than 5 000 inhabitants in a few other regions, and in France its coverage was limited to only 3% of the population living in a few municipalities. Since 2011 however, it is mandatory in whole France for major producers, like catering businesses, to sort out food waste in order to make it more properly recyclable. Nevertheless, it is not very likely that country-wide impacts of these two instruments on diverting waste towards recycling are large in Group II as a whole.

3.3.2.3 Reference Group

In the Reference Group, three countries – Sweden, Netherlands and Austria – have revised their WMPs at least twice since 2001. But unlike Group I and II, these countries, and in particular the Netherlands and Sweden, have been far ahead of the EU legislation: they initiated policies against the municipal waste problem already in respectively the 1970s and 1980s. What is more, the Dutch waste management policies of the 1990s have served as examples for more recent EU legislation. The other three reference countries have no national WMPs and waste management policies are more decentralized. In Germany, the national 1996 Recycling Management of Waste Act assigns responsibility for many stages of management, including planning and construction of facilities, to local waste disposal authorities in order to achieve the Act's targets. The major of these targets is recovery of all municipal waste in Germany, including incineration residues, by 2020. Switzerland has an explicit national legal framework for regional plans - the 1990 Technical Ordnance on Waste that was revised completely as Ordnance of Waste Prevention and Disposal in 2015 – but cantons have to draw up and to periodically review their own management plans. Belgium, finally, is the only European country without any national legal framework for waste management. The Brussels Capital Region, Flanders and Wallonia are fully autonomous in this respect. Accordingly, their first regional WMPs date back to different years – 1986 in Flanders and 1991 in Wallonia – and Flanders has undertaken further reaching endeavours in waste management policy.

There is no big difference in the number of selected policy instruments introduced in Group II and in this group of reference countries. But in this latter group, exceptions to mandatory and country-wide implementation of the instruments are rarer than in Group II. In all reference countries, landfilling has been banned comprehensively for rather precisely defined waste streams, mostly in the categories of combustible, bio-degradable and reactive waste. The Netherlands have set up a rather detailed list of 35 different waste categories to banned from 1995 onwards. Landfill taxes have been charged in all reference countries except Germany, with different rates for different waste streams. Again, the Netherlands is a special case: the charged rates for

respectively combustible waste and non-combustible waste 'with no other favourable recovery option' were both extreme in 2010 - the highest rate in Europe, € 107.50, versus the very low € 13. And two years later, the Netherlands completely abolished this form of taxation. There was indeed no more the pressing need for that tax: streams of waste towards landfill had become nihil due to strict bans, high taxes for most types of waste, and an extensive infrastructure of facilities higher up in the hierarchy. It is for similar reasons that landfill tax rates have been increased only modestly – definitely less than 50% - in Switzerland since the introduction in 2001 and in the Belgian regions of Flanders and BCR, and that landfill tax on reactive waste was abolished in 2009 after the modernisation of landfills. Similar reasons were also behind the repeal of incineration tax only four years after introduction in 2010 in Sweden, and why it has never been introduced at all in the Netherlands, Switzerland and Germany. It is obvious that waste management policy plans and instruments contribute to countries' waste disposal performance, but these examples show that the reverse relation may also occur.

Separate collection of bio-waste is not mandatory in several references countries and regions, for instance Switzerland and Sweden. Nevertheless, bio-waste collection covers about three-quarters of the Swiss population and Sweden has formulated precise targets for sorting and biologically treating food waste by households and producers like restaurants and hotels: 35% since 2003 and 50% since 2012. Finally, a PAYT system has been introduced in all countries but not always nation-wide: in the Netherlands in 40% of the municipalities, and in Belgium not in the Brussels Capital Region.

3.3.3 Performance of waste management strategies

This section describes the waste management performance of the 14 countries. Before presenting the quantitative data on performance, it is commented that we should view these with some doubts regarding the validity, reliability and comparability of data presented in the EEA Country Fact Sheets. First and foremost, EU member states could choose between four different 'methods' to measure waste management indicators: most but not all countries choose the same one. Although the choice for one method leaves the true performance unknown, it is supposed that some figures are undervalued. The report of no landfill at all (0) is not exactly true for some countries in case these consider waste treated in mechanical-biological facilities to be recovered totally although sorting residues are still landfilled. Country-wise, further, each Fact Sheet presents some uncertainties in the reporting due to the country's (changes in) methodology of data collection and features like level of decentralisation. Belgium is the most extreme of the 14 countries: since no data is collected on national level, the Fact Sheet presents results of ex-post analysis of reported data by the three Belgians autonomous policy makers. The EEA (2013: 6) comments that "steps are needed to harmonise national reporting methodologies, especially on the waste fractions to be included when reporting on municipal waste".

3.3.3.1 Generation of municipal waste

Before turning to waste management performance, an overview of the generation of municipal waste by country is presented. Not surprisingly, the total amounts vary with the size of their population and, in a few cases, also with the net total annual number of tourist days[1]. In 2014, 29.6 and 33.7 million tonnes were generated in the large countries Italy and France, against only 1.6 and 5.6 in Croatia and Greece (EEA, 2013). The impact of tourism is most notable in Cyprus; a country with a relatively small population and large net inflow of tourists.

[1] *∑ # of days that all tourist together stay in a country in a given year*

Table 2: Generation of municipal waste per capita (EEA, 2016)

	Generated municipal waste per capita (kg)	
	2001	2014
Group I		
Croatia	304 (2004) #	387
Cyprus	650	617
Greece	414	505 (2013) ##
Group II		
Portugal	450	453
Spain	650	435
France	525	512
Italy	516	488
Denmark	606	760
Reference group		
Sweden	440	438
Netherlands	595	527
Switzerland	661	730
Belgium	470	435
Austria	575	566
Germany	632	618
EU	510 (2004)	474

#: first year available

##: last year available

The comparison of the countries' municipal waste production per capita (Table 2) shows a variation in 2014 between 387 kg in Croatia and almost twice that amount, 730 kg, in Switzerland. The picture of the trend between 2001 and 2014 is similar for all countries except Germany: an increase, in most cases rather gradual, up to a peak value in the second half of the decade, mostly in 2007, 2008 or 2009, that was followed by a decrease towards 2014. Germany followed the opposite trend: a decrease until 2006 (564 kg) followed by an increase in the years after 2006. The most frequently mentioned explanation for the reversal trend in the majority of the

countries is the economic recession. This is indeed a more plausible explanation than a very sudden success of prevention measures or sudden increase of environmental awareness of the population. This means, hence, that there is still work to be done to achieve decoupling waste generation from economic growth. Significant impacts of waste prevention programmes upon the decrease of waste generation per capita up to 2014 are neither plausible because these programmes became mandatory only by December 2013 (EEA, 2015). These impacts are hard to determine anyway because it involves to measure amounts of not produced waste.

Obviously, the net results in the 14 countries over this 14-year period was either less, approximately similar or more waste generation. A significantly growing amount was produced by the Danes, Swiss, Greeks and Croats, hence inhabitants of countries in all three groups. Furthermore, Table 3 shows several clear exceptions to the frequently made observation that people in wealthier countries produce more waste than in less wealthy. These are mainly Cyprus and Greece on the one hand and Belgium and Sweden on the other. In Cyprus, the large tourist industry in a comparably small country with low number of inhabitants may contribute to the large amounts of waste generated.

Table 3: Ranking by waste generation per capita in 2014 (EEA, 2016)

	< 400 kg	400 – 499 kg					500- 599 kg				600 – 699 kg		700 – 760 kg	
Rank in 2014	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Group I	Croat						Gre				Cypr			
Group II		Spa		Port	Ital		Fran						Den	
Ref. Group		Belg	Swe					Neth	Aus		Ger	Swi		

3.3.3.2 Landfilling

The overview of waste management performances starts at the bottom of the hierarchy: the landfill. The Country Fact Sheets present data on landfill of biodegradable waste only. Table 4 shows the share of landfill of biodegradable waste in the years that the successive EU Landfill Directive targets of respectively 75%, 50% and 35% of the landfilled amount in 1995 should have been achieved. The regular target years are 2006, 2009 and 2016 but some countries, Cyprus and Greece in in Group I and Portugal in Group II, successfully requested for four-year derogation for one or more of these target years. Italy was also qualified to request for derogation but decided not to do so. Croatia is a particular case because it is a member state only since 2013.

Overall, Table 4 shows that countries with a medium proportion of the 1995 amount of generated municipal waste landfilled have made most progress in the decade since 2006, the first EU target year. That proportion changed less in countries where that amount had grown further, to rates over 100% in 2006 (Group I) and in countries where it had already decreased to nil in that year (Reference Group plus Denmark). Hence, the countries in Group I have achieved by no means the EU 75% and 50% targets on time. Furthermore, it seems to be an extraordinary challenge for these countries to achieve the 35% target in spite of the derogations. Actually, it appears highly unlikely that they will be able to reduce their shares from over 100% - in the case of Greece

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even 144% in 2012- to 35% in just a few years. In 2011, there were still over one hundred illegal or semi-legal dump sites in operation, despite that these dumps have to be ruled out according to the European Court of Justice. For Greece and Cyprus, a low level of organisation and a lack of appropriate treatment facilities higher up in the hierarchy play an important part in the explanations of why they lag behind the EU targets. In the case of Croatia, the date of entry in the EU plays a significant role. The European Environmental Agency (2016) concludes that (with one exception) all of its 32 member countries with recycling rates below 30 % entered the EU in 2004 or later, indicating that these countries started to implement EU recycling policies more recently. Croatia started only in 2013.

Table 4: Landfilling of biodegradable waste (EEA, 2016)

	75%		50%		35%	
	target year	achieved %#	target year	achieved %##	target year	achieved %##
Group I						
Croatia	2013	116	2016	108 (2014)	2020	108 (2014)
Cyprus	2010	126	2013	117 (2012)	2016	117 (2012)
Greece	2010	149	2013	144 (2012)	2020	144 (2012)
Group II						
Portugal	2006	75	2013	62 (2012)	2020	49 (2014)
Spain	2006	65	2009	47	2016	47 (2012)
France	2006	40	2009	38	2016	38 (2009)
Italy	2006	62 (2007)	2009	57	2016	33 (2014)
Denmark	2006	2	2009	0	2016	0 (2012)
Reference group						
Sweden	2006	12	2009	2	2016	1 (2012)
Netherlands	2006	28	2009	5	2016	4 (2012)
Switzerland	None	0	None	0	None	0
Belgium	2006	17	2009	ND	2016	22 (2011)
Austria	2006	10	2009	7	2016	4 (2014)
Germany	2006	0	2009	0	2016	0 (2012)

#: 2007: first year available

##: 2009: last year available

In Group II, Portugal was on schedule and the other four countries ahead of schedule to achieve the 75% target in 2006. France was ahead to such an extent that reducing the share of landfilled municipal waste target to achieve the new targets of 2009 and 2016 was reasonably achievable. The same may hold for Italy, but for both Portugal and Spain these targets seem unachievable. Portugal has invested a lot in other facilities, like incineration, composting and MBT plants for the treatment of municipal waste, but more efforts are needed. Denmark, on the other hand, does no longer landfill its municipal waste for quite some time: it is an exceptional case among the countries of our URBANWASTE pilot cases and performing even better that some reference countries. Denmark introduced many initiatives to move up towards the highest level of the waste hierarchy already before the turn of the century - obviously successful - and in 2013 it adopted the prevention strategy "Denmark Without Waste" that has been implemented by means of many projects.

All reference countries have been ahead of the schedule of the EU landfill targets in the past decade. Out of these countries, relatively most municipal waste is still landfilled in Belgium. Overall, the Country Fact Sheet raises the impression that Flanders is, on average, higher up in the waste hierarchy than the other two regions. In 2006, relatively more municipal waste was landfilled in the Netherlands than in all other reference countries, including Belgium, but that country made a significant catch-up effort that resulted in the very low proportion of 4% in 2014; the same as Austria. The other three reference countries - Sweden, Germany and Switzerland - arrived at amounts of landfilling of municipal waste that were negligible or nil in 2014. Actually, Germany and Switzerland already did so in 2006, the first target year of the Landfill Directive. Sweden landfilled more in 2006 but waste specific bans on landfilling of combustible and organic waste as well as the steep rise of landfill taxes have been very effective in the last decade. There are hardly any operating sites left in Sweden after those that did not comply these strict regulations were closed. EU targets do not apply to Switzerland, but no municipal waste has been landfilled in the country since 2004.

3.3.3.3 Recycling

Table 5 shows the percentages of the total amounts of generated municipal waste that was recycled in 2001 and 2014. The division into three groups of countries corroborates the idea that the economically more developed and more wealthy ones effectuate higher rates of recycling: higher rates not just require more comprehensive policies and a more adequate set of policy instruments but also availability of more money to finance expensive waste treating facilities.

Overall, recycling rates have increased in EU countries since the turn of the century with the expansion of the legal framework on waste management by the Commission. In the 14 countries included here, the increase was largest, roughly speaking, in the countries with medium values (Group II), and smallest in the reference countries that had already a high rate at that beginning.

To achieve the EU target of 50% of total generated waste being recycled in 2020, Italy, France and Denmark in Group II show good progress but need to accelerate their efforts in an effective way. The recycling rate in Spain has shown a very changeable pattern since 2007: it increased to 31% in 2007, varied between 40% (2008) and 27% (2011) and end up in 34% in 2014. But overall, both Spain and Portugal are still far away of achieving the 50% target: the plans and measures proposed in both countries' 3rd national WMP are requisite to move further forward. In both Denmark and the reference countries, waste management policies were formulated and policy instruments were implemented already in the 1980s and 1990s. As a result, all reference countries had achieved the EU 2020 target by 2014, and Austria and Germany already in 2001. After 2001, these two countries

interchanged their ranking: Austria had the highest rate in 2001 (62%) but as a notable exception to the big EU picture - the recycling rate has decreased since then - it lost its number one position to Germany.

Group I countries, finally, hardly practiced recycling in 2001. Since then, their performance has come along by leaps and bounds: actually, their progress in percentages was hardly less than in Group II countries. But the prognosis for Group I to achieve 50% recycling in 2020 is worse than for Group II: whereas for Italy, France and Denmark an acceleration of their efforts may suffice, this target is practically impossible to achieve for Group I countries. In Cyprus, efforts in making plans and attempts to introduce new regulation and to build new recycling facilities should be turned into action, and the opening of two new MBT plants in Greece between 2004 and 2006 that could have contributed to an increase of recycling needs to be extended with more investments in facilities.

Table 5: Recycling rates by type of waste in percentages, 2001 and 2014

	2001			2014		
	Total	Material	Organic	Total	Material	Organic
Group I						
Croatia	3 (2007)	2 (2007)	1 (2007)	17	15	2
Cyprus	3	3	0	18	13	4
Greece	9	8	1	19	15	4
Group II						
Portugal	12	4	8	30	14	17
Spain	22	11	10	34	16	17
France	26	14	13	42	23	19
Italy	18	12	6	42	26	16
Denmark	31	17	14	44	27	17
Reference Group						
Sweden	39	29	10	50	34	17
Netherlands	44	20	24	51	23	27
Switzerland	46	33	13	54	33	21
Belgium	49	28	21	55	34	21
Austria	**62**	**23**	**40**	56	**25**	**31**
Germany	53	38	15	64	46	18

When distinguishing the material and organic components of municipal waste, the recycling rate of material waste was higher than of organic waste in 2001 in all countries but one, and also raised more rapidly in most countries in the years up to 2014. Hence, progress in enhancing recycling rates is primarily due to trends in recycling of materials with bio-waste recycling performing less well. In Spain, recycling of material waste increased very steadily while that of organic was subject to such great fluctuations that it is hard to conclude a structural increase. And Austria was the most notable exception to the general observation: the amount of recycled organic waste was largest during this whole period, although the gap with material waste narrowed.

3.4 Conclusion

The comparison in this chapter of 14 countries - the eight 'URBANWASTE countries' and a reference group of the six best performing countries - is a subsection of the municipal waste policy review by EEA (2016) of all its 32 countries. Since the tourist industry as generator of waste is neither a separate field of national waste policy nor are data on this specific part of the municipal waste stream available, the comparison includes national policies and performances regarding the management of the undivided stream of municipal waste.

The list of policy instruments included in the review is far from exhaustive. Furthermore, country-specific uncertainties of the reported data are to the disadvantage of both their validity and comparability. Nevertheless, EEA (2016) observed a few 'messages' emerging from the review. This conclusion on policies and performances of the subsection of 14 countries is based on a combination of these messages and some key findings by EEA (2013) in an earlier report.

- There is no systematic difference in performance between countries with national plans and countries with only regional plans. What the comparison of those 14 countries does show, however, is that those that landfill least and recycle most introduced their first waste management plan earlier, before 2000, and have revised it more often since then. Thus, exactly these countries will not need to make an extraordinary and accelerating effort in order to achieve the EU target of landfill and recycling in the coming years. What is more, some already achieved these. For the late starters on the other hand, it will be extraordinary difficult if not practically impossible to achieve these targets. Which is not to say that there is only a time gap at stake; some started only when made mandatory by EU legislation and still lag behind EU targets for other reasons, e.g. a low level of organisation of municipal waste management, a lack of appropriate treatment facilities and budget to invest in new ones, a low level of environmental awareness of the population etc. In the case of Croatia, the date of entry in the EU plays a significant role.
- Overall, there are clear indications of a shift away from landfill towards waste management approaches higher up the hierarchy in the EEA countries. Declining rates of landfilling and increasing recycling rates go together. This observation also holds for the 14 countries in this chapter. Both taxes – although landfill more than and incineration tax – and PAYT schemes appear effective instruments to incentivise this shift up. As to PAYT, all EEA countries with recycling rates above 45% employ a similar system of sorts, while most countries with recycling rates below 20% do hardly use them (EEA, 2016: 6).
- EEA (2013) concludes for its 32 member countries that landfilling usually declines much faster than recycling grows. The explanation is that "waste management strategies mostly move from landfill

towards a combination of recycling and incineration, and in some cases also mechanical-biological treatment" (EEA, 2016: 5). This conclusion is much less obvious for the group of 14 countries. Landfill decreased much slower than recycling grew since the turn of the century both in the three countries (Croatia, Greece and Cyprus) with very high landfill rates – over 100% of the 1995 value - and in three countries (Denmark, Switzerland and Germany) at the other extreme, i.e. with already very low landfill rates. The picture is mixed for the other countries.

- Countries using a broad range of the instruments listed in Table 1 have a higher municipal waste recycling rate than countries using few or no instruments. However, the way in which policy instruments are combined may be more relevant than the total number of instruments. Hence, interactions between these policies within a waste management life cycle approach also counts.

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4. Current Waste Prevention and Management Practices in Pilot Cities

This chapter contains a description of the current waste prevention and management practices in the URBANWASTE Pilot Cases. The 11 URBANWASTE pilot cases are (in alphabetical order): Copenhagen (DK), Dubrovnik (HR), Florence (IT), Kavala (GR), Lisbon (PT), Nice (FR), Nicosia (CY), Ponta Delgada (PT), Santander (ES), Syracuse (IT) and Tenerife (ES; Municipalities of Adeje, Arona and Puerto de la Cruz).

Besides describing briefly some general characteristics of the pilot case areas, the description focusses on waste prevention activities that currently exist in the pilot cases as well on the municipal solid waste management. Attention is further paid on the organisation of waste collection from tourist establishments and touristic ships.

Definition of terms

According to the EU Waste Framework Directive (WFD, 2008), **waste "prevention"** means measures taken before a substance, material or product has become waste, that reduce:

(a) the quantity of waste, including through the re-use of products or the extension of the life span of products;

(b) the adverse impacts of the generated waste on the environment and human health; or

(c) the content of harmful substances in materials and products;

"Re-use" means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived (WFD, 2008).

Further definitions for terms such as "metropolitan area", "tourist establishments", "touristic ships" or "municipal solid waste (MSW)" are provided in the **Glossary**.

Waste prevention and management strategies can be designed and implemented by using one or a combination of various **policy instruments and measures**. In accordance with Reisinger and Krammer (2007) as well as Salhofer et al. (2010), to classify the waste prevention activities that are currently existing in the URBANWASTE pilot case the following categories are used.

1. **Regulatory instruments**: enforcing limits on waste generation and expanding environmental obligations, ensure law enforcement, introduce new regulatory approach, Public-Private Partnership approach
2. **Economic Instruments**: applying the "Polluter Pays Principle" for waste generators (e.g. Pay-as-you-throw schemes and tax on waste disposal) and providing financial and logistical support for beneficial initiatives;
3. **Infrastructural/Technological Instruments**: introducing the most suitable technical solutions for implementing sustainable waste management schemes and supporting good practice implementation

thanks to the use of IT tools or other enabling technologies targeting tourists, citizens and service providers

4. **Information Instruments**: aimed to change behaviours and make informed decisions. In particular, the strategies will include two main action lines: Waste prevention and reuse.
5. **Voluntary Agreements**: agreements between industry and the authorities or self-commitments of industry

4.1 Copenhagen (DK)

Trine BJØRN OLSEN

4.1.1 Brief description of the URBANWASTE pilot case area

Copenhagen, the capital of Denmark, is a municipality characterised as a metropolitan area. The area of Copenhagen is 86.2 km2[2]. The total number of inhabitants by first day in the fourth quarter the recent three years were[3]:

2014 (Q1): 579,513

2015 (Q1): 589,699

2016 (Q4): 601,448

The waste management in Copenhagen is continuously improved through strategic plans in accordance with national and European objectives for waste and resource management. Danish waste management plans are revised every four years.

The City of Copenhagen is ambitious in the field of resource and waste management as well as sustainable actions. The current Resource and Waste Management Plan 2018, approved by the City Council of Copenhagen, has been introduced for the period 2013-2018. The plan outlines the objectives of waste prevention and increasing the share of materials for recycling:

- Waste for incineration should be reduced by 20% by 2018
- At least 45% of the household waste should be recycled by 2018

The initiatives in the plan ensure that by 2018 approximately of 90,000 tonnes of waste a year are separated for other treatment than incineration, including waste prevention measures.

The municipality has the vision of becoming zero waste city by 2050. Circular economy and environmental sustainability are important focus areas in this context. The Resource and Waste Management Plan also

[2] *StatBank Denmark: http://www.statistikbanken.dk/statbank5a/default.asp?w=1440*
[3] *StatBank Denmark: http://www.statistikbanken.dk/statbank5a/default.asp?w=1440*

interplays with other strategic plans in the municipality, not least the Climate Plan, aiming at Copenhagen becoming carbon neutral by 2025.

Currently all households segregate recyclable fractions at source and more fractions will be introduced with the development of new technologies for waste separation. The MSW fractions are collected from kerbside and from recycling stations.

The businesses in Copenhagen are obliged to manage their own waste in compliance with the municipal waste management system. Businesses are free to hire a private company collecting the waste for treatment but source segregation in recyclable fractions is compulsory. The businesses are also obliged to secure documentation that the recyclable fractions are actually being recycled.

At the moment, prevention of food waste is a main issue for both households and businesses. A range of measures are taken helping different stakeholders to prevent food waste e.g. social supermarkets, mobile phone apps, restaurants providing guests with doggy bags, teaching households as well as staff in large kitchens to use food items close to "best before"-date.

Incineration of non-recyclables is also an essential part of the waste management system. Danish households are mainly supplied with district heating from an extensive pipeline network and co-generation of heat and power (CHP) ensures a high rate of energy recovery from the combustion process. At Amager Ressource Center in Copenhagen the world's most energy efficient incinerator will be put into operation from 2017 onwards.

Regarding tourism, Copenhagen hosted around 7 million overnight stays in 2014 and the number is increasing. On average, tourists stay in Copenhagen for 3.5 days. Summer is high season peaking in July. Tourism is an integrated part of the activities in Copenhagen and therefore waste management from tourists is not a sector by itself. Several hotels in Copenhagen have the Green Key eco-label and some have the Nordic Swan eco-label. The City of Copenhagen has made a targeted effort to help hotels introduce waste separation to their operations.

4.1.2 Description of Waste Prevention Actions

Table 6: Waste prevention activities in Copenhagen

Name of activity	Description	In place since …	Affected waste stream	Category	Source
More reuse	The City of Copenhagen promotes more reuse through 3 initiatives: • Residents are encouraged to hand in items to swap facilities at local recycling hubs. • Three new local recycling hubs are being established • Bricks from demolition sites are reused	2013-2014	MSW	Informational Infrastructural	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Less food waste	The potential for reducing food waste is utilized by: • Cooperation with retailers on reduction of food waste • Campaign for reduction of food waste from households	2013- 2014	Food waste	Regulatory Informational	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Resource consciousness in procurement	The City of Copenhagen enter into partnerships with private players to prevent resource waste by: • Deposit-refund schemes for packaging • Resource minimising requirements in procurement policies	2013- 2014	Plastics	Regulatory Economic	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Promoting environment-tally and socially responsible procurement	The City of Copenhagen has set a paradigm for environmental and climate requirements that must be integrated in any tender document from the municipality. Copenhagen is part of Partnership for Green Public Procurement which is based on shared obligating green purchasing goals. The goals are automatically adapted into the city's tendering requirements.		Food and groceries, transport, building and construction materials, sustainable wood, cleaning products, kid's products, IT, lighting, kitchen equipment, paper and printed matter	Regulatory	Environmental and climate requirements for tendering in the City of Copenhagen (internal document) Partnerskab for Offentlige Grønne Indkøb: http://www.gronneindkob.dk
Too Good To Go - Avoiding food waste	BC Hospitality Group is cooperating with Too Good To Go, an environmental social enterprise dedicated to reducing food waste.		Food waste	Informational	BC Hospitality Group : http://www.bchospitalitygroup.dk/en-GB/Frontpage.aspx Too Good To Go : http://toogoodtogo.dk CSR Manager, Mireille Jacobsen : mij@bchg.dk
Green Key	40 hotels (approximately) and 5 conference centres in Copenhagen have the Green Key eco-label				Green Key : http://greenkey.dk

Name of activity	Description	In place since …	Affected waste stream	Category	Source
The Nordic Swan Ecolabel	All 5 Scandic Hotels in Copenhagen have the Nordic Swan Ecolabel. 67% of the waste from Scandic Hotels is recycled				Nordic Ecolabel: http://www.ecolabel.dk/da/produkter/hotel-og-restaurant-m-m Scandic Annual Report 2015: http://www.scandichotelsgroup.com/en/sustainability/
Green Globe	4 hotels have a Green Globe certification				Green Globe : http://greenglobe.com/europe/
Other environment friendly labels: Det Økologiske Spisemærke (Organic Food Label)	23 cafés, 14 restaurants and 10 hotels have the Danish state-controlled organic food label. 18 of these establishments serve >90% organic food.				Det Økologiske Spisemærke : http://www.oekologisk-spisemaerke.dk/om-spisemaerket/hvad-er-det-okologiske-spisemaerke
Less disposable cups	Recyclable cups are used for all kinds of beverages served within Tivoli. The cups are returned in vending machines that return the deposit to the guests. The cups washed and sent into circulation again.	1998	Plastics	Informational Economic	Tivoli: http://www.tivoligardens.com/en/om/virksomheden/csr

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4.1.3 Description of Municipal Solid Waste Collection

The definition of MSW in Copenhagen is consistent with the definition in the Glossary of this report.

- Responsibility for the collection of MSW

Copenhagen municipality is responsible for MSW collection from all households, public institutions and small businesses located in residential buildings, if the amount of waste is similar to that of a household. The collection is operated by private hauliers having a contract with the municipality.

All other businesses are responsible for organising collection of their own waste and for hiring authorized hauliers to undertake the service.

- Changes of waste collection services during the year because of tourism

The tourist flow of Copenhagen is spread over the whole year. Summer is high season peaking in July. No special collection service is organized in relation to tourism except for reinforcements in connection with special events e.g. Copenhagen Marathon, festivals, concerts etc.

- Possibility of linking collected volumes / mass of waste to waste generators

The municipality is currently conducting tests with containers tagged with microchips to register when containers are full and need to be emptied. The tests are run for defined areas, not for the whole city.

- Collection system used for the different types of waste fractions

The following waste fractions are collected separately:

Table 7: Collection system for different waste fractions in Copenhagen

Kerbside collection from households:	Collection from recycling stations:
• Residual waste • Metals • Plastics • Smaller WEEE • Cardboard • Paper • Hazardous waste • Batteries • Glass (also from public collection points) • Organic/food waste (from September 2017) • Garden waste • Bulky waste (on demand)	• Small combustibles • Hazardous waste • WEEE and cables • White goods • Bulky waste • Metals • Paper • Cardboard • Glass • Garden waste • PVC • Tyres • Construction and demolition waste • Wood for recycling • Impregnated wood • Plastic • Textiles • Waste for landfilling

- Other options available for households to give away certain types of waste

Other options for giving away reusable products and items:

- There are many second-hand and antiques shops in Copenhagen receiving clothes, books, furniture and other reusable items, reselling them either for charity (e.g. Red Cross, Save the Children) or as customary revenue based business.
- In Denmark beverage packaging like beer- and soft drink bottles/cans are included in a deposit system and not regarded as a part of the waste management system. Beverage cans and bottles are collected separately at supermarkets and grocery stores where people bring it and get back their deposits. The deposit system is state-controlled and regulated through the Danish Environmental Protection Act.

- Composition of residual waste

The fractional composition of residual waste in Copenhagen was last measured in 2015:

Table 8: Composition of residual waste in Copenhagen (2015)

Fraction	%	Fraction	%
Advertisements	2.07	Milk cartons (carton/plastic)	1.82
Aluminum foil and containers	0.49	Newsprints	2.14
Animal excrements and bedding (straw)	1.15	Non-recyclable glass	0.39
Animal derived food waste	9.07	Non-recyclable plastic	5.33
Ash	0.39	Office paper	0.46
Batteries	1.16	Other clean cardboard	0.33
Beverage cans (aluminum)	0.40	Other clean paper	0.86
Books, phone books	0.09	Other combustibles	1.32
Brown glass	1.03	Other metals	0.93
Cat litter	1.79	Other non-combustibles	0.69
Ceramics	0.72	Paper and carton containers	1.03
Cigarette butts	0.31	Plastic bottles	0.75
Clear glass	1.03	Plastic products (toys, hangers, pens)	0.89
Cotton, bandages	0.22	Plastic-coated aluminum foil	0.74
Diapers, sanitary towels, tampons	9.81	Rubber	0.09
Dirty cardboard	0.98	Shoes, leather	0.67
Dirty paper	1.37	Soft plastic	5.16
Disposable sanitary products (cloths, gloves)	0.40	Soil	0.45
Food cans (tinplate/steel)	0.15	Stones, concrete	1.02
Green glass	1.03	Textiles	3.59
Hard plastic	0.29	Vacuum cleaner bags	1.16
Juice cartons (carton/plastic/aluminum)	0.54	Vegetable food waste	28.53
Kitchen towels	1.99	Wood	0.57
Magazines	0.58	Yard waste, flowers	4.02

Waste treatment in Copenhagen:

- Treatment of residual waste

Waste combustion is an integrated part of the Danish energy system. Residual waste from the City of Copenhagen is incinerated at two local CHP plants; Amager Ressource Center in Copenhagen and Vestforbrænding located in the greater Copenhagen area (Glostrup municipality) producing district heating and power for the supply network.

Waste for landfilling is deposited at AV Miljø with is also located in the greater Copenhagen area (Hvidovre municipality).

- Treatment of recyclables

All recyclables are exported from the City of Copenhagen to other locations in Denmark or outside the country for further treatment. The recycled fractions are:

- WEEE and cables
- White goods
- Metals
- Paper
- Cardboard
- Glass
- Rigid PVC
- Tyres
- Construction and demolition waste
- Wood for recycling
- Rigid plastic
- Textiles

- Management of street bins and street sweeping

Waste collected from street bins is considered a part of MSW. Street bin waste is sent for incineration without further segregation.

Waste from street bins and street sweeping is not under the waste authority's administration, but falls under another department in The Technical and Environmental Administration in the City of Copenhagen.

Some seasonal variations are seen in street sweeping waste as leaves make up a large share in autumn and road salt alike during winter. Apart from this, street sweeping waste mainly consists of grit. Litter is considered part of the street sweeping waste and therefore not included in the definition of MSW as presented in the Glossary of this report.

Table 9 shows further waste management activities in Copenhagen.

Table 9: Waste management activities in Copenhagen

Name of activity	Description	In place since …	Affected waste stream	Category	Source
Municipality: Copenhagen					
Better separation options in apartment blocks	Better and easier accessible waste separation is facilitated by: • Containers for plastics, metal and small WEEE • Increased collection of hazardous waste • Better labels and signs • Review and optimisation of waste schemes	2013	Plastics Metals WEEE Hazardous waste	Informational Infrastructural	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
More options for separation in single family houses	Better and easier waste separation in single family houses is facilitated by: • Collection of plastics and metal • Better waste collection service • Optional cardboard containers	2014-2015	Plastics Metal Cardboard	Informational Infrastructural	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Integration of waste solutions in the urban space	Waste solutions are adapted to the specific areas in public space and easier access to information about waste solutions is introduced for developers of new building projects: • More waste separation options for the inner city • Multifunctional waste solutions in public spaces • Clear common guidelines about waste solutions	2013-2015		Informational Infrastructural	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
More separation in business community	More separation of waste from businesses for recycling is encouraged by dialogue and information • Information for new businesses • Cooperation with industrial organisations • Intensified supervision and enforcement • Customization of recycling centres	2013-2014	Various fractions	Informational	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Cleaner construction- and demolition waste	Cooperation with the construction sector for better separation and more responsible handling of waste by: • Environmental surveys of municipal buildings • Introduction of PCB strategy • Stricter environmental requirements for municipal building projects • Better control of waste streams	2013	Construction and demolition waste Hazardous waste	Informational Regulatory	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf

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Name of activity	Description	In place since …	Affected waste stream	Category	Source
Noise-free and zero-carbon waste collection	Alternative fuels and smarter collection methods are tested and introduced	2013		Infrastructural	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Improved bulky waste collection for better recycling	The collection method of bulky waste is improved in order to enhance recycling	2013	Bulky waste	Infrastructural	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
New waste treatment centre in Amager	Enhanced reception control and establishment of facilities for waste separation and recycling in connection to the new waste incineration CHP plant at Amager Ressource Center	2013-2015	MSW	Infrastructural Economical Informational	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Improved WEEE control	Cooperation with external players to avoid illegal transport and treatment of WEEE • Surveillance • Information	2013-2017	WEEE	Regulatory Informational	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
More waste outlets and development of new treatment options	• Stricter requirements in tenders for collected waste • Survey of new recycling options • Influencing behaviour on private waste treatment plants	2013	MSW	Regulatory Informational	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Establishment of Sydhavn Recycling Centre (flagship project 1)	A centre for innovation, knowledge, and green growth in the resource and waste field is being established in the Sydhavn quarter. By 2018 the centre is expected to receive 22,000 tonnes of waste a year of which 10% is reused directly.	2015	MSW	Informational	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Copenhageners separate waste (flagship project 2)	By 2018 at least 4,500 school children will be taught how to separate waste correctly thus making waste separation a natural part of everyday life. Caretaker networks are established. Residual waste quality is monitored and analysed regularly.	2013-2016	MSW	Informational	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Biowaste and biogas fuelled heavy transport	At least 25,000 tonnes of organic waste should be separated for biogas production by 2018. Choice of scenario for bio-waste collection, biogas generation and utilization technology is currently considered.	2013-2016	Food waste Bio-waste	Infrastructural	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf

Name of activity	Description	In place since …	Affected waste stream	Category	Source
(flagship project 3)					
Prevention and recycling of plastic waste (flagship project 4)	15,000 tonnes or 35% of the plastics from residual waste should be separated and recycled by 2018 by means of a specialized separation system, development of a roadmap tool, better collection programmes and information (Life+ project).	2013-2014	Plastics	Infrastructural	Resource and Waste Management Plan 2018: http://kk.sites.itera.dk/apps/kk_pub2/pdf/1184_LfcAsFCDJS.pdf
Amager Bakke	Amager Ressource Center has built in recreational elements into its architecture by constructing a rooftop skiing slope and hiking track and a climbing wall at the CHP plant, in this way making the waste treatment facility an integral part of the city experiences	2017		Informational	Amager Ressource Center: https://www.a-r-c.dk
REnescience	Amager Ressource Center has a pilot biogas plant processing unsorted MSW. The pilot provides data and knowledge for further development and upscaling of biogas production from unsorted MSW	2009	MSW Bio-waste	Infrastructural	Amager Ressource Center: https://www.a-r-c.dk REenscience: http://www.renescience.com/en
Dansk Retursystem	Danish Retursystem collects returnable beverage packaging in Copenhagen. In 2016 they purchased their first biogas fuelled truck to serve the collection route.	2016	Bio-waste	Infrastructural	Dansk Retursystem: https://www.danskretursystem.dk/en/sustainability/climate-friendly-energy/
REN kærlighed til KBH ("PURE love for CPH")	Development of joint solutions and shared experience in cooperation on common issues concerning waste in the city e.g. public bins and containers, events, information, nudging etc.	2012	MSW	Informational	REN kærlighed til KBH: https://www.facebook.com/renkaerlighedtilkbh/
Biogas from food waste	Food waste from the kitchens at Bella Center Copenhagen, AC Hotel Bella Sky and Hotel Crowne Plaza Copenhagen Towers is collected and utilized for biogas production.		Food waste	Infrastructural	BC Hospitality Group : http://www.bchospitalitygroup.dk/en-GB/Frontpage.aspx CSR Manager, Mireille Jacobsen : mij@bchg.dk

4.1.4 Collection of Waste from Tourist Establishments

Like other businesses most tourist establishments like e.g. hotels have made arrangements with private waste collectors though some are serviced by the municipal waste collection.

In general, all companies have a responsibility to sort their waste properly and make sure that it is treated environmentally appropriate. The waste from businesses should at least be separated into:

- residual waste
- paper
- cardboard
- rigid plastic
- glass
- garden waste
- cooking oil
- organic waste (food waste)
- hazardous waste
- plastic sheeting
- metal
- WEEE

Companies are allowed to use the municipal recycling centres if the total weight of the waste, vehicle and trailer combined does not exceed 3500 kg at a time.

The City of Copenhagen does not have the full overview of which types of waste are separately collected from the different types of tourist establishments.

4.1.5 Description of waste from touristic ships

Approximately 1% of the tourists in Copenhagen arrive by ship.

The harbour management, CPH City & Port Development[4], is responsible for the collection of waste from cruise ships. The collection is provided by private hauliers.

The waste fractions collected from cruise ships are:

- Light bulbs
- Metals
- Glass
- Cardboard
- WEEE
- Hazardous waste
- Rigid plastic (mostly PET)
- Ashes from waste incineration on board

Information on the composition of waste from touristic ships is not available.

[4] http://www.byoghavn.dk/english.aspx

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4.2 Dubrovnik (HR)

Erneszt KOVÁCS

4.2.1 Brief description of the URBANWASTE pilot case area

Dubrovnik-Neretva County is the southernmost county in the Republic of Croatia, adorned by the blue-green landscape, valuable cultural and natural heritage and tremendously rich history. The county covers a total area of 9,272.37 km^2, of which 7,489.8 km^2 or 80.78% belongs to the Adriatic Sea, and has the population of 122.568.

The whole area used to be a republic for itself called the Republic of Ragusa, which was an important Mediterranean force from the 13th century onwards. This maritime society had highly expressed ethical and human values, with liberty as the highest worth. Ragusa was the first in Europe to abolish slavery (1416). Its motto was "Non bene pro toto libertas venditur auro" – "Liberty is not well sold for all the gold". This republic made one of the first medieval sewer systems (1296), while other major cities across Europe had little or none awareness for the disposal of this type of waste. Today, 29% of the area is under NATURA 2000 protection and managed to preserve its beauty with very indented coastline that varies from sheltered bays, sandy beaches of exotic beauty, steep shoreline with cliffs facing the open sea, islands, forest parks, reserves and its gracefulness of numerous fortifications, civil structures, religious buildings, summer residences… Our pilot case boasts of with the World Heritage Site (Old City of Dubrovnik) with its medieval, 6 meters thick and 2 kilometres long walls that have been popular filming site for Game of Thrones series, the latest episode of the Star Wars franchise and will become Nottingham Castle in the new Robin Hood blockbuster.

4.2.2 Description of Waste Prevention Actions

Dubrovnik Neretva County has no waste prevention activities in place at the moment and the only actions that could be considered as such are voluntary agreements and commitments, such as ISO standards and Green Key, from hotels or other institutions.

4.2.3 Description of Municipal Solid Waste Collection

According to the county's interpretation and **definition of municipal solid waste**, it is defined as waste generated in households and waste that has its composition and quality similar to the waste from households, except industrial waste and waste from agriculture and forestry. Mixed municipal solid waste, on the other hand, is household waste and waste from commerce, industry and institutions which has properties and composition similar to waste from households in which the individual waste streams are not isolated. Municipal solid waste in the county also includes litter.

Municipal waste collection is within the local authorities' responsibilities. All local government units in Dubrovnik Neretva County (22 of them) have a waste management and collection responsibility. There are also private companies that are authorised and in charge of specific kind of waste collection, such as cooking oils, electric and electronic waste, etc. All these companies cooperate with the touristic sector (e.g. hotels, restaurants) since there are no specific industry facilities in the County. These services of municipal waste

collection extend beyond solely household waste collection to similar establishment producing waste similar to household waste (commercial activities, office buildings, schools, government buildings, small businesses etc.). The collection frequency and intensity increases with the high touristic season (June – September) and adapts to the required situation.

Unfortunately, **tracking of the created volumes of waste and the identification of their generators is not yet possible**, as the County has no such technology (e.g. containers with optical codes, chip readers) installed on its territory. The weighed amounts of waste are not at the County's disposal either.

The Department for Environmental and Nature Protection of Dubrovnik Neretva County issues municipal waste management licences, as well as licences for special categories of waste to private companies. For hazardous waste the licences are issued by the Croatian Ministry for Environment and Nature Protection. From 2011 to 2014 the number of companies licensed for municipal and non-hazardous waste varied between 8 (2011) and 13 (2013) in the County. In 2014, 11 companies had a license for municipal and non-hazardous waste which is the same number of companies licensed in 2010. The number of companies licensed for municipal and non-hazardous waste has, therefore, not changed significantly from the previous reporting period (2007 - 2010). The total amount of collected municipal waste in the County in 2011 amounted to 61,332.89 tonnes, 67,955.12 tonnes in 2013 and 64 942.19 tonnes in 2013. If the data from the previous study period (2007 – 2010) is taken into account, when the amount of collected municipal waste was between 68,000 tonnes and 80,000 tonnes, it can be concluded that there is a trend of reducing the total amount of collected municipal waste in the County.

The **waste streams that are separately collected** are listed below. This list comes from the latest Regulation of categories, types and classification of waste with a waste catalogue and list of hazardous waste, released by the national Ministry of Environment.

- Paper and cardboard
- Glass
- Biodegradable waste from kitchens and canteen
- Clothing
- Textile
- Solvents
- Acid
- Alkaline
- Photographic chemicals
- Pesticides
- Fluorescent tubes and other mercury containing waste
- Discarded equipment containing fluoro-chlorohydrocarbon
- Cooking oil and fat
- Oil and fat
- Paint, inks, adhesives and resins
- Detergents
- Cytotoxic and cytostatic
- Medicines
- Batteries and accumulators and
- Unsorted batteries and accumulators containing these batteries
- Discarded electrical and electronic equipment
- Wood
- Plastic
- Metals
- Electronic equipment (e.g., circuit boards)
- Packaging waste

Separate collection activities are described and updated yearly in the environmental report released by the County. The latest available one is from November 2015. It reports on 8 local authorities (out of 22) which have

implemented a partial selective collection scheme for paper, plastics, glass, textile and metal by setting up bring banks. However, according to the report, these are not accessible for all the residents. The city of Metković has also installed wired containers for paper collection and containers for glass and plastic packaging, as well as metals which is collected by a private concessioner.

14 local authorities (out of 22) do not have any separate collection schemes in place, except for bulky waste. Separate collection of bulky waste is being provided by a majority of local authorities from once a week to twice a year, in some cases. Bulky waste is being discharged in landfills where certain parts are being removed and passed on private concessioners.

Most of the total amount of collected municipal waste generated in the County over the years was disposed in landfills (more than 90%) and only about 7% of municipal waste was sent for recovery. However, according to the Croatian Agency for Environmental Protection's report, an estimate of the total rate of recycling municipal waste is significantly higher in 2013, at around 15% (there is no more recent data available).

Kerbside collection is applied to mixed municipal waste and separated waste. There is only one recycling yard in which citizens can personally dispose of certain wastes. This recycling yard – the first one opened in Dubrovnik Neretva County, started working in July 2016 but it only covers the city of Dubrovnik. There are still no data available from this facility for this publication. Like elsewhere in Croatia, plastic packaging (PET bottles) can be returned to shops for a recovery of 0.50 HRK per bottle (€¢ 7). There is no data available on the composition of residual waste.

The collected residual waste is landfilled and, in terms of statistics, appears in the total landfilled amounts presented above. The County has one landfill Grabovica, which is not sufficient and which already shows signs of being outdated and a threat for the environment. By the end of 2017, the County should see a competition of a brand new regional recycling centre which will provide the entire County with proper waste management treatment. Furthermore, the centre will include an artificial marshland for remediation of waste waters from hotels and other touristic facilities, produce fertiliser and let the water into sea once it meets necessary quality standards.

Since Dubrovnik Neretva County only has landfills as a destination for the waste generated on its territory, without any official and certified facility for recycling and recovery of certain waste streams it is forced to transport and export to neighbouring and other counties in Croatia. However, one recycling yard has been opened in July 2016. Apart from transporting to other counties, one part of the Dubrovnik Neretva County (Pelješac peninsula) is exporting its waste to another country, where it is disposed in a landfill in a non-registered and non-certified disposal area. Data on the fractions and their destined treatment options are not available for the publication, as the operation is done by a private company.

When it comes to treatment options for **waste coming from street bins and street sweeping**, the local authorities are responsible for its management and it is classified into 4 categories:

- Road waste (dust, dirt, mud …) which occurs as a result of weather conditions and the traffic
- Seasonal waste (leaves, twigs …) which occur due to weather conditions or human activities and is associated with certain seasonal variations
- Random waste (empty cigarette boxes, cigarette butts, matches, tram tickets, oil residues from vehicles …) as the result of traffic of pedestrians and vehicles and littering in general
- Unusual waste which is usually bulky waste that occasionally and irresponsibly appears in the streets after being rejected.

This waste stream and the categories are affected by seasonal variations what reflects in a nearly 400% increase of mixed municipal waste in the summer season, like in the city of Korčula in July and August, or less – 150% in the municipality of Mljet. The city of Dubrovnik has a seasonal increase of 50%.

4.2.4 Collection of Waste from Tourist Establishments

The waste from tourist establishments is covered by municipal waste collection. The hotels and restaurants can also contract authorised private companies that handle specific kinds of waste and these companies can further pass on the collected waste to specific facilities for its recovery or disposal. All the major recovery and disposal facilities are located in other parts of Croatia while there is none in Dubrovnik Neretva County. The data that we have available on specific waste fractions are from the Croatian Registry of Environmental Pollution of the Croatian Environment Agency. This data is taken with caution since 2015, as these companies must report the quantities of particular waste only when they cross the threshold of 20 tonnes of non-hazardous waste, and 0.5 tonnes of hazardous waste in the current year. As long as they do not reach the threshold, the companies are not required to report it.

4.2.5 Description of waste from touristic ships

Waste from cruise ships is under the responsibility of the Luka Dubrovnik d.d. company (the Port of Dubrovnik). This company is concessionaire of the port area and the waste collection is part of the activities of the concession. The collected waste is managed as the waste they produced. Until 2016, Luka Dubrovnik d.d. delivered the collected waste to the official communal company of city of Dubrovnik as municipal waste. Same as all other waste from city of Dubrovnik, these waste have been further sent to landfill Grabovica (data reported in the Registry of Environmental Pollution). From 2016 onwards, Luka Dubrovnik began to collect waste from the cruise ships separately and deliver it to authorized companies for certain categories of waste. The County does not have any official data or information for now because the data on waste types and amounts are reported to the Registry of Environmental Pollution in early 2017.

4.3 Florence (IT)

Claudia DE LUCA

4.3.1 Brief description of the URBANWASTE pilot case area

Regione Toscana is full partner in URBANWASTE, but the analysis of urban metabolism and the implementation of the strategies will take place in the city of Florence. Florence is located in a basin surrounded by hills and bisected by the Arno River. The historical centre contained in medieval walls gathers the most important cultural heritage of the city. The historical centre was declared a Word Heritage Site by UNESCO in 1982.

Within an area of around 100 km², Florence counts 377.207[5] inhabitants although in 2015 Florence was visited by 9 million of tourists of which 76% were foreigners. The largest number of tourists come from the United States of America, followed by those from the United Kingdom. However, the flow of Chinese tourists is in constant growth. The type of tourism is mainly cultural: museums, churches and works of art are the main attractions of the city. The Uffizi museum alone has welcomed almost 2 million visitors in 2015. The period of greatest influx of tourist is from April to October, but there are many tourists also in other months. There are different types of tourists who visit the city of Florence: family, individual or organized tour. The residence time varies too: there are weekend tourists, transit tourist and visitors staying one week or more. The residence time is on average 2.5 days.

4.3.2 Description of Waste Prevention Actions

Green Public Procurement (GPP)

In order to make the GPP targets more compelling, the Tuscany Region has issued the Regional Law n. 37/2012 on "Green purchases and guidelines for sustainable purchases in the public administration. Amendments to the Regional Law n. 38 of the 13 July 2007". The article 3bis reads as follows: In order to enhance the protection of the environment, the Region promotes the integration of public procurement with environmental concerns and initiatives to orient citizens and operators of the public administration towards an environmentally sustainable behaviour, in compliance with European regulations and the national transposing law;

The same Article 3 further introduces an important provision: To promote and encourage the advancement of a responsible behaviour towards the environment, in all cases where incentives are provided by the Region to local authorities, for actions that envisage procurement procedures for the acquisition of works, supplies and services involving green purchases, in the call the financing mechanism is subjected to a minimum percentage of at least 35% of green purchases.

[5] *ISTAT 2014 http://www.istat.it/storage/urbes2015/firenze.pdf*

Eco-labels and similar

No hotel in Florence has been awarded by the EMAS certification, while two hotels have received the Greenkey award: The Westin Excelsior Florence, St Regis Florence.

According to the GreenLeader Program of TripAdvisor, 1 hotel received the Bronze Green Lead, while 3 hotels received the Silver Green Lead, and other 3 the Gold Green Leave. The prevention actions most commonly identified are:

- Heating temperature set to save energy
- Education for guests on green practices
- Composts biodegradable products (e.g. packaging)
- Linen reuse program
- Recycles
- Tracks energy use
- Locally produced toiletries
- Water-efficient bathroom fixtures
- Staff training on green practices
- ISO 14001 Certified
- Efficient ventilation system
- Electric car charging station
- Air conditioning temperature set to save energy
- Towel reuse program
- Local plants in garden
- Energy saving guest room controls
- Energy-efficient lightbulbs
- Efficient laundry dryers
- Composts food waste
- Toiletries w/ recycled packaging
- Composts biodegradable products (e.g. packaging)

Further waste prevention actions

Further improvements have been made in national legislation, and in particular with the so-called environmental provision attached to the stability law for the year 2016 (L.221 / 2015) on "Environmental conditions to promote green economy measures and for the limitation of the excessive use of natural resources".

The Tuscany Region has financially supported projects for the reduction and prevention (of waste production). In particular, from 2007 to 2010, 221 projects have been selected for funding, being distributed as follows:

- 106 for the construction of 220 fountains and providers of high quality water;
- 52 related to the distribution of 20,000 domestic composters;
- 23 to 30 interventions in school canteens and 10 eco festival;
- 15 for the construction of eco-centres (centres for the reparation, exchange and distribution of unsold material)
- 25 for other reduction interventions (communication, environmental education, reducing paper in public offices);

Dedicated resources amounted to approx. 7.5 million Euros.

In Table 10, some prominent waste prevention activities in Florence are presented in a bit more detail.

Table 10: Waste prevention activities in Florence

Name of activity	Description	In place since …	Affected waste streams	Category	Source
Home composting	Home composting has been promoted through the city		Organic matter	Informational	Regione Toscana
Use of Tap Water	Reduce the use of water in plastic bottles with public drinking fountains of high quality water installed in the municipality main public spaces.		Plastic	Informational	Regione Toscana
Waste-Less in Chianti	The implementation and monitoring of an integrated programme for waste reduction in the municipalities of Florentine Chianti. Several activities in place: tap water and composting promotion, exchange market organization, GPP in the municipalities involved, etc.	2011	Several	Informational Regulatory	http://www.wasteless-in-chianti.it/eng/index.aspx

4.3.3 Description of Municipal Solid Waste Collection

The definition of MSW in Florence is consistent with the definition in the Glossary of this report.

Within the metropolitan area of Florence, the responsible for collection of MSW is the local waste management authority and it covers both the collection from households and from similar establishments (e.g. Schools, offices, hotels, etc.). There are no particular change and/or reinforcement of the waste collection services during the year because of tourism seasonality.

Concerning the possibility to link to collected volumes to certain waste generators, the containers are tagged with optical codes, but the waste is not directly weighed when being collected.

Separate collection

The following fractions of MSW are collected separately:

- paper and cardboard,
- glass,
- food and garden waste,
- green waste,
- clothing/textiles (providing clothing to charity is also an option available),
- hazardous waste,
- co-mingled fractions of recyclables (metals and plastics are collected together)

Overall data on the composition of residual waste are not available because they depend on the type of collection system used (door to door, underground bins etc.).

Paper, organic, multi-material and unsorted waste are collected through:

- Underground bins (historical centre)
- Up loader with volumetric access control (urbanized area)
- Door to door/proximity (urban area with low density)

Bulky and Green waste are collected through:

- Collection centre
- Service on demand

WEEE, expired drugs and batteries are collected through:

- Collection centre
- Eco-van (an equipped vehicle)

Waste Treatment

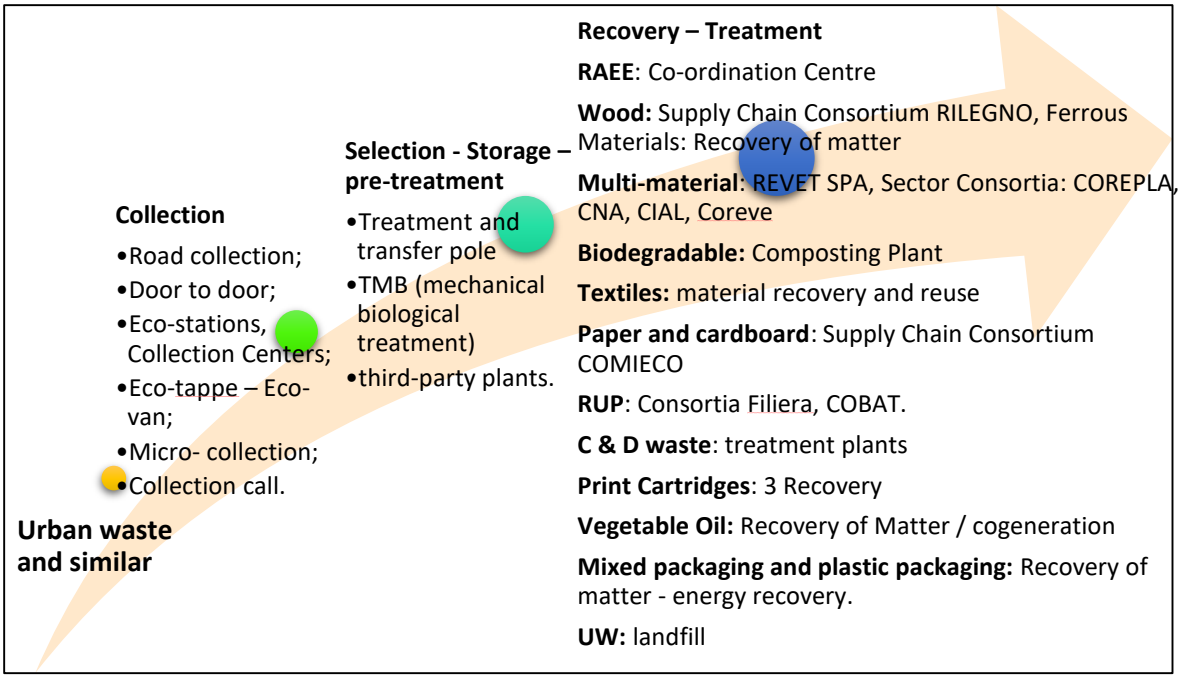

Figure 2: Urban waste collection, storage and treatment in Florence

Figure 2 considers the collection, selection-storage and treatment systems and responsibility of the waste management system in Florence, while Figure 3 is better explaining how the different materials are treated. As one can see, most of the materials are following 4 different pathways:

- energy recovery (mostly in relation to light multi-material and non-recyclable plastics)
- recycling (paper, glass, and plastic)
- composting and anaerobic treatment (organic matter)
- landfill

Considering only the unsorted urban waste, Figure 4 well described the respective treatment processes. Most of it is treated and then disposed into landfill and or use for energy recovery.

All the waste fractions are treated and disposed within Tuscany region.

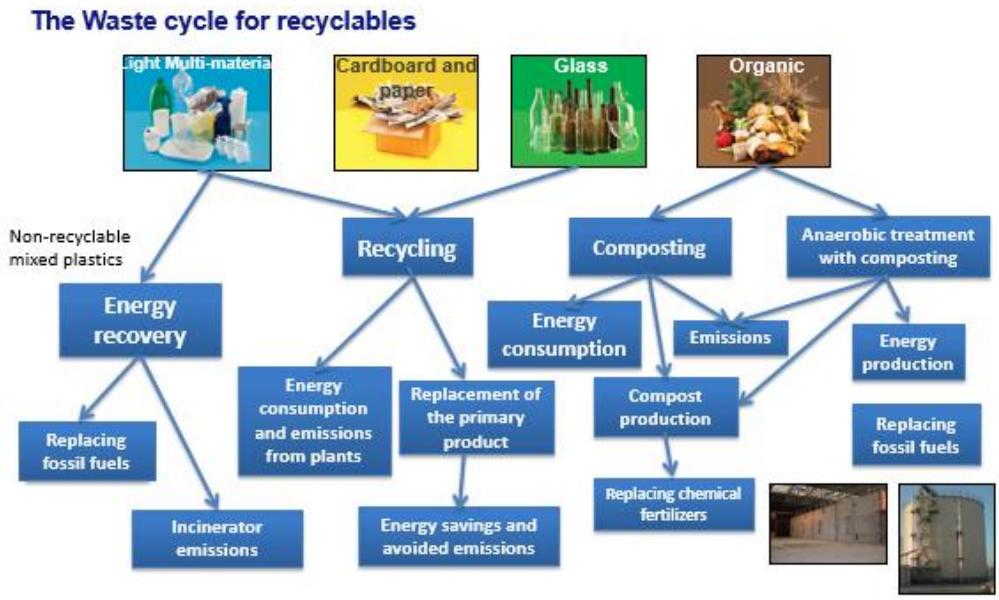

Figure 3: Waste cycle in Florence

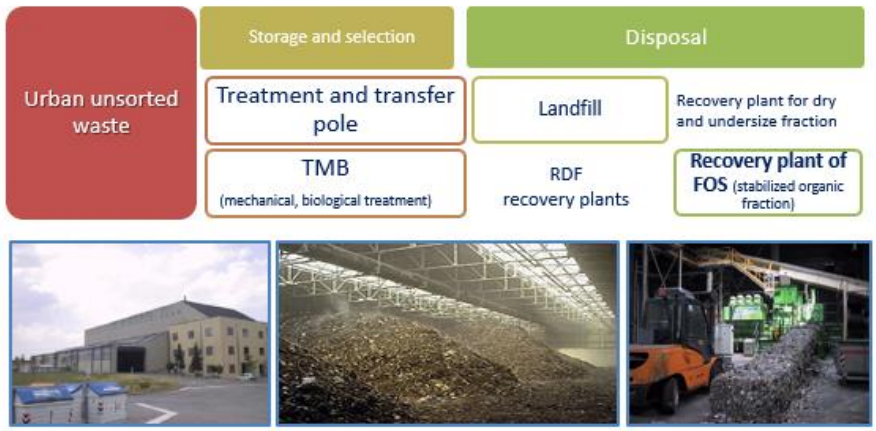

Figure 4: Urban unsorted waste treatment and disposal

Street sweeping waste

In Florence, the definition of "street sweeping waste" is coherent with the definition provided in the Glossary of this report. "Street sweeping waste" consist of:

- waste that accumulates from street sweeping and
- the contents of public waste bins.

The responsibility to collect this waste is also upon the local waste management authority and no significant seasonal variation in composition of this waste is visible in Florence.

4.3.4 Collection of Waste from Tourist Establishments

The municipal waste collection system explained previously also includes the collection of waste from tourist establishments.

4.3.1 Description of waste from touristic ships

Florence is not a coastal city and the pilot case therefore has no port or waste from tourist ships.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

4.4 Kavala (GR)

Marie KAZERONI

4.4.1 Brief description of the URBANWASTE pilot case area

Kavala as a metropolitan area has 70 501 inhabitants[6] and its area is 350,61 km².

Kavala is the principal seaport of eastern Macedonia, and is well connected to other main touristic destinations of the northern-east part of Greece, since it combines an airport and a port, and is also easy to reach by car because of the connection to "Egnatia" highway. Kavala aims to enhance tourism and become a main touristic destination for tourists of Eastern Europe. The type of tourists who visit Kavala are either business tourists, transit tourists travelling through Kavala's port, family tourists and cultural tourists, for weekend stays or longer stays.

The tourism in Kavala is a seasonal tourism limited to the summer period, the high season being between May and September. It contributes significantly to the income of the local population.

The municipality of Kavala is currently and gradually shifting its waste management practices to new practices stated in the recently approved "Regional solid waste management plan", so the practices described below might change in a short future.

4.4.2 Description of Waste Prevention Actions

The only waste prevention action in Kavala is home composting, as detailed in Table 11.

Table 11: Waste prevention activities in Kavala

Name of activity	Description	In place since …	Affected waste streams	Category	Source
Domestic composting	Collective composters have been allocated in some of the residences in Kavala	December 2014	Organic waste	Infrastructural	Survey on data availability

4.4.3 Description of Municipal Solid Waste Collection

- Definition of municipal solid waste (MSW)

The municipal solid waste is defined by the pilot case Kavala in the same way as presented in the Glossary of this report, that is to say all types of solid waste collected by municipalities or on behalf of them, including waste originating from households and similar establishments.

- Responsibility for the collection of MSW and organization of the waste collection

[6] Data from 2011

Only the municipal authority is responsible for the collection of MSW and owns part of the equipment for collection and transfer of wastes. The Waste Management Authority (DIAAMATH) provides part of the equipment necessary for the collection and transfer of the waste streams to the collection centres.

The municipal waste collection covers waste from households and similar establishments. All waste streams are collected by the municipality, except hazardous waste which is collected by private actors.

- Changes of waste collection services during the year

There is a change in waste collection services during the year because of tourism. From May to September, which corresponds to the highest touristic period in Kavala, there is an increase of the number of employees and of the trucks schedule for waste collection.

- Identification of the bins

All the bins have an ID number and GIS coordinates so they can be linked to a specific location. The waste is not directly weighted on site when collected, thus, the mass of waste produced cannot be linked to specific waste generators.

- Collection systems used for the different types of waste fractions

The current waste management practices include separate collection for paper, cardboard, glass, metal (steel and aluminium packages), and plastic. They are sorted at source.

- Paper, cardboard, metal and plastic are collected as one recyclable stream in **blue bins**.
- Glass is collected in the **red glass bin**. Besides, there is a dense network of glass bring banks in the municipality (bell containers), and are particularly strengthened in the areas of the municipality that have a strong presence of restaurant and bars.
- At residence level, food and garden waste is collected in **brown bins**.
- All the other waste streams are collected in **green bins**, which correspond to the residual municipal waste.

There is no door to door collection in Kavala but only collection points: the green bins and blue bins consist in containers located on the streets. However, the collection points are bins that are situated at every neighbourhood and the city has numerous collection points. This not a classical door-to-door collection system though.

"Bring it yourself" systems are also available for bulky waste, batteries, electronic waste, tires, motor oils and car batteries, waste cooking oil:

- Small electrical and electronic equipment (WEEE) are collected in special bins in schools and public services' buildings. WEEE can also be collected in the garage of the Municipality, being is led there by the producers or the cleaning department.
- There are specific bins in some neighbourhoods of Kavala where waste cooking oil is collected.
- There are 8 specific large containers for people to depose their bulky waste.

- Other options available for certain types of waste

Clothing can also be given to charities that are from private or community initiatives.

- Composition of residual waste

The average qualitative composition of the municipal solid waste in the prefecture of Kavala in presented in Table 12:

Table 12: Average composition of the MWS in Kavala in 2008

WASTE STREAM	PERCENTAGE
Organic food waste *with waste > 40 mm* *and waste < 40 mm*	43,61% *24,13%* *19,48%*
Paper - Cardboard	13,26%
Plastic	18%
Metal	2,42%
Glass	5,98%
Textiles – Rubber – Leather – Wood	6,11%
Toilet napkins	6,06%
Dirt-ash	3,68%
Hazardous waste	0,45%
Other waste	0,44%
TOTAL	**100.0%**

Waste treatment

- **Treatment of residual waste**

The residual waste is landfilled in Kavala landfill unit which is located 10 km away from the city of Kavala.

- **Treatment of separately collected waste fractions**

The recyclable waste fractions are collected in the same bin (Paper, cardboard, metal and plastic). This waste stream is separated with magnetic separation and human separation in order to sort out the recyclable fractions. The recyclable fractions are either directly recycled or sold for recycling, out of Kavala, in a different region (Thessaloniki or Serres).

Glass is transferred to private actors in charge of the recycling. This stream is exported out of Kavala since it is recycled in Larissa (a different region).

Street sweeping waste

Street sweeping waste is understood as the waste accumulated from street sweeping, together with the content of public street bins and litter. There is bigger amount of litter during the summer due to the tourists' presence.

The Municipality of Kavala is responsible for street bins and street sweeping.

4.4.4 Collection of Waste from Tourist Establishments

The collection of the waste from tourist establishments is done by the Municipality of Kavala as these establishments are considered as "similar establishments" and the waste collection operated by the municipality concerns both households and similar establishments.

4.4.5 Description of waste from touristic ships

In 2015, there were 139 647 tourists in Kavala, with 8.7% of them arriving by ship (12 915). Waste from touristic ships is managed by a private subcontractor of the Port of Kavala. The private subcontractor collects waste as a single waste stream and transfers it to Kavala landfill.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

4.5 Lisbon (PT)

Arie ROMEIN

4.5.1 Brief description of the URBANWASTE pilot case area

Made a 'municipium' by Julius Caesar, Lisbon is one of the oldest cities in Western Europe. After the reconquest from the Moors by crusaders in 1147 the city has developed as the major political, economic and cultural centre of Portugal[7]. As the country's capital city, it is the seat of Government and the residence of the Head of State.

The municipality of Lisbon is part of a larger Metropolitan Area (MA), a type of administrative entity in Portugal. Next to Lisbon, there is one other MA, Porto. Both were created as such in 1991. In 2004, the Lisbon Great Metropolitan Area (LGMA) was assigned the status of a public collective person of associative nature. It is a union that is composed of 18 municipalities, one of which is Lisbon itself, with a territorial scope that aims to reach their common public interests. Its territory is almost the same as the NUTS II Lisbon Region.

LGMA is the largest population concentration in Portugal. It houses 26.7% of the national population on 3.3% of the country's territory, i.e. 2 821 876 people on 3015.24 km². The 18 municipalities of LGMA are geographically divided into two clusters of nine each, separated by the Tagus River. North of the river they form the Lisbon District and south of the river the Setúbal District. Lisbon District is the smallest of the two in surface (46%) but the largest in population (72% in 2011). This difference is mainly explained by the population densities of some municipality of the Lisbon District that are the highest in the LGMA: 19.4% of LGMA's inhabitants live in Lisbon municipality on 3.3% of its territory. These figures raise to 30.7% and 4.9% if we add the two adjacent ones Amadora and Odivelas to it[8].

The administrative structure of LGMA is composed by three organs:

- Assembleia Metropolitana (Metropolitan Assembly): legislative organ, composed by the chosen representatives in the Municipal Assembly of the City Halls, in odd number, over the triple of the number of the towns that it integrates, in a maximum of 55.
- Junta Metropolitana (Metropolitan Board): executive organ, composed by the presidents of the 18 'municipal chambers'.
- Conselho Metropolitano (Metroplitan Council): the consultative organ composed by representatives of the State and by the members of the Junta Metropolitana.

Besides the political capital and major demographic concentration, LGMA is also Portugal's major economic centre of gravity. This metropolitan area is called a global city because of its importance in finance, commerce, media, entertainment, arts, international trade, education and tourism. Most of the headquarters of multinationals in the country are located in the Lisbon area[9]. Its active population of about 1.3 million people holds 32.7% of the national employment and produces over 36% of the country's GDP (2011). Both this contribution to the national GDP and its GDP per capita are highest of all Portuguese regions.

As to tourism, the historic scenery and soulful atmosphere of Lisbon, most in particular in Lisbon municipality as its historic centre, made the city with 1,740,000 tourists the 7th-most-visited one in Southern Europe - after

[7] https://www.goepic.pt/st_location/lisbon/
[8] http://www.wow.com/wiki/Lisbon_Metropolitan_Area
[9] https://en.wikipedia.org/wiki/Lisbon

Istanbul, Rome, Barcelona, Madrid, Athens and Milan - in 2009[10]. Six years later, in 2015, its growth rate for foreign visitors was the fourth highest in Europe, resulting in an estimated 3.56 million foreign visitors spending €1.620 billion[11]. Data about numbers of guests of 'Local Accommodations' like B&B and Airbnb in the city of Lisbon is available for 2013 and 2014 only, but it is not clear if their numbers are included in the overall statistics on tourism. Regarding all these data, it should be taken into account that Lisbon has a clear seasonal variation in tourism, with May and August to October as months of high season.

4.5.2 Description of Waste Prevention Actions

Several waste prevention actions are being implemented in the URBANWASTE pilot case of Lisbon, for example:

- Repair and reuse of second-hand goods for charity (action done with some partners such AMI).
- Project "RE-FOOD": This is a 100% voluntary, solidarity-based project aimed at re-seizing food surpluses and re-feeding those who need it most. The mission is to eliminate food waste and end hunger at the level of each neighbourhood, including in this effort community members. Started on March 9th, 2011 (http://www.re-food.org/pt).
- Project "Ugly Fruit": The aim is to combat the waste of more than 30% of the fruit produced in Portugal rejected by the aspect, despite being tasty and having food quality, creating a market for the so-called "ugly fruit" (http://frutafeia.pt/pt).
- "The Food Bank against hunger" is an initiative of the "Portuguese Federation of Food Banks Against Hunger", which aims to fight against waste, recovering food surpluses, to lead to those who have food shortages, mobilizing people and companies, which on a voluntary basis, associated with this cause (http://www.bancoalimentar.pt/).
- "European Week for Waste Reduction (EWWR): Annually, in November, a "Waste Reduction Week" is celebrated, with a series of actions addressing this theme. Every year, a theme is proposed for the week: in 2013 it was "Reuse"; in 2014 "Food waste"; in 2015 "Dematerialization" / "Day without purchases" and in 2016 "Packaging waste reduction". (http://www.ewwr.eu/).

Over the years 2010-2015, Lisbon Municipality has initiated quite a number of different actions in the EWWRs. The long-list includes the following initiatives

- Awareness raising at schools on prevention by waste reduction that addresses, among other things, the themes domestic composting, sustainable consumption and the 4R policy to Reduce, Reuse, Recycle and Recover waste.
- Awareness raising in municipal canteens, for employees and users, to adopt the 'The Right Portion' to disseminate concepts such as 'food capitation', with the objective to reduce food waste.
- Creation of an area on the Lisbon Municipality website dedicated to waste prevention with information on both entities and initiatives and campaigns for repair, reuse and recycling of used goods. These include '"Tips and Disclosure Materials", "Do It Yourself!", "Promotional Videos"; "News" and "Opinion Space".

[10] https://www.qoepic.pt/st_location/lisbon/
[11] http://www.algarvedaily news.com /news/5794-lisbon-many-more-tourists-but-nobody-knows-what-they-are-doing

- In-house mailing and promotion films for Lisbon Municipality employees on "How to reduce waste in everyday life", including information on how to reduce waste in the office, at home, during meals, at school and when shopping.
- Envisage a series of measures in the field of prevention in order to contribute to meet the national target of 10% reduction between 2012 and 2020 by means of the "Municipal Waste Management Plan 2020", including a diagnosis of the municipality's current contribution, and by participating in European-financed projects.
- Creation of an Advisory Council for the reduction of waste production.
- Implementation of domestic composting of organic and green residues in condominiums and garden dwellings (4,000 homes by 2020).
- Creation of one or two reuse centres, type "Repair Café".
- Increase the use of green waste in municipal parks.
- Continue and reinforce the online publication of initiatives in the field of waste prevention.

The current national policy framework of waste prevention actions in the municipality of Lisbon is mainly formed by the country's third national Waste Management Plan (PNGR 2014-2020) in connection with the Strategic Urban Waste Plan (PERSU 2020; the successor of PERSU I and PERSU II), PNGR 2014-2020 has two main objectives: support the efficient use of natural resources in production and consumption and prevent or reduce the adverse environmental impacts of the generation and management of waste.

As regards statements or voluntary agreements to reduce waste, Lisbon received the European Green Capital Award after adopting a door-to-door waste collection scheme. According to the website of the Interreg IVC project R4R (Regions for Recycling)[12], "[T]he city has become a national example and benchmark in selective and mixed collection […] The municipality's selective collection rate of 33% is, however, still far from the overall national target of 55% by 2020".".

Further information related with to waste prevention actions can be found on the website of Lisbon Municipality (http://www.cm-lisboa.pt/viver/higiene-urbana/prevencao-de-residuos/iniciativas-e-campanhas).

4.5.3 Description of Municipal Solid Waste Collection

The area of Lisbon as URBANWASTE pilot case is the Lisbon municipality, governed by the Lisbon City Council. Nevertheless, its embeddedness in the LGMA is reflected by some data, for instance the data provided by 'Lisbon Tourism' for the whole of the metropolitan area. Further, the main company that is responsible for collection, transporting and treating of municipal waste, VALORSUL, has the entire northern half of the LGMA as its service area.

In 2014, the municipality of Lisbon generated a total of 291,704 tonnes of waste. Per capita this was 564 kg, an amount above the EU and Portuguese figures (see section 3.3). The municipality itself (Lisbon City Council) is responsible by law (of September 1997) for the collection of municipal waste in its own area, with the exception of clothing and textiles, and for the transportation to waste treatment and recovery centres. That includes waste produced by households, by so-called *similar establishments* like schools, offices, public institutions, tourist

[12] http://www.regions4recycling.eu/pertners/Lisbon_City_Council

establishments like hotels, and businesses more in general with a maximum production of 1,100 litres a day. Furthermore, the municipality is also responsible for emptying street bins and street sweeping.

Besides the legal responsibility of the municipality, there are some private companies operating waste collection for specific types of waste. This includes, for example, construction and demolition waste: The Lisbon City Council is responsible for the collection of construction and demolition waste up to 1 m^3, but for larger amounts the producer can choose to pay the City Council for collection or to settle a contract with a private collection company. Collection from major waste generators, i.e. businesses that generate more than 1,100 litres a day like supermarkets, is also being done by private companies and collection in the area Parque das Nações (Park of the Nations) takes place by pneumatic or vacuum technology. This is being done by the Swedish company ENVAC, the global leader in vacuum waste collection industry according to its own website.

In November 1994, the company VALORSUL was created for treatment of municipal waste of North Lisbon Metropolitan Area. VALORSUL is responsible to carry out conception, construction and management of all the necessary installations to recover or disposal municipal waste produced. According to its website, VALORSUL 'valorises' more than one fifth of domestic waste produced in Portugal. The municipality is paid by VALORSUL according to the amount of some separately collected (!) municipal waste fractions (paper and cardboard, glass and packages) delivered to its waste treatment and recovery centres.

The major systems for separate waste collection in Lisbon are door-to-door collection (introduced in 2003) and to types of bring-in systems - bring collection points and civic amenity sites or household waste recycling centres. In addition, underground containers are located across the city and public space facilities are operational. The containers are not tagged with e.g. a chip or optical code to define their availability to users (customers) in a specific location or specific types of customers.

Most large fractions of waste that are separated are collected by means of various systems (Table 13). Paper and cardboard, packages (metals and plastics are collected together) and glass are collected by four different systems: door-to-door, bring-to collection points, civic amenity sites and underground containers. For both paper and cardboard as well as packages, the major system used was (in 2015) still the bring-to collection points, but this is being substituted gradually by door-to-door collection. Door-to-door collection of both glass and food waste is only available for businesses, so households depend for glass on bring-to collection points, civic amenity sites and underground containers while they can bring organic waste only to certain civic amenity site. Smaller fractions of clothing, textiles, cooking oils and hazardous waste are only collected by one specific system. i.e. either public space facilities or certain civic amenity sites.

The food waste collections have specific routes in the catering sector, namely restaurants, hotels, canteens, markets and other food retail and the final destination is for anaerobic digestion. The brown food waste bins are locked to avoid contamination with waste from other producers. Attending local context and climate, this waste collection is performed six times a week to avoid unpleasant smells.

The collection by request allows the collection of certain types of waste that cannot be collected by the conventional ways. It enables also the differentiated treatment and valorisation of a waste fraction, instead of being mixed in the residual waste collection or dumped away in the streets. This collection system helped to increase the percentage of selectively collected waste. It is a widely spread and a frequent/daily service in the Municipality of Lisbon, which involves more than 90 requests per day. This service must be done within a period of 24 hours and is certified by quality standards (ISO 9000). The municipality offers a high density net of a bring bank system to collect glass packages, mainly with green igloo bins.

In addition, other options are available to households like donating clothing to charities or collection boxes for certain types of waste like batteries or worn shoes at retailer establishments. Unfortunately, specific data about these alternatives is still missing.

Table 13: Lisbon: Waste collection system by fraction (Lisbon Municipality)

Fraction	Collection system
Paper and cardboard	- door-to-door collection system - bring bank system / bring collection points[13] - civic amenity sites - underground containers
Package	- door-to-door collection system - bring collection point - civic amenity sites - underground containers
Glass	- door-to-door collection; only restaurants and bars - bring collection points - civic amenity sites - underground containers
Organic (food waste / bio-waste)	- door-to-door collection; only restaurants and bars - can be delivered to certain civic amenity sites
clothing/textiles	- public spaces facilities
cooking oils	- public spaces facilities
hazardous waste.	- civic amenity site

Table 14 presents some features of three of the major collection systems that are operational in Lisbon. As can already be seen in Table 13, each system collects various fractions of separated waste. Paper and cardboard, glass, as well as plastic and metal packages, actually, are collected by all three different types of collection systems. Organic waste is only collected by door-to-door collection and batteries can be brought to collection points. The door-to-door collection system of glass and organic waste is only available for businesses, usually the tourist facilities of hotels and restaurants. Furthermore, for fractions that are collected door-to-door from both households and businesses, businesses are served more frequently than households.

[13] *The EC Capital Factsheet on separate collection (2015) speaks of Bring collection points, the City Council as URBANWASTE partner of Bring bank. The author considers these synonyms.*

Table 14: Features of the door-to-door, bring collection points and civic amenity site separation systems (EC – Capital factsheet on separate collection[14])

Door-to-door	Bring collection points	Bring-in civic amenity sites
Fractions collected: Paper & cardboard Glass (only bu) Packaging Organic waste (only bu)	**Fractions collected:** Paper & cardboard Glass Packaging Batteries	**Fractions collected:** Paper & cardboard Glass Packaging
Frequency: Paper & cardboard 1 d/w* (hh) 1-5/w (bu) Glass 1-3 d/w (bu) Packages 1-2d/w (hh) 1-2d/w (bu) Organic waste 6-7d/w (bu)	**Number of collection points#** All major fractions 303 Not all fractions 148 Glass only 878	**Number of sites** 28
Collected quantities (kg/cap/yr) Paper & cardboard: 19.54 Glass: 1.82 Packages: 11.48 Organic waste: 0.47 Residual waste: 254.65	**Collected quantities (kg/cap/yr)** Paper & cardboard: 4.54 Glass: 15.32 Packages: 3.30 Organic waste: PM Residual waste: 0.01	**Collected quantities (kg/cap/yr)** Paper & cardboard: 4.98 Glass: 1.61 Packages: 2.28
Source of funding Municipal tax and waste budget Tax based on water consumption: 0.17€/m^3 (hh), 0.80€/m3 (bu)	**Source of funding** Municipal tax and waste budget	**Source of funding** Municipal tax and waste budget
Cost to consumer Indirect via water bill	**Cost to consumer** Free	**Cost to consumer** Free

bu businesses
hh households
* days per week
\# 2015

The waste glass of households is not collected door-to-door: they have to bring it to collection points or to civic amenity sites. The number of collection points for glass is much larger than the number of civic amenity sites where it can be brought to. Glass is accepted at all points for 'glass only' and for 'all major fractions': 1 181 in total. Because the number of the remaining points for 'not all fractions' that actually do accept glass is unknown, the total number where one can bring it to amounts to a figure between 1 181 and 1 329. The maximum number of civic amenity sites where glass can be brought is, on the other hand, only 28. As a consequence, the quantity of glass collected by bring collection points is almost 10 times larger than at civic amenity sites.

[14] Retrieved January 2017 from http://www.municipalwasteeurope.eu/sites/default/files/PT%20Lisbon%20Capital% 20factsheet.pdf

Although door-to-door is a relatively new type of collection system in Lisbon, it collects a much larger quantity of waste than the other two systems, even if these are taken together. This is mainly due to the enormous amount of residual waste that is exclusively collected by the door-to-door system. By comparing the separated fractions only, the door-to-door system still collects more waste than the other two together, but their amounts are then in the same order of magnitude.

According to the data in Table 14, waste collection in Lisbon is financed by municipal tax and the public waste budget. The tax is being levied to households and business included within the water bill and is based on their water consumption ratio. Notably, businesses pay almost five times as much as households do. Bringing waste to collection points and civic amenity sites is for free for "private" citizens, on the other hand, they do charge a levy to producers when accepting their waste.

In the composition of the waste that is being separately collected (Table 15), the largest part (in weight) of over one-third is paper and cardboard. Smaller proportion of roughly between one fourth and one fifth consist of glass, organic waste and packaging waste of metal and plastic. The smallest share, finally, consists of batteries. More detailed data on the composition of (residual) waste is available by VALORSUL for 2011, hence a bit outdated and therefore not presented here. New updated data by VALORSUL on the composition of residual waste for 2016 shall be available soon.

Table 15: Lisbon: Separate collection rate for major fractions in Lisbon in 2013 (EC – Capital factsheet on separate collection[15])

Fraction	Rate
paper and cardboard	34.5 %
glass	24.4 %
organic waste	22.3 %
packaging (metals and plastics)	18.9 %
Batteries	0,001 %

To conclude this section on waste collection, Figure 5 gives an overview of the integrated system of waste treatment as practised by VALORSUL. It shows that different main fractions of waste are separated and treated in different levels of the waste hierarchy: recycling, incineration, composting and landfill. VALORSUL manages all the waste it collects in its serve area, including the municipality of Lisbon. This means that no waste or waste fractions are exported to other regions of Portugal or abroad.

[15] Retrieved January 2017 from http://www.municipalwasteeurope.eu/sites/default/files/PT%20Lisbon%20Capital%20factsheet.pdf

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

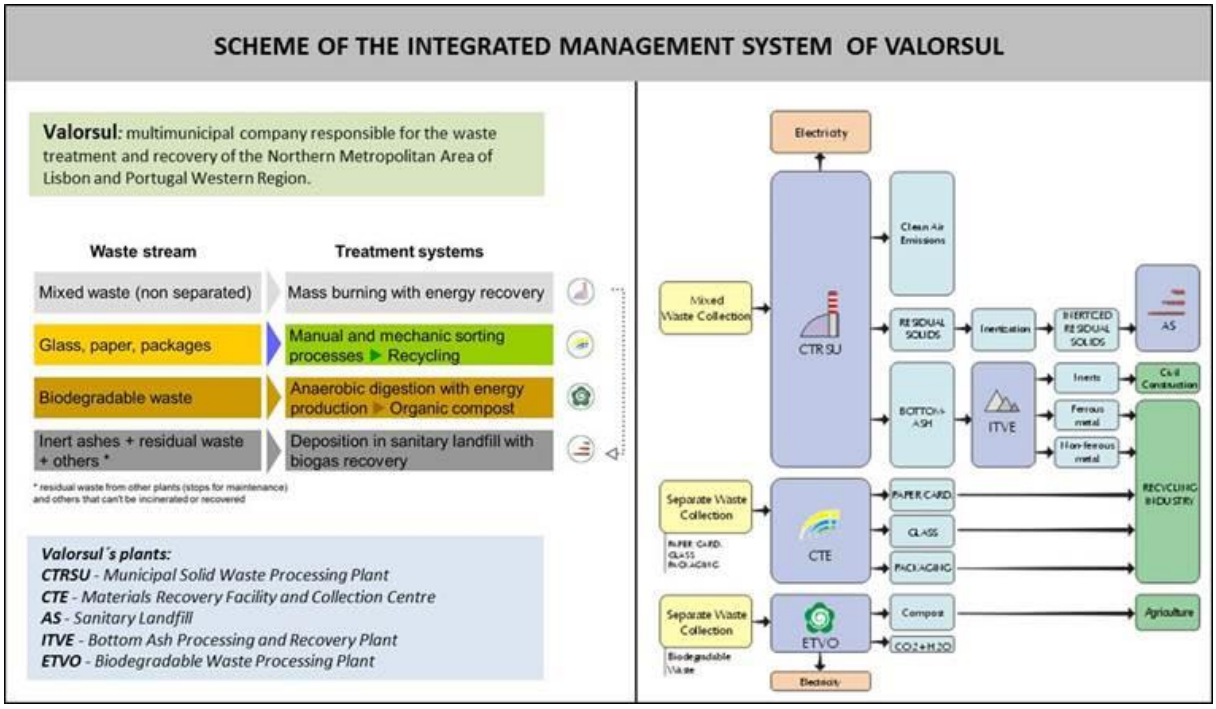

Figure 5: The waste treatment scheme of VALORSUL (VALORSUL)

4.5.4 Collection of Waste from Tourist Establishments

The collection of waste from tourist establishments is covered by the municipal waste collection systems. Actually, the door-to-door collection system of glass and organic waste is only available for businesses, including tourist facilities like hotels and restaurants as major producers of these waste fractions. However, collection from businesses that generate more than 1 100 litres (1.1 m^3) a day is also being done by private companies. These major waste generators include for instance hypermarkets but also the largest among tourist venues like hotels and restaurants.

The separation of the sub-stream of municipal waste collected from tourist establishments is part of the general 'separation regime', i.e. it is about the same major fractions. These are paper and cardboard; glass; metal and plastic packages; organic waste, including food; clothing and textiles; hazardous waste and used cooking oils. By far most of these fractions are collected from tourist establishments are collected by the door-to-door system, and treated by the company VALORSUL. The waste collection service does not change according to the seasonal fluctuations of touristic flows during the year.

4.5.5 Description of waste from touristic ships

Waste produced on board of touristic ships is not included in the municipal waste figures. Actually, this waste is not considered municipal waste because these ships do not dispose into the municipal waste system. Hence, data on its amount and composition is not available.

The port of Lisbon receives all types of cruise ships, from the smallest to the largest in the world, that bring more than 400 000 passengers per year to the city[16], but it is unknown how many of these leave the ships to spend some time in Lisbon. Lisbon City Council defines cruise passengers as visitors rather than tourists because they do not sleep in the city. The contribution of cruise passengers to municipal waste generation is unknown.

The contribution to municipal waste generation by passengers that embarked or disembarked in Lisbon is unknown as well: However, their number was 42 536 in 2015, almost negligible compared to the estimated 3.56 million tourists and the almost 550 000 inhabitants that produce waste almost all year round.

[16] http://www.portodelisboa.pt/ portal/page/portal/PORTAL_PORTO_LISBOA_ING/CRUZEIROS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

4.6 Nice (FR)

Marie KAZERONI

4.6.1 Brief description of the URBANWASTE pilot case Métropole Nice Côte d'Azur

The pilot case is the French Metropole "Nice Côte d'Azur" (MNCA) which is composed by 49 municipalities. Its total population is 2014 was 537 769 inhabitants, on a territory representing over 1 400km². The Metropole has several touristic attractions including costal municipalities (located between Cagnes-sur-Mer and the Cap d'Ail), mountain stations around the Mercantour natural park (Isola 2000, Auron, Saint-Dalmas-le-Selvage). The tourism is a very important sector for the economy of the Metropole has it represents 30% of the Metropole's wealth and 13% of the employment. Besides, Business tourism is also important thanks to the "business friendly" style of the Metropole.

4.6.2 Description of Waste Prevention Actions

Table 16 presents the main waste prevention actions implemented on the territory of the Metropole Nice Côte d'Azur, either by the metropole itself, or by other actors. Some of these actions are no longer implemented, other actions are still ongoing or being developed.

Table 16: Waste prevention activities in the Metropole Nice Côte d'Azur

Name of activity	Description	In place since …	Affected waste streams	Category	Source
Individual and collective composting	MNCA delivers composters on request to households, businesses, and local authorities. 11 000 composters have been delivered so far. Collective composting and composters in schools are delivered by MNCA: 100 composters have been delivered. Besides, bring banks for green waste have been implemented in certain municipalities of the metropole in order to divert green waste from residual waste and to make compost. Finally, a leaflet on sustainable gardening promoting compost among other actions, was created and distributed by the Metropole.	2008 - ongoing	Bio-waste from households, public catering services business and local authorities	Infrastructural	Information from MNCA
Composting on site in restaurants	Within the partnership with the chamber of commerce and industry (CCI and MNCA), and the European project MED3R, restaurants and catering services experimented bio-waste selection and on site composting	End of 2014 / beginning of 2015	Bio-waste from restaurants	Infrastructural	http://ccitv.cote-azur.cci.fr/video-579-projet-europeen-med-3r--dechets-de-la-restauration and additional information from the MNCA
Campaign against food waste in schools	Awareness campaigns on food waste are organised in primary schools in schools are organised. The action is still ongoing	End of 2013 / Be-ginning of 2014	Bio-waste from households	Informational	http://www.preventiondesdechets.org/le-gaspillage-alimentaire/ and additional information from the MNCA
Campaign against food waste from food markets	In partnership with the chamber of commerce and industry, campaigns against food waste from markets were organized and donation of food waste encouraged.	2014	Bio-waste from food markets	Informational	Internal URBANWASTE documents and website http://ccitv.cote-azur.cci.fr/video-629-la-demarche-dechets

Name of activity	Description	In place since …	Affected waste streams	Category	Source
Doggy bag	In several municipalities of the MNCA, doggy bags were distributed to nearly 50 restaurants in order to stop food waste and the restaurants also receive a training on waste management within this action. This action should be extended to other municipalities within the MNCA and is still ongoing. The tourists are highly using this doggy bag system.	July 2014	Bio-waste from restaurants	Infrastructural and informational	Website http://www.preventiondesdechets.org/doggy-bag/ information from the MNCA
Doggy bag	Within a partnership between the MNCA and the chamber of commerce and industry (CCI) and in link with the European project MED3R, restaurants in Nice starting to have doggy bags in order to avoid food waste (70 restaurants were preselected). This action is still ongoing.	2014	Bio-waste from restaurants	Infrastructural and informational	Website http://ccitv.cote-azur.cci.fr/video-579-projet-europeen-med-3r--dechets-de-la-restauration information from the MNCA
Website on waste prevention	The MNCA has a dedicated website for waste prevention giving information on the different possible actions for waste prevention, reduction, and reuse.	2014	All type of waste	Infrastructural and informational	http://www.preventiondesdechets.org/
Sticker "no advertisers"	The MNCA delivers sticker "no advertisers" in order to stop receiving advertisers: approximatively 100 000 stickers have been distributed	2013	Paper	Informational	Internal URBANWASTE documents
Reusable cups	Awareness campaign organized towards employees from the local authorities and municipalities of the MNCA encouraging drinking water from the tap, with the distribution of reusable cups (8 000)	2016 / 2017	Plastic waste (plastic bottles and cups)	Informational	http://www.preventiondesdechets.org/eco-exemplarite/ Annual report on waste collection and management (2014)
Reusable bags	The MNCA promotes using reusable bags and distributed such bags during public events (25 000). This action is still ongoing.	2014	Plastic waste	Infrastructural and informational	http://www.preventiondesdechets.org/eco-exemplarite/ Annual report on waste collection and management (2014)
Reusable batteries	The MNCA promotes using reusable batteries within its directions. This action was successful and ended in 2015.	2014	Electronic waste	Informational	http://www.preventiondesdechets.org/autres-astuces/

Name of activity	Description	In place since …	Affected waste streams	Category	Source
					and additional information from the MNCA
Eco-event operation (Opération "Eco-manifesta-tions")	Different tools have been created (a charter, informative material, a monitoring tool). This approach contains 6 commitments, among which on waste management. It includes action such as waste reduction by avoiding over-packaged products and distributing reusable cups and tap water to avoid plastic bottles. The Nice Jazz Festival is the biggest public event in the municipality. During this event, reusable cups are distributed (in 2014, around 25 000 cups were sold and 13 000 returned).	2015-ongoing	Plastic waste, cardboard	Infrastructural	http://www.nicecotedazur.org/environnement/outils-de-d%C3%A9veloppement-durable/eco-manifestation and additional information from the MNCA
in-centive scheme for admini-strations and private com-panies waste collection service	Some administrations and private companies which waste is included in the municipal solid waste were previously collected for free. Thanks to the implementation of this special fee, the collection service is now being charged to these establishments.	2014	All waste flows included in municipal solid waste	Regulatory	Rapport annuel 2014 collecte et gestion des déchets
Swap, repair and re-use promotion	Several actions are being implemented in order to encourage swap, repair and re-use in order to reduce waste generation and to extend the lifespan of the products. This includes among other actions promoting furniture donation and videos promoting employment linked to product re-use. Besides, there are charity shops and repair centres in the Metropole, owned by private associations.	2016	All type of waste	Informational	Information from the MNCA

Some hotels in the Metropole Nice Côte d'Azur have implemented waste prevention actions in the context of sustainable certification such as the eco-label "Green Key" or the TripAdvisor Green Leaders program. In the city of Nice, at least 14 hotels involved in such programs have been identified. Among the waste prevention actions implemented, the most common ones are:

- Reusable dinnerware and cutlery (the hotels involved in the TripAdvisor Green Leaders program commit to have at least 90% of crockery and cutlery reusable)
- Completed waste assessment of building (the hotels have evaluated the amount and type of waste they create, in order to plan how to reduce it)
- Refillable toiletries dispensers (the hotels involved in the TripAdvisor Green Leaders program commit to have at least dispensers in over 90% of guest room bathrooms, this action helps reducing the amount of waste generated, especially from packaging)
- Among the identified hotels, at least 3 hotels do compost on-site or at on offsite composting facility, from food waste, yard waste and biodegradable products.

4.6.3 Description of Municipal Solid Waste (MSW) Collection

- Definition of municipal solid waste

The MNCA defines "municipal solid waste" the same way as presented in the Glossary of this report, that is to say waste originating from households and similar establishments that produce waste similar to household waste and dispose the waste at the same facilities used for municipally collected waste. Litter is not part of MSW, it is handled by the urban cleaning service.

- Responsibility for the collection of MSW

The local waste management authority is responsible of MSW collection together with partners from the private sector, depending on the municipalities of the Metropole and on the respective waste flows. In general, the municipal waste collection **covers households and similar establishments**.

Regarding residual waste, the collection is managed by each operational centre on its territory of action, and is either realized by the local authority public establishment in charge of the collection or by a private company through a public procurement contract.

Packaging waste is also collected either by the local authority public establishment in charge of the collection (34% of the municipalities) or by a private company through a public procurement (66% of the municipalities).

Regarding glass and papers, these are collected by private companies through a public procurement except in one municipality where it is collected by the local authority public establishment in charge of the collection.

- Changes of waste collection services during the year

During the summer, the waste collection is reinforced but not because of the tourists but because employees from the collection services are on holiday.

- Identification of the bins

All the bins used for packaging waste collection are tagged with a chip that locates the bins. This includes both bins for door to door collection, collection points' bins and bring stations' bins, which represent more than 57 000 bins tagged. Only the geolocation can be associated to the bins, and not the weight of the bins because the bins are not weighed when being collected.

- Collection systems used for the different types of waste fractions

Depending on the type of waste fraction, different collection systems are used:

- **Residual waste**: door to door collection in the urban areas and concentration points for the collection in the most rural areas. In some areas, there are also bring banks (123) which are either buried or half-buried
- **Packaging waste** (cardboard, plastic, recyclable metals): door to door collection in the urban areas and concentration points and brings banks in the less urban areas
- **Paper**: door to door collection for schools and administration, otherwise bring banks (buried or semi-buried waste container or aerial waste container)
- **Glass**: bring banks (buried or semi-buried waste container or aerial waste container) for households and door to door collection for certain business establishments (hotels, restaurants, bars)

- Other options available for certain types of waste

In the Metropole of Nice Côte d'Azur, there are 13 civic amenity sites where private individuals can bring bulky waste (furniture, domestic electrical goods), garden waste, wood, but also hazardous waste such as batteries and accumulators, oils.

The eco-organisation "Corepile" in charge of the EPR scheme related to batteries and accumulators provides containers to collect batteries in public areas like the town hall, hospitals, etc.

They are also several centres similar to charity shops and repair centres, such as the examples in the city of Nice:

  - "Falabrac Nice", in Nice, sells second hand clothes and has a repair centre project
  - "ACTES Resources", in Nice, collects for free second hand objects and furniture and resell them

- Composition of residual waste

Data on composition of residual waste is not available.

Waste treatment

- **Treatment of residual waste**

The residual waste is treated in four different ways:

- 90% of the residual waste is incinerated with energetic recovery
- 2,3% of the residual waste is landfilled
- 1,8% of the residual waste is composted
- 2,5% of the residual waste is transformed in refuse-derived fuel with energetic recovery

- **Treatment of separately collected waste fractions**

Packaging waste goes to the sorting centre where the different recycling flows are separated (cardboard, plastic, tin).

- 72,7% of the packaging waste in recycled
- 27,3% are impurities, 97% of these impurities are incinerated, and 3% landfilled

Glass and paper flows are recycled to 100%.

- **Export of waste fractions out of the area of the MNCA**

84% of the waste collected from households and similar establishments is treated within the MNCA. 16% of the waste is treated out of the area of the MNCA. These waste fractions concern wood and scrap metal which are recycled, and bulky waste which is partly recycled and partly treated with energetic recovery.

Further, clinker and smoke purification residues (RPIFHW) are sent to authorised landfilling centres out of the MNCA.

Street sweeping waste

Street sweeping waste is understood as defined in the project Urban-Waste, that is to say it refers to waste that accumulates from street sweeping when cleaning large areas, and it also includes public waste bins. This includes flows such as cans, papers, plastic, garden waste. The street sweeping waste is incinerated.

The urban cleaning service is in charge of the management of street bins and street sweeping; thus the waste management service has no information on a significant seasonal variation in the generated quantities of street sweeping waste.

4.6.4 Collection of Waste from Tourist Establishments

The waste collection of tourist establishments is covered by the Metropole Nice Côte d'Azur. As mentioned previously, certain businesses (e.g. hotels, restaurants, bars) have a specific door to door collection for glass waste.

4.6.5 Description of waste from touristic ships

The port of Nice does not have a specific infrastructure to handle waste from touristic ships. Usually, touristic ships on cruise journeys empty their waste at the beginning or at the end of the cruise journey. Nice is not a starting or final destination of cruise journeys but rather an intermediate stop. Thus, the cruise ships stopping in the port of Nice for a halt do not dispose their waste there.

There are public bins on the public space of the port but this bins are street bins and there are not meant for touristic ships to dispose their waste.

Finally, for smaller touristic ships (e.g. yachts) or touristic ships with Nice as final destination, the chamber of commerce is in charge of the waste collection and has a contract with a private company who implements the waste collection from the ships.

4.7 Nicosia (CY)

Mattias ERIKSSON

4.7.1 Brief description of the URBANWASTE pilot case area

Nicosia (Lefkosia), the capital of Cyprus, one of the oldest cities in our part of the world, today is a sophisticated and cosmopolitan place in the Eastern Mediterranean, rich in history and culture, combining its historic past with the amenities of a modern city. The heart of the city, within the 16th century Venetian Walls, has a number of interesting museums and art galleries, Byzantine churches and a number of mediaeval and neo-classical buildings while the narrow streets retain the romantic atmosphere of the past.

Since 1974, the people of Cyprus are experiencing the tragedy of a divided country, with the Green Line cutting in two the heart of the capital city Nicosia which still remains the last divided city in Europe. The regeneration of the divided historic centre of Nicosia constitutes a priority for Nicosia Municipality with a focus on the protection and reuse of its architectural and cultural heritage, as an asset of major cultural, economic and social significance. Outside the Walls, the new city with its modern facilities is a cosmopolitan centre of a modern European capital.

There are several administrative levels with the name Nicosia. The largest is the district which includes several municipalities. A few of these municipalities lie within the metropolitan area of Nicosia, where Nicosia municipality is the second largest one in terms of inhabitants. The tourist area is mainly located in the old town within the venetian city walls, which is partly located in the municipality of Nicosia. Nicosia Municipality has 55 014 inhabitants (statistical service, 2011 census). There is no metropolitan authority as such for Greater Nicosia and various roles, responsibilities and functions for the wider area are undertaken by the Nicosia District administration, bodies such as the Nicosia Water Board and, to some extent, Nicosia municipality.

4.7.2 Description of Waste Prevention Actions

In order to promote **sustainable tourism** there are several **initiatives with minimum standards and labels** that include waste among other indicators. One of these are the Cyprus Tourism Organisation Guidelines provides minimum standards for sustainability in hotel establishments. In their guidelines for minimum standards in hotel establishments the Travel Foundation include as evaluation criteria concerning waste generation the amount of waste produced in kg per guest and night. At the beginning of their sustainability initiative, they propose to identify the different waste streams each hotel produces. These are likely to include glass, paper and card, cans, food waste and other general waste. Over a period of seven days, all waste generated (and if possible, each waste stream separately) shall be weighed in kilograms (kg). To identify the volumes of waste of each type the hotel is producing – and where waste should be collected in different coloured bags according to the different hotel operations such as the kitchens, the gardens, rooms etc., or by type of waste (plastics, card and paper, glass, cans, food, general waste etc.). This differentiation shall help to find out which to focus waste reduction measures first. A similar initiative is taken by the Cyprus Tourism Organization in cooperation with Cyprus Sustainable Tourism Initiative and Travel Foundation (non-profit British organization) that created a project with title 'waste mapping' that aims to reduce hotel's food waste and improve the management of their waste.

Other initiatives for sustainable tourism in Nicosia is the website www.bookdifferent.com that associate a carbon footprint (CO^2 per room per night) to each hotel in their list. Also hotels with the green key **label** is listed so that

guests can base their choice of hotel on some environmental indicators. In the list 18 of the 71 listed hotels got the green footprint indicating the lowest level of greenhouse gas emissions in this comparison. Two of the hotels were labelled with the green key.

Nicosia Municipality is also performing a number of **activities to reinforce citizen's awareness**, enhance their willingness to reduce their waste and participate to recycling programs. The municipality therefore, organizes cleaning campaigns, participates to volunteer campaigns, published press releases, prepare and disseminate informational leaflets and announcements and use of posters in important key areas such as bus stations.

The contribution of immigrants towards achieving the goals of sustainable waste management in Cyprus

Nicosia Municipality, lead partner of the consortium for the Programme "New Channels for Integration" has organized a discussion forum of the Network of Cooperation involving immigrant organizations, NGO's and Local Authorities under the title "The contribution of immigrants towards achieving the goals of sustainable waste management in Cyprus: The role of effective information and involvement at the level of the local community".

The forum brought together more than 30 participants representing several immigrant communities that live and work in Nicosia as well as Local Authorities and NGO's. During the event, Nicosia's policies regarding waste management and the framework of actions for the Programme period of 2014-2020 were presented by Michael Lagos, Municipal Health Inspector of Nicosia Municipality. During the same occasion, a project regarding waste reduction, reuse and recycling funded by the EU Program LIFE+ under the title "RETHINK" was presented by George Kirkos, project manager.

The participants had the opportunity to inform themselves about waste management as well as express their views and opinions during the fruitful discussion following the presentations. Project Manager Roula Thoma, European Affairs Officer of Nicosia, mentioned that "the EU considers waste management a priority and local authorities all over Europe are required to adopt measures in order to achieve sustainable waste management. But for a policy to be implemented successfully, the whole society must be actively involved. We believe that the contribution of immigrants towards achieving the goals of sustainable waste management policies is important".

The discussion forum took place within the framework of the project "Integration programmes by Local Authorities" co-funded by the Asylum, Migration and Integration Fund of the EU and the Republic of Cyprus. The programme "New Channels for Integration" is implemented for the 5th consecutive year with the aim to assist the integration of third country nationals in the local community through various actions and services. The consortium includes the Municipality of Nicosia (lead partner), the Municipalities of Agios Dometios, Egomi and Lakatamia, the Nicosia Municipality Multifunctional Foundation and the consultants Losadeal ltd and NVK Advent Consulting Ltd.

Table 17 summarizes the activities described above.

Table 17: Waste prevention activities in Nicosia.

Name of activity	Description	In place since …	Affected waste streams	Category	Source
The contribution of immigrants towards achieving the goals of sustainable waste management in Cyprus	An educational program of Nicosia's policies regarding waste management and the framework of actions for participants from immigrant communities that live and work in Nicosia.	2014	MSW	This is an informational measure that aims to reduce the wasted quantity and improve recycling.	http://www.urban-waste.eu/nicosia-brings-together-immigrant-communities-to-discuss-sustainable-waste-management/
Reinforce citizen's awareness	The municipality organizes cleaning campaigns, participates in volunteer campaigns, published press releases, prepare and disseminate informational leaflets and announcements etc. to enhance citizens' willingness to reduce their waste and participate to recycling programs.	n.a.	MSW	Mainly informational.	Information from Nicosia Municipality. www.bookdifferent.com and other web-sources.
Eco-labels and guidelines for hotels	Eco-labels / guidelines provide minimum standards for sustainability in hotel establishments including indicators for waste management performance amongst others	n.a.	MSW	Informational and Infrastructural	Information from Nicosia Municipality.

4.7.3 Description of Municipal Solid Waste Collection

In Nicosia municipality the MSW includes the total quantity of solid waste collected by the municipality. This waste derives from sources like households, businesses and street cleaning and includes recyclable materials, green waste, bulky waste, electric waste etc. Since Nicosia municipality is the local authority responsible for waste management within the municipality borders it is responsible for the collection of MSW from both households and similar establishments within the area. Mixed waste and green waste are collected from municipal personnel by using municipal vehicles. The recyclable materials (paper, glass, PMD), electric waste and used household batteries are collected from collective systems on behalf of Nicosia Municipality. Also collection of clothes for reuse purposes has been established in Nicosia Municipality through a private company that uses special bins to collect the clothes.

The **mixed waste** is collected from bins (private and municipal bins). The **recyclable materials** (paper, PMD) are collected from door to door or from special bins. The recyclable glass is collected only from special (green) bins. Metals and plastics are collected together (PMD). Paper, glass, green waste and clothing are collected separately. Both green and bulky items e.g. carpets and electric equipment, are collected from kerbsides three times per

year (during organised campaigns). Additionally, there is a temporary green point where the citizens have the opportunity to transfer the different streams of household waste to which are there collected from the municipal workers without any charge. The special bins for clothes are also located at this green points. For the collection of batteries there are special plastic columns in public and municipal buildings and in banks. The businesses / companies which produce or handle hazardous waste maintain contracts with private companies for the separate collection and special treatment of their waste. A normal **composition of the collected waste** is displayed in Table 18.

Table 18: Illustration of the composition of waste produced in Cyprus (Department of Environment evidences 2010)

MATERIAL	COMPOSITION % per weight
Biodegradable organic waste & green waste	37,29%
Paper and cardboard	24,59%
Other	14,89
Plastic	13,01%
Glass	3,79%
Metal	3,5%
Wood	2,94%

The municipal solid waste that is collected by municipal garbage trucks or from some collective system's (private companies) vehicles from households and business are picked up at least once or twice a week. The **non-recyclable part of municipal solid waste** is then **transferred to** Kotsiatis **landfill** which is situated outside the municipality boundaries area. **Recyclable materials**, green waste, electric and electrical equipment, household batteries, used clothing, textiles and bulky items that are collected separately are transferred to appropriate facilities of private units for special treatment and handling. The glass is transferred to Vasilikos Plant (also outside the municipality boarders) and converted through a fragmentation process to dust that is used for the production of cement. Other recyclable materials like paper, plastics and metal are sorted in different types and packed on pallets in order to be exported to materials **recovery facilities** abroad. Also old batteries and some quantities of electric and electrical equipment are exported.

The recyclable materials such as paper, plastic and metal beverage boxes are collected separately from door to door or from bins located in private or public points. The recyclable glass is collected from special bins. Since the different streams of recyclable materials must be separated from the other types of waste from households or businesses in order to be collected from the collective systems (sorted at source), Nicosia Municipality has operated a temporary drop off point (green point) where the citizens have the opportunity to transfer the different streams of household waste to without charge. The drop of point is operated by municipality workers to promote the households and businesses to improve the waste management by reducing, reusing and recycle their waste.

Waste from **street sweeping and street bins** contains recyclable materials such as pieces of paper, plastic, metal, few glass, and organic waste including food waste, dust and leaves. The only seasonality of this waste is the leaves that appear during autumn in some main streets outside the walled city, but no data of the quantities of this organic waste stream is available.

4.7.4 Collection of Waste from Tourist Establishments

Waste from tourist establishments is collected and treated together with other waste streams arising from businesses and households in Nicosia municipality. Since the waste management of tourist activities is integrated in that of the non-tourist activities, and since there are no tracking systems in place for individual bins, there are no specific statistics describing these waste flows. However, the waste collection service is reinforced during the year according to the touristic flows. According to official statistics, Nicosia has less tourism traffic during summer months, but the quantity of municipal solid waste collected is slightly higher during summer. This is probably because there is increased traffic in the centre of the city (walled city) by locals spending time in the area. Also, the slightly increased quantity of solid waste might be due to the fact that there is an increased number of tourists in organized tours visiting the city for a couple of hours even though their main place of stay might be in the coastal cities.

4.7.5 Description of waste from touristic ships

Nicosia is not a coastal city and the pilot case therefore has no port or waste from tourist ships.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

4.8 Ponta Delgada (PT)

Juliane GROßE, Gisela MC. NASCIMENTO

4.8.1 Brief description of the URBANWASTE pilot case area

The pilot case Ponta Delgada comprises the municipal area. Ponta Delgada is the administrative capital of the Autonomous Region of the Azores in Portugal. It is located in the south of São Miguel Island, the largest and most populated island in the archipelago. The municipality has a population of nearly 70,000 inhabitants and an area of 232.99 km^2. Ponta Delgada has more than half of the supply of the Azores hotel beds, 4.900 of a total of 8.900, with more than 600,000 overnight stays per year. The core touristic season spans from June to September. Tourists arrive to Ponta Delgada – obviously – either by plane or ship.

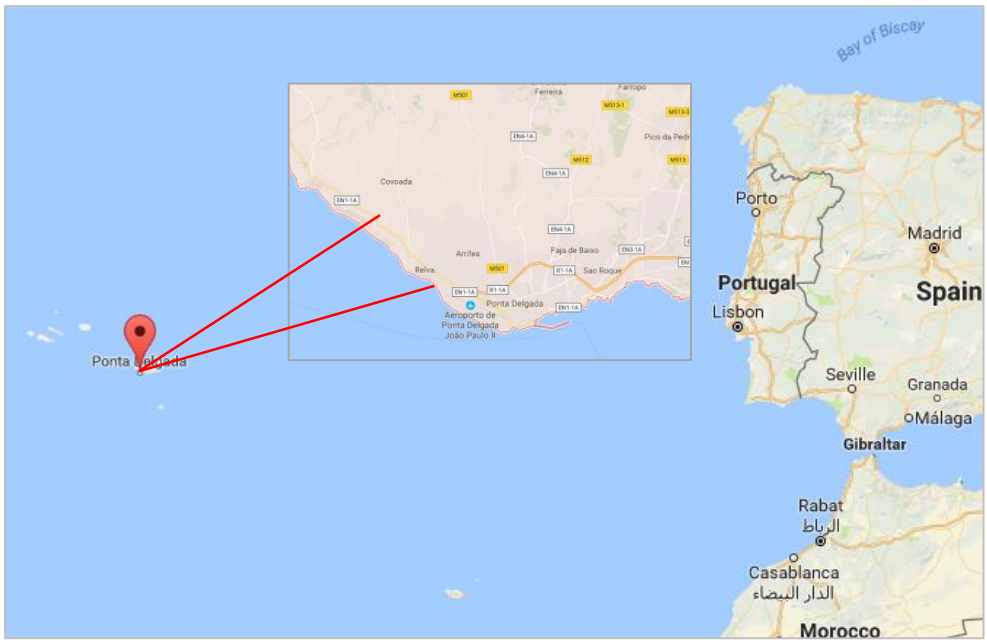

Figure 6: Location of the pilot case Ponta Delgada

4.8.2 Description of Waste Prevention Actions

The waste prevention actions are mainly driven by *PEPGRA – Azores Strategic Plan on Waste Prevention and Management*. The plan includes a series of strategic objectives, each one with several programmed actions/measures. The Objective 1 is on waste prevention and includes the disclosure of the new regional program on waste prevention. This plan is still not available, but the measures listed as follows have already been put in to place (based on the old *PEGRA - Azores Strategic Plan on Waste Management*).

Table 19: Waste prevention activities in Ponta Delgada taken on in 2016 (or previous), based on PEGRA - Azores Strategic Plan on Waste Management (previous version)

Name of activity	Description	In place since …	Affected waste streams	Category	Source
Eco-fee on plastic bags	Eco-fee on plastic bags (0,05 €/bag) in large commercial establishments – all Azorean islands; measure will be extended to all commercial establishments during 2017	2016 (or previous)	Plastic waste	Economic	PEGRA
Ecofreguesia ('Eco-town') contest	Promotion of the Ecofreguesia contest – an environmental award on the cleaner parish; it includes prevention actions (parishes need to develop, take act on prevention measures to be able to score) – all Azorean islands	2016 (or previous)	Waste prevention general	Informational	PEGRA
Eco Escolas ('Eco-schools') program	A voluntary programme designated for schools; is promoted by ABAE, a Portuguese NGO[17], partner of the FEE (Foundation for Environmental Education) - all Azorean islands;	2016 (or previous)	Waste prevention general	Informational	PEGRA
European Waste Prevention Week (EWWR)	all Azorean islands;	2016 (or previous)	Waste prevention general	Informational	PEGRA
Reciclar é valorizar ('Recycling is valuing')	Waste prevention and sorting programme developed only in Ponta Delgada, since 2014; it's a door-to-door information and awareness programme that aims to change people's waste behaviour. It's based in an American methodology that uses – after a previous evaluation and sorting criteria – well informed (on waste management) people from the neighbourhood, to influence next door neighbours;	2016 (or previous)	Waste prevention general	Informational	PEGRA

Besides the measures of PEGRA the following additional waste preventions measures could be identified in Ponta Delgada (see Table 20):

[17] *non-profit and non-political organization*

Table 20: Further waste prevention activities in Ponta Delgada

Name of activity	Description	In place since …	Affected waste streams	Category	Source
SIET-MAC project (System of Sustainable Tourism Indicators in Macaronesia)	develop and maintain a system of statistical indicators of tourism, through which the regions can measure and monitor the sustainability of tourism			Infrastructural / informational	
EMAS Accreditation	84.11 - General public administration activities; Some hotels are also EMAS certified, no numbers available			Informational	EMAS Register: http://ec.europa.eu/environment/emas/register/search/registration.do?registrationId=489579; Information by pilot case partners
ISO 14001 certificate	Certification of "environmental management" of, e.g. hotels (some hotels in Ponta Delgada are certified, no numbers available)			Informational	Information by pilot case partners
GreenKey	4 GreenKey-labelled hotels on Azores, 1 small accommodation in Ponta Delgada			Informational	www.bookdifferent.com/en/green-hotels/pt/region/1530/
Miosótis Açores	Regional "eco label" for touristic facilities, intended to all regional housing units that implement good environmental practices, with the exception of campsites			Informational	Information by pilot case partners
Turismo de Portugal Sustainability Report (yearly until 2011)	Refers to regions (e.g. Azores)			Informational	
LIPOR Generation+ Project (PLG+) (children's education)	promotes good environmental practices to citizens, facilitating the acquisition of skills and enabling a greater civic intervention in order to promote the growth and consolidation of sustainable processes	Oct. 2013		Informational	Background Report on Best Environmental Management Practice in the Waste Management Sector, 2016

Ponta Delgada reports furthermore that **house composting** it is still not an official prevention measure in Ponta Delgada; however, many of the households in the rural area of the municipality actual do it, because subsistence farming has always been present.

"Green public procurement guidelines" are an area still not very developed in Portugal. The new public procurement code already has some guidelines about green procurement, but these guidelines have to be developed and specified, so that purchase of goods and services can be made in a simple and clear way. At the city hall, due to its environmental management system, a green procurement code is in use since 2009. This document includes some of the most important (in terms of quantity or danger) goods and services with environmental impact.

The inter-municipal waste management company produces quarterly reports on waste management and waste variation and gives regular sector data to the regional government (data that is used to control and monitor the PEPGRA objectives).

4.8.3 Description of Municipal Solid Waste Collection

In Ponta Delgada, the same definition of "**municipal solid waste**" (MSW) is used as presented in the Glossary of this report. MSW includes thereby all types of solid waste that are collected by the municipality (Câmara Municipal de Ponta Delgada, Environment and Urban Services). They include waste originating from households and similar establishments (e.g. commercial activities, office buildings, institutions such as schools and government buildings and small businesses) that produce waste similar (quantity and quality) to household waste and dispose waste at the same facilities used for municipally collected waste. The waste collection of "similar establishments" is called "domestic kind of like waste" in Ponta Delgada and includes also hotels and touristic establishments.

The **collection of MSW** is entirely under the responsibility of the municipality (Câmara Municipal de Ponta Delgada, Environment and Urban Services)[18]. It covers households as well as similar establishments ("domestic kind of like waste", e.g. hotels, touristic establishments). The Hygiene and Cleaning Service (HCS) of the City Council is responsible for the collection and transportation of solid waste in all parishes of the municipality. Routing of undifferentiated waste and packaging waste (paper/cardboard, plastic, metal and glass) collected selectively is carried out for the entity responsible for its treatment and final destination (Association of Municipalities of the Island of S. Miguel). In order to guarantee a quality collection service, the HCS provides residents with containers for the disposal of undifferentiated waste and promotes the distribution of eco-points throughout the municipality, in order to encourage the practice of separating packaging waste.

The waste collection is reinforced during the **touristic core season between June and September**.

There is no possibility to link collected volumes/mass of waste to waste generators as bins/containers are neither tagged, nor is the waste directly weighted when collected.

Certain fractions of MSW are **collected separately**, mainly through kerbside collection, these are: Paper and cardboard, glass, plastics, metals, green waste (trees, grass and bushes), batteries, domestic waste on great format (refrigerator, washing machines, furniture, etc.) and bulky waste:

[18] *Except for touristic ships (see chapter 4.8.5)*

- Bulky waste and plastic/metal: kerbside collection;
- Green and great format waste: kerbside collection after dial-up to the municipal services;
- Paper/cardboard: kerbside collection, on some commercial areas;
- Glass: kerbside collection, on restaurants and coffee shops;
- Paper/cardboard, glass, plastics and metals: Bring-it-yourself system (eco-points);
- Cooking oils: kerbside collection and bring-it-yourself system.

Besides these waste collection services, no further possibilities exist to give away specific types of waste, such as clothing to charities or return certain types of waste (e.g. batteries, worn shoes, worn clothes …) to retailers. Only for packaging waste there is the "Green Dot System / SOCIEDADE PONTO VERDE (SPV)", a non-profit-making company with the mission to promote the selective collection, take-back and recycling of packaging waste in Portugal (ACR+ "Good Practices in collection and closed-loop glass recycling in Europe", 2012).

Regarding the further **treatment of the separately collected waste fractions**, bulky waste ends on landfill, just as great format waste, which – after screening/separation of different components – also ends as landfill or is further screened. Paper and cardboard, plastic, metal, batteries and glass are stored and reduced in volume until final shipment to the mainland of Portugal. Green waste (trees, grass and bushes), however, is composted and cooking oil is transferred into biodiesel production.

The **residual waste** of Ponta Delgada was in 2016 composed of the following fractions[19]:

- >80 % mixed municipal waste (20 03 01)
- 8 % biodegradable waste (20 02 01)
- 2 % bulky waste (20 03 07)
- 3 % metals (20 01 40)
- 4 % paper and cardboard (20 01 01)
- <1% plastics (20 01 39)
- <1% municipal wastes not otherwise specified (20 03 99)

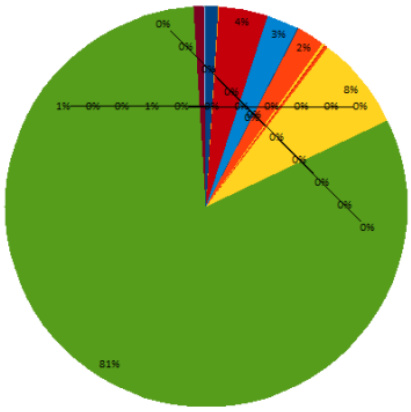

Figure 7: Composition of residual waste (Ponta Delgada, 2008)

Regarding **street sweeping waste**, the definition in Ponta Delgada is partially consistent with the definition used in the URBANWASTE project. The local definition of "street sweeping waste" includes grit, dust, abraded particles of the roadbed, interspersed with organic components of soil, roadside greenery and leaves as well as waste from collection containers/bins along the roadside and in parks and public squares. Regarding seasonal variation, there is a higher emergence of street sweeping waste during festivities, particularly in waste collected in containers/bins along the roadside and in parks or public squares. The management of street bins and street sweeping is also under the responsibility of the municipality (Câmara Municipal de Ponta Delgada, Environment and Urban Services).

[19] *According to the European List of Waste*

4.8.4 Collection of Waste from Tourist Establishments

The collection of waste from tourist establishments is covered by the municipal waste collection ("similar establishments"), therefore the same waste collection and treatment principles as described above apply. During the touristic core season between June and September the waste collection is reinforced.

4.8.5 Description of waste from touristic ships

The collection of waste from touristic ships underlies – other than the before discussed waste – the *Azores Seaports, SA* (Portos dos Açores), who use the collection services of the private company *Varela*. The waste from touristic ships is also collected separately according to the following waste fractions

- Residual waste,
- Paper,
- Tetra pak®,
- Glass;

which proceed after collection to further treatment.

According to the Câmara Municipal de Ponta Delgada, data on the composition of waste from touristic ships is currently not existing.

Estimated, about 10% of the tourists arrive by ship, however, this number needs to be verified according to the Câmara Municipal de Ponta Delgada.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

4.9 Santander (ES)

Johannes MAYERHOFER; Pilar ZAPATA ARANDA

4.9.1 Brief description of the URBANWASTE pilot case area

Santander, the capital of the autonomous region of Cantabria (Spain), is one of the most elegant and beautiful cities on the northern coast of Spain with nearly 175,000 inhabitants. Both the sea and the mountains are continually present in this city, which captivates visitors with its aristocratic atmosphere, its 19th-century buildings, its charming outdoor terraces and its spectacular bay, considered to be one of the most beautiful in the world. Santander has an Oceanic climate and its humidity is quite high throughout the year, with average temperatures ranging from 25°C in summer to 10°C in winter.

The city is very popular by tourists, not least because of its historical development: At the beginning of the nineteenth century, the city became the summer headquarters of the Spanish bourgeoisie and royalty. A golden age that brought with it new urban development, new channels of communication, the creation of new neighbourhoods and new services for residents and visitors.

Around 400,000 tourists visit Santander city per year, especially in the summer season from July to September (36.2% percent of the total tourists a year).

The URBANWASTE pilot case area includes only the municipal term of Santander City, with an area of approximately 35 km^2.

Figure 8: Location of Santander (Santander City Council. December 2015. Plan de Acción Turistica Santander 2015-2020)

4.9.2 Description of Waste Prevention Actions

Green procurement guidelines for public authorities

All procurement tenders set up by the Municipality include some eco-friendly guidelines, for instance, that the paper has to be recycled paper.

Santander has a new "**environmental monitoring system**": Currently there are more than 6 000 Internet of Things (IoT) devices installed spread over the whole city, using various sensors, Radio-frequency identification (RFID) and near field communication (NFC) tags to improve the urban waste management by knowing in real

time the locations and the status of rubbish bins and containers and also the fill level. This system also includes GPS/GPRS tracking in order to optimize the waste logistics of urban waste. Environmental sensors on board of municipal vehicles further gather information about e.g. air quality, temperature and humidity. "Cuida Santander" App integrates all these information and citizens/visitors can use it to report events and incidences in the city by uploading pictures and comments. Each report is classified and forwarded to the corresponding municipality service which is in charge of managing the issue. The App serves as Communication channel from citizens to Santander City council.

By this effort, also known as "SmartSantander", city waste-management bills were supposed to be cut 20 percent in 2013 (Matlack, 2013). No confirmation could be found on this.

Table 21: Waste prevention activities in Santander.

Name of activity	Description	In place since …	Affected waste streams	Category	Source
"Cuida Santander" App	App for citizen (also tourists) to check information about waste and bulk waste pickup, recycling services, schedules and other services. The App is a Communication channel from citizens to Santander City council.	August 2014	MSW	Technical, Informational	Santander City Council
Awareness campaigns	Workshop at the beach, Municipal webs, newspapers, video on municipal buses	NA	MSW	Dissemination, (Informational)	Santander City Council

4.9.3 Description of Municipal Solid Waste Collection

- Responsibility for the collection of MSW

As local administration, Santander City Council has different competences. The competence of the Santander City Council is at City level. The Santander city council administers various municipal services such as local transport, tourism, waste management, water supply and energy among others. Thus, the municipality is also responsible for the collection of municipal solid waste (MSW). The waste management as public utility service is provided by a local waste management enterprise through a public tender. The current service provider working on behalf of the municipality is ASCAN-GEASER.

The definition of MSW in Santander is consistent with the definition in the Glossary of this report. Litter is also part of the definition of MSW. Santander waste collection covers both households and similar establishment.

- Collection System

Separate collection is established in Santander for paper/ cardboard, glass, plastics, residual waste, metals, green waste (pruning waste), debris, clothing/textiles, furniture, mattresses and other household effects, batteries, motor oil, kitchen oil and paints and varnishes. Organic waste is included in the residual waste. Residual waste is

collected and transported to the regional waste treatment plant in Meruelo. Management of organic waste is not a competence of municipality.

In the city, the following **bins** are used:

- Yellow containers: Plastic packaging, cans & tins and cartons (compound packaging)
- Blue containers: Paper and cardboard products
- Light green bin: glass container (white and coloured glass; bottles etc. no windows, bulbs, …)
- Dark green bin: Rest fraction incl. organic waste (residual waste)

While **paper/cardboard, glass, plastics and residual waste** are **separately collected** in special bins from households by a local waste management enterprise on behalf of the municipally authority (**kerbside collection**), other wastes such as **metals**, debris, motor and kitchen oil, paints and varnishes can be disposed separately at several "**collection points**" (Clean Points, puntos limpios). There are also some specific bins spread over the city to collect clothing for charities or for the collection of batteries.

Further, door-to-door collection is offered by the municipality also for furniture from households or cardboards from shops. Both services have to be previously requested by users calling to a specific telephone number or through the mobile app "Cuida Santander". This app, being the new way of communication between citizens and the Santander City council, allows the users to request certain services related to the collection of goods or to report incidents on cleaning or related to the collection of waste.

There are several "**clean points**" (puntos limpios) located throughout the city area to encourage and facilitate waste separation among citizens. Clean points are recycling stations that can be used to dispose of waste that, due to its size or potential hazard, need to be treated differently, for example building debris, pruning, furniture, oil, batteries, fluorescent tubes, batteries, lamps, medicines, varnishes and paints, cleaning products, mobile phones, phytosanitaries, toner and disposable printing (Ayuntamiento de Santander, https://youtu.be/MY4M0Uio0fQ). There are two categories of clean points: fixed (placed permanently in the same address) and mobile ones (following different periodic routes in the city). Currently in Santander there are four mobile clean points that provide weekly services through four periodic routes and 24 stops for Mobile Points. In 2016, 82,228 kilos of household waste were collected via the mobile clean points, which is an increase of 1.46 percent over 2015 and confirms the growth of the selection and recycling by the Santander people (Ayuntamiento de Santander, https://youtu.be/VqHi9F3jTRw).

The amount of collected waste is weighed daily at the end of each collection route. The municipal managers, thus, have data on the amounts of waste produced by each route in the city every day. On "bin"-level (due to the tagging of bins with RFID and NFC tags) the following parameters are known: location, fill level, type of waste, temperature, model, last emptying date. The amount of waste in each bin is not available as the bins are not weighed when they are emptied. Currently, Santander City Council publishes some information relating to trash bins and litter bins in the city (e.g. location, state of conservation, type of waste and capacity) on the Open Data Portal http://datos.santander.es/dataset/?id=residuos.

Because Santander is a tourist destination mainly in summer season, during these months there is a reinforcement of the waste collection by strengthening the workforce and increasing the number of work shifts.

Figure 9: Mobile clean points in Santander (Santander City Council, 2017)

- Waste treatment

The following information regarding the waste treatment was provided by the Santander City Council as well as retrieved from a video about waste management in the Cantabria region from the Gobierno de Cantabria (s.a.).

The separately collected waste fractions are transported and delivered to an authorised residue manager for further treatment. Each authorised residue manager treats the waste fraction according to its nature in order to obtain raw material or to be treating in the nearest waste treatment plant.

The **residual waste** is transported directly to the regional waste treatment plant, which is placed in Meruelo (Cantabria, 35 km to Santander) and belongs to the regional administration level of Cantabria (government of Cantabria region). The capacity of the integral Meruelo Waste Plant (Meruelo Environmental Complex) has been dimensioned so that it manages all the solid urban waste generated in the Autonomous Community of Cantabria. The Urban Solid Waste Treatment Plant has to guarantee that the waste generated in the municipalities of the region will be treated, obtaining recycled by products and a compost of high quality. Meruelo Environmental Complex includes all the waste treatment processes (Sorting, Anaerobic Digestion, Composting and Energy Recovering) thereby providing an optimum solution for the management of waste. Priority is given to separation of recyclable materials and obtaining energy from those materials that cannot be materially recovered (http://www.urbaser.es/seccion-12/Plantas-Integrales-de-Residuos).

- Sorting process

At Meruelo Waste treatment plant, in a first **pre-treatment** (**sorting**) stage big products, glass, paper and cardboard are separated from the residual waste by hand. The remaining waste is deposited into a rotary drum sieve that separates organic from non-organic waste. From the non-organic fraction, cardboard, plastics and cartons are separated by hand. Aluminium and iron objects are sorted out mechanically.

After sorting, the different fractions of **recyclables** are baled to be **expedited to recycling centres**.

- Energy Recovery Plant

Combustible residues are used as fuel and are fed into a **furnace** at the electricity valorisation plant. This waste is representing approximately 40% of the total waste. The gases generated during the combustion process produce steam used as electric power later.

The Energy Recovery Plant is designed to treat an approximate volume of 12 tonnes / hour for 7500 hours / year, equivalent to a total of 98,000 tonnes / year. The expected electric production is 9,900 Kw. The process of energy

recovery from waste is designed to comply with the limits of Directive 2000/76 / EC of 4th December on the incineration of waste.

- Fermentation park / Composting Plant

After sorting out metals, the **organic fraction** is sent to the **fermentation** facility. The biogas produced in the fermentation process is used for energy production. The fermentation parks are covered and have a system of odour purification through bio filters. The generated leachates are collected in a raft and the inorganic products or refuse are sent to the controlled landfill. The residues of the fermentation process are sifted again to recover the remaining ferric, glass and organic materials. Finally, it is gathered in a covered park for its maturation and commercialization. The resulting compost is sold for farming use.

The process of fermentation and maturation is carried out in two independent parks of 10,880 m^2 in which organic matter is treated separately depending on the system it was collected through: In one of them, the organic fraction from the selective collection is treated, and in the other, the organic matter separated from the residual waste.

- Non-hazardous waste dump

Non-combustible and non-recycling residues are sent to the non-hazardous waste dump, where the **landfill gases** produced are used to generate **electricity**. The electrical power generated at both plants supplies the Complex of Merulo facilities and the surplus is sold to the mains network to serve about 23,000 homes. Landfill leachate is treated on site.

Separately collected **recyclables** are transported to special recycling and recovery centres.

All materials collected from the **yellow and blue dumpsters** is taken to **Candina and El Mazo recycling and recovery centres**. Improper solid waste materials are sorted out and transported to Meruelo Environmental Complex.

- Plastic packaging, cans & tins, cartons (yellow containers): After removing big objects that do not belong into this waste stream by hand, the waste materials are placed on a conveyor belt. Operatives on both sides of the conveyor belt sort the garbage into different material fractions. Iron and aluminium materials are sorted out mechanically. The sorted fractions of recyclables are baled to be expedited to recycling centres.
- Paper and cardboard disposed of into the blue containers and the commercial paper and cardboard door-to-door waste collection service is crushed or baled to be transported to recycling companies.

Glass is taken **directly** from the glass containers **to the recycling centres**.

4.9.4 Collection of Waste from Tourist Establishments

Waste from tourist establishments like hotels, restaurants, camping sites or public structures such as museums, etc. are collected and treated together with waste streams collected from households. During the summer time, there is a reinforcement of the waste collection by strengthening the workforce and increasing the collection frequency from once a day to twice a day. The reinforcement of the waste collection is in particular focussed on

some special collection routes covering most touristic zones in the city during summer time such as the Sardinero Area.

Because of the "SmartSantander" initiative (described in Chapter 4.9.2), the Ayuntamiento of Santander has detailed information about waste collection available at the level of collection routes and at waste bin level, thus being able to obtain very specific statistical information. Data on different collection zones (e.g. the touristic Sardinero zone with lots of hotels and restaurants near beaches) in different periods of the year can be compared and analysed.

4.9.5 Description of waste from touristic ships

Amounts of waste from touristic ships are not included in municipal waste figures of the city, because these waste streams are not under the responsibility of Santander City council. Based on MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, the port authority has the competence of waste management in the port area.

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4.10 Syracuse (IT)

Marie KAZERONI

4.10.1 Brief description of the URBANWASTE pilot case area

The Municipality of Syracuse is one of the URBANWASTE pilot cases. The municipality has 123 248 inhabitants and its area covers 207,78 km². Syracuse was declared by UNESCO in 2005 heritage of humanity. The city is visited by more than 1 300 000 tourists every year.

The Municipality of Syracuse aims to promote a "Zero Waste" strategy in the city and to improve the solutions and policies for the effective sustainable urban development. This includes extending "door to door" collection and the waste streams collected (paper, plastic, bio-waste) to all the city, since it is not yet implemented in the city centre. The Municipality of Syracuse also wants to enhance communication activities on the practices of existing local waste management.

The impact of tourism on waste management in Syracuse is generated by the catering activities and shops, which were multiplied in the last years with the increase of tourism. The increase in the quantity of waste produced because of the touristic activities is especially important during the summer. Indeed, the highest touristic period is from May to October.

4.10.2 Description of Waste Prevention Actions

The municipality of Syracuse has implemented different prevention actions detailed in Table 22. The actions mainly concern organic waste composting. Currently there are no agreements with the tourist facilities to decrease the amount of waste, but there are agreements with environmental groups for the promotion of home composting.

Table 22: Waste prevention activities in Syracuse

Name of activity	Description	In place since …	Affected waste streams	Category	Source
Domestic composting	Free distribution of domestic composters on request was implemented in Syracuse. 2013 800 composters have been distributed to citizens and 10 to schools. The action was related to other instruments: - Inclusion of a discount in the garbage fee by 15% and 20% in 2016 (waste tax incentive); - Controls on the use of compost.	2013	Organic waste	Infrastructural Informational Economic	Survey and additional information from the pilot city
Domestic composting	"Good composting" communication campaign	2014	Organic waste	Informational	Survey

Name of activity	Description	In place since …	Affected waste streams	Category	Source
Community vegetable gardens and composting	Administration allocated garden lots for a total of 140 community gardens, each of 73 m², associated with a community compost to get free mulch to use for the gardens. Some lots have been allocated to the educational sector.	n.a.	Organic waste	Infrastructural	http://www.siracusaoggi.it/siracusa-una-compostiera-per-gli-orti-sociali-a-giorni-la-graduatoria-per-altri-40-lotti/
Course for volunteer environ-ment inspector	The municipality has organised some courses open to everyone willing to be an "environment inspector", as a volunteer. This action includes themes such as the reuse.	2016	All flows	Informational	http://www.lacivettapress.it/it/index.php?option=com_content&view=article&id=1900:a-termine-il-corso-di-ispettore-ambientale-volontario&catid=63&Itemid=172
Reduction of plastic waste in schools	Three schools in the municipality were chosen as pilot projects to reduce plastic waste from school canteens by using a lunch box instead of plastic dinner ware.	2015 – in pro-gress	Plastic waste	Infrastructural	http://www.siracusanews.it/siracusa-ridurre-a-zero-i-rifiuti-in-plastica-nelle-mense-scolastiche-progetto-pilota-in-tre-scuole/
Reuse	There are some charity shops in the municipality of Syracuse, such as "Seconda Manina" for children clothes (private initiative) where people can sell and buy second hand clothes or the local project "io dono" which is a reuse and barter solidarity project led by an association (furniture, electronic device, objects, etc.).	2014 – in pro-gress	Textile All type of flows	Infrastructural	http://www.secondamanina.it/siracusa https://www.facebook.com/IODONOSIRACUSA

4.10.3 Description of Municipal Solid Waste Collection

- Definition of municipal solid waste

The municipality of Syracuse defines municipal solid waste as solid urban waste composed by household waste and bulky waste.

- Responsibility for the collection of MSW and its organisation

The municipality of Syracuse is responsible for the collection of MSW, which is collected by a private company (IGM Rifiuti Industriali). The local waste management authority together with partners from the private company (IGM Rifiuti Industriali) have the responsibility for the collection of MSW.

Furthermore, the private company covers also other *similar establishments* producing waste similar to household waste like schools, hotels, tourist establishments. The collection of the waste is strengthened in the Isle of Ortigia (Pilot), one of the central districts from Syracuse where there is a strong presence of tourists.

All the waste streams included in MSW are collected by this private company (IGM).

- Changes of waste collection services during the year

There is no change of timetables and frequency of collection during the summer, which is the highest touristic period. The only difference is the cleanliness of the beaches that is intensified from May to October

- Identification of the bins

The bins do not have a weighting system and are not tagged with a chip which would allow to link the amount of waste to a specific waste generator.

- Collection systems used for the different types of waste fractions

The fractions of MSW collected separately are paper and cardboard. This stream is managed with a door to door collection. This door to door collection is not yet implemented in the whole municipality: the historical centre Ortigia and the marine quarter do not have a door to door collection. Instead, there are many collection points in the historical centre for separate collection of 3 streams, which are paper and cardboard, plastic, and glass.

In 2017, the Municipality of Syracuse should implement door to door collection in the whole municipality for the following five waste streams:

- paper and cardboard,
- plastics,
- metal and aluminium,
- glass and
- organic waste.

- Other options available for certain types of waste

The Municipality of Syracuse has a municipal collection centre (MCC), which is an area where citizens can bring their recyclable materials such as paper, cardboard (even bulky such as cardboard packaging) plastics, metal and aluminium, bulky waste and hazardous municipal waste.

Since December 2016, the voluntary system of the municipal collection centre is encouraged thanks to a waste tax incentive: citizens who bring from 100 to 200 kg of separated waste per year have automatically a discount of 20% on the variable part of the waste tax. The discount can reach up to 40% in a year if the citizens bring more than 200 kg of recyclable materials. There are weighting coefficient depending on the type of material for each kilogram of waste: 1 for paper and cardboard, 0,3 for glass, 1 for plastic and 1 for one aluminium and metal.

Besides the MCC, since 2014 there is a communication campaign called "Don't fry the environment" which aims to promote a specific management and collection of vegetable oils and animal fats of households and other producers. There will be specific containers on streets for the collection of these oils in every neighbourhood of the municipality that is interested in this specific collection.

Finally, there are also private initiatives and voluntary associations committed to reuse and barter, through charity shops and specific places receiving for free second hand products as mentioned in the Table 22.

- Composition of residual waste

Data the composition of residual waste is not available.

Waste treatment

There is a single option for the treatment of residual waste, and separate waste streams are managed by a consortium through a private contract as explained below.

- **Treatment of residual waste**

The residual waste is landfilled.

- **Treatment of separately collected waste fractions**

Municipality of Syracuse has a private contract with the consortium CONAI, a private non-profit organization. Separate waste collection fractions are managed by the consortium and send to the related treatment establishments. In fact, CONAI is responsible for recovery and recycling of packaging, including steel, aluminium, paper, wood, plastic and glass waste. There are specific supply chain consortia for each of this different types of waste.

- **Export of waste fractions out of the area of the MNCA**

The consortium CONAI, which is in charge of the treatment of waste fractions collected separately through a contract with the Municipality of Syracuse, sends each type of material to the related consortia (RiCREA for steel, CIAL for aluminium, COMIECO for paper and cardboard; RILEGNO for wood, COREPLA for plastic, and CO.RE.VE. for glass). Each entity manages the material and sends it to the related treatment establishments. All the waste streams are sent out of the area of the Municipality of Syracuse for treatment, as Sicily has no treatment plants except for glass, which is treated in other municipalities of Sicily (Marsala and Trapani).

Streets bins and street sweeping waste

The street sweeping waste is defined as waste of any kind or origin which is lying on streets and roads and in public areas and also private areas subject to public use. The definition also includes waste lying on sea and lake beaches and on the banks of the waterways. Green waste from green areas (such as gardens, parks, cemeteries) is also included.

The collection of the street bins and street sweeping is done by a private company (IGM Rifiuti Industriali).

4.10.4 Collection of Waste from Tourist Establishments

Tourist facilities' waste is collected by the service operated by the same private company as municipal waste (IGM Rifiuti Industriali). There is no chip or optical code on the bins, so they cannot be linked to a specific location and the waste is not weighed during collection. Besides, there is no change in the frequency of waste collection from tourist establishments during the year.

4.10.5 Description of waste from touristic ships

The touristic ships dispose of their waste by entrusting themselves to the service of their trust business (private companies). So the waste from touristic ships is not collected by the municipality of Syracuse and there is no information available on this type of waste. In the Municipality of Syracuse, the port authority (Capitaneria di Porto) is responsible for the collecting waste from touristic ships.

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4.11 Tenerife (ES) (Municipalities of Adeje, Arona and Puerto de la Cruz)

Johannes MAYERHOFER; Pilar ZAPATA ARANDA

4.11.1 Brief description of the URBANWASTE pilot case area

Tenerife is an island that has always aroused the interest of different cultures: Phoenicians, Carthaginians, Greeks, Arabs, Romans, Vikings, and different European countries have coveted their strategic position, such as Great Britain, Portugal and Germany in many phases of history. Part of this interest is motivated by the exceptional climate that can be enjoyed all year round in this territory, which since the 18th century has begun to attract tourism for both sick people and people motivated by the natural beauty and agriculture of the island, which began to consolidate with the first hotels in the nineteenth century.

In Tenerife, the National Park of the Cañadas del Teide, a UNESCO World Heritage Site, is one of the island's main attractions, next to the Anaga Massif, a biosphere reserve. Finally, San Cristobal de la Laguna, its oldest city has been chosen a world heritage city. The Carnival celebrated on the island, usually in the month of February, is a world-wide festival of international tourist interest.

Tenerife is the largest and most populated island of the autonomous community Canary Islands (Spain) with around 890 000 inhabitants and more than 5,3 Million tourists in 2015 (Tourism Review, 2015).

The three most representative towns have been chosen as the URBANWASTE pilot cases, with the largest number of tourists on the island (Adeje and Arona in the south, and Puerto de la Cruz in the north) and a wide and varied range of services and facilities for all its visitors being near the two airports of the island. Below, a short description of these three URBANWASTE pilot case areas of Tenerife is given:

- **Arona** is a municipality in the south of Tenerife, containing some coastal tourist cities like Los Cristianos, Playa de las Americas, Las Galletas and Costa del Silencio (Tembel). Playa de las Americas has a part that belongs to Arona and to Adeje. The city of Arona itself has no coast and is located at 600m altitude above sea level, approximately 75 km away from the capital of the island, Santa Cruz de Tenerife, and away 4 km of the coast and the coastal tourist centres (Las Americas, Tembel, Los Cristianos, etc.).
- **Puerto de la Cruz** is a municipality and is a coastal tourist area at the same time, which grew around its old fishing port, with small neighbourhoods located in the periphery of the population nucleus. "El Puerto", as it is known in a familiar way, is very close to La Villa de la Orotava, which in the past was forming one municipality together with Puerto de la Cruz. Puerto de la Cruz is the oldest tourist town at the Canary Islands (there is evidence of British and German tourism in the seventeenth century), and is located in the north of the island about 40 km from the capital of the island.
- **Adeje** is a town and municipality in the southwest of the island that has some tourist cities of coast like Americas, Armeñime, Costa Adeje (La Caleta, Playa Paraiso, Playa del Duque, Playa de Fañabe, San Eugenio y Torviscas). The capital Adeje (City of Adeje) is located 4 km from the coast at 295 m altitude and approximately 78 km to the capital of the island.

4.11.2 Description of Waste Prevention Actions

In Arona, Adeje and Puerto de la Cruz, some hotels or groups of hotels have implemented protocols (e.g. environmental guidelines) to reduce waste by tourist facilities and for a better separate collection. Currently, this effort is not connected to any discounts on waste collection fees.

In Arona Municipality, some guideline has been edited to improve this management in the municipality area.

Further, the "Cabildo de Tenerife" organised training sessions on sustainable waste management in municipal associations, schools and college, or enterprises, or companies and associations (Table 23). There are also some activities organized by the three URBANWASTE pilot case municipalities, but information on those activities was not available for this report.

Table 23: Waste prevention activities in the pilot case areas of Tenerife

Name of activity	Description	In place since …	Affected waste streams	Category	Source
HORECA PERSONAS + SOSTENIBLES AULAS + SOSTENIBLES EMPRESAS + SOSTENIBLES 70-20	Training sessions on sustainable waste management in municipal associations, schools and college, or enterprises, or companies and associations Provision of training and materials such as containers, composting box, reusable bags etc.	2010	MSW, Organic waste, selective collected waste,	Informational, Infrastructural	Cabildo de Tenerife

4.11.3 Description of Municipal Solid Waste Collection.

Tenerife has the Special Territorial Plan for Waste Management (PTEOR) since 2009 (finally approved in 2011). In that plan, a series of rules and considerations as well as planning (size, location) of the infrastructures necessary to achieve a correct waste management throughout the island were outlined. The Special Territorial Plan for Waste Management (PTEOR) is structured around seven fundamental strategic axes. One of these strategic axes lays the focus on prevention and minimization of waste generation.

In the different municipalities, and especially those of the three chosen tourist areas (URBANWASTE pilot cases), the measures outlined in these strategic axes have been implemented, both at the municipal level and with the help of the Cabildo de Tenerife[20] (which is the political institution which governs the island). New and better systems for the collection and distribution of waste have been adopted and their effectiveness has been evaluated and improved.

At Insular level (meaning all 31 municipalities in Tenerife including the three pilot case areas), there is a system of separate waste collection. This system is managed by each city council within its geographic scope. This system uses four or seven containers, depending on the municipality, as detailed below:

[20] *In Spain there are 4/5 levels of public administration: National, Autonomies, Province, Island [Only Baleares and Canarias Island] and municipality*

- Mixed waste: grey container
- Glass: green container
- Paper and paperboard: blue container
- Brics, plastic, cupboards, and metal: yellow container
- Organic waste: brown (new; available only in some municipalities; also already conducting a pilot composting experience)
- Used food oil: orange containers (Currently, this service is only available in some municipalities but soon it shall be available in all the municipalities.)
- Used clothes: light blue container (only available in some municipalities)

At present, there is a Mechanical Biological Treatment Plant where the bulk waste is separated from the mixed waste container (grey), separating it into different fractions that are reincorporated into the channels for separately collected fractions, eliminating the remaining inert waste in landfills, separating the organic part and bio stabilizing it in an aerobic plant and landfilling the resulting inert material.

In Tenerife, municipal solid waste (MSW) is defined the same way as presented in the Glossary of this report. The definition of "litter" in the Glossary is quite similar to the one used in Tenerife. In Tenerife, litter is a part of the fraction of MSW collected by other means, mainly manual collection supported by mechanical collection (mechanical sweepers).

Municipal Waste Collection

The collection of MSW is under the responsibility of the municipality and cover households as well as similar establishments (e.g. hotels, other tourist establishment, restaurants, bars, pubs, discotheque, shops, shopping malls and other establishment related with tourism, also schools, offices, public institutions). The service of collection of MSW is carried out by private enterprises on behalf of the municipal department of environment.

In Tenerife, several **fractions of MSW** are **separately collected**, mainly through kerbside collection: paper and cardboard, glass, plastics, metals containers (packaging), green waste (tree-cut, grass and bushes), domestic waste on great format such as waste of electrical and electronic equipment (WEEE) (refrigerator, washing machines), and other bulky waste (furniture, mattresses, beds, etc.).

There are other waste fractions, with own legislation, that must be collected by an authorized company for the management of this fraction: biogenic waste (Hospitals, medical and veterinary clinics and office), some dangerous and toxic waste (e.g. from car repair shops), remains of dead animals produced in enterprises (slaughterhouses, fishmongers, malls, food industries), expired drugs and medicines, etc.

All household waste and bulky waste is collected by a **private waste management company on behalf of the local waste management authority**, **with the exception of** the following separately collected fractions: **Paper and paperboard, glass and packaging**, as well as fractions such as **clothing / textiles** and **used vegetable oils**. Those fractions are collected by special waste management companies or by the waste management company hired by the EPR system (extended producer responsibility).

There also exists one "clean point" (Puntos limpios) each in Arona and Adeje to dispose further waste fractions in higher amounts. This service is only available for the citizens, for private companies have been set up a loading and unloading plant (Planta de transferencia) only for several fractions. At the Clean Point it is possible to dispose a large part of waste fractions (even some dangerous materials) e.g. WEEE, mineral oil, batteries, tonner, bulbs and fluorescent lamps, cooking oil, paints, construction and demolition waste. Puerto de la Cruz has no waste collection point, but the citizens can dispose the fractions mentioned above at a logistic centre in the next municipality of La Orotava.

Besides these waste collection services, citizens can give away used clothes, shoes and textiles using special containers (light blue; new and not available in all municipalities of Tenerife).

Kerbside collection is established for bulky waste, WEEE, green waste, and great format waste and plastic/metal after calling a service number provided by municipality, paper/cardboard gets picked up at some commercial areas, glass at restaurants and coffee shops and also cooking oils.

There also exist further options to give away certain types of waste: Clothing and other products can be given to non-governmental and charitable organizations that later prepare them for reuse. These organizations have social centres where they do these operations: to select, clean, repair, and after these actions, give them to the poor or needy groups (as it is done in **CARITAS** (Catholic association)), or sell them and use the benefits for social groups with special problems (e.g. for abused women, rehabilitated addicts (**REMAR**), long-term unemployed, (**ATARETACO**), etc.).

Data of the composition of residual waste are not available. A new waste characterization is currently being made but results were not yet available at the time of drafting this report.

Waste collection is reinforced during the touristic core season (if it is necessary or upon request). In the Canary Islands, there are almost three high seasons: In wintertime from October/November to February/March, in summertime from June to September/October and the week around Easter.

Waste treatment

Paper and cardboard, plastics, metals, batteries, paints and dissolvent are previous separated, reduced in volume, stored and correctly packed until they are finally shipped per container to mainland Spain. Glass is similarly processed and transported to the near island Gran Canaria for recycling.

Green waste is transported to composting plants. Currently only some municipalities that have a private or public composting plant. The organic fraction of MSW is only treated in Santa Cruz de Tenerife, the capital of the island, in a pilot plant within the environmental complex managed by the Cabildo de Tenerife. All the organic matter collected on the island will be treated in public compost plants distributed throughout the island that are scheduled to be built soon.

Cooking oil is transferred to plants in Tenerife producing biodiesel and ecological fuel (same for mineral oil).

While chemical and hazardous waste is eliminated or recycled by physical-chemical methods at the mainland, WEEE are transport after previous separation and storage to recycling plants on Tenerife island.

Waste treatment of bulky waste and great format waste covers the following steps: separation, preparation for recycling, pressing or fragmenting, screening before mechanical separation of different components or materials and further recycling of the useful fractions or disposal of non-recyclable inert waste (landfilling).

Used clothing, shoes and textiles are provided for reuse or recycling.

4.11.4 Collection of waste from tourist establishments

The collection of waste from tourist establishments is also covered by municipal waste collection, therefore the same waste collection and treatment principles as described above apply. However, the waste management tax for private companies with large waste production is higher than the one for households (there is a municipal ordinance that regulates these public prices). Some hotels do not use the municipal waste management system but have contracts with private waste management companies.

In Arona, the collection of waste from tourist establishments is carried out by both the local waste management authority and private enterprises. In Adeje and Puerto Cruz, only the local waste management authority is responsible.

4.11.5 Description of waste from touristic ships

The collection of waste from touristic ships is under the responsibility of the port authority of Tenerife. Through a public tender they have a contract with a private waste management company that is carrying out the collection of the different fractions of waste produced on tourist vessels and cruise ships. The waste fractions separately collected are mixed (residual) waste, paper and cardboard, metals and plastics, and glass.

Arona is the only of the three URBANWASTE pilot cases in Tenerife having a port for cruise ships (in Puerto de los Cristianos). Though, only a small percentage of tourists travel to Arona per ship. The main port of the island is located in the capital, Santa Cruz de Tenerife, where around 99% (in 2015; data from the Cabildo de Tenerife) of tourists travelling on ships arrive.

In the port of Arona there further arrive a line of ferries (used by many tourists) and other types of tourist boats that do occasional or thematic day trips (e.g. Pirate boats, round trips to photograph whales, dolphins and other marine fauna, ships to look at the seabed, even submarines, and private boats).

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4.12 Waste prevention and management strategies in the URBANWASTE pilot cases

Through analysing the waste prevention activities and waste management systems in the 11 URBANWASTE pilot cities, several waste prevention and management strategies could be identified. In different cities the sometimes the same activities were implemented sometimes in different ways. Within the subsequent section the activities are structured and summarised to point out the essential contents and main focus of the identified waste prevention and management activities. The suitability of each of those strategies for the implementation in the tourist context and therefore for URBANWASTE is discussed. This discussion does not claim to be comprehensive but should give some impulses for further considerations.

4.12.1 Waste prevention strategies

In the URBANWASTE pilot cases the following waste prevention strategies have been identified:

- Changing waste behaviour of citizens
- Composting activities at the point of waste generation
- Eco-events
- Promotion of re-use activities
- Promotion of tap water for drinking
- Reduction of food waste
- Reduction of paper waste from advertisements
- Resource consciousness in procurement
- Taxes on one way packaging

4.12.1.1 Changing waste behaviour of citizens

In several of the URBANWASTE pilot cases (e.g. Nice, Nicosia, Ponta Delgada, Syracuse) awareness-campaigns are/were implemented in order to change the waste behaviour of citizens. Those activities are mainly targeted at citizens in general or at specific groups such as school children or immigrants for example and potentially affect different fractions of MSW. Examples for such activities include:

- **Websites** with information about waste prevention, reduction and reuse.
- **Promotion / Information campaigns** on specific topics such as, for example, using reusable bags instead of disposable plastic bags.
- **Activities** in schools to educate children about waste prevention.
- Participation in the "European Waste Prevention Week".

- Ecofreguesia ('Eco-town') contest: In all Azore islands, the Ecofreguesia contest – an environmental award on the cleaner municipality - was promoted. Municipalities need to develop or take act on prevention measures to be able to score.
- Courses for volunteer "environment inspectors": Syracuse municipality has organised some courses open to everyone willing to be an "environment inspector", as a volunteer. This action includes themes such as the reuse.

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: In order to change the waste behaviour of tourists, awareness campaigns could be used to inform them about what they can do to prevent waste (e.g. use public drinking water fountains to refill empty plastic bottles, use reusable bags, …).

Level of implementation: Awareness campaigns aimed at changing waste behaviour would have to be implemented at municipality level, but the distribution of information would have to be carried out mainly via tourist accommodation establishments or other tourist information points.

Aspects that should be considered when implementing such strategies:

- How to reach tourists staying in private accommodation?

4.12.1.2 Composting activities at the point of waste generation

There has to be made a differentiation between home composting as waste prevention measure as less waste reaches the official waste management system and separate collection of biowaste. In several URBANWASTE pilot cases (e.g. Nice, Kavala, Syracuse, Florence) different examples for **individual and collective composting activities** at the point of waste generation exist. Such activities can be targeted at individual citizens/households, businesses (restaurants, hotels, catering services, …), schools, local authorities or citizens in a specific resident area and affect the amount of organic waste that enters the municipal waste management system. Those activities mainly include the provision of infrastructural solutions as well as information measures:

- Composters are distributed on request (for free) to individual households/citizens, businesses (e.g. restaurants, hotels, catering services), authorities, schools or put up in residence areas/block of flats etc. by the city/municipality or local waste management authority. There **are different technological options for composters ranging from simple composting boxes / frames** (primarily for individual "home composting") **to special composting machines** with different degrees of efficiency.
- **Information/communication campaigns or leaflets to promote composting activities** at the point of waste generation: Such campaigns, amongst others, focus on providing information on how to do ""good composting"", how to use the produced compost, aspects of sustainable gardening etc.
- **Other activities**: In Syracuse, the municipality allocated public space for establishing **community gardens**. Organic waste originating in these gardens shall be composted on-site and used as mulch for the gardens. Such garden lots can also be allocated to the educational sector.

In Syracuse, the free distribution of technical solutions for **composting at the point of waste generation** is further **connected to a waste tax incentive** (e.g. inclusion of a discount in the garbage fee by 15% to 20%).

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: On-site composting at hotels (hotel gardens) and restaurants seems to be a potentially suitable strategy for URBANWASTE. Information campaigns on composting (incl. technological solutions) could be targeted to accommodation establishments as well as food and beverage providers for tourists to increase separate collection of the organic waste produced by tourists and compost it on-site. Such measures could further be connected to tax discounts (or other economic incentives) which are received for implementation of on-site composting.

Level of implementation: On-site composting could be implemented at hotel level and for other establishments providing food and beverage to tourists to catch the organic waste produced by tourists.

Aspects that should be considered when implementing such strategies:

- What happens with the end product? Only if the produced compost is used this can be allocated to waste prevention
- How is the product quality (depending on quality of composting process)?

4.12.1.3 Eco-events

In Nice, an environmental friendly approach for events was developed in order to reduce impacts on the environment. Different tools have been created (a charter, informative material, a monitoring tool). This approach contains action such as waste reduction by avoiding over-packaged products and distributing reusable cups and tap water to avoid plastic bottles. Waste streams affected by such a "green organisation" of events are or example plastic waste or cardboard.

The Nice Jazz Festival, for example, is the biggest public event in the municipality. During this event, reusable cups are distributed (in 2014, around 25 000 cups were sold and 13 000 returned).

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE as the "green" organisation of events may affect the all over amount of waste produced by tourists. Especially the amount of waste of bigger events like sport or music events attracting thousands of tourists can be highly influenced by the green event concept. But also small events, even meetings can be oriented according the green event concept. Several aspects of this strategy such as avoiding over-packaged products and distributing reusable cups and promoting tap water to avoid plastic bottles might be relevant for URBANWASTE in any case.

Level of implementation: Bigger Green Events could be implemented at municipality level. But also on hotel level conferences or seminars can be organised as green event.

4.12.1.4 Promotion of re-use activities

In several URBANWASTE pilot cases (e.g. Copenhagen, Florence, Nice, Santander, Syracuse) activities exist that aim to promote the re-use of (mainly) consumer products, thus affecting different fractions of MSW. The majority

of those activities is targeted at individual citizens, but measure aiming at the re-use of construction materials (e.g. bricks) are targeted to construction and demolition companies. Examples for such activities include:

- **Consumer products**: Several activities are being implemented in order to encourage swap, repair and re-use in order to reduce waste generation and to extend the lifespan of the products. This includes among other:
  - Establishing **swap facilities at local recycling stations** to separate items for reuse and encourage citizens to hand in items that can be re-used and establishing of exchange markets.
  - Establishment of **repair centres.**
  - **Charity shops / second hand shops** where people can sell and buy second hand clothes and other items. This shops can be managed by private initiatives or charity organisations.
  - Other actions such as promoting **furniture donation** and videos promoting employment linked to product re-use. Besides, there are charity shops and in the Metropole, owned by private associations.
- **Construction materials**: The re-use of bricks from demolition sites can be promoted through activities initiated by local authorities (e.g. Copenhagen).
- **Re-usable cups and dishes**:
  - Reusable cups can be used in conference centres, amusement parks, at festivals etc. in order to prevent waste generation. The cups can be returned for example to a vending machine that also returns the deposit for the cups to the guests. The cups are washed and sent into circulation again. Recyclable cups are used for all kinds of beverages (Copenhagen).
  - Syracuse municipality is carrying out a pilot action in schools to reduce plastic waste from school canteens by using a reusable lunch box instead of disposable plastic dinner ware.
- **Reusable bags**: In Nice, the use of reusable bags is promoted and reusable bags are distributed during public events.
- **Reusable batteries**: Nice promotes using reusable batteries within its directions.

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: Activities aimed at re-use that potentially could be implemented in URBANWASTE could include, for example:

- Swap facilities for products the majority of tourists might only need temporarily such as travel guidebooks, city maps, bathing and beach gear such as air mattresses, snorkelling gear, etc.
- Use of reusable cups and dishes in tourist attractions that provide food and drinks as well as in tourist establishments (e.g. bars in hotel garden areas)
- Providing reusable equipment like furniture, TV, minibar or computers from hotels to people in need or social organisations instead of disposing them is another potential implementation option for this strategy

Level of implementation: Swap facilities could both be installed at hotel or at municipality level. The use of reusable cups and dishes could be implemented at the level of establishments providing food and drinks to tourists (restaurants etc. but also hotels) but also on municipality level providing a reusable cup system on a rent or leasing basis. The provision of reusable equipment from hotels to social organisation should be installed at hotel level but may be promoted on municipality level.

Aspects that should be considered when implementing such strategies:

- How to promote swap facilities among tourist? It is likely that accompanying information campaigns have to be designed and implemented.

4.12.1.5 Promotion of tap water for drinking

In Florence and Nice different activities exist to promote the use of tap water instead of bottled water for drinking, thus reducing mainly plastic waste. Those activities are mainly targeted to citizens and employees from local authorities and municipality administration, but also can be used by tourists (public drinking water fountains). Existing activities include:

- **Awareness campaigns** to promoting the use of tap water for drinking (Nice).
- Distribution of **reusable drinking cups** to employees from local authorities and municipality administration in order to promote the use of tap water (Nice).
- **Installation of public drinking fountains**: Through the installation of public drinking fountains providing high quality tap water in main public spaces the use of plastic water bottles can be reduced (Florence).

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: Through the installation of public drinking water fountains (and accompanying information measures) tourists could be encouraged to refill their empty plastic drinking bottles, thus, reducing PET-bottles waste.

Level of implementation: Municipality level

4.12.1.6 Reduction of food waste

In Copenhagen, Nice and Santander different activities targeted at food waste reduction exist. The target groups of those activities are citizens (in general), businesses, schools, markets and customers (citizens, tourists). Through information and dialogue with citizens and businesses local authorities aim at reducing the amounts of food turning into waste. Initiatives to meet this objective include:

- Campaigns for reduction of food waste from households.
- Awareness campaigns on food waste in primary schools (education).
- Co-operations between local authority's / interest groups / NOGs / others with businesses (e.g. hospitals, retailers, markets, ...) to reduce food waste. Encouraging food donation is done as well.
- Campaigns against food waste from markets.

- Introduction of "**doggy bags**": Restaurants provide "doggy bags" to their customers in order to prevent food waste. Customers can take home their food leftovers with these doggy bags.
- Projects with retailers aiming at combating the wastage of perfectly edible food because of aesthetic reasons by selling "ugly fruits".

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: Reducing food waste resulting from tourist activities is useful (as food and beverage provision to tourists was identified to be one of the main hotspots for waste generation by touristic processes) and seems feasible for URBANWASTE. Experience from Nice shows that tourists highly use the doggy bags system. Even more the reduction of food waste in the kitchen itself shall be emphasised as studies showed that high amounts of food waste already could be prevented in the kitchen.

Level of implementation: Measures aiming at reducing food waste from tourism are likely to be implemented at the level of tourist establishments providing food and drinks to tourists (restaurants, hotels etc. but maybe also certain tourist attractions). The organisation of information and guidelines for the food service sector at municipality level assists the implementation of food waste prevention.

Aspects that should be considered when implementing such strategies:

- Different reasons for food waste in hotels, restaurants, catering... have to be considered to have tailor made prevention strategies

4.12.1.7 Reduction of paper waste from advertisements

In Nice, citizens/households can put up "No advertising" stickers at their front doors or mailboxes to show that they do not want to receive any flyers, leaflets or similar advertisements, thus reducing paper waste. Such stickers can be distributed to the citizens by local authorities or ordered on request.

Suitability for URBANWASTE

"no advertising" stickers as such seem not suitable for tourists.

However, measures targeted at reducing paper waste from flyers or leaflets for tourists (e.g. with information about local tourist attractions etc.) are considered to be suitable for URBANWASTE.

Level of implementation: Leaflets, flyers etc. with information about local tourist attractions etc. would mainly be distributed at accommodation establishments, restaurants, tourist attractions, local tourist information offices etc. Measures aimed at reducing paper waste from tourist information materials would have to be implemented at those locations.

Aspects that should be considered when implementing such strategies:

- What other options than flyers/brochures are there to inform tourists about local attractions etc.?
- Is it possible to have free and easily understandable IT-solutions as information sources for tourists?

4.12.1.8 Resource consciousness in procurement

In some URBANWASTE pilot cases (e.g. Copenhagen, Florence, Ponta Delgada) activities for the integration of waste prevention requirements into municipal procurement policies as well as into the procurement policies of private businesses to prevent the generation of different types of waste (e.g. plastic waste) exist. For this purpose, local authorities can enter into partnerships with private players. Usually, some kind of green public procurement manuals/guidelines are developed. Such guidelines are related to the procurement of (amongst others): Food and groceries, transport, building and construction materials, sustainable wood, cleaning products, kid's products, IT, lighting, kitchen equipment, paper and printed matter ...

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: Within the scope of URBANWASTE it seems possible to promote resource consciousness in procurement amongst tourist accommodation establishments as well as food and beverage providers for tourists. Partially this could be reached by promoting environmental certification labels/schemes.

Level of implementation: Measures aiming at increasing resource consciousness in procurement would have to be implemented at the level of tourist accommodation establishments as well as food and beverage providers.

Aspects that should be considered when implementing such strategies:

- What incentives could be offered to touristic establishments in order to promote green procurement policies?

4.12.1.9 Taxes on one-way packaging

In Ponta Delgada, economic (dis-)incentives are used to change peoples' consumer behaviour: as in all Azores island, there is an eco-fee on plastic bags (0,05 €/bag) in large commercial establishments. This measure shall be extended to all commercial establishments during 2017.

Suitability for URBANWASTE

This strategy is considered not suitable for URBANWASTE: Economic incentives to reuse e.g. plastic bags instead of buying new ones (fee on plastic bags) could also stimulate tourists, but it is unlikely that such measures are introduced only because of tourists. Such measures normally have to be implemented on a national level. Rarely the implementation on islands seems to be also possible.

4.12.2 Waste management strategies

In the URBANWASTE pilot cases the following waste management strategies have been identified:

- Awareness-raising to change waste separation behaviour (of citizens)
- Better control of certain waste streams
- Biogas from organic waste
- Deposit-refund schemes for reusable packaging
- Improve access to information about waste management system
- Improving waste treatment and recycling
- Increase waste separation in the business community
- Provision of better waste separation options for citizens
- Reduce emissions and noise of waste collection (service)

4.12.2.1 Awareness-raising to change waste separation behaviour (of citizens)

In several of the URBANWASTE pilot cases (e.g. Copenhagen, Nicosia, Ponta Delgada, Tenerife) there are awareness-campaigns and education programmes to change waste separation behaviour of citizens (in general) or specific target groups such as school children or immigrants. Awareness campaigns and similar can be initiated by different actors such as local (waste management) authorities, interest groups/NGOs, stakeholders from the waste management system (e.g. Green Dot System / SOCIEDADE PONTO VERDE (SPV), a non-profit-making company with the mission to promote the selective collection, take-back and recycling of packaging waste in Portugal), etc. They can be aimed at various target groups (e.g. kids, citizens, immigrants, ...) and affect different fractions of MSW. Examples existing in the URBANWASTE pilot cases are:

- **Teaching of school children** how waste is separated correctly.
- **Educational programmes** with information about sustainable waste management targeted at participants from the **immigrant** community.
- **Training sessions** on sustainable waste management in municipal associations, schools and college, or enterprises, or companies and association.
- **Door-to-door information and awareness programme** designed in a way that people well informed on waste management issues from the neighbourhood influence next door neighbours (Ponta Delgada).

Some initiatives further aim at the **development of joint solutions and shared experience on common issues** concerning waste in the city (e.g. public bins and containers, events, information, nudging etc.) **in cooperation with stakeholders.**

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: Information on correct waste separation could be adapted to create an easily understandable "waste guide" for tourists.

Level of implementation: "Waste guides" for tourists etc. could be part of the information package tourists receive in their accommodation establishment.

Aspects that should be considered when implementing such strategies:

- Only effective if there are public bins for different waste fractions available in the pilot case and visible to tourists.

4.12.2.2 Better control of certain waste streams

Copenhagen initiated measures aiming at a better control of certain (hazardous) waste streams (primarily of construction and demolition waste as well as WEEE). Such measures are targeted at stakeholders from construction/demolition and waste management.

- **Construction and demolition waste**: Hazardous substances should be separated from the construction waste so the clean building materials can be reused and recycled. Local authorities can ensure the best possible management of demolition waste through cooperation with the construction sector and surveys of own buildings. This can be reached, for example, by:
  - Environmental survey of municipal buildings
  - Introduction of strategies for different hazardous wastes such as PCB for example
  - Stricter environmental requirements for municipal construction projects
  - Better control of waste streams
- **WEEE**: Local authorities in Copenhagen survey WEEE streams and make a special effort to avoid illegal treatment and export of WEEE (surveillance and information).

Suitability for URBANWASTE

This strategy is not considered to be suitable for URBANWASTE as construction and demolition waste related to touristic processes or the control of potentially hazardous waste streams by local authorities are not in the main focus of URBANWASTE.

4.12.2.3 Biogas from organic waste

Copenhagen pursues the strategy to use organic waste for biogas production. Biogas can be used to fuel heavy transport or waste management vehicles. Usually, separately collected organic waste is used for biogas production. In Copenhagen, for example, food waste from a conference centre and selected hotels is collected and used for biogas production. In Copenhagen further exists a pilot biogas plant that can also process unsorted MSW. This pilot provides data and knowledge for further development and upscaling of biogas production from unsorted MSW.

Separate collection of food waste (either separately collected from restaurants, canteens etc. or from households together with green garden waste) is currently existing in Copenhagen, Dubrovnik, Florence, Kavala and Lisbon.

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: (Enforcing) The separate collection of organic waste/food waste from establishments providing food and drink to tourists (restaurants, hotels, …) to use it for biogas production could be an option to deal with organic/food waste from tourism. Food and beverage provision for tourists has been identified as one of the touristic processes with major implications on waste management.

Level of implementation: Municipality level (The implementation of this strategy would be under the responsibility of the local waste management authority).

Aspects that should be considered when implementing such strategies:

- Are there already biogas plants existing in the (surroundings of the) pilot case area where the organic waste/food waste could be treated? Transport distance?
- Is the installed capacity sufficient to treat an increased amount of food waste?
- What happens to the residues?
- Is composting the better option

4.12.2.4 Deposit-refund schemes for reusable packaging

Deposit-refund systems are a market-based instrument creating an incentive to return a product. There is a surcharge on products with reusable packaging when purchased and a refund is given when the reusable packaging is returned. This strategy is mainly affecting packaging waste streams (glass, metals, plastics) and targeted at consumers. From all URBANWSTE pilot cases Copenhagen is the only pilot case that indicated to have such deposit-refund schemes in place.

Suitability for URBANWASTE

This strategy is not considered to be suitable for URBANWASTE. Although this system could be used by tourists as well it mainly has to be used by local citizens and businesses. Compared to local citizens and businesses, the contribution of tourists to waste reduction achieved with this system is small. Additionally, this strategy could only be implemented on national level.

4.12.2.5 Improve access to information about waste management system

In Santander, citizens (and also tourists) have access to information about waste and bulk waste pickup, recycling services, schedules and other services by using the **app "Cuida Santander"**. This App further acts as a communication channel from citizens to Santander City council.

Suitability for URBANWASTE

This strategy is considered not to be suitable for URBANWASTE: Normally tourists are not responsible for their waste as it is disposed into the collection bins either by hotel personal or by the renter. The percentage of tourists affected by such an app is very low.

4.12.2.6 Improving waste treatment and recycling

Copenhagen further currently pursues the strategy of improving waste treatment and recycling (mainly of bulky waste and recyclables). Related measures include, for example:

- **Collection of bulky waste in fractions** in order to enhance recycling of, for example, wood and other materials.
- Development of new **treatment/recycling options (technologies)** to drive development towards even better exploitation of resources.
- Establishment of **new, innovative and eco-efficient waste treatment centres** that presents options for separation and recycling. Recycling centres can be designed to be multifunctional, being a spot where people can organise various events such as weekend outings for their families, flea markets, and waste art exhibitions.
- More **reception control and fines at incineration plants**: divert waste streams from incineration to sorting/recycling. The City of Copenhagen, for example, wants to divert plastic waste away from incineration to separate collection and reprocessing into a quality allowing for the manufacture of new plastics."

Suitability for URBANWASTE

This strategy is not considered to be suitable for URBANWASTE. The establishment of new treatment / sorting / recycling facilities could, in theory, be an option for pilot cases with less advanced waste management systems. However, it has to be doubted that such measures will be implemented within the scope of URBANWASTE.

4.12.2.7 Increase waste separation in the business community

Waste separation (different fractions of MSW) in the business community can be stimulated by various measures as the examples of Copenhagen and Nice show.

- **Technological measures** to increase waste separation from businesses can be, for example, the customization of recycling centres to meet the requirements of the business community.
- Better waste separation in the business community can also be reached by **intensified supervision** and enforcement of **legal requirements**.
- Separation of waste from businesses for recycling can further be encouraged by **dialogue and information**. This can include providing information about multifunctional waste solutions for new businesses and cooperation with industrial organisations or advising businesses about better separation of plastic waste (Copenhagen).

- In Nice, an **incentive scheme** was implemented. The waste of some administrations and private companies covered by the municipal solid waste was previously collected for free. With this special fee, the collection service is now being charged to these establishments. The cost of the tax paid is modulated according to the type of bins that are collected: the bins for recycled waste (packaging and glass) have a lower fee than the bin for the residual waste. In this sense, this incentive scheme aims to do a better waste separation, and to produce less residual waste.

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: Especially information about multifunctional waste solutions could be a support for hotels that are not concerned with waste management issues so far. Legal requirements or economic incentive schemes would theoretically be options as well, but it is doubtable if such measures could be implemented within the URBANWASTE project.

Level of implementation: Information campaigns could be targeted for example to all tourist establishments in a given area. Legal regulations regarding waste management or incentive schemes could have the same target group/area.

Aspects that should be considered when implementing such strategies:

- Are there already information initiatives / materials for e.g. hotels? Do they work? Why do they not work? What are the barriers for hotels?

4.12.2.8 Provision of better waste separation options for citizens

Copenhagen and Syracuse demonstrate that better separation of different fractions of MSW by citizens can be reached by various (mainly technological) measures, such as:

- **Better separation options** in block of flats and more options for separation in single family houses by providing containers for (more) different waste fractions, better labels and signs.
- Establishment of **additional waste collection points/recycling hubs/"bring banks"** in order to improve separate collection of recyclables.
- Establishment of **collection points for green waste** (from gardens) (e.g. at local recycling stations).
- **Improve waste collection service**: Citizens can voluntarily order containers for additional waste fractions.

As the descriptions of the 11 URBANWASTE pilot cases (Chapters 4.1 to 4.11) reveal, separate collection of different fractions of MSW exists in all pilot cases. Differences, however, exist regarding which fractions are separately collected (e.g. if there is a collection of recyclables only for single material streams such as glass, metals, plastics etc. or if there is a collection of co-mingled fractions of at least two recyclables) and the collection systems used for specific waste fractions (door-to-door collection; brings-systems such as collection points/bring branks or recycling centres/civic amenity sites).

Separate collection of recyclables (single stream or co-mingled) does exist in all URBANWASTE pilot cases. Organic waste (meaning food and garden waste from households and/or green waste from private and public gardens) is currently collected separately in all pilot cases except Nice and Syracuse.

As "food and beverage provision for tourists" can be considered as one of the waste relevant hotspots in touristic processes (in addition to "accommodation"), food waste will be one of those waste fractions URBANWASTE is focussing on. Separate collection of food waste (either separately collected from restaurants, canteens etc. or from households together with green garden waste) is currently existing only in Copenhagen, Dubrovnik, Florence, Kavala and Lisbon.

Suitability for URBANWASTE

This strategy is considered potentially suitable for URBANWASTE: Having many public bins for different waste fractions available and visible might be an incentive also for tourists to do proper waste separation.

Level of implementation: Such measures would have to be implemented on municipality level, but the idea of designing an "attractive" and "easy to understand" waste collection system could also be adopted for hotels as well. Especially separate collection of food waste can be implemented easily at least at the hotel and restaurant level

Aspects that should be considered when implementing such strategies:

- Bins for different waste fractions have to be visible for tourists and not "hidden" in order to provide an undisturbed scenic picture of a touristic hotspot etc.

4.12.2.9 Reduce emissions and noise of waste collection (service)

The City of Copenhagen will reduce emissions of CO_2 and noise nuisances from collection vehicles. This will be done through trials of alternative fuels and smarter collection methods as well as through stricter requirements in tenders for collected waste. To receive this goal, the city further tries to also influence private sorting and treatment plants.

Suitability for URBANWASTE

This strategy is not considered to be suitable for URBANWASTE as the reduction of emissions and noise of waste collection (service) is not directly influenced by touristic processes.

4.12.3 Other initiatives with implications on waste generation and management

Eco-labels and similar environmental certifications

Eco-labels and guidelines for hotels provide minimum standards for sustainability in hotel establishments including indicators for waste management performance amongst others. Among the waste prevention actions implemented, the most common ones are:

- Reusable dinnerware and cutlery

- Waste assessment of building
- Refillable toiletry dispensers
- On-site composting or composting at an offsite composting facility of the establishment's food waste, yard waste and biodegradable products.

In the URBANWASTE pilot cases Copenhagen, Dubrovnik, Florence, Nice, Nicosia, Ponta Delgada and Tenerife the following eco-labels, environmental guidelines and environmental management systems are used by tourist establishments:

- **Eco-labels**: Green Key, The Nordic Swan, Green Globe, Det Økologiske Spisemærke (Organic Food Label, DK), Miosótis Açores[21]
- **Environmental guidelines**: TripAdvisor Green Leaders program
- **Environmental Management System**: EMAS (Ponta Delgada for public administration), ISO 14001

4.12.4 Policy instruments for implementing waste prevention and management strategies

To assist future implementation of waste prevention and management strategies in the pilot cities the relevant policy instrument will be explained in more detail based on examples of activities from the URBANWASTE pilot cases for each instrument.

4.12.4.1 Information instruments

Public information and motivation measures aim at changing consumers' lifestyle and behaviour as well as at stakeholders from production, retail and the service sector in order to change production processes and the range of products they offer or range of services they provide. Such instruments include, for example, information programmes, awareness campaigns or education programmes and inform about consumer behaviour, resource availability or ecological production technologies (Reisinger and Krammer, 2007).

In the URBANWASTE pilot cases several activities representing information instruments exist, aiming to:

- Change citizens' waste generation behaviour (information about waste prevention activities everyone can implement to reduce the generation of specific waste streams such as food waste, paper waste from advertisements or plastics (plastic bottles))
- Change citizens' waste separation behaviour
- Inform citizens about the existing waste management system
- Inform citizens and other stakeholders about how to do "good" (home) composting
- Promote repair, reuse and donation of consumer products

[21] *Regional "eco label" for touristic facilities, intended to all regional housing units that implement good environmental practices, with the exception of campsites*

The types of information instruments in place in the URBANWASTE pilot cases are various, including for example:

- Awareness campaigns for citizens (in general) or specific target groups (e.g. immigrants)
- Education programmes
- Training sessions on sustainable waste management for different target groups such as municipal association, schools and colleges, or enterprises, or companies and associations

The distribution of information is implemented by the means of, for example:

- Leaflets, brochures, other information material sent by (e-)mail
- Door-to-door information
- On-site training sessions and seminars
- IT-based solutions (e.g. "Cuida Santander" app, websites, …)

Awareness campaigns and similar can be initiated by different actors such as local (waste management) authorities, interest groups/NGOs, stakeholders from the waste management system (e.g. Green Dot System / SOCIEDADE PONTO VERDE (SPV), a non-profit-making company with the mission to promote the selective collection, take-back and recycling of packaging waste in Portugal), etc. They can be aimed at various target groups (e.g. kids, citizens, immigrants, ...).

4.12.4.2 Regulatory instruments.

Regulatory instruments are designed to create a regulatory framework that promotes sustainable production and a sustainable lifestyle. Free market development or the freedom of choosing an individual lifestyle shall not be restricted but rather directed in the direction of more efficient resource use and less negative consequences for health and the environment (Reisinger and Krammer, 2007).

Regulatory "command and control" instruments include quality standards, obligations and prohibitions/bans. **Quality standards** allow the markets to operate on conditions which are known to all market participants and apply equally to all market participants. **Obligations** (such as the obligation to use the best available technology or to fulfil waste reduction targets, landfill or recycling targets etc.) shall promote environmentally-friendly behaviour and define legal responsibilities for certain actors (principle of producer responsibility) (Reisinger and Krammer, 2007). Producer responsibility is a concept applied to some waste streams (e.g. for packaging materials) and requires the producer to ensure that post-consumer products are disposed of safely. This leads to a clear distinction of competences between establishing the targets (authorities) and fulfilling the targets (producers). A negative consequence could be that parallel collection systems are established, meaning one collection system organised by the producers and another one organised by the local waste management authority (Salhofer et al., 2010). **Bans** on toxic substances or other **prohibitions** (e.g. threshold limits, …) shall prevent that dangerous substances are put into circulation (Reisinger and Krammer, 2007).

Selected examples from the URBANWASTE pilot cases for regulatory instruments with implications on waste management[22]:

- **Increased control of certain waste streams:**
  In Copenhagen, local authorities survey WEEE streams and make a special effort to avoid illegal treatment and export of WEEE (surveillance and information). Further, hazardous substances should be separated from the construction and demolition waste so that clean building materials can be reused and recycled. For this purpose, those waste streams are controlled more strictly, strategies for different hazardous wastes such as PCB are introduced and stricter environmental requirements for municipal construction projects are applied.
- **Stricter rules for reception control at incineration plants to divert waste streams from incineration to sorting/recycling:**
  The City of Copenhagen wants to divert plastic waste away from incineration to separate collection and reprocessing into a quality allowing for the manufacture of new plastics. Therefore, more and stricter reception control and fines at incineration plants are applied.
- **Less exemptions from the obligation to pay waste taxes/fees:**
  In Nice, some administrations and private companies covered by municipal solid waste collection that previously were collected for free are now being charged a special fee for the collection service.

4.12.4.3 Economic instruments

Economic instruments include both fiscal instruments and market development instruments. **Fiscal instruments** are, for example, fees, taxes (e.g. landfill taxes), pay as you throw schemes ("polluter pays principle") or deposit-refund schemes (Salhofer et al., 2010). The aim of fiscal instruments is the internalization of external costs or external benefits in such a way that the resulting resource utilization corresponds to the economic optimum (Reisinger and Krammer, 2007).

With **market development instruments** the state cannot only help to eliminate market barriers, but can also actively guide market development. By applying public procurement policies, it can act, for example, as a customer and thus create markets for low-waste products or products from recycled materials. Further, it can also contribute to the organization of markets for second-hand goods and exchange platforms, as well as of repair networks and provide financial support (Reisinger and Krammer, 2007).

Examples from the URBANWASTE pilot cases for fiscal instruments with implications on waste prevention and management:

- **Eco-fee on plastic bags:**
  In Ponta Delgada, economic (dis-)incentives are used to change peoples' consumer behaviour: as in all Azores island, there is an eco-fee on plastic bags (0,05 €/bag) for large commercial establishments. This measure will be extended to all commercial establishments during 2017.
- **Deposit-refund schemes for reusable packaging:**
  Deposit-refund systems are a market-based instrument creating an incentive to return a product. There

[22] *No regulartory instruments aimed at waste prevention could be identified.*

is a surcharge on products with reusable packaging when purchased and a refund is given when the reusable packaging is returned. Such a system is currently existing in Copenhagen.

- **Deposit-refund system for reusable cups used in amusement parks and similar:**
  In Copenhagen, recyclable cups are used for all kinds of beverages served within Tivoli (amusement park) in order to prevent waste generation. The cups can be returned for example to a vending machine that also returns the deposit for the cups to the guests. The cups are washed and sent into circulation again.
- **Waste tax incentive to promote home composting:**
  In Syracuse, the free distribution of domestic composters on request was connected to other instruments such as a discount in the garbage fee by 15% and 20% in 2016 (waste tax incentive).
- **Differentiated taxation / fee structure as incentive for better waste separation:**
  In Nice, an incentive scheme using different fees for different waste streams was implemented. The cost of the fee paid is modulated according to the type of bins that are collected: the bins for recycled waste (packaging and glass) have a lower fee than the bin for the residual waste. In this sense, this incentive scheme aims to do a better waste separation, and to produce less residual waste.

Examples for market development instruments in the URBANWASTE pilot cases:

<u>Public Procurement</u>

Acting as a client of (big) infrastructure projects and as a consumer, the public administration can have a great influence on the development of the economic system. In-house regulations and internal procurement rules make it possible to promote waste prevention and recycling without imposing any obligations on industry or other consumers. According to Reisinger and Krammer (2007), the main obstacles why environmental criteria in public procurement have so far not been used more widely are:

- the expectation that environmentally friendly products are more cost-intensive,
- the negative image, which is associated with the concept of waste, or the fear that new environmental problems are created with waste recycling,
- insufficient support in the management of the tender (including time and money) or too little importance for the company strategy,
- the lack of training of the employees responsible for tenders on how to implement environmental criteria in accordance with the award directives (greater risk of complaints).

Waste prevention and recycling measures where the public sector acting as a consumer can set a good example include (Reisinger and Krammer, 2007):

- Use of reusable containers and other reusable packaging,
- Use of reusable dishes at public events,
- Double-sided use of (printing) paper,
- Use of reusable hand towels,
- Quotas for a minimum proportion of recycled building materials in public construction.

Green public procurement policies/guidelines exist in the URBANWASTE pilot cases Copenhagen, Florence and Ponta Delgada.

- The City of Copenhagen has set a paradigm for environmental and climate requirements that must be integrated in any tender document from the municipality. Copenhagen is part of Partnership for Green Public Procurement which is based on shared obligating green purchasing goals. The goals are automatically adapted into the city's tendering requirements.
- Florence: In order to make the Green Public Procurement targets more compelling, the Tuscany Region has issued the Regional Law n. 37/2012 on "Green purchases and guidelines for sustainable purchases in the public administration.
- Ponta Delgada: "Green public procurement guidelines" are an area still not very developed in Portugal. The new public procurement code already has some guidelines about green procurement, but these guidelines have to be developed and specified, so that purchase of goods and services can be made in a simple and clear way. At the city hall, due to its environmental management system, a green procurement code is in use since 2009.

4.12.4.4 Voluntary agreements

Voluntary agreements are agreements between some part of industry and the authorities (Salhofer et al., 2010) or self-commitments of individual industry branches (Reisinger and Krammer, 2007). According to Salhofer et al. (2010) such agreements represent softer regulations than producer responsibilities. Examples for this type of instruments are, amongst others, certifications based on specific standards (e.g. EMAS, ISO 14001) or eco-labels, which the producer is allowed to use only if he fulfils certain requirements.

In comparison to regulatory "command and control" instruments, voluntary agreements have the following advantages (Reisinger and Krammer, 2007):

- Less resistance to the introduction.
- The monitoring effort may be less.
- Less interference into the market.
- More flexible implementation.
- There is a stronger motivations of stakeholders to not only obey rules but to act proactively.
- Can be used to communicate a specific business image.

The disadvantages of voluntary agreements are that there is less protection against free riders and voluntary agreements are not enforceable, so it is not ensured whether they are actually fulfilled (Reisinger and Krammer, 2007).

Tourist establishments in the URBANWASTE pilot cases (Copenhagen, Dubrovnik, Florence, Nice, Nicosia, Ponta Delgada and Tenerife) have the following certifications based on specific standards (e.g. EMAS, ISO 14001) or eco-labels:

- **Eco-labels**: Green Key, The Nordic Swan, Green Globe, Det Økologiske Spisemærke (Organic Food Label, DK), Miosótis Açores[23]
- **Environmental guidelines**: TripAdvisor Green Leaders program
- **Environmental Management System**: EMAS (Ponta Delgada for public administration), ISO 14001

Exact numbers on how many tourist establishments in a given pilot case have such environmental certifications or eco-labels are not available for all pilot cases. More details on the number of hotels with eco-labels etc. (if available) can be found in the descriptions of Chapters 4.1 to 4.11.

4.12.4.5 Provision of infrastructure

Providing attractive and easy to use infrastructure can foster the prevention of waste. In the URBANWASTE pilot cases the following examples for the provision of infrastructure with implications on waste prevention and management exist:

- **Distribution of technological solutions for on-site composting:**
  In Florence, Kavala, Nice and Syracuse on-site composting is supported by the local administration/authority. For this purpose, technological composting solutions are distributed on request (for free) to individual households/citizens, businesses (e.g. restaurants, hotels, catering services), authorities, schools or put up in residence areas/block of flats etc. by the city/municipality or local waste management authority. There are different technological options for composters ranging from simple composting boxes / frames (primarily for individual "home composting") to special composting machines with different degrees of efficiency.
- **Installation of drinking water fountains:**
  In Florence, public drinking fountains are installed. Through the installation of public drinking fountains providing high quality tap water in main public spaces the use of plastic water bottles can be reduced.
- **Installation of attractive and tailor-made waste collection infrastructure:**
  An attractive and easy to use waste collection system is a key requirement to promote separate collection - and, thus, recycling activities in a subsequent step – and reduce the amounts of residual waste.
  - Installation of better separation options in block of flats and more options for separation in single family houses by providing containers for (more) different waste fractions, better labels and signs.
  - Establishment of additional waste collection points/recycling hubs/"bring banks" in order to improve separate collection of recyclables as well as organic waste (food and garden waste) / green waste from gardens.
  - Customization of recycling centres to meet the requirements of the business community.
- **Provision of infrastructure for reuse activities:**
  - Copenhagen: Installation of swap facilities (e.g. at local recycling stations)

[23] *Regional "eco label" for touristic facilities, intended to all regional housing units that implement good environmental practices, with the exception of campsites*

- Nice: Initiation of repair networks

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

5. Best Practices for Waste Management in Tourist Cities

Beside the review of existing waste prevention and management examples in the pilot cities an international review on best practice examples related to the tourism sector was performed- The following examples are based on a secondary literature research, with following search terms: *Waste management tourism; waste prevention in tourism; standards and certifications in tourism; best environmental practices in hotels/tourism; best practice waste management measures in tourism;* Additional focus was laid on the prevention of food waste as food waste is one of the most important issues connected to tourists although of course not only tourists are responsible for the total food waste occurring in a city. In order to identify best practice activities or initiatives waste prevention, normally several selection criteria are used. Some general criteria such as "targeted", "effective", "measurable", "innovative" and "replicable" are for example defined within the EU project FUSIONS (Vittuari et al., 2015) focusing on food waste prevention:

- **targeted**: practices that have a strong waste prevention focus, clearly distinct from other waste management strategies or broad environmental goals;
- **effective**: practices based on guidelines, protocols, standards, reports, or preferred practice patterns that have been proven to lead to effective food waste prevention/reduction practices;
- **measurable**: practices that have an evaluation plan in place to measure program outcomes, even if they do not yet have evaluation data available to demonstrate the effectiveness of positive outcomes;
- **innovative**: practices that use original or resourceful techniques for waste prevention;
- **replicable**: practices that can be easily reproduced and are similarly relevant in regions across Europe;

In general, each measure to prevent waste has the potential to become best practice. Within the URBANWASTE project the selection of best practice project was mainly based on the replicability within the planned pilot activities. But also the innovation of actions was one selection criteria. Therefore, well known actions might not have been mentioned, as they are already practiced in all participating countries. If there were similar examples normally only one was pointed out.

5.1 Best practices for waste management suitable for URBANWASTE

5.1.1 Eco-tourism certification scheme and labelling

Certification schemes play an important role in improving the environmental performance of the tourist industry. In this way they partly make great demands on a waste management system of the stakeholders involved.

Certification can be differentiated into Environmental Management System, EMS, certification (e.g. EMAS; ISO 14001) that essentially associated with monitoring and reporting of environmental performance, and

environmental standards that cover requirements for implementation of specific environmental management practices or compliance with particular environmental specifications. However, there remains a variety of rigour criteria, and their verification, across standards. The most rigorous standards are the EU Ecolabel (EU Flower), the Nordic Swan and the Austrian Ecolabel that include extensive mandatory criteria related to respectable environmental practices and performance levels (Styles et al., 2013). Many other standards are typically less quantitative and/or less transparent, and differ of their level of implementation.

Table 24 summarizes several sustainability standards and eco-tourism labels of European countries. A brief description and references of waste management requirements are given beside.

Table 24: Examples of environmental certification schemes for accommodation

Category	Certification	Waste Management Requirements
Environmental standards	EU Ecolabel (EU Flower)	Awarded to organisations that are in compliance with a comprehensive range of mandatory criteria and a selection of optional criteria, the EU ecolabel includes quantitative performance benchmarks. It requires a waste management to facilitate waste separation by guests, to sort waste, to avoid disposable products and single-dose food packaging (except where required by law). http://ec.europa.eu/environment/ecolabel/
	Green Tourism Business Scheme	A sustainable tourism certification scheme in the UK and Ireland that qualitatively assesses performance based on implementation across 120 environmental measures (e.g. cost savings by using returnable and reusable packaging). Businesses are rated according to three levels: Bronze, Silver, or Gold. http://www.green-tourism.com/
	Green Globe	Primarily legal compliance and sustainability monitoring criteria, but also qualitative requirements to implement better environmental practices. Waste management criteria, such as Plan and Reduce, Reuse and Recycling must be met, but the standards do not include quantitative performance requirements. http://greenglobe.com/
	Green Key	An international sustainability certification scheme based on a set of 13 criteria areas. Most criteria are imperative and must be in compliance, some of which are optional. These include specific environmental measures, but in some cases quantified benchmarks are missing (e.g. the establishment is encouraged to reduce the amount of waste). http://www.greenkey.global/
	Ibex label	A Swiss sustainability label for accommodations as well as clinics, health centres and senior citizen residences which combines the standards of ISO 9001 and 14001 with further criteria. This standard awarded at five levels depending on points attained across five relevant sustainability areas: management, regional, social services, ecology, economics; http://ibexfairstay.ch
	Latvia Green Certificate	Latvian ecolabel awarded to tourism establishments in rural areas / small towns, camping sites and small producers working in tourism that comply with a wide range of mandatory environmental and social criteria across 14 themes. Regarding waste management, minimum criteria must be met, but also additional criteria exist. http://eko.celotajs.lv/
	Legambiente Turismo	Italian eco-tourism label for any type of tourist accommodation business. in compliance with good management practices described in relation to ten social and environmental themes that aim to, amongst others, waste minimisation, recycling, using less water and energy, or promoting healthy

		food and typical local produce and products. http://legambienteturismo.it/en/home/
	Nordic Swan	Nordic Eco labelled hotels have to be in compliance with a comprehensive range of mandatory criteria and a selection of optional criteria. The label also includes quantitative performance benchmarks (e.g. limit value for hotels is set at 0.20 kg unsorted waste per hotel guest). http://www.nordic-ecolabel.org/
	Travelife Sustainability System for Hotels	An international tour operator (supply chain) driven sustainability certification depending on performance across a range of environmental and social criteria. From 2014 onwards all Travelife audits are now undertaken against the new criteria that are more extensive and demanding. http://travelifecollection.com/awards

Sustainable Tourism Education Program

Designed by Sustainable Travel International, the Sustainable Tourism Education Program, abbreviated STEP, is based on a framework that addresses all aspects of sustainability for tourism businesses or destinations and serves as a practical tool for assessment, benchmarking and education. The focus of the program particularly is on improving business systems and greening workplace practices. Based on a comprehensive set of sustainability criteria and indicators, STEP provides a number of online tools that help businesses manage and improve their environmental issues and impacts, e.g. energy-use, waste-reduction, water consumption, sustainable sourcing and carbon footprint.
The process includes, amongst others, education and training programs, a self-assessment framework for measuring and benchmarking up to a globally recognized eco-certification. The latter requires independent, third-party verification of business practices.

5.1.2 Best practice of local and accommondation activities

Over the last few decades' tourism has developed into one of the world's most important industrial sectors, but such a rapid growth has been coupled with substantial and irreversible direct and indirect environmental, economic and social impacts, especially on communities where tourism has established. Solid waste is a generally identified and ever increasing aspect of tourism, therefore waste management is an increasing complex challenge facing the municipalities or those responsible in the affected areas (Budeanu, 2005; Ezeah et al., 2015). In context to a sustainable tourism, it would be necessary to start by the places where waste is produced and that are in many cases hotels.

The hotel industry can considerably reduce their waste generation by implementing and following a waste management system that is designed by the concepts of reduce, reuse and recycle (Greenhotelier, 2004). Approximately 54 percent of a hotel's solid waste can delivered to recycling or reuse processes (Alexander, 2002), Bohdanowicz (2005) also estimated those waste fractions by 50-60 percent in accommodation facilities.

Hotels are often limited not only by barriers to sorting and recycling their waste, but also by the waste management infrastructure in their locality, commonly owned and operated by the local authority, especially if there no other purchaser for waste fractions that are not collected and treated by the local system.

Styles et al. (2013) identified that "a relevant starting point for waste prevention, sorting and recycling is to record on-site waste generation by category and source". In addition, it may be useful to consider local reuse and recycling options, or rather seek opportunities for product reuse before waste is sent for recycling, e.g. returning packaging to suppliers. To implement a successful waste sorting and recycling plan, it demands a committed management to coordinate technical and human resource requirements across all departments, including educational measures, such as staff trainings, and time allocation (Table 25).

Table 25: Best practice measures to separate and recycle waste for accommodations (Styles et al., 2013)

Department	**Measure**	**Description**
All (management led)	Develop waste inventory and identify options	Survey of all areas and processes to identify types and sources of on-site waste generation. Identify waste recycling and packaging return options available locally
	Monitoring and reporting	Continuously monitor and periodically report waste generation and collection by fraction
Procurement	Procurement selection	Select products and packaging made from recycled and recyclable material
Housekeeping	Waste bins	Install separated waste collection bins in rooms
	Waste collection in rooms	Separate waste during room cleaning into fractions collected separately from accommodation premises
	Back-of-house waste management	Separate waste arising from public areas, maintenance of outdoor and indoor facilities, and other back-of-house areas into appropriate fractions for recycling and correct disposal
Catering	Green procurement	Consider packaging volume, production impact and recyclability when assessing products for green procurement
	Separation	Install and train staff to use conveniently located bins for separate collection of glass, plastics, and paper and cardboard in kitchen and dining areas.
Reception and public areas	Collection Points	Install collection points for paper and magazines, batteries and other hazardous waste

Below, some examples of best practices for waste management in the hotels are given:

Hilton Slussen Hotel, Sweden

The Hilton Slussen in Stockholm sorts waste into 26 different fractions. Since the introduction of a sorting and recycling scheme in 1997 more than 125 tonnes per month sent to landfill were reduced by 76 %, to 0.3 kg per guest-night. In addition to cardboard which were recycled and wooden pallets which were diverted for heating buildings outside Stockholm, other combustible materials were sent to generate district heating for apartments. Also candle stumps were donated to day care centres and to a church to be made into new candles for sale. Further, separated organic waste is used for biogas production, food residues are sent to farmers outside Stockholm for anaerobic digestion (Baker, 2006; Styles et al., 2013).

The Savoy, United Kingdom

The Savoy hotel in London implemented a comprehensive waste recycling programme in accordance Fairmont Hotel's Sustainability Partnership Program, upon reopening in 2010 following a major refit (Fairmont hotels and resorts, 2016a). This included extensive and ongoing staff training, e.g. in form of daily staff briefings incorporate environmental management topics, and the introduction of a waste separation, reuse and recycling system. Consequently, over 95 % of non-food waste is now diverted from landfill, and unsorted waste generation could be reduced to approximately 0.3 kg per guest-night. Separated organic waste amounting to a further 344 tonnes per year is used for energy recovery.

The whole waste of the hotel is separated into eight fractions: cardboard and paper, glass, wood, plastic and metal, cork, organic oil, batteries, and electrical. Already housekeeping staff recover recyclable waste from room bins, while a waste management company undertakes further separation after collection (Fairmont hotels and resorts, 2016b; Styles et al., 2013).

Following, some key actions of The Savoy's waste management programme are given:

- purchasing department reduces packaging as part of green procurement;
- instigation of 'Food waste to Renewable Energy Scheme' that sends separated organic waste for heat and electricity generation by PDM Group;
- installation of an 'Oilsense' management and collection system for used cooking, to enable efficient reuse as biodiesel;
- an integrated pest management programme, operated by Ecolab Pest Control, minimizes hazardous waste generation;
- redistribution of household goods and unclaimed lost property items to charity

Tower Hotel, United Kingdom

In 2006 the Tower Hotel in Perthshire (Scotland) installed an automated composting system that consumes less than 4 kWh per day and converts organic waste to compost in around 14 days (compared with 12 – 18 months for the basic compost heaps it replaced). The output material is screened for size, greater fractions are returned for further composting while finer material is stored for maturation for a further two months before use on the hotel grounds. Through this procedure 2.5 m^3 (1.25 tonnes) of vegetable waste from the hotel kitchen and 6 m^3 (1.25 tonnes) of garden waste could be processed to produce 1.5 tonnes of compost in the first year after installation (HUB4, 2007; Styles et al., 2013).

5.1.3 Best practice of municipal or regional waste management

A universally transferable best practice model of municipal or regional waste management could not be identified, because each area is dependent of its own characteristic limitations. Common barriers or waste management problems of such locations are (Santamarta et al., 2014):

- Reduced number of facilities for treatment or disposal
- Significant variations in waste arising based on tourism season
- High population density
- Difficult to achieve economies of scale
- Limited territory to locate landfills
- Transportation of waste to the mainland (islands)

According to Practical Action Nepal (2008) and Santamarta et al. (2014), some examples of generally valid requirements for a sustainably waste management system are minimisation and separation/segregation of waste at source, an effective collection system, the establishment of recycling and treatment plants, greater participation of local communities, support of public-private partnerships and short-term and long-term planning.

As mentioned above, the on-site composting systems of the Tower Hotel may be seen as a leading implementation of a closed-cycle principle. Two further examples of sustainable waste management measures are presented subsequently:

Selective collection of organic waste for recycling in tourist areas (SCOW)

This European project from 2013 to 2015, funded by the Cross Border Cooperation in the Mediterranean (ENPI CBCMED) Programme, aims to develop low cost, technically simple and high quality bio-waste collection and recycling models in territories with touristic areas and agricultural activity in Mediterranean zones.

SCOW's goal is to define and built up an innovative and sustainable bio waste management system through effective collection and waste treatment into decentralised small-scale composting plants, situated near the bio-waste production areas, and, at the same time, where the compost could be applied.

Amongst others the project includes following outputs:

- Database of Good Practices
- Technical study of the key elements and management options
- Guidelines defining the SCOW management model and monitoring protocols
- Handbook on small-scale composting facilities management / Vademecum
- Database with the result indicators of the implemented management models.

Recovery of used cooking oil

Another opportunity to selectively grade incurring wastes is the separation of useful organic fractions such as cooking oils, fats and grease before organic waste is send to anaerobic digestion or composting. Oils can be stored in secure containers for collection by waste disposal contractor specialising in the production of biodiesel, or animal feed, soap or cosmetics production. Oils traps, fitted in kitchen drains, can also be another option for recovery (Styles et al., 2013).

Albert composter

Selected Albert stores (Ahold) uses a special composter that transforms otherwise useless scraps into a concentrated soil substrate. The entire process takes just 24 hours. This ecological solution can transform unsold and unsatisfactory fruits and vegetables but also, for example, leaves or foliage of vegetables into natural fertilizer for farmers. This technological innovation is aimed to reduce the environmental burden of food waste in landfills and also to simplify the handling of food waste. There are currently composters in five large stores.

This pilot operation of using a special composter began in Albert two years ago (2014).

The special composter used works on the same principle as natural composting or domestic composting; however, the composter is bigger (about the size of a freezer) and it is also faster. At the back of the stores fruits and vegetables that cannot be sold anymore are collected in crates. Leaves or stems are also included. Once the crate is full an authorized employee simply dumps the content into the composter. The special machine speeds up the natural composting process using high temperatures, micro-organisms and air. The result at the end of the process is nutritious substrate formed within only 24-48 hours. Once more humus is produced the fertilizer is then transported via a local composting facility to local farmers.

Due to the high concentration of the resulting product it is mixed into substrate fertilizing mixtures used for local fertilization of agricultural land. The organic component is thus returned into the soil and the cycle is closed contributing to a circular economy. Composting on site simplifies the logistics of the process of discarding food that cannot be sold. The bio-waste weight reduction is up to 90% and allows easy collection and transport of a uniform substrate to local composting facilities. This reduces both the number and the length of transport and thus significantly reduces the carbon footprint.

Source: http://www.albert.cz/pro-novinare/tiskove-zpravy/kompostery-v-prodejnach-albert-zpracovavaji-neprodejnou-zeleninu-a-ovoce-na-hnojivo-pro-farmare

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5.2 Best practices for waste prevention suitable for URBANWASTE

5.2.1 Best practice waste prevention in accomodations

The first step for waste prevention measures in accommodations and touristic destinations is to elaborate an inventory of the waste types and sources. This should help to locate avoidance potentials of waste generation in different departments. Table 26 gives an overview of items to prevent, items to select and actions to avoid waste in accommodation. Following different best practice guidance and guidelines addressing (food-) prevention measures in tourism sector are given.

Table 26: Best practice to prevent, select and take actions to avoid waste in accommodation (International Tourism Partnership, 2008; The Travel Foundation, 2016)

Prevent	Select	Do
• Bought-in bottled water • Single-use hygiene products • Single-portion food products • Disposable plates, cups and cutlery • Excessive use of paper napkins • Items with unnecessary or • excessive packaging • offering newspapers and magazines	• refillable amenity dispensers in guest bathrooms • food sold in bulk packaging where appropriate • cloths instead of disposable paper towels • durable coasters instead of paper ones • electrical resistance or refillable burners instead of disposable heating fuel cartridges for buffet lines • cloth bags or baskets instead of plastic bags to collect and return towels, linens and guest laundry • refillable printer and copier cartridges • rechargeable batteries	• provide guests with filtered tap water • provide guests with reusable glasses and cups in rooms • put condiments and food servings in refillable containers • purchase chemicals in bulk and dispense them from refillable pump bottles or containers • give preference to vendors that supply their products in returnable and reusable containers • minimise the use of hazardous chemicals (e.g., drain cleaning chemicals, solvents and bleach) • provide electronic information and newspapers • print double sided • disposable plastic • identify reuse possibilities

Cyprus Tourism Organisation, Cyprus Sustainable Tourism Initiatives and The Travel Foundation (2013): Waste Mapping Guidance for Hotels in Cyprus: Saving money and improving the environment (CYP)

This guidance document addresses hotel operators and other organisations working in the Cypriot tourism industry to highlight the financial and environmental benefits of undertaking waste mapping as part of their on-going business operations. Waste mapping is designed to identify the sources, types and quantities of waste that can be attributed to tourism. The mapping approach allows them to examine where and how waste arises and present this visually in a way that can help to identify hidden costs of waste (e.g. purchasing costs). The process should help to prioritise areas where simple actions can be taken to minimise waste, save money and achieve lasting sustainable waste management (Owen et al., 2013).

Some of these simple recommendations to reduce food waste mentioned in the Waste Mapping Guidance are given in table **Fehler! Verweisquelle konnte nicht gefunden werden.**.

Table 27: Quick win opportunities for hotels

Hotel area	Example 'quick win' opportunities	Benefits of taking action
Food & beverages	Display food in smaller trays enabling additional items to be stored appropriately in the kitchen, thereby extending the shelf-life of the product, and enabling unused food to be chilled for use the following day/ meal	• Reducing food waste has financial benefits as outlined above. • Removing individual portions and sachets can often save money as well as reducing waste. • Data on the number of portions remaining can be fed into future menu planning and identify those meals that do not sell as frequently as others.
	Providing smaller plates and serving spoons for guests as research has identified that this can cut food waste by 20%.	
	Ask whether the customer actually wants accompaniments for meals, e.g. bread, salad garnish, vegetables rather than simply serving them automatically.	
	Remove individual portions and sachets of condiments and replace with dispensers, pourers and shakers.	
	Monitor stock control and overproduction of waste regularly, for example at the end of each sitting the number of portions remaining can be recorded.	

Further, other options to reduce food waste are mentioned in the Guidance:

- Composting food waste such as vegetable peelings and other food preparation waste is ecologically worthwhile than disposing of waste to landfill. Composting food waste on site also has the benefit of producing a valuable product that can be used in the hotel gardens as a plant fertiliser.
- Donation of unused, over produced (surplus) food to charities. Local charities, soup kitchens or other organisations often accept and allocate food donations for people in need.

Fair Hotel reducing packaging waste, Italy

The main objective of the Fair Hotel project is to reduce the production of waste packaging in the hotels and enhance the hotel offer in an environment friendly way. Origin of the initiative was the high amounts of waste in Piemonte Region, where 2.270.000 tons of urban waste have been produced (522 kg/inhabitant), more than 30% of the whole waste was represented by packaging. At the monitoring phase various waste streams were identified and determined, on this basis of "standard experience", there have been individuated 12 meaningful actions to minimize waste of packaging in hotels. On average more than 210/kg/year of plastic waste, 49 /kg/year of paper waste and 47/kg/year of polylaminated material could be avoided in the participated hotels.

http://www.prewaste.eu/index.php?option=com_k2&view=item&id=153:fair-hotel-reducing-packaging-waste&Itemid=83

5.2.2 Food Waste Prevention in Food service sector:

Waste Watch

Sodexo operates over eighty restaurants in the Czech Republic, mostly in companies, and large amounts of food is thrown away each day amounting to about 330 tons of food each year. Therefore, in September 2015 Sodexo CZ joined the initiative of Waste Watch, which promotes methods to better monitor food wastage and has pledged that by 2025 they will reduce waste by 30 percent, which means that each year they will produce ten tons less food waste.

In practice, Waste Watch means that Sodexo measures and then analyses four kinds of food waste. First, foods that cannot be consumed because it is expired or otherwise impaired. Second, waste generated during food preparation, such as peelings, vegetable waste, scraps of meat. Third, the portions that are not issued to customers. Fourth, and finally food that customers buy, do not eat, and return it on their trays.

These four groups are collected separately in plastic containers for better monitoring not only the quantity but also the composition. Measured values are recorded in daily reports and subsequently put into an overall review. These reports serve as a basis for drawing up action plans to reduce waste. Related to this initiative is the internal plan of Sodexo CZ to reduce its food waste by 2025 by thirty percent. For instance, by refining production planning, enhancing control of deliveries and warehouse management, discussing the range of meals with clients, optimizing the size of portions and better responding to seasons. 95 percent of all Sodexo restaurants are in companies, thus focus so far is mainly in this sector.

"Menu Dose Certa", Portugal

Intermunicipal Waste Management of Greater Porto (LIPOR), responsible for the management, recovery and treatment of the Municipal Waste produced in the eight associated municipalities around Porto, won the Portuguese Sustainable Development Awards for its campaigns on waste prevention in 2009. One of the main goals of LIPOR´s is the reduction of annual waste generation by 100 kilos per person. The city of Espinho, part of greater Porto and with one of the highest bio waste generation, was selected for the pilot "Menu Dose Certa" or Right Serving Menu. The pioneering project aims to support restaurants in creating menus that avoid food waste. By this way LIPOR's ambitions are to reduce food waste by 48,5 kilos per year per restaurant client by 2011 and attempts to change attitudes and behaviours by raising awareness on the problem of food waste.

http://ec.europa.eu/environment/waste/prevention/pdf/MenuDoseCerta_Factsheet.pdf

Using unused food for people without homes

This is a unique project in the city of Brno and the Czech Republic, whereby canteens provide free left-over or unsold lunch menus to the homeless on weekdays. Employees of the Social Services Centre pick up the left-over or unsold lunch menus directly from the canteens and transport them to the Centre of emergency assistance for those in extreme social situations where the homeless can get a good hot meal which would have otherwise been thrown away.

All organization and financing of the project is under the Social Services Centre, which includes the purchase of fuel, workers' wages, the purchase of menu boxes, thermos-bags and thermos-containers in which the food is transported, and disposable plastic tableware, including other resources necessary for serving food. All this is applied according to the recommendations of the hygiene station in Brno. The project is implemented under the supervision of the Regional Hygiene Station in Brno.

Especially in the food waste sector numerous activities and best practise examples can be detected all over Europe. Most of them are not connected to the activities of tourists and to food waste that occurs because of tourist activities but focus on a more general level. Examples are shown in Chapter 5.1.5.

UNITED AGAINST WASTE

United Against Waste (UAW) was launched in Austria in 2014 in form of a cross-border cooperation platform. Companies from the food service market as well as the federal government, the provinces, science and NGOs are pursuing an ambitious goal: reduction of avoidable food waste in kitchens by half by 2020.

In the KÜCHENPROFI[T] advisory service, independent kitchen professionals assist in optimizing the use of goods. Two information brochures and a kitchen poster provide plenty of inspiration and tips on how to save food waste in the kitchen every day. Numerous examples of practical solutions are also available online, some of these tips are summarized in **Fehler! Verweisquelle konnte nicht gefunden werden.**. Likewise, UAW implemented an online tool for waste analysis: A quick test allows the calculation of the avoidable food waste in our company and a comparison with the branch average with only a few inputs. Interested hoteliers and other stakeholder of the gastronomy can take the opportunity of borrowing equipment for waste ascertainment to analyse food waste in their company and find out where their savings potential lies (UAW, 2017).

Table 28: UNITED AGAINST WASTE- practical solutions for food waste prevention in gastronomy

measures for	solutions	description
Menu card / food offer	Adaption of the food portion	Weight the individual components of the dishes and analyse the leftovers to adapt standard portions.
	Food size selection for guests	Introduce different portion sizes and choose the right wording for it.
	Free food seconds	Serve smaller portions and offer instead seconds for free.
	Variable side dish	Guests should have a choice of salad, vegetables or other side dishes.
	Boxes for leftover	Guests can take leftovers to their home.
buffet	Adjustment of the container size	Use lower or separable containers, thereby you can offer less food at the end of the buffet.
	Beverages from vending machines and tap systems	Through the use of coffee machines or beverage dispenser each guest can take as many drinks as needed.
	Clear description of the dishes	Mark the dishes at the buffet with their ingredients and spices as clearly as possible, so the guests have to try less, they just take what tastes them
	Reduction of edible decoration	Avoid salad, fruit and vegetables as optical decoration, with decorative oils, pasta or preserving glasses, you can create a delightful buffet without having to throw away valuable food.
	Fresh food preparation by front-cooking	Prepare certain hot dishes right in front of the guest. This makes it easier to dispense appropriate portions.
preparation of food	Separating and optimized utilisation	Insert containers in the kitchen to separate useable from not utilizable ones.
	Into the cool box	Vacuum utilizable preparation residues and freeze them for later processing.
	Information for personnel	Conduct internal trainings: e.g. kitchen staff learn to use as much as possible of the food
food over-production	Less food pre-production	Reduce the amount of pre-production and produce only more if it is really necessary.

	Leftover creations	Process not distributed food into new dishes (e.g. vegetables side dishes for a stew
	food donation	Numerous charitable institutions are organisations are grateful for prepared food.
	Food for employees	Offer prepared but not distributed food to your personnel.
	Preservation of food	By vacuuming and freezing, sous vide cooking or cook & chill, food usually can be served without a loss of quality at a later time.
food management	Storage place management	"First in, first out" - check the food stock daily and continuously adjust the menu. Use the food that is first purchased or whose shelf life is limited.
	Awareness and education	Awareness raising training courses for kitchen and service staff to avoid food waste, to improve efficient use of food products and to visualize that food is precious.
	Food & beverage-controlling	Input-output analysis of dishes, selection of food according to weather and season or production planning based on bed occupancy rate are only a few measures which help to match supply and demand in a better way.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

5.3 Best practice to improve sustainability performance

Although the focus of the project is laid on the minimization of waste and its impact resulting from tourist activities other best practice activities focusing on either environmental issues relevant for the tourist sector e.g. minimization of energy use or carbon food printing as well as innovative waste prevention activities that are not connected to tourist activities like prevention of food waste not resulting from tourists have been taken into account.

Cyprus Tourism Organisation, Cyprus Sustainable Tourism, Travel Foundation (2013):
Guidelines for meeting the Cyprus Tourism Organisation minimum standards for sustainability in hotel establishments (CYP)

This programme builds a framework of mandatory minimum standards for sustainability to support Cyprus as a destination in becoming a leader in sustainable tourism.

Launched by the Travel Foundation in 2013, these guidelines will encourage hotels in Cyprus to take steps towards improving their sustainability performance and cover some measures to manage and prevent (food-) waste partitioned in different departments where waste streams are generated such as housekeeping, laundry, food and beverage, purchasing, maintenance and security.

In Table 29 several tips for waste prevention in hotels are listed.

Table 29: Food waste prevention measures allocated to different departments

Department	Waste
Reception and office- based stuff	Only print what you need and if needed, double sided Use email rather than printed communication
Housekeeping	Use bins that do not require a plastic bag liner. If one is needed (e.g. bathroom bin), only replace when soiled or damaged Collect any recyclables from guest rooms (paper, cans, glass, plastic) separately to general waste Use refillable amenity dispensers do not replace half used toilet rolls until checkout and then use these back of house
Food and beverages	Avoid disposable / single use items: plates, cups, cutlery, plastic straws, aprons, hats, heating fuel cartridges etc. Use reusable placemats, tray covers, coasters and linen napkins Use storage containers instead of plastic wrap, foil etc.

	Separate waste into reusable, returnable and recyclable items: cardboard, paper, plastic glass, metals, used cooking oil, fruit and vegetable waste Bulk purchase to reduce packaging and work with suppliers to reuse or return packaging
Purchasing	Buy reusable kitchenware, crockery and durable cups Buy cleaning solutions in concentrated form Avoid purchasing single-use disposable items Buy rechargeable batteries instead of disposable

Environmental protection in the tourism sector

There is a huge range of activities to save environmental impacts of the tourism sector. At this point only two best practice examples shall be highlighted showing this bandwidth as there is own from the accommodation sector and another from the tourist attraction sector.

Zero Carbon Iveagh Garden Hotel in Dublin

Europe's "first sustainable hotel" opened in Dublin. The Iveagh Garden on Harcourt Street sources all of its energy from an underground river, running 50 metres below the hotel. Large turbines convert power from the river Swan to meet all of the hotel's energy requirements. The ground-breaking energy system uses turbines which were installed by Eurotech Renewables, and Swedish company Ochsner Warmepumpen. All heating, cooling, plumbing and hot water systems have been removed and replaced by this new natural system which owners the McGill Family are confident will wipe out waste and their carbon footprint.

Environmental Policy of the Zoological Garden in Vienna

The Zoological Garden in Vienna with its more than 2.2 million visitors per year participates at the EcoBusiness plan Vienna which was launched in 1998 by the Municipal Department for Environmental Protection on behalf of the Vienna City Administration. To date, 1,041 enterprises have participated in EcoBusiness Vienna, implementing more than 11,000 environmental projects and actions. Through appropriate environmental management practices, these enterprises have been able to generate substantial cost savings totalling about EUR 121.4 million.

One main issue of the environmentally-conscious activities in the zoological garden is the energy management. Animals from tropic zones or polar regions need heating or cooling and also the water purification is an elaborated process. With the help of new technologies like photovoltaic, alternative concepts and regular controlling the necessary input of energy and resources is kept as low as possible. Warm water for showers of the elephants but also the Antarctic temperatures for the King Penguins is produced by photovoltaic systems of 292 square meters. Other major improvements in terms of environmental impact found, were the segregation of PET bottles on site and bring them to recycling. This measure in waste collection was found to reduce the electricity consumption equal to 78 single-family houses.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

Social markets

Products coming mainly from wholesale/retail and industry that are near or past their "expiration" date incorrect labels or damaged packaging are sold at symbolic prices in social markets (e.g. SOMA-Market) or sometimes even spread for free to needy people. The products might have e.g. lightweight packaging damage or close to their expiration date but are still suitable for consumption. Meanwhile, many "social-markets" have been established all over Europe e.g. SOMA in Austria, last minute market in Italy or Wefood supermarkets in Denmark. Those activities are a good example for a win-win situation as at the one hand needy people have the possibility to improve their nutrition and at the other side environmental impacts because of food waste are saved.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690452

6. Concluding Remarks

A comparative policy review of national waste management strategies and targets in the European Union (EU) showed that there is no separate field of policies and instruments for waste generated by tourism neither on European level nor on the national level of EU member states. On the everyday level of implementation, specific practices to manage tourist waste, if existing at all, are usually designed and implemented at city or even local level and are linked to features of the local societal and geographical context.

Currently there are no waste related activities targeted at waste from ships. As several pilot cities are important destinations for touristic ships (cruise ships, yachts etc.), this could be focused on and developed when developing strategies in URBAN WASTE's works package 4.

The identified waste prevention and management strategies existing in the URBAN WASTE pilot cities, as well as international best practice examples, consist of well-known policy instruments mainly based on information and awareness building as well as provision of infrastructure (e.g. bins for separate collection of food waste). Also regulatory instruments (e.g. ban of plastic bags), economic instruments and voluntary agreements (e.g. use of returnable containers) could be identified.

Both, waste management and prevention practices in pilot cities as well as international best practice focus on nutrition of tourists. Most measures deal with **food waste prevention** as well as **food waste management** like **selective collection of organic waste for recycling in tourist areas** and subsequent **composting** activities, either at the point of waste generation or central as well as the production of **biogas** from organic waste. Besides the measures implemented in some of the pilot cities, international best practice examples included the aspect of separate collection and **use of cooking oil**. Through the **installation of public drinking water fountains** (and accompanying information measures) tourists could be encouraged to refill their empty plastic drinking bottles, thus, reducing PET-bottles waste.

Besides activities dealing with food and food waste as two additional general issues, the organisation of events and in general the **promotion of re-use activities** seem to be promising topics to reduce tourist waste generation. Both bigger events, like sport or music events, as well as small events, even meetings, can be oriented according the **Eco-event** concept. Activities aimed at re-use that potentially could be implemented in URBANWASTE could include on the specific tourist side swap facilities for products the majority of tourists might only need temporarily or at the side of operators the use of reusable dishes and the donation of reusable equipment.

The **promotion of resource consciousness in procurement** amongst tourist accommodation establishments as well as food and beverage providers for tourists is another positive example identified. Partially this could be reached by promoting environmental certification schemes.

Most identified international best practice examples connected to tourist waste management also refer to **eco labelling** and connected guidelines. The hotel industry can considerably reduce their waste generation by implementing and following a waste management system

One interesting aspect to be highlighted from international best practice examples as first step for waste prevention the **elaboration of an extended inventory of waste types and sources** is recommended. This should help to locate avoidance potentials of waste generation. An overview of items to prevent, items to select and actions to avoid waste in accommodation is the basis for subsequent waste prevention.

7. References

Bio by Deloitte (2014), *Comparative Study on EU Member States' legislation and practices on food donation. Final report.* Retrieved January 2017: http://www.eesc.europa.eu/resources/docs/ executive-summary_comparative-study-on-eu-member-states-legislation-and-practices-on-food-donation.pdf

Căilean, D. & Teodosiu, C. (2016), An assessment of the Romanian sold waste management system based on sustainable development indicators. *Sustainable Production and Consumption*, 8, 45-56

Cecere, G. & Corrocher,N. (2016), Stringency of regulation and innovation in waste management: an empirical analysis on EU countries. *Industry and Innovation*, 23, 625-646

Crotti, R. & Mishrahi, T. (Eds.) (2015), The travel and tourism competitiveness report 2015: Growth through shocks. Geneva: World Economic Forum.

EC (2005), *EU waste policy. The story behind the strategy*. Retrieved December 2016: http://ec.europa.eu/environment/waste/strategy.htm

EC (2008), *Directive 2008/98/EC of the European Parliament and of the Council*. Retrieved December 2016: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN

EC (2010), *Being wise with waste: the EU's approach to waste management*. Retrieved December 2016: http://ec.europa.eu/environment/waste/pdf/WASTE%20BROCHURE.pdf

EC (2011), Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Thematic Strategy on the Prevention and Recycling of Waste. Retrieved January 2017: http://ec.europa.eu/environment/ waste/pdf/Progess%20report.pdf

EEA (2013), *Managing municipal solid waste – a review of achievements in 32 European countries*. EEA Report | No 2/2013. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2015), *Waste prevention in Europe – the status in 2014.* EEA Report | No 6/2015. Retrieved December 2016: http://www.eea.europa.eu/publications/waste-prevention-in-europe-2015

EEA (2016), *Municipal waste management across European countries.* Retrieved December 2016: http://www.eea.europa.eu/themes/waste/municipal-waste/municipal-waste-management-across-european-countries

EEA (2016a), *Municipal waste management. Country Fact Sheet Croatia.* Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016b), *Municipal waste management. Country Fact Sheet Cyprus*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016c), *Municipal waste management. Country Fact Sheet Greece*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016d), *Municipal waste management. Country Fact Sheet Portugal*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016e), *Municipal waste management. Country Fact Sheet Spain*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016f), *Municipal waste management. Country Fact Sheet France*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016g), *Municipal waste management. Country Fact Sheet Italy*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016h), *Municipal waste management. Country Fact Sheet Denmark.* Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016i), *Municipal waste management. Country Fact Sheet Sweden*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016j), *Municipal waste management. Country Fact Sheet The Netherlands*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016k), *Municipal waste management. Country Fact Sheet Switzerland*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016l), *Municipal waste management. Country Fact Sheet Belgium*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016m), *Municipal waste management. Country Fact Sheet Austria*. Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

EEA (2016n), *Municipal waste management. Country Fact Sheet Germany.* Retrieved December 2016: http://www.eea.europa.eu/publications/managing-municipal-solid-waste

Fusions (2015), *Review of EU legislation and policies with implications on food waste*. Final Report of 7FP project FUSIONS / Reducing Food Waste through Social Innovation. Retrieved January 2017:

https://www.eu-fusions.org/index.php/download?download=161:review-of-eu-legislation-and-policies-with-implications-on-food-waste

Matlack, C. (2013): Spain's Santander, the City That Runs on Sensors. BloombergBusinessweek. https://www.bloomberg.com/news/articles/2013-05-16/spains-santander-the-city-that-runs-on-sensors. Last accessed: 19.01.2017

Reisinger, H., Krammer, H.-J. (2007): Weissbuch Abfallvermeidung und -verwertung in Österreich. Report, Bd. REP-0083. Umweltbundesamt, Wien.

Salhofer, S., Unger, N., Bilitewski, B.(2010): Waste Prevention and Minimization: Concepts, Strategies and Means, Solid Waste Technology & Management. John Wiley & Sons, Ltd, pp. 181-192.

Sharp, V., Giorgi, S., Wilson, D.C., 2010. Delivery and impact of household waste prevention intervention campaigns (at the local level). Waste Management & Research 28, 256-268.

Tourism Review multilingual marketing & publishing team (2015): Tenerife tourism estimates 5.3 million visitors in 2015. http://www.tourism-review.com/tenerife-tourism-board-estimates-over-5-million-visitors-news4815 (accessed 17.01.15).

Vittuari, M., Gaiani, S., Politano, A., Aramyan, L., Gheoldus, M., Schneider, F. (2015): D3.1 Review of current EU Member States legislation and policies addressing food waste. Report of the project FUSIONS (contract number: 311972) granted by the European Commission (FP7)

Weißenbacher, J. & Seyring, N. (2016), *Detailed assessment of Waste Management Plans - first batch, final report*. Luxembourg (Publications Office of the European Union).

WFD (2008): Waste Framework Directive: Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098

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