SEVENTH FRAMEWORK PROGRAMME
THEME ENERGY.2009.3.2.2

Biowaste as feedstock for 2nd generation

VALORGAS

Project acronym: **VALORGAS**
Project full title: **Valorisation of food waste to biogas**
Grant agreement no.: 241334

D2.2 - Assessment of typical source segregated food waste collection schemes in operation in Europe detailing factors influencing yield, capture rates and efficiency

Due date of deliverable: Month 25
Actual submission date: Month 28

Project start date: 01/03/2010 Duration: 42 months

Lead contractor for this deliverable

Veolia Environmental Services (UK) Ltd (Veolia)

Revision [0]

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1 Introduction

The aim of this part of the research carried out in the VALORGAS project was to assess a range of source segregated food waste collection schemes in an attempt to identify some key factors affecting performance. A number of well-established methods exist for gathering information on this type of scheme, ranging from detailed quantitative and compositional analysis of collected waste material to observational studies and public opinion surveys. In the development of the work plan, however, it became clear that these approaches were not ideal for the current purpose. Although some work of this type has been carried out in the project (see VALORGAS deliverables D2.1, 2.3 and 2.4), the methods used are time-consuming and labour-intensive and the resources available would limit the number of sites that could be covered. As the study was intended to include a representative section of Europe, this would necessarily involve a very wide range of climatic, economic and socio-demographic factors capable of confounding the data and making it unlikely that such surveys could deliver clear results.

There was also a need for an improved understanding on which key factors and parameters are likely to affect the overall performance of a collection system. As an example, one significant issue with respect to the processability of food waste and the usability of the final digestate product is contamination of the feedstock; thus gross yield in terms of wet tonnes is not necessarily the most important factor unless it can be linked with detailed information on reject rates and quality of output from a downstream anaerobic digestion (AD) plant. Even convenient measures, such as capture rate, may be difficult to interpret where changes have been made to a collection system: with a small number of exceptions there is usually very little baseline data to allow comparison of outcomes. Capture rates may also be misleading, as there have been several reports that introduction of a source segregated food waste collections leads to a reduction in the quantity of food waste generated (Arcadis, 2009; Matsuda et al., 2012).

In discussions during the development of the study it also became clear that, apart from in some broader studies (e.g. Orbit, 2008; EIONET, 2009; IPTS, 2011), there was relatively little data specifically on the existence of food waste collections in the different EU member states, or even agreement on the definition of what constituted 'separate' collection of food waste. As a result of this, it was decided that the best approach for obtaining the information required was to carry out a web-based survey of each of the 27 EU member states, with the aims of identifying trends and models in source segregated food waste collection, and of assessing whether these are likely to have a significant impact on the effective valorisation of this material to renewable energy and useful digestate products. This report summarises the results of the survey.

2 Methods

Two main methods were used in the survey: firstly, visiting the websites of all or a selected proportion of the organisations responsible for providing waste collections (e.g. municipalities, local or regional authorities, or waste management contactors) or waste management information (e.g. government bodies, non-governmental organisations); and

secondly using search terms related to segregated collections and food waste. Terms encountered during the survey were also recorded.

Surveyors were chosen primarily on the basis that they were fluent and where possible native speakers of the main language(s) of the country to be surveyed, and only secondarily for their interest and expertise in waste management. They were provided with a set of instructions, which continued to evolve in response to feedback and discussions during the survey; and with a sample spreadsheet for recording data in the case of FW-only collections (Table 1). They were, however, encouraged to adapt this spreadsheet as necessary for the specific conditions of the country surveyed. A full pilot survey was carried out in summer 2011 and the rest of the surveys as far as possible were conducted in the shortest possible period each, and within a 9-month period overall.

The first pilot trial was run in England and adopted the exhaustive approach, visiting the waste management pages of each of the 325 local authorities responsible for waste collection. This proved effective, but was not necessarily the most efficient method and in the case of some EU countries was deemed impractical. Waste collections are often organised at a municipal level (or in some cases by groups of municipalities, and with waste management performance data sometimes centralised at a higher regional level). In both Spain and Italy, for example, there are over 8,000 municipalities and with a 15-minute search of each website it would require over one year to complete a country survey, during which time the results would also be changing. In these cases a structured approach was adopted, with an overview at regional level followed by drilling down in more detail in certain areas. In Spain particular attention was given to the north of the country where food waste collections are more widespread. In Italy a systematic search was carried out of the webpages of all 516 municipalities with more than 20,000 inhabitants; this included a further 270 associated municipalities, and covered over 55% of the population. In Germany websites for all 401 districts in 15 federal states were searched to determine whether FW collections existed, then collection practices in the 96 districts in one state (Bavaria) were considered in detail. In other cases, the use of search terms indicated that municipal websites made little or no reference to collection services, and local waste management companies or even non-governmental organisations were better sources of information.

There are clear methodological issues and potential weaknesses in the survey methods adopted. Even within Europe, web access by citizens is more widespread in some countries than others, and as a result of this local and national authorities adopt different strategies for passing on information to the public. In some areas several pages of a local authority website will be dedicated to waste management issues, with real-time visual or downloadable resources and detailed responses to Frequently Asked Questions (FAQs); while in others the municipality itself may not even have a website. The result of a web survey which shows an absence of information on local waste collections may therefore indicate that this is not the method of dissemination used, rather than that such collections do not exist. In addition the sources of supporting data used were different in different countries, and even with a single country might refer to different years. The results are therefore not comparable between countries and should be treated with caution in a quantitative sense. Furthermore, the collection of source segregated biodegradable wastes is still a rapidly developing area in many countries and the information obtained may thus go out of date in periods of only a few months. The purpose of the survey was not to produce a definitive picture of the status of collections in the EU, however, but rather to provide a snapshot of different approaches and of the information currently available to the public on the operation of these schemes.

Table 1. Example of information collected in survey

Local Authority	Name	Unit	1	Contents
LA Characteristics	Type		2	e.g. District Council, Borough Council, London Borough Council, Metropolitan Borough Council, County Council, Unitary Authority (UK categories)
			3	e.g. collection, disposal, unitary (UK categories)
			4	e.g. E Midlands, Eastern, London, North East, North West, South east, south West, West Midlands, Yorkshire and Humberside (UK regions)
	Area	km2	5	no.
	Population	no.	6	no.
	Population density	person/km2	7	no.
General waste	Household - total waste	tonnes/person-year	8	no.
	Household waste sent for recycling/composting/reuse	tonnes/person-year	9	no.
		% total	10	no.
Socio-economic	Indices of Multiple Deprivation	Average Score	11	no. (UK category)
		Rank	12	no. (UK category)
Separate FW collection?	Type		13	e.g. None, with GW, FW-only
	Status		14	e.g. Opt-in, compulsory, NS (not stated)
	Comment		15	
Collection frequency	Separate FW Collections		16	e.g. Weekly, Fortnightly, Other, None, NS
	Residual waste collection		17	e.g. Weekly, Fortnightly, Other, None, NS
	Separate Recyclables		18	e.g. Weekly, Fortnightly, Other, None, NS
	Separate Green waste		19	e.g. Weekly, Fortnightly, Other, None, NS
	Comment		20	
Materials	Bones		21	Yes, No, NS
	Eggshells		22	Yes, No, NS
	Paper/ card		23	Yes, No, NS
	Shredded paper		24	Yes, No, NS
	Liquid		25	Yes, No, NS
	Oil / fat		26	Yes, No, NS
	Faecal		27	Yes, No, NS
	Plant		28	Yes, No, NS
	Biodeg bags		29	Yes, No, NS
	List accepted		30	Yes, No, NS
	Accept		31	Provide list from website
	List rejected		32	Yes, No
	Reject		33	Provide list from website
	Comment		34	
Containers	Caddies (e.g. 5-10 litres)	yes/no	35	Yes, No, NS
		size (l)	36	no.
	Buckets (e.g. 10-25 litres)	yes/no	37	Yes, No, NS
		size (l)	38	no.
	Wheeled bins	yes/no	39	Yes, No, NS
		size (l)	40	no.
	Other bins	yes/no	41	Yes, No, NS
		type	42	
		size (l)	43	no.
	Biodegradable bags	yes/no	44	Yes, No, NS
		user pays?	45	Yes, No, NS
		Comment	46	
	Wrap in newspaper		47	Yes, No, NS
	Comment		48	
Destination plant	Plant		49	Yes, No, NS
			50	Name
	Treatment type		51	Composting, AD, NS
	Treatment comment		52	
Information provided	Promote home composting?		53	Yes, No
	Gives reasons for collection?		54	Yes, No
	Comments		55	

Quality assurance. Many of quality assurance procedures that would normally be adopted were not possible in the circumstances described, but two approaches were applied in order to provide a degree of control and confidence in the survey results. For one country (England) both of the basic survey methods were tried. As noted above, each of the local authority websites in England were individually visited and surveyed; then a second independent survey was carried out using the search terms 'food waste' and 'kitchen waste', and making use of both the local authority websites and any documents and reports identified by this method. When the list of local authorities with FW-only collections complied by visiting each site was compared to that developed using the search terms, no differences were found in terms of schemes omitted or overlooked, and these methods were thus considered to be equally satisfactory for the UK. As a further check, for 3 countries (Latvia, Poland and Slovakia) the web surveys were carried out by two independent surveyors and the reports compared. While the style of reporting and details of interpretation naturally differed, there were no significant differences between the two versions in each case in terms of the sources of information identified, thus indicating that a reasonable degree of repeatability could be achieved.

3 Summary of results and output

The results of the web survey are presented in Appendices 1-27, with key points summarised in Table 2.

In the course of the work it rapidly became evident that there are strong common elements between schemes in different countries, but also major differences even within a single country; and as yet there is no single widely-accepted method for collection of source segregated food waste. The current work has identified a variety of models and trends, ranging from schemes that specifically set out to collect mixed food waste and green waste in large containers (e.g. 240-litre wheeled bins) to those targeting food waste only by using small kitchen caddies and lockable bins. There is also a middle range of schemes which accept household biowastes, and which may in practice collect something very similar to food waste only (FW-only) schemes. This may be due to the specification for materials accepted in conjunction with the high degree of public cooperation achieved, as in Denmark; or because of the location of the scheme itself, e.g. serving urban areas without gardens, so that the materials gathered in household biowaste schemes are effectively the same as those from FW-only collections that accept small quantities of kitchen paper products etc (see e.g Finland, Netherlands, Slovenia).

This information is important, as early experience at the South Shropshire biodigester and elsewhere suggests that what a collection scheme asks for is critical in terms of quality of materials collected, and that the size of bin or container provided can also affect this considerably (see VALORGAS deliverables D2.3 and D2.1). This is turn may have significant consequences for the performance of the whole anaerobic digestion scheme. Preliminary conclusions from the mass and energy balances being conducted for the Valorsul AD plant and the South Shropshire Biowaste digester indicate that, while the Valorsul plant performs well and is a net producer of renewable energy in addition to its role as an effective treatment facility for organic waste, it has a lower energy output to input ratio than the South Shropshire plant (see VALORGAS deliverable D4.2). The Valorsul AD plant includes a number of process steps, such as hydro-pulping, centrifugation, supernatant treatment and recycling, and aerobic composting of separated solids with further screening to reduce

plastics and other inert contaminants. In contrast the South Shropshire plant, and a range of similar AD plants currently coming into operation in the UK and elsewhere, have very linear process flow sheets: waste enters the plant, passes through a shredder, into a buffer storage tank, to the digester (including a pre- or post-pasteurisation step), into digestate storage and to land, frequently without a solids/liquid separation stage. These simpler systems generally receive feedstock from FW-only collection systems that use small containers (e.g. a ~7 litre kitchen caddy plus a ~20 litre external bin), making it both difficult and not especially attractive to use them for the disposal of other types of waste. It is not possible to state that the more complex process flowsheets of many European AD plants receiving mixed biowaste are a necessity due to higher levels of contamination in this feedstock. It is clear however that the extremely low levels of contamination found in waste from the FW-only schemes (see VALORGAS deliverable D2.1) makes it amenable to this type of simple processing, and thus allows a high energy ratio. As a result of this insight, the next stages of the research will consider some flowsheets of plants with simple processes and low energy requirements.

The survey also noted that definitions of acceptable and unacceptable materials are frequently inconsistent between different municipalities and waste management authorities, even within the same country and region: the only exception to this is in the Netherlands, where the central government provides a single nationwide definition. Biodegradable plastic bags provide an important example of this, with no consistency between neighbouring schemes and unclear or in some cases even contradictory information given to the public. This is especially important in view of the findings of VALORGAS deliverables 2.1 and 2.3 that, in collection schemes with apparently high proportions of contamination, a very significant fraction of this is made up by non-biodegradable plastic bags. The survey results suggest that rules and practices on the use of alternative wrapping materials such as paper are also inconsistent and some harmonisation is called for, perhaps accompanied by experimental work in this area.

4 Conclusions

So-called food waste only (FW-only) collection schemes are not widespread in Europe but their numbers are growing rapidly, especially in countries that have adopted source segregated collection systems relatively recently. Schemes to collect household biowastes are more common. In many cases, however, the operating conditions mean these are effectively the same as FW-only schemes: this may be due to the definition of acceptable materials, or the fact they serve urban areas where the majority of inhabitants live in apartments without gardens. There is a lack of consistency in the items accepted by collection schemes, however, which may lead to poor performance and confusion on the part of the public.

From the viewpoint of renewable energy production through anaerobic digestion of food waste, with beneficial use of the digestate, the most important features of the collection system appear to be what it accepts, and what type of container is used for collection (large or small). It has been noted that FW-only collections that use small containers have a very low degree of contamination which minimises pre- and post-processing requirements and the energy demand associated with these. While it is not possible to say that the flowsheets of more complex plants are a response to contaminated feedstock, it is clear that collection systems which minimise contamination make it possible for a simple plant to produce a high quality outputs. This deliverable has identified the present extent of some different types of schemes, and the location of those with key characteristics: the next stage of the work will

endeavour to link these directly to AD plant configurations. It is also planned to extend the survey to EEA/EFTA countries (Iceland, Liechtenstein, Norway, Switzerland).

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Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
1	Austria	Only with green waste	Search terms, key sites and targeted municipalities	biomüll, essensreste, küchenabfall, bioabfall	Readily available on websites	Biowaste collection is organised by municipalities and includes both kitchen and garden waste. Different collection systems exist in different federal states and municipalities. Austria has high material recovery rates but some organic waste is still going into the residual waste stream.
2	Belgium	Only with green waste	Search terms, key sites and targeted municipalities	déchets alimentaires, déchets de cuisine, voedselafval, keukenafval, Groente- Fruit- en Tuinafval (GFT)	Readily available on websites	Separate collection of food and kitchen waste without garden wastes seems to be unknown. In 2010, one third of the population of Wallonia received door-to-door GFT collection, and this is increasing. In Brussels-Capital Region, there are no separate collections for domestic food and only 15 municipalities with door-to-door GW collection. In 2010, over half of all GFT-waste in Flanders was collected but home composting is recommended as a disposal method.
3	Bulgaria	None found	Search terms, key sites and targeted municipalities	хранителни отпадъци, органични отпадъци	Not on municipal websites	Waste collection coverage is not complete in rural areas. Municipalities say green waste for composting is a priority. 40 out of 190 municipalities have provided home composters. FW is estimated to make up ~29% or 129 kg/person-year. Trial collections carried out 2004-9 were not adopted; a small-scale trial is planned for 2013.
4	Cyprus	None found	All municipalities plus key sites and search terms	απόβλητα τροφίμων, yiyecek atıkları, biyolojik atık	Some information for the public on municipal websites, but no FW	Only one municipality subsidises domestic composting bins
5	Czech Republic	Canteens and institutions.	Search terms, key sites and targeted municipalities	kuchyňský odpad , Biologický odpad, Organický odpad	Some information for the public on municipal websites	Small municipalities do not report data to the central database. none, some anaerobic digestion of mixed organic waste streams including commercial food waste. Initiatives in progess but attention currently focused on green waste

Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
6	Denmark	Yes. 13 municipalities collect FW only, others collect with GW.	All 98 municipalities plus key sites and search terms	organisk affald, grønt affald	Data on most municipal websites, including plans and performance	Source separated collection of a wide range of materials is well established. A number of municipalities already offer collections of food waste only or FW with small quantities of GW, and there are signs that this trend is increasing. In most cases detailed instructions are available on materials accepted by the scheme and on the correct method of disposal for unacceptable materials, but there is some inconsistency between different municipalities. FW is usually collected fortnightly and GW is only collected in summer
7	Estonia	111 out of 266 local bodies collect biowaste, in reality identical to FW	Search terms, key sites and targeted municipalities	toidujäätmed	Local authority website details available on main ministry website	Self-governing bodies organise waste management within their own territory, according to 4 schemes which may include separate collection of biowastes. Definitions used for biowaste effectively limit this to food waste in many cases. 51% of local bodies have organised biowaste collections and in 2011 12,530 tonnes of food waste was collected. There are at present no biogas plants in Estonia that produce biogas from biodegradable canteen and kitchen wastes.
8	Finland	Biowaste but often identical to FW	Search terms, key sites and targeted municipalities	biojäte	Readily available on websites	Waste management is very localised in Finland. There are national guidelines, but practical advice is given locally. Composting is common for detached households. Flats and high rise building are typically serviced with segregated waste collections. In sparsely populated areas biowastes can go into residual waste, but composting is recommended. There is no single common list of materials accepted in biowaste collections – instructions differ slightly from region to region.
9	France	No evidence from households; plenty from canteens and schools	Search terms, key sites and targeted municipalities	déchets alimentaires, déchets de cuisine, déchets organiques ou putrescibles, biodéchets	Readily available on websites - no FW	Separate collection of source segregated household waste is almost unknown. Around 57% of municipalities currently collect mixed green waste and household biowastes. There is no immediate priority to increase this or to introduce source separated food waste collections. The Département of Haut Rhin runs a collection service that accepts household biowastes from apartments or flats.

Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
10	Germany	Biowastes but generally in large containers so with GW	401 districts in 15 federal states plus key sites and search terms	essensreste, küchenabfall, bioabfall, organischer abfall	Readily available on websites	Food waste is typically collected with GW. Most authorities use bins of 80 or 240 litres for kerbside biowaste collections. Out of 79 authorities in Bavaria, all but one used large bins. One authority (Neumarkt) operated a bag system. Biowaste yield varies between districts. An advanced pay-as-you-throw system in Graefelfing achieved the lowest yield per person-year. In 2015 source segregated biowaste collections may become mandatory.
11	Greece	No	Search terms, key sites and targeted municipalities, email enquiries	απόβλητα τροφίμων	Some information for the public on municipal websites, but no FW	Source segregated FW collections are not applied in any region in Greece nor there is a trend towards this. Only a few pilot projects exist for segregated collection of GW. When composted, organic matter from food waste is mixed with green and other kinds of biodegradable solid waste. In 2009, recycling and landfill disposal accounted for almost 99% of total MSW.
12	Hungary	Not from households - yes for canteens etc	Search terms, key sites and targeted municipalities	élemiszer hulladék, biohulladék, szerves hulladék	Information on GW etc, not FW. Comprehensive information on commercial company sites	Separate food waste collection and recycling is not common practice in Hungary. There are a few mini programs and initiatives for biowaste collection and preparation of compost for home use. These are mainly started by educational institutions, primarily by nurseries, recognising that environmental education must be started at a young age. 80% of web pages visited were not updated on a regular basis.
13	Ireland	With GW; commercial premises should separate FW	Search terms, key sites and targeted municipalities	food waste, kitchen waste	Some information for the public on municipal websites, but no FW	Source segregated food waste collection from households is still in a very early stage in Ireland. Around 35% of Irish households are provided with an organic (e.g. food and garden waste) waste collection service. From 1 July 2010 commercial premises have been required to segregate their food waste into a dedicated bin
14	Italy	Yes - widespread	Stratified selection of municipalities plus key sites and search terms	rifiuto alimentare; rifiuto organico; rifiuto putrescibile; rifiuto umido	Mixed - more available in north than south	An estimated 83% of municipalities with over 20,000 inhabitants in Italy provide a separate food waste collection, with 68% offering food-waste only collections. As yet there is no single common list of materials accepted in FW-only schemes, but a degree of consistency is emerging with only small differences between schemes. 2 or more times per week collection of food waste and weekly collection of residual waste is practiced in the majority of Italian municipalities.

Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
15	Latvia	No	Search terms, key sites and targeted municipalities	pārtikas atkritumu, virtuves atkritumi	Some information for the public on municipal websites, but no FW	Source segregated food waste from the households is still not collected in Latvia. A pilot project on source segregated food waste collection has provided valuable knowledge and experience for waste management industry and related organisations. There is a need to establish financial instruments for source segregated food waste collection schemes.
16	Lithuania	No - only pilot stage	Search terms, key sites and targeted municipalities	maisto atlieku	Available on municipal or contractors' websites	Source segregated food waste from households is still not collected in Lithuania. A pilot study showed that home composting is a promising option in Lithuania. This study considered only privately owned households, however and did not include flats in which most of the population currently live. The Strategic Waste Management Plan states that biodegradable waste must be composted or treated in an AD plant. Most biodegradable commercial waste is treated in the composting facilities. The production of biogas from AD is at the experimental level and there is still a need for an infrastructure. In order for an AD plant to be viable in Lithuania, consistent FW collections are needed.
17	Luxembourg	Biowaste but definitions similar to FW	Search terms, key sites and targeted municipalities	biomüll, déchet biodégradable, déchets de cuisine	Readily available on websites	In all municipalities, biowaste includes garden waste as well as food waste. About 30 municipalities have a 'Biotonne' or bio-bin for biowaste; the collection service, however, varies between municipalities. Currently, organic waste still makes up 39% of household waste. Households living in flats are shown to be less efficient in separating biowaste. Luxembourg is aiming to increase its biowaste separation in the next 8 years and to increase the number of biogas plants. There is no evidence of separate collection of green waste and food waste and no evidence of intention to introduce this in future.

Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
18	Malta	No	Search terms, key sites and targeted municipalities	food waste; kitchen waste	Readily available on websites	There is no separate collection of food waste or organic waste from households in Malta. A limited number of civic amenity sites (5) do provide disposal of green waste but not food waste. Home composting is recommended but not widely practised. Although separate collection of organics from catering facilities has been recommended in the waste strategy, implementation thus far is limited to hotels only. There is one anaerobic digestion facility for organic waste in the country; this is part of a mechanical-biological treatment (MBT) plant processing mixed waste. Two additional MBT plants have been proposed, that may potentially also process other organic waste streams such as animal manures, fishery waste and sewage sludge.
19	Netherlands	With GW but definition similar especially in urban areas; bin size likely to be a factor	Search terms, key sites and targeted municipalities	voedselafval, Groente Fruit en Tuinafval (GFT)	Widespread. Government website www.GFT-afval.nl provides a lot of information on this waste stream	Food waste and garden waste (GFT) of household origin are collected in one waste stream in the Netherlands. Collection systems are well established and widespread. Local authorities are responsible for collection but have freedom to decide how this is done and may base decisions on practical factors e.g. lack of space to store containers for separate waste collection in most households in the area. the amount of separate GFT collection is therefore lower in high density urban areas than in areas of lower density . Detailed information is available on the quantity of GFT collected per area Materials accepted are defined centrally by the Netherlands government. Materials are compatible with FW-only collections in many cases. The majority of collected waste is still treated by aerobic composting; anaerobic digestion is still uncommon but appears to be growing rapidly
20	Poland	No - only very small number of pilot schemes for joint GW and FW	Search terms, key sites and targeted municipalities	odpady organiczne, odpady kuchenne, odpady zielone, bioodpady	Available on contractors' websites	In Poland at present there are only a few pilot projects on collection of biodegradable waste. Household biowastes are collected only for use on site or as mixed municipal waste. When waste is composted, organic matter originating from food waste is mixed with green and other kinds of biodegradable solid waste. The majority of webpages visited were informational and educational rather than describing specific initiatives or available options.

Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
21	Portugal	Trial only - mainly commercial waste	Search terms and key sites	restos e/ou resíduos alimentares, lixo alimentar, lixo de cozinha	Some information for the public on municipal and contractors' websites, but no FW	Only 7.4 % of all MSW in Portugal is currently sent for organic recovery. 3 companies in Portugal have implemented food waste selective collection schemes. Implementation of other schemes is delayed by economic considerations and the likely focus in on collection from larger producers. Meanwhile plants for valorisation of organic waste through compositing or anaerobic digestion will receive organic waste from the mixed MSW collection
22	Romania	No	Search terms, key sites and targeted municipalities	deseuri alimentare; deseuri bucatarie	Some information for the public on municipal and contractors' websites, but no FW	Source segregated domestic food waste collection is not yet implemented in any region of Romania. Only one governmental website was found referring to separated collection of domestic food waste. Every county can decide its preferred solution for biodegradable municipal waste (individual composting, centralised composting, MBT) and the treatment capacities. In 2010, recycling and landfill disposal contributed to almost 99% of the total municipal waste management. Only 1% of the total MSW of Romania is separately collected. 70 waste transfer and sorting plants and 60 composting stations for MSW were built by 2010-2011. The national target for 2010 – to landfill a smaller biowaste quantity of 75% compared to the quantity of 1995 – was reached already in 2009. In order to reach the goals for 2013 and 2016, Romania must improve the separate collection of food waste and the infrastructure.
23	Slovakia	With GW but definition similar especially in urban areas; bin size likely to be a factor	Search terms, key sites and targeted municipalities	potravinový odpad; biologicky rozložitelný odpad	Information for the public is available on municipal and other websites, but no FW	Separate collection of food waste from households in Slovakia is not common. Some cities and towns have source-separate food waste collections in place but these are together with green waste. The area in and around Bratislava is the only region where food waste collections are in place to a certain extent. Definitions of biodegradable waste are close to those for food waste, especially in urban areas without gardens. The population of 5.4 million and a total biodegradable waste yield of 94000 tonnes mean, however, that only 17 kg of organic waste is collected per person per year in 2010.

Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
24	Slovenia	With GW but definition similar especially in urban areas and as large wood prohibited	Search terms, key sites and targeted municipalities	odpadki hrane, kuhinjski odpadki, biološki odpadki	Information for the public is available on municipal and other websites, but no FW	Separate collection of domestic food wastes in household is almost unknown in Slovenia. There has however been at least one pilot project related to separate kitchen waste collection. Food wastes are collected together with garden wastes in 120 and 240-litre containers within the door to door biological wastes collection scheme. More than 50% of households in urban areas and approximately 10% of households in rural areas use biological wastes collection schemes. Others compost their biological wastes themselves. There is a priority to increase the share of collected biowastes and to decrease the share of biowastes in other/mixed household wastes. However, separate food waste collection from households is not planned in the near future. Quantities of collected and composted biowastes are increasing. Biogas production and the number of operating biogas plants have also increased constantly in the last decade.
25	Spain	Biowaste widely collected - similar, varies between communities; also some specific FW	Search terms, key sites and targeted municipalities with in-depth case studies	restos de comida (Spanish), restes del menjar (Catalan)	Readily available on websites	Very detailed information available especially in northern Spain. 41% of the autonomous regions in Spain, covering 36.5% of the population, are providing some type of FW collection. FW schemes are highly concentrated in the north of Spain and in communities with the highest indices of human development. From the current schemes 1 autonomous region is collecting FW only, 5 are collecting FW/GW and 1 is collecting biowaste. Only 3 of the CA have well established schemes, whilst the remaining 4 CA have schemes on pilot level status. Only 1 CA is using AD as the primary treatment process. As yet there is no single common list of materials accepted in biowaste or FW-only schemes

Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
26	Sweden	Widespread	All 290 municipalities plus key sites and search terms	matavfall or bioavfall	Readily available on websites	Separate collection of source-separated household food waste is expanding rapidly in Sweden. 152 municipalities, equal to 52% of the total report having separate collection of food waste through their web-pages. Another 3 municipalities are currently introducing the scheme which will be in place by 2013. The most common design of collection system is separate collection in paper bags for disposal in wheeled bins – commonly in a separate bin for food waste, but the use of multi-compartment bins is increasing. The most common treatment technology for source-separated food waste is anaerobic digestion. The source separation of food waste is likely to increase in Sweden, as this is a part of the National Environmental Quality Objectives since 2005. Newly suggested changes to these objectives, together with increased use of biogas as vehicle fuel and certification systems for produced digestate, are likely to increase interest in anaerobic digestion of separately collected food waste in Sweden, at the expense of composting.

Table 2. Summary of survey findings

	Country	Status	Method	Terms	Web	Notes
27	UK	Yes. FW-only schemes growing rapidly.	All municipalities plus search terms and key sites (325 England, 32 Scotland, 22 Wales, 26 N Ireland)	food waste, kitchen waste	Readily available on websites	As yet there is no single common list of materials accepted in FW-only schemes in the UK, but a degree of consistency is emerging with only small differences between schemes. 37% of LAs in England provide some form of separate food waste collection, with 18% offering food-waste only collections. Instructions on the acceptability of biodegradable plastic bags are unclear and are likely to cause confusion amongst the public. In Scotland 47% of LAs provide some form of source separated food waste collection, with 25% offering food-waste only collections. There is still some way to go, however, in order to achieve the targets set in Zero Waste Scotland Regulations 2011.100% of LAs in Wales provide some form of separate food waste collection, with 91% offering food-waste only collections. Weekly collection of food waste and fortnightly collection of residual waste is practiced in the majority of Welsh unitary authorities. In Northern Ireland only Belfast City Council provides a source-separated food waste collection scheme covering 9000 households: this is a pilot scheme started in June 2008. Newtownabbey Borough Council introduced a source separated food waste collection in October 2007, which was the first food waste collection scheme run by a local council in Northern Ireland and the first in multi-occupancy housings. 17 district councils collect food waste with garden waste, equal to 65% in total. Among those councils, 65% of them provide a small kitchen caddy and liners to households.

Appendix 1: Results of web-based survey on collection of source segregated domestic food waste in Austria

Organisation of waste collection in Austria

The Federal Republic of Austria is an Alpine country with 8.415 million inhabitants in 2011 (www.statistik.at). Austria is divided into 9 federal states (Wien, Niederösterreich, Oberösterreich, Burgenland, Salzburg, Kärnten, Steiermark, Tirol and Vorarlberg) with a total of 2357 municipalities. The federal states are responsible for the organisation of biowaste disposal and treatment while the municipalities are responsible for the organisation of collection. Each of the 9 states has its own waste law:

Burgenländisches Abfallwirtschaftsgesetz, LGBl 1994/10
Niederösterreichisches Abfallwirtschaftsgesetz, LGBl 1992/8240-0
Oberösterreichisches Abfallwirtschaftsgesetz, LGBl 1997/86
Salzburger Abfallwirtschaftsgesetz, LGBl 1999/35
Steiermärkisches Abfallwirtschaftsgesetz, LGBl 2004/65
Tiroler Abfallwirtschaftsgesetz, LGBl 1990/50
Vorarlberger Abfallgesetz, LGBl 2006/1
Wiener Abfallwirtschaftsgesetz, LGBl 1994/13

Biowaste is recycled in composting plants or biogas plants (Hutterer, 2009). Austria pioneered source separate organic waste collections as early as 1986 when pilot collections were trialed in Vienna. In 1991 all of Vienna was serviced with organic waste collections (VIENNA, 2012). Food waste collections in Austria have been mandatory in Austria since 1 January 1995, unless home composting is in place. This has led to high recycling rates but also to high composing rates in more rural communities. The 1995 'Organic waste law' is short and clear:

"§ 2. (1) If organic wastes …. from households or commercial entities can not be valorised, then these organic wastes must be collected or must be brought to a centralised collection point".

Figure 1.1. The nine federal states in Austria together with the districts (www.divagis.org).

Households in Austria have a duty to contribute and participate in waste collections. Costs for waste collection and the supply of bins differ regionally (HELP, 2012). Waste separation is

required by law (Gebot der Abfallverwertung). Municipalities are responsible for collecting residual waste, biowaste including garden waste, secondary materials as well as hazardous waste materials. Waste companies offer collection services and vehicles to the municipalities (LAND SALZBURG, 2012).

Methodology

A general web search was carried out using google.com and google.at. For each of the search engines the following keywords and specific searches were used:

"biomüll trennung oesterreich" (biowaste separation Austria)
"biomüll sammlung oesterreich" (biowaste collection Austria)
"Müllsplittinganlage 'divitec'" ('divitec' materials recovery facility or MRF)
"merkblatt biotonnen kompost niederoesterreich" (biotonne compost flyer lower Austria)
"biomülltrennung" (biowaste separation) + Wien/Niederoesterreich/Oberoesterreich/ Burgenland/Salzburg, Kaernten/Steiermark/Tirol/ Vorarlberg
"bioabfallsammlung" (biowaste collection) + Wien/Niederoesterreich/ Oberoesterreich/Burgenland/Salzburg, Kaernten/Steiermark/Tirol/Vorarlberg
"bioabfall" (biowaste) + Wien/Niederoesterreich/Oberoesterreich/Burgenland/ Salzburg, Kaernten/Steiermark/Tirol/ Vorarlberg
"biogener abfall oesterreich" (biogeneic waste Austria)

The search was first structured at a federal level with the 9 states, followed by a more detailed analysis of waste collection system in the municipalities. For the state of Burgenland, the joint waste administration (Burgenlaendischer Muellverband) was contacted directly. For Upper Austria the joint waste administration (Landesabfallverband, UMWELT, 2012) was contacted directly. For Salzburg the Land Salzburg (LAND SALZBURG, 2012) was contacted.

Results

Biowaste in Austria includes kitchen waste, such as teabags, coffee grounds, grass cuttings, flowers, bread, hair and feathers (in small amounts), newspaper (in small amounts) and garden waste, such as grass- and shrub cuttings, leaves, flowers, reduced tree-cuttings and sawdust (ÖÖI, 2012; MUELLTONNE, 2012).

In Austria biowaste, garden and leaf wastes are collected mainly in the 'Biotonne'– a bio container, but smaller bags are also used. According to the federal environmental agency (Umweltbundesamt), 714900 tonnes of biowaste were collected in 2008. This corresponds to about 86 kg/person-year (8.3 million inhabitants in Austria). The composition of waste in the Biotonne in 2008 was made up of 68% garden waste, 29% kitchen waste and 3% impurities. Biowaste is recycled in composting plants or biogas plants. Household garden waste is included in the biowaste, but higher quantities of garden waste from communal areas such as parks are often collected separately and this waste stream is recycled in composting plants for green waste (ECO, 2011).

- **Burgenland**

General information about waste separation and collection systems in the department of Burgenland can be found at the Burgenländischen Müllverband (BMV-waste collective of Burgenland; BMV, 2012). In 1980, the municipalities in Burgenland formed a waste

collective that operates throughout the state and organises waste collection in the whole of Burgenland. In 2004, a large residual and organic waste recycling plant, the Müllsplittinganlage 'divitec' started operating. The plant is situated next to the mechanical-biological plant (mechanisch-biologische Behandlungsanlage Umweltdienst Burgenland GmbH) and separates and recycles industrial and household waste. The plant separates and treats wastes using biological and thermal treatment options, and has an annual capacity of 80,000 tonnes (OJ, 2004).

- **Oberösterreich (Upper Austria)**

The Landesabfallverband (waste collective) of Oberösterreich (Upper Austria) was founded in 1993 and represents a waste partnership between the 15 District Waste Associations (Bezirksabfallverbände) and the three larger cities (Statutarstädte) of Upper Austria (UMWELT, 2012).
Biowaste collection differs from authority to authority, and some have only recently introduced biowaste collections (Gemeinde Pasching). The towns of Schärding and Rohrbach, for example, offer a bag collection system (Biosackerl) and garden waste can be taken to a composting site or is collected in a 110-litre bag (Grünschnittsack). In Linz-Land, most authorities collect with 120 - 240-litre bins (UMWELT, 2012).

- **Niederösterreich (Lower Austria)**

The separation and collection of biowaste in Lower Austria was made compulsory in 1995 (BGBl. Nr. 68/1992). In 2004, 130,685 tonnes of biowaste were delivered to composting plants (86 kg/person-year, 20% of waste). 40% of households were served with biowaste collections, and around 220,125 tonnes/year was recycled through private composting and 83,060 tonnes/year through garden waste collection. However, a total of 29,900 tonnes/year were still going into the residual waste stream (Kirchmeyer et al., 2005).

The ARGE Kompost und Biogas NÖ is a partnership (‘Interessensvertretung’) of rural composting plants and biogas plants in Lower Austria and brings in over 70 farmers from Lower Austria. The ARGE is currently responsible for 45 composting plants and 7 biogas plants (SPERBER, 2010). Out of the 573 municipalities, 555 are connected to 22 regional waste partnerships. These waste partnerships were introduced by the waste management association of Lower Austria (NÖ Abfallwirtschaftsverein) in 1993 (NÖ AWV).

Waste partnerships usually have different collection systems. With the exception of the region Horn and Tulln, garden waste is included in the biowaste collection. Horn and Tulln have additional areas, such as ALZ Rodingersdorf and the municipal waste collection centre (Gemeindesammel- zentrum GSZ), respectively, where garden waste can be taken to household waste recycling centres (NÖ AWV).

Biowaste and garden waste are collected using the Biotonne. In 2010, composting plants recycled 204,182 tonnes (83% Biotonne, 35% shrubs, 20% sewage sludge and 2% other material) (SPERBER, 2010). Some farmers run their own biogas plants and recycle biowaste, such as waste from restaurants and canteens. Composting plants exist in 51 municipalities and biogas plants in 12 municipalities in lower Austria (BIO, 2002).

- **Wien**

Vienna introduced biowaste collections in 1991. Biowaste is collected via a Biotonne which is the same size as the residual waste bin (Figure 1.2) and additional garden waste can be collected in a so-called "Laubsack", which is a 100-litre bag for collection of leaves (http://www.wien.gv.at/umwelt/ma48/beratung/muelltrennung/biogener-abfall/laubsack.html.

Green and garden waste is recycled in the composting plant 'Lobau' (Kompostwerk Lobau). Biowaste from the inner city, however, is collected in the biogas plant Vienna (Biogas Wien) which opened in 2007. More than 100,000 tonnes of biowaste is collected in Vienna, which produces 45,000 tonnes compost per year (HELP, 2012).

Figure 1.2. Bin system in the City of Vienna (www.wien.gv.at).

- **Steiermark (Styria)**

Since 1989, the separation, collection and recycling of household waste in the federal state of Styria (Steiermark) is mandatory (Steiermärkischen Müllwirtschaftskonzept 1989). Because of the different strategies of the waste collectives, the amount of collected biowaste (biogener Abfall) differs within the collectives. Some encourage collection through the Biotonne, some promote recycling through private or communal composting.

In 2009 a total of 98,000 tonnes of biowaste was collected (81 kg/person), with the majority (51%) collected from the Biotonne (56 kg/person), 23 kg/person communal garden- and park waste and 2 kg/person from cemeteries. In October 2009 a total of 19 communal and industrial composting plants were in operation with a capacity of 61,000 tonnes/year. In three processing plants (Lannach, St. Michael Obersteiermark-Upper Styria and Graz) communal biowaste is mixed with bulking material. The treated and recycled biowaste is then taken to farms. In addition, around 50 farmers recycle communal compost (landwirtschaftlichen Haus- und Wirtschaftskompostierung, 58,000 tonnes/year). The total capacity of composting plants in Styria is around 119,000 tonnes/year, while biogas plants, which recycle agricultural- and industrial waste, have a capacity of 500,000 tonnes/year (CB, 2012).

- **Tirol (Tyrol)**

A pilot project for biowaste separation and collection in Tyrol began in the early 1990s. Biowaste was taken to a central collection point on a voluntary basis, in a novel bring type system. This was later replaced with a bin collection system, and in the late 1990s organic waste collections ('Bioabfall') were introduced in all larger authorities. Various systems of biowaste collection are common even though some municipalities do not collect at all, mainly in rural areas. This saves service costs, but leads to higher costs for residual waste processing because of food waste contamination. Some authorities run a bring system, but these communities usually have lower organic waste yields compared to kerbside systems. It is now known that authorities with organic waste collection (77% of authorities) spend less for residual waste recycling and save about 640,000 Euro (2008). Organic waste collection service is particularly beneficial in tourist areas, as a large holiday population can more than double the amount of biowaste. The type of collection containers also greatly influences the

amount of collectable biowaste. About 59 % of municipalities operate a 'Biotonne' and these authorities collect more waste than municipalities with a bag-collection system, which is operating in about 18% of authorities (Neurauter and Moelgg, 2002).

In a 2010 study by the Tyrolian state government, where 7000 kg of waste in 350 samples were examined, there is still 21% of biowaste by weight in the residual waste in Tyrol (Residual waste analysis in Tyrol - Restmüllanalysen Tirol 2010, Techical report, pdf-file at www.tbhauer.at, accessed Jan 2012).

- **Vorarlberg**

In Vorarlberg, householders are allowed to be exempt from biowaste collection if they have garden composting facilities (UUV, 2012). Biowaste collection is to a large extent carried out by the company Häusle Biomüll (Lustenauer Unternehmen Häusle, ORF 2007). In 2003 almost 12,000 tonnes of biowaste collected were recycled using anaerobic digestion, while garden and park waste (17,000 tonnes) was treated through composting (HARATHER, 2004). In municipality of Feldkirch the type of biowaste container depends on the size of a household. For small houses and residential facilities with up to four flats biowaste is collected in an 8 or 15-litre bag ('Biomüllsack'). For residential facilities with five flats or more, biowaste is collected in the biotonne (BIOMUELL 2012).

- **Kärnten (Carinthia)**

Carinthia has three regional composting plants, seven biogas plants and 15 decentralised composting plants. Municipalities and waste collectives have increased recycling and managed to reduce the amount of residual waste.
Biowaste is collected through the biotonne. Depending on the end product, biowaste is either separated or mixed with green waste for composting. Biowaste from the biotonne is mainly recycled in composting plants, but in some regions biowaste is recycled in biogas plants (AWV, 2012).

- **Salzburg**

In Salzburg, as in the other federal states, biowaste includes garden waste. In addition to biowaste collections, bags for garden waste are provided by the authority. Biowaste is recycled in the biogas plant SAB (Biogas-Anlage der SAB) and at the ZEMKA plant (LAND SALZBURG, 2012). An additional garden waste bag (70 litres) can be ordered if the biotonne is not sufficient.

Summary of key findings

- Biowaste in Austria includes both kitchen and garden waste
- Biowaste collection is organised by the municipalities
- Although Austria has progressed biowaste separation and recycling well, differences in collection systems exist in the different federal states and their municipalities.
- Austria has high material recovery rates but some organic waste is still going into the residual waste stream.

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Appendix 2: Results of web-based survey on collection of source segregated domestic food waste in Belgium

Organisation of waste collection in Belgium

Belgium is divided in three parts: the Brussels-Capital Region, the Walloon Region and the Flemish Region. Each region has different policies concerning waste (PB, 2010). The types of waste that have to be collected separately are also decided by the region: there is a compulsory minimum service and then municipalities are encouraged financially to develop other segregated waste collection systems. Waste collection and management is organised by the municipalities: they choose whether there is a door-to-door collection for each waste type and how frequently each is collected (CIRIEC, 2010). For this purpose, municipalities are sometimes grouped together as inter-municipal associations. The municipalities can choose to carry out waste collection using their own workforce or can ask a private company to do it.

Information about waste and recycling can be obtained from the municipalities within each region. If a member of the public wants information about waste collections, the easiest way is to look at the municipality's website. This usually provides information on the categories into which refuse must be sorted, which bins to use, how to ask for a bin, and when the different collections occur; alternatively a link is provided to another dedicated website where this type of information is grouped together.

Methodology

For each region, an official agency collects information on waste collection and management: the Institut Bruxellois pour la Gestion de l'Environnement (IBGE, Brussels Institute for Environmental Management) for Brussels-Capital Region; the Openbare Vlaamse AfvalstoffenMaatschappij (OVAM, Public Waste Agency of Flanders) for Flanders and the Office Wallon des Déchets (OWD, Wallonia Waste Office) for Wallonia. The websites of these organisations were searched for information on separate food waste collections.

A general web search was also carried out using google.be advanced search with 'Belgium' as the region restriction and pages from the past year. The keywords used were: collecte (collect) + "déchets alimentaires" (food waste) OR "déchets de cuisine" (kitchen waste). The search was then repeated with "porte à porte" (door to door) and commune added to the key words. Another search was carried out with: "collecte + appartement" (apartment) + "déchets alimentaires" OR "déchets de cuisine". The same searches were also conducted without date restrictions. Another search was conducted to see if any food waste was collected separately for anaerobic digestion, using the key words: méthanisation (methanation) + "déchets alimentaires" OR "déchets de cuisine" + commune + Belgique. Related terms found and included in the search were: "déchets de cuisine, déchets organiques, déchets putrescibles, déchets fermentescibles, biodéchets".

A similar search was carried out using google.be advanced search with 'Belgium' as the region restriction and from the past year. Keywords used were: "voedselafval" (food waste), OR "GFT" (Groente-, Fruit-, en Tuinafval = Vegetable, Fruit and Garden waste) + "ophalen" (collection). This search was then repeated with "gemeente" (municipality) and "huis-aan-huisophaling" (house to house collection). This search was then conducted a second time without date restrictions. Another search was conducted to see if any food waste was collected separately for anaerobic digestion, using the keywords: "methanisering"

(methanation) + "voedselafval" (food waste) + gemeente + Belgie. Related terms found and included in the search were: "keukenafval" (kitchen waste), "bioafval" (biowaste), "organische afval" (organic waste)," putrescible afval" (degradable waste).

A number of websites from randomly selected large and small municipalities were also checked to see if they gave any relevant information not covered by the above search terms.

Results

None of the official websites surveyed provided information on source separated food waste as a specific waste category: food waste and kitchen waste are included in organic waste, along with kitchen paper, tissues and garden waste. The statistics given for the regions do not provide any data on separate collections of domestic food waste.

The websites of some inter-municipal associations (INTRADEL, http://www.intradel.be; BEP, http://www.bep.be) and a selection of large and small cities in the Wallonia region were checked (Andenne, http://www.andenne.be; Eghezée, http://www.eghezee.be; Liège, http://www.liege.be; Namur, http://www.namur.be; Perwez, http://www.perwez.be; Walcourt, http://www.walcourt.be/). The information given on these was usually clear and practical but none of them stated that they collected food or kitchen waste separately from garden waste. A similar check was also carried out for Flanders: in this case the inter-municipal associations checked were ecoWERF, http://wwww.ecowerf.be, and Fostplus, http://www.fostplus.be. The cities selected were Leuven, http://www.leuven.be; Lubbeek, http://www.lubbeek.be; and Antwerpen, http://www.antwerpen.be. From these websites the same conclusions could be drawn as for Wallonia.

The results indicated that in Wallonia and Flanders, food waste and kitchen waste are very commonly collected but always with garden waste and items like kitchen paper and other biodegradable materials: this material is referred to as organic waste. In Wallonia and Flanders, organic waste is collected either in bins (often fitted with a chip) or in biodegradable bags, depending on the municipality's choice.

Wallonia. In 2010 1,160,242 inhabitants were served by door-to-door organic waste collection schemes in Wallonia, allowing the collection of 36000 tonnes of organic waste (OWD, 2010b; OWD, 2010a). 124 out of the 262 Walloon municipalities were collecting organic waste door-to-door in 2010 (OWD, 2010b). Apparently, no mixed organic waste was collected in waste reception centres, only garden waste (OWD, 2010a). As the total number of inhabitants in Wallonia was 3,498,384 in 2010, this means that about one third of the population received a door-to-door organic waste collection (OWD, 2010a).

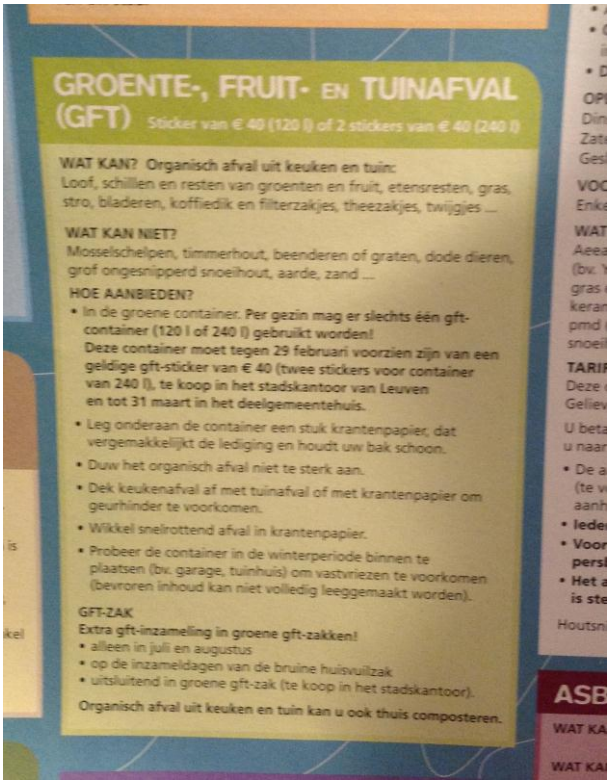
In 2009, organic waste door-to-door collection was slightly lower (28037 tonnes). At least 3600.5 tonnes were then transformed into biogas and the rest was composted or incinerated (OWD, 2009). 9 composting plants exist in Wallonia with a total capacity of 150 000 tonnes $year^{-1}$ of organic and green waste (CIRIEC, 2010). These Figure s are changing very rapidly, however, as organic waste collection is being developed throughout Wallonia. For example, Liège is now collecting organic waste: since September 2011, inhabitants can fill a form to ask for a registered bin fitted with a chip (Lesoir, 2011).

In 2010, organic waste represented 41% of the waste collected in Wallonia, with about 16% food waste, 21% kitchen waste and 4% of garden waste (SPW, 2010).

Brussel-Capital. In the Brussel-Capital Region, garden waste is collected door-to-door in only 15 municipalities (not including Brussels itself). It is collected in special green bags and no food waste or kitchen wastes are accepted in this collection (BP, 2011). In 2008, 11150 tonnes of garden waste were collected in this region, taking into account also the 10 waste reception centres (BP, 2011). Until now, all the garden waste collected is composted but a methanation plant should be created soon (IBGE, 2009).

Flanders. In 2007 310,000 tonnes of GFT-waste were collected separately in Flanders. (EIONET, 2009) In 2009 73% of all household waste was collected separately, of which 24% was garden waste and 10% fruit and garden waste (MIRA, 2010). In 2010 56% of total GFT-waste was collected separately and processed. All efforts are made to ensure that organic waste does not end up in landfills, and hence collected GFT-waste is all composted. To reduce the amount of waste to be collected, composting at home is also encouraged. To motivate this, a large number of communes give courses on how to compost correctly for free. (EIONET, 2009) The MIRA report (2010) implies that this is having the desired effect since between 2000 and 2009 the total amount of GFT-waste collected has been systematically decreasing.

a) 120-litre bio-bin for individual household



b) Information on GFT provided on the back of collections calendar

Figure 2.1. GFT collections in Flanders

Summary of key findings

- Separate collection of food and kitchen waste without garden wastes seems to be unknown in Belgium.
- In 2010, one third of the population of Wallonia was served by door-to-door organic waste collection and this number is increasing.

- In Brussels-Capital Region, there are no separate collections for domestic food and only 15 municipalities are covered by garden waste door-to-door collection.
- In 2010, over half of all GFT-waste in Flanders was collected separately.
- In Flanders emphasis is put on home composting as a method of disposal for GFT-waste.

KEUKENAFVAL EN AANMAAKOVERSCHOTTEN		
WAT?	**EURALCODE**	20 01 08
Resten van fruit, groenten, vlees, vis, zuivel, brood, banket, sauzen, soep, …	**WETTELIJKE STATUS/ CATEGORIE**	Bedrijfsafvalstof Dierlijke bijproducten
WAT NIET?		
Verontreinigingen zoals verpakkingsmateriaal, bestek, bekers, glas, mosselschelpen, soepbeenderen, frituurvet en -olie, …		
PREVENTIEMAATREGELEN		
- Aankoop van vooraf gereinigde en geschilde grondstoffen; - Aanpassing van de maaltijdhoeveelheid volgens de aard van en het aantal patiënten. Ontwikkeling van vaste receptuur en een goede voedingsadministratie.		
GEVAARSEIGENSCHAPPEN	**VEILIGHEIDSMAATREGELEN**	
VERPAKKING		
In vaten of vloeistofdichte container		
INTERN TRANSPORT	**INTERNE OPSLAG**	
	In koele ruimte	
OPHALING		
Ophaling door een overbrenger met een OVAM-erkenning voor niet-gevaarlijke afvalstoffen (keukenafval).		
VERWERKING		
Compostering Vergisting Verbranding } in vergunde installaties voor verwerking van dierlijke bijproducten Stort- en verbrandingsverbod van selectief ingezameld keukenafval dat geschikt is voor recyclage. Verbod om als dierenvoeding te gebruiken		
NUTTIGE ADRESSEN EN WEBSITES		
www.ovam.be: meer informatie + lijsten van overbrengers en verwerkers van afvalstoffen		

Figure 2.2. Information from OVAM website: Waste Sheet: Kitchen waste and excess production http://www.ovam.be/jahia/Jahia/pid/1722

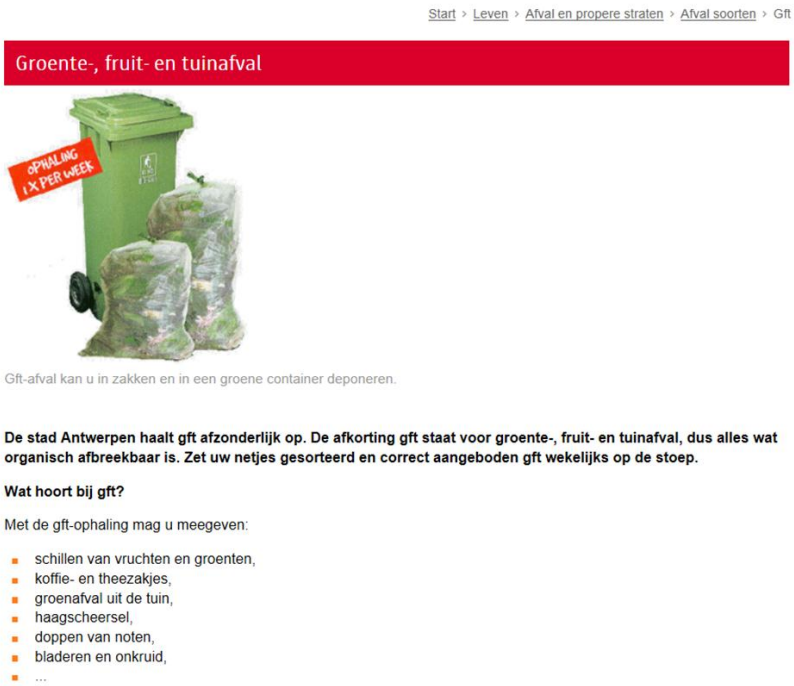


Figure 2.3. Information on Antwerp website

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Appendix 3: Results of web-based survey on collection of source segregated domestic food waste in Bulgaria

Organisation of waste collection in Bulgaria

National waste management policy in Bulgaria is developed by the Ministry of Environment and Water (Министерство на Околната Среда и Водите, MoEW) and includes drafting and enforcement of legislation, strategies, and programmes and regulation of activities in the public and private sectors. Waste collection in Bulgaria is the responsibility of local authorities and is mainly designed according to building types (e.g. high or low-rise) and the population density of the community served. In most municipalities biodegradable waste is not separated and is collected and treated as part of the domestic waste. Results from a questionnaire prepared by the Norwegian Agency and forwarded to all of Bulgaria's municipalities suggested that biowaste management in Bulgaria is still in an early stage of development. The results indicated that the majority of refuse collected in Bulgaria is going to landfill; composting and pre-treatment of waste are still poorly practiced; waste collection covers 95% of the urban and 33% of the rural areas in Bulgaria; 78 out of 190 municipalities are collecting waste and the rest employ waste collection companies to operate on their behalf; in the rural areas a large proportion of food waste is used as food for animals or is incinerated (MoEW, N.D.).

It is currently difficult to find any detailed information on waste collection systems in Bulgaria on the web. No waste management information is available on the local authorities' websites and the main source of data is the MoEW website (www.moew.government.bg). The most common way for a member of the public to find information on the waste management system is to visit the waste management department in the local authority, where he/she can register for a waste collection service, ask for a bin and find out the frequency of the collection.

Methodology

The main national body providing information on waste management in Bulgaria is the MoEW, and its website was searched thoroughly for information on source segregated food waste collection. The other body responsible for monitoring the execution of waste management in Bulgaria is the Executive Environmental Agency (Изпълнителна Агенция по Околната Среда) which publishes some legislation on its website (http://eea.government.bg/), but does not provide any data or statistics on waste management. Statistics on generated waste by type and economic group is provided by the National Statistical Institute (Национален Статистически Институт, NSI) (http://www.nsi.bg).

Recycling Bulgaria (www.recycling.bg) and Екопак България (www.ecopack.bg/bg) which are two of the leading waste management companies in Bulgaria were contacted to request any information on food waste recycling but did not reply.

A general web search was carried out using www.google.bg. The keywords used were: "Преработка" (Processing) + "Органични Отпадъци" (organic waste) with restriction "Pages from Bulgaria" to see the existing biodegradable waste streams in Bulgaria. Another search with keywords: "Събиране" (collection) + "Битови" (domestic) + "хранителни отпадъци" (food waste) was conducted for more specific information on food waste

collection systems. The search was carried out with a date restriction of one year and then repeated without date restriction.

Another search was carried out with keywords: "Анаеробно Ферментиране" (anaerobic digestion) +"България" (Bulgaria) to find out if there are any operating anaerobic digesters in Bulgaria. To ensure the reliability of the survey information on food waste collection was also searched for in the websites of the five biggest local authorities in Bulgaria.

The survey was conducted in January 2012

Results

The results of the survey indicated that there is no source segregated food waste collection in Bulgaria. The official MoEW website does not provide information on source segregated food waste but describes standards and practices for dealing with waste. As a new member of the EU, Bulgaria was required to comply with EU directive 1999/31/EC for reducing biowaste by up to 75% until 2010. After failing to comply with the EU legislation by 2010, Bulgaria is now using a 4-year postponement and will have to meet the requirements of the EU directive by 2014 (MoEW, 2003). Yet the only food waste processing in Bulgaria at the moment is home composting as an initiative of the inhabitants.

The MoEW's report states that the average household waste production in Bulgaria in 2006 is 448 kg per inhabitant per year (MoEW, 2009). The morphological analysis in the report shows that food waste accounts for up to 28.8% or 129 kg per inhabitant per year. However, the NSI web site does not have food waste as a specific category for refuse in Bulgaria, from which it can be concluded that if the food waste is segregated, it is collected together with another waste group.

No data for food waste collections were found on the surveyed websites of the individual local authorities (София, Варна, Пловдив, Благоевград, Смолян; Sofia, Varna, Plovdiv, Blagoevgrad, Smolyan). All of them stated that at present collection of source segregated food waste is not a priority in the waste management policy and they are first aiming to establish a segregated garden waste stream going to composting plants. The main impediment to that, as explained by one of the local authorities (Смолян, Smolyan), is the need for considerable initial investment and the small return from compost marketing (Smolyan, N.D.).

Currently in Bulgaria 85% of the waste produced goes to landfill, and biowaste accounts for up to 52% of the total waste produced (Dimitrova et al., 2009). Yet, due to the low waste collection taxes (roughly 50 euro per inhabitant per year) in Bulgaria, local authorities are failing to establish source segregated food waste collections in either household or commercial sectors. Their only initiative to reduce the food waste going to landfill at the moment is encouraging people to carry out home composting. In the households of over 40 municipalities have been given free composters to anyone who wishes (NL Agency et al., 2011), but most of those projects have stopped and the local authorities have not conducted monitoring of the results and do not have information in the extent to which the composters are used, whether any compost is produced or the quantity of the produced compost.

In a number of municipalities in the period from 2004 to 2009 an attempt was made at segregated biowaste collection but the results of the trial (not available on internet) were

inconclusive and have not led to the establishment of source segregated biowaste collections at a municipality level (NL Agency et al., 2011).

According to a report of MoEW, a small-scale door-to-door collection of segregated food and garden waste (together) is due to start in 2013 (MoEW, 2006). The target group of this scheme will be low-rise buildings with gardens, stores, restaurants and retail zones with concentrated production of biowaste; however, the scheme makes no provision for collecting only food waste from households. According to the Handbook on Waste Management in Bulgaria (Veeken et al., 2011) household food waste collections can be launched only when there are well established garden waste streams which are still in the planning stage in Bulgaria. This indicates that there is still a lot of development to be done in waste management in Bulgaria hence, collection of household food waste is not a priority at the moment and segregated food waste collection is not planned in the near future. One of the most innovative plants processing household waste in Bulgaria has started work in April 2011 and is near Varna. The plant processes only municipal solid waste (MSW) but it is planned to upgrade this with an anaerobic digester and to start processing of biowaste as well (Tcenova, 2011). The establishment of segregated food waste streams in the near future is unlikely however due to poor practice in separation and recycling of household waste in Bulgaria.

Summary of key findings

- Segregated food waste collection is almost unknown in Bulgaria in both household and commercial sectors
- The only initiatives to reduce the waste going to landfill have involved encouraging people to carry out home composting by providing them with free composters
- Around 85% of the produced waste in Bulgaria is going to landfill and 22.8% of this waste is food waste
- Prior to establishing food waste collection only, local authorities intend to focus on garden waste and biowaste in general
- Currently there are no operating anaerobic digesters in Bulgaria

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Appendix 4: Results of web-based survey on collection of source segregated domestic food waste in Cyprus

Background

Cyprus has incorporated the 94/62/EC directive in its national legislation by the Regulatory Administrative Act (Κανονιστική Διοικητική Πράξη - ΚΔΠ) No. 562/2003 which determines that by 16/07/2016 the biodegradable matter of urban solid waste ending up in landfills must be less than 35% of the total weight of the biodegradable urban solid waste produced in 1995, or of the year before 1995 for which Eurostat data exist (Cypriot-Government, 2003).

Municipal waste management is a responsibility of the Cypriot local authorities. However, the Ministry of Interior (Υπουργείο Εσωτερικών; İçişleri Bakanliği) is responsible for building the infrastructure and planning for waste management (information obtained from personal communication with Mr Theopemptou, the Environmental Commissioner in Cyprus).

The situation is complicated by the status of the northern part of Cyprus, which is regarded by the majority of the international community to be an occupied territory but is recognised as a self-declared separate state by Turkey.

Methodology

A general web search was carried out using www.google.com.cy search engine with "Κύπρος" (Cyprus) as the region restriction and date restrictions for the last 3 years. The keywords used were: αποκομιδή + απόβλητα + τροφίμων + Κύπρος (collection + waste + (of) foods + Cyprus). The search was then repeated with "πόρτα πόρτα" (door-to-door) and δημοτικος (municipal) added to the key words. The same searches were also conducted without date restrictions. Another search was conducted to see if any food waste was collected separately for anaerobic digestion, using the key words: δημοτική+ αποκομιδή+ Κύπρος+ αναερόβια+ χώνευση+ απόβλητα+ τροφίμων (municipal + collection + Cyprus + anaerobic + digestion + waste + (of) foods). Further searches were carried out using the keywords "yiyecek atıkları" (food waste), "katı + atık + toplama" (solid + waste + collection) and "atık evsel yağ" (waste domestic oil) and the related term "biyolojik atık" (biowaste), to cover the Turkish-speaking area.

In addition, the websites of the Ministry of Interior (http://moi.gov.cy/), Ministry of Agriculture, Natural Resources and the Environment (Υπουργείο Γεωργίας, Φυσικών Πόρων και Περιβάλλοντος; Tarım, Tabiî, Kaynaklar ve Çevre Bakanlığı) (http://www.moa.gov.cy) and the websites of all municipalities in Cyprus (obtained from http://www.ucm.org.cy/Account_List.aspx) were searched for information on separate food waste collections. All municipalities were contacted by email asking for their plans on food waste management. The website of the Environmental Commissioner in Cyprus (http://theopemptou.com/portal/index.php) was searched for related information and the Commissioner himself was contacted by email asking for information on food waste management. Finally the websites of the Cyprus Turkish Chamber of Environmental Engineers (Kıbrıs Türk Çevre Mühendisleri Odası, http://www.ktcmo.org/) and of ISG CEVRE (http://www.isgcevre.com/ were searched. The main survey was conducted between 16/02/2012 and 09/03/2012, with additional Turkish language searches completed between 5 - 13/03/2012.

Results

In Cyprus, 38.4% of the total municipal solid waste produced in 2007 comprised of organic matter which was wholly disposed of in landfills (CY.STAT., 2007). Also, a Eurostat survey covering the period 1995-2009 revealed that of the total municipal waste produced in 2009 in Cyprus, 87% was disposed of to landfills and the rest 13% was recycled (Blumenthal, 2011).

From the web search, it seems that segregated source collection of food waste is not common practice in Cyprus, as there was not a single governmental or private website found referring to current or planned segregated source collection of food waste in Cyprus. Municipalities' websites in Cyprus do not provide any kind of information about segregated food waste disposal and the only information provided is mostly about waste collection times and landfill regulations (Larnaka, 2012a, Lemesos, 2012, Lefkosia, 2012, Pegeia, 2012) or about recycling schemes (mainly of plastic, paper/cardboard and glass) (Aglantzia, 2012, Larnaka, 2012b, Deryneia, 2012, Idalion, 2012, Yermasoyia, 2012, Mesa-Geitonia, 2012). The only website found to provide information about food waste was that of Strovolos municipality (Strovolos, 2012) which subsidises the cost of domestic composting bins that mix green with food waste. Finally, lists of licenced waste collection, transhipment and treatment managers published by the Ministry of Agriculture, Natural Resources and the Environment do not contain a single manager dealing with food waste (MANRE, 2011a, MANRE, 2011b).

The above results were also confirmed by the Environmental Commissioner Mr Theopemptou (Pers. Comm.) who clearly said that despite his efforts there is currently no segregated source collection anywhere in Cyprus. Mr Theopemptou also mentioned that he has launched campaigns on domestic composting (Theopemptou, 2012c), on municipal green waste composting (Theopemptou, 2012b, Theopemptou, 2012a) and on mixed composting of pig farm waste and expired food products (Theopemptou, 2012d).

The research also received replies from 2 municipalities (Sotira, Tseri) and from the Union of Cyprus Municipalities (UCM, Ένωση Δήμων Κύπρου) (Pers. Comm.). They all confirmed that no segregated collection or treatment is applied for food waste. In addition, Mr Christodoulos Rousia from UCM mentioned the (only) case of a restaurant in Cyprus which composts its waste (Theopemptou, 2012e); however he also raised concerns related to cost and hygiene which might affect segregated food waste collection and treatment in warm climates.

The northern part of Cyprus has its own waste policy and solid waste management plan (CMTRNC, 1997; Alkan, 2010), but there are few formal recycling activities or composting initiatives in the region and the impossibility of sharing waste treatment infrastructure with other areas impacts on solid waste management (TCC, 2008). A number of initiatives have been undertaken to promote development of improved waste management (Farmer et al., 2006; Milieu, 2007). A master plan on solid waste management has been prepared which notes the high proportion of food waste in household waste and proposes composting as the most suitable option (Master Plan Part A, 2007; Master Plan Part B, 2007). At present there is thus no evidence of source separated food waste collections in the northern part of Cyprus.

Summary of key findings

- Segregated food waste collection is not applied in any region in Cyprus, nor is there a trend towards this

- Domestic composting of mixed food and garden waste seems to be encouraged, however it still remains at a very low level

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Appendix 5: Results of web-based survey on collection of source segregated domestic food waste in the Czech Republic

Background

Waste management is a relatively new but growing sector of the national economy of the Czech Republic (CR): the first Waste Act was adopted in 1991. Prior to 1991, handling of waste was subject to no legislative control or rules, and was not governed by any sectoral rules with the exception of so-called secondary raw materials (http://www.mzp.cz/en/waste).

Regulation of waste management in CR. Legal rights and obligations are closely related to administrative tasks. The current Act no. 185/2001 Coll. (Waste Act 2001) emphasizes waste prevention, defines the hierarchy of waste handling, and promotes the fundamental principles of environmental and health protection in waste handling.

The Waste section comprises information on how to handle generated waste as well as on waste prevention, obligatory procedures for selected products, waste types and appliances, and relevant methodological guidelines. Examples include batteries and accumulators, PCBs, waste oils, wastewater treatment plant sludge, asbestos waste, car wrecks, and electrical and electronic appliances. The Used Product Collection section provides information on products that are subject to collection rules, the relevant methodological guidelines, and additional information under the Waste Act.

The basic rules for waste treatment are set out by the Waste Act and its executive regulations. Targets for the various waste treatment methods and the optimum ways of achieving them are set out in the Waste Management Plan of the Czech Republic for 2003-2013. Its implementation is reviewed annually by means of an Assessment Report, published on the Ministry website. Regional waste management plans and the waste management plans of waste producers in the entire country have to comply with the Waste Management Plan of the Czech Republic.

To allow assessment of the waste management plans and to obtain data for administrative and inspection work, detailed records are kept on waste production and treatment in compliance with EU regulations. The information obtained is essential for further waste management planning, legislative work, and for ministerial advisory bodies, including the Czech Republic Waste Management Board, composed of leading experts from all government departments as well as the non-governmental sector.

The field of waste management also includes the transboundary transportation of waste from and to the Czech Republic or across its borders. Transboundary transportation is covered by EU legislation and permitted under administrative procedures with the aim to minimize its risks and environmental impacts.

Waste Management Plan of the Czech Republic for 2003-2013
The objectives of WMP CR mainly result from the requirements of European Union legislation on waste management. The binding part of WMP CR, including amendments, is a basis for the development of waste management plan and regional decision-making and other activities of the competent administrative authorities, counties and municipalities in waste management (§ 42 section 6 of the Act on Waste).

The main objectives of WMP CR related to biological waste handling are to: "Reduce the maximum amount of biodegradable municipal waste going to landfill so that the amounts of this component in 2010 is the most 75% in 2013 and 50% by weight, and future, in 2020 most 35% of the total amount of BMW produced in 1995".

Following the Waste Management Plan of the Czech Republic there are partially developed Regional Waste Management Plans and Waste management plans of waste producers (this category also includes Implemented WMP of Municipalities)

Methodology

Data Sources. The data source for calculating the waste production and arising from municipalities was mainly the database of ISOH (the waste management information system database of CR) that keeps track of waste production and handling in accordance with the reporting obligations of the Waste Act. The disadvantage of this source is that only municipalities with the production of more than 50 tonnes or 50 kg of hazardous waste are included in the database. Municipalities which have no obligation to report to the national database represent approximately 41% of municipalities, but in terms of population only about 4.5-5% of the whole CR. Other data were obtained in cooperation with individual regions, professional organizations, CENIA (http://issar.cenia.cz/issar) and from the databases of EKO-KOM (www.ekokom.cz).

Czech terms for food waste, and related terms found in the search, included the following:
"odpad z kuchyní a jídelen" (food waste from the canteens and dining)
"Kuchyňský odpad " (Kitchen waste)
"Biologický odpad" (biowaste)
"Odpad ze zahrad a parků " (garden and park waste)
"Organický odpad" (organic waste)
"biodegradabilní materiál" (biodegradable material)
"Anaerobní digesce" (anaerobic digestion)
"Kompost" (compost)
„BRKO" (biodegradable part of municipal waste)
"Kompostovatelný odpad" (compostable waste)
„ Nádoby na bioodpad" (bio-bin)
"Zelený odpad" (green waste)
"Tříděný sběr" (separate collection)
"Využití " (re-use)

Results

Production of municipal waste in CR. Figure 5.1 shows that more than three quarters of municipal waste in 2009 was mixed and bulky waste. Recyclable waste collected in separate collections was 13%. Other wastes represent only 11% in the total amount of municipal waste.

Table 5.1. Collected parts of Municipal solid waste in Czech Republic in 2006

Waste	Thousand tonnes
Municipal solid waste	4121
Household waste	2895
Household waste and industrial waste similar to household waste which is collected by public collection system (mixed waste)	2217
Bulky waste	247
Waste from bins for biological waste	0.6
Biological degradable waste from parks and gardens	76
Separately collected waste	354
Paper and cardboard	142
Glass	84
Light packaging waste	61
Electrowaste	6
Other waste (metals, textiles)	61
Other municipal waste	1226
Industrial waste similar to municipal waste	926
Street cleaning waste	300

Table 5.2. Treatment of MSW in CR and EU countries

Waste	CR (2006)		Germany (2005)		Austria (2004)		Switzerland (2006)	
	kg/person-year	%	kg/person-year	%	kg/person-year	%	kg/person-year	%
MSW	401	100	564	100	669	100	710	100
Paper and cardboard	14	3.50	96	17.00	74	11.00	170	24.00
Glass	8	2.0	43	7.50	23	3.50	41	5.50
Light packaging and plastics	6	1.50	56	10.00	16	2.50	4	0.50
Separately collected reusable waste	28	7.0	195	34.50	113	17.00	215	30.00
Waste from bins for bio-degradable waste	0	0	46	8.00	67	10.00	118	17.00
Total separate collection	28	7.0	241	42.50	180	27.00	333	47.00

Table 5.2. Total production of Municipal Solid Waste in districts of CR in years 2005-2009

District	2005	2006	2007	2008	2009
Prague	488889	510 802	574458	643739	637899
South Bohemia	211205	246343	254988	229991	230449
South Moravia	555026	450248	458896	498788	522480
Karlovy vary	113639	125007	162733	124334	117860
Hradec Kralove	214692	193062	185 148	185970	188601
Liberec	162927	189896	201457	211 121	205518
Middle Moravia	483805	471 928	471 244	565287	530543
Olomouc	219 112	253844	271 622	280372	270932
Pardubice	173 173	195 176	193527	212223	201460
Pilsen	211983	205785	248239	213 191	210 061
Middle Bohemia	560497	532736	534204	596694	667058
Usti nad Labem	403 854	342766	426510	416076	434451
Vysočina	282385	188413	187531	199058	187914
Zlín	195018	214666	221 741	224883	216806
Total SUM	4276204	4120673	4392298	4 601 727	4622030

Sources: ISOH, VUV - CeHO (2005-2006), CENIA (2007-2009)

Table 5.3. Registered production of individual types of municipal waste for municipalities and agencies involved in the municipal system in 2009

Waste code	Waste name	Total	Municipality reporting	Fraction
		(tonnes/year)	(tonnes/year)	(%)
TOTAL		**4622030**	**3187013**	**69%**
Separately collected reusable waste		**434465**	**275186**	**63%**
200101	Paper and cardboard	233180	113 845	49%
200102	Glass	75251	65540	87%
200139	Plastics	66142	51927	79%
200140	Metals	59892	43873	73%
Separately collected biodegradable waste		**205369**	**122831**	**60%**
200108	Biological waste from kitchen and restaurants	15624	2709	17%
200201	Biological waste	189745	120123	63%
200301	Mixed municipal waste	3040987	2316744	76%
200307	Bulky waste	464698	353781	76%
Other waste		**476511**	**118471**	**25%**
200110	Cloths	820	355	43%
200111	Textiles	5601	4351	78%
200113	Solvents	221	196	89%
200114	Acids	36	29	82%
200115	Alkalis	236	23	10%
200117	Photochemical	32	26	81%
200119	Pesticides	70	66	94%
200121	Fluorescent lamps and other waste containing Hg	188	II	6%
200123	Waste containing chloride CFCs	1766	729	41%
200125	Kitchen fats	2383	9	0%
200126	Fats and oils not included in 200125	407	384	94%
200127	Hazardous colours and glues	3215	3031	94%
200128	Colours and glues not included in 200127	39	1	3%
200129	Detergents containing hazardous components	69	23	34%
200130	Detergents not included in 200129	7	O	0%
200131	Non used cytostatics	8	5	67%
200132	Other chemicals not included in 200131	152	99	65%
200133	Batteries a accumulators, under 16060l	477	400	84%
200134	Batteries and accumulators, not included in 20 01 33	22	15	67%
200135	Electro waste containing hazardous parts identified under 20 0121 and 20 01 23	2960	940	32%
200136	Electro waste not covered under 20 01 21, 20 01 23 and 20 01 35	4234	675	16%
200137	Wood containing hazardous parts	191	1	1%
200138	Wood not covered by 20 01 37	19638	13067	67%
200141	Waste from cleaning chimneys	31	27	88%
200199	Other not specified fractions	207	13	6%
200202	Soils and stones	131590	5797	4%
200203	Other biological waste	28636	13665	48%
200302	Market waste	10993	2502	23%
200303	Street cleaning waste	106378	59954	56%
200304	Sludge	126233	6142	5%
200306	Waste from wastewater discharge system cleaning	14183	87	1%
200399	Unspecified MSW	15490	5847	38%

Source ISOH.

Table 5.5. Handling of separate waste types containing biodegradable waste CR (2009)

	Material use	Energy use	Use total	Landfilling	Other
Biological waste	80%	1%	81%	4%	16%
Biological waste Waste from kitchen and restaurants	48%	37%	85%	9%	6%
Metals	73%	0%	73%	0%	27%
Bulky waste	5%	1%	6%	91%	3%
Cloths	90%	2%	91%	7%	2%
Paper and cardboard	96%	1%	97%	0%	3%
Plastics	79%	2%	82%	4%	14%
Glass	93%	0%	93%	0%	7%
Mixed MSW	1%	9%	10%	88%	2%
Textile materials	68%	8%	77%	13%	10%
Total sum	20%	7%	26%	70%	4%

Table 5.6. Registered management of selected types of municipal waste in 2009 (Waste group 20) in wt %

	Material usage	Energy usage	Usage total	Landfilling	Other
Biological waste	80%	1%	81%	4%	16%
Biological waste from kitchen and restaurants	48%	37%	85%	9%	6%
Metals	73%	0%	73%	0%	27%
Bulky waste	5%	1%	6%	91%	3%
Cloths	90%	2%	91%	7%	2%
Paper and cardboard	96%	1%	97%	0%	3%
Plastics	79%	2%	82%	4%	14%
Glass	93%	0%	93%	0%	7%
Mixed MSW	1%	9%	10%	88%	2%
textile materials	68%	8%	77%	13%	10%
Total sum	20%	7%	26%	70%	4%

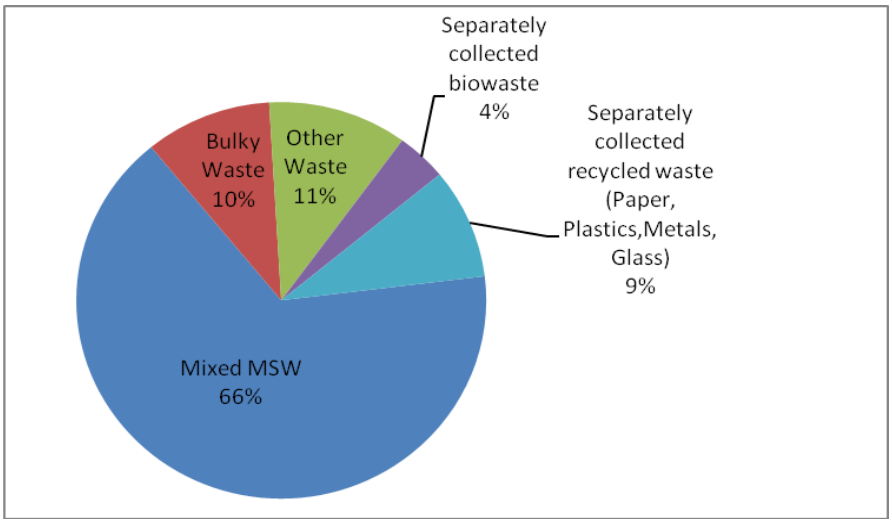

Figure 5.1. MSW composition

Separately collected types of recoverable components of municipal waste are mainly utilised. Other separately collected components (textiles, biodegradable waste from the kitchen, canteens and gardens) are used in the range 78-81%. The analysed values confirm the fact that when the wastes are collected separately, then are treated or recycled or otherwise used.

From Table 5.6 it is evident that use of mixed municipal waste and bulky waste is a minimum. The energy used amount of mixed municipal waste in 2009 was 9%. Major proportion of mixed municipal waste, 88% is landfilled. The amount of landfilled waste is increasing gradually, as a result of increasing total production of municipal waste.

Biodegradable Waste

a) **Biodegradable waste** in accordance with Decree No. 294/2005 Coll. (§ 2. B)) is any waste biologically degradable under aerobic or anaerobic conditions. Biodegradable waste is waste from gardens and public green areas, food and kitchen waste from households, restaurants, catering or retail premises and comparable waste from food processing plants. Amendment to the Waste Nr.154/2010.

b) **Biodegradable Municipal Waste** is the biologically degradable part of Municipal Solid Waste. The biodegradable municipal waste (BMW) consists of all kinds of biodegradable waste in the Waste Group 20 (Decree No. 381/2001). BMW includes waste paper and cardboard waste, biodegradable waste from kitchens and canteens, part of clothing and textile materials, wood, biodegradable waste from gardens and parks, part of mixed municipal waste, waste and bulky waste from marketplaces in the group of 20 and in subset 15 01 waste.

Current Biological Municipal Waste production in CR

Table 5.7. Production of Biodegradable Municipal Waste in CR in 2007-2009

Waste code	Waste name	Total (tonnes/year)	From the municipality evidence (t/rok)	Fraction of waste in the Municipality evidence (%)
150101 *	Paper and cardboard packaging	50649	50649	100%
200101	Paper and cardboard	233 180	113 845	49%
200110	Biodegradable waste from kitchen and restaurants Clothes	820	355	43%
200111	Textile materials	5601	4351	78%
200138	Wood not covered inside the Nr. 2001 37	19638	13067	67%
200201	Biodegradable waste	189745	120123	63%
200301	Mixed Municipal Waste	3040987	2316744	76%
200302	Market waste	10 993	2502	23%
200307	Bulky waste	464698	353781	76%
Total		4031935	2978125	74%

Source: VUV T.G.M. - CeHO, Works out by EKO-KOM, SLEEKO

The current production of all biodegradable waste is approximately 2,031 million tonnes per year. About 74 % of the total amount of biodegradable waste is produced by municipalities and entities involved in the municipal system, and the remaining 26% is produced by other municipal waste producers operating in the municipality. With the development of separate collections of garden waste the amount of recovered waste increases, and landfilling is only 4%. Unfortunately, the decrease in the amount of biodegradable waste in the MSW is not recorded. The register receives waste that was before the implementation of separate collection used in home composting, or removed out of the system.

Implementation of new plants for anaerobic digestion has led to almost a quarter of biodegradable waste collected from canteens being used for energy recovery by biological treatment. The obtained data evaluation and documentation on the production, handling and composition of the waste containing biodegradable show that for the indicators to achieve the objectives can only be used a waste which are handled in the municipal systems, i.e. waste from households, community and service organizations involved in the management of the municipality.

Handling of Biological Waste in Czech Republic

Management of biodegradable municipal waste prevention associated with prior reducing its quantity. Municipalities are since 2006 in its independent jurisdiction to determine generally ordinance of the local community composting system and method of use.

Table 5.8. Management of separate types of biodegradable waste (BMW) (2009)

	Material use	Energy use	Total use	Landfilling	Other
Biological waste	80%	1%	81%	4%	16%
Biological waste from kitchen and canteens	48%	37%	85%	9%	6%
Wood not covered in 2001 37	43%	17%	60%	24%	16%
Bulky waste	5%	1%	6%	91%	3%
Cloths	90%	2%	91%	7%	2%
Market waste	2%	2%	5%	93%	2%
Paper and cardboard	96%	1%	97%	0%	3%
Paper and cardboard packages	96%	1%	97%	1%	2%
Mixed Municipal Waste	1%	9%	10%	88%	2%
Textile materials	68%	8%	77%	13%	10%
Total	28%	6%	34%	64%	3%

Source: VUV T.G.M. - CeHO, Worked out by EKO-KOM, SLEEKO

Composting

Community composting in CR is realized mainly in garden colonies and in some cases includes composting of household waste. Several projects organised by non-government organizations have taken place and are still in operation. Community composting can be set up by a municipality act. Such biological waste is not registered, but is rather regarded as waste prevention.

Large-scale composting. In the Czech Republic there are in operation composting plants with various capacities for waste treatment and with different operation rules. Most of the

operating companies are also producers of biowastes (maintenance of parks, gardens, Municipal Technical Services, florists), and often also users of the produced compost. The treatment of biowaste as a service provided by waste producers is at a low price, which is lower than the price for such waste handling on landfills or incineration plants.

A large part of the biowaste, mainly from maintenance of green areas and parks, is used as mulch or the waste is mixed with the organic fertilizers and is not even delivered to composting plants. For this reason many of the composting plants in CR are in a bad economic condition.

There are 102 composting plants in operation in the CR (The l Environment Yearbook 2010). According to Internet applications, "An overview of treating biodegradable waste" prepared by the Centre for Waste Management TGM it is stated that 247 composting plants are in operation.

Anaerobic digestion of biological waste
As reported by CEHO there are approximately 108 facilities with the technology for anaerobic digestion of waste (biogas) in the CR. The technology is operated mainly for agricultural and food biogas plants and water treatment sludge from the WWTP. The main inputs to these plants are materials from animal housing (pig slurry, poultry litter), slaughterhouse waste, bone meal, waste from kitchens and restaurants, fruit and vegetable waste, waste from greenery. No operating biogas station is designed primarily to handle municipal waste.

Overview of plants in operation in Czech Republic:

Map of Composting plants in CZ:
http://www.ceho.cz/fileadmin/user_upload/CeHO/BRO/index.html

Map of biogas plants in CR:
http://www.ceho.cz/fileadmin/user_upload/CeHO/BRO/index.html

Separate collection of biological waste
Separate collection in the CR is mainly focused on green waste from gardens and parks and other suitable waste of plant origin. There is only a little experience with the operation of separate collection of biowaste from households.

Several cities in the CR (egg. Bystřice Pernštejnem, Kromeriz, Nova Paka, Písek, Plzen, Prague 12, Trebon, Rýmařov, Strážnice, Uherske Hradiste) have on their own initiative introduced separate collection of biowaste from gardens and homes in the 1990s and these continue to operate also in the present.

In several other cities, after 2000, pilot projects are being implemented in separate collection of BMW (Bílina, Černošice, Česká Lípa, Děčín, Frýdek Místek, Jindřichův Hradec, Kladno, municipalities in Náměšt and Novy Jičín , Olomouc, Ostrava, Plzen, Praha – Dolní Chabry, Třinec, Uherské Hradiště, Vysoké Mýto, Zlín and others).

Most projects are focused on the separate collection of biowastes of plant origin in family houses. Separate collection of biowaste from households in the CR is at the stage of pilot projects and extension of the surcharge cannot yet be foreseen.

The amount of separately collected biowaste in towns and cities depends, among other things on which system of separation method is being implemented.

If green waste is delivered by citizens to collection sites, then the system is used by the population in close proximity to such sites and other separation of biowaste will use people in the vicinity of these yards and other citizens who are interested in such separation.

If there are regular (2 - 4 x a year) for the collection of biological waste large containers placed in the municipality, the collection yield is higher. The highest separation yield is achieved by separation of green waste into green bins placed permanently near to residential buildings or by the introduction of sack collection.

Based on experience with the introduction of pilot biowaste separate collection system in smaller cities in CR can be stated that:
- the amount of mixed municipal waste going to landfills is demonstrably reduced, by an estimate 17-30 kg / person-year (reduction of 5-15% by weight)
- the amount of biowaste collected in villages / localities with established separate biowaste collections gradually increases and in 2 to 3 years stabilizes at 100-120 kg / person-year
- the total quantity of waste generated by municipalities, however, increases by 10-30% by weight.

Targets and goals in biodegradable waste management
Evaluation reports on the implementation of the Waste Management Plan CR pointed out that implementation of the strategy in handling with biological waste is not sufficiently effective.
It is a strategy based on the development of separate collection of biowaste in the municipalities and its treatment, which is financially supported by the Operational Programs of Environment Minister in the years 2007-2013.

The operation of plants for biological waste handling focuses many problems. The offered amount of separately collected biological municipal waste is presently still insufficient, as well as the lack of demand for output products (compost, fertilizers).

Expansion of separate collection of biowaste in the municipalities and its treatment require implementation of some of the administrative and economic instruments, such as an obligation of municipalities to establish and modify the decree of the municipal system for separate collection of biodegradable waste on their territory, increasing of fees for landfilling of waste, implementation of measures to stimulate economic recovery municipal biowaste in agriculture. The priority strategy to meet the biological waste diversion from landfill is to support the construction of facilities for treatment of mixed municipal waste within the integrated regional systems.

Under the present legislation the municipalities are obliged to sort out of the MSW only Hazardous waste, to ensure places for its deposition by inhabitants. The amendment introduces an obligation for municipalities to sort from 1st January 2010 at least five usable

components of municipal waste: paper, glass, plastic, beverage cartons and biodegradable waste.

The obligation to sort biodegradable waste in 2010-2012 only applies to municipalities with a predominance of the family houses. From 1st January 2013 the municipality will have to offer waste recycling on housing estates. Along with the amendment landfilling of separated biowaste will be prohibited, including the green waste from gardens and parks, waste from kitchens and dining rooms, wood, paper, cardboard etc. The amendment provides specific measures to motivate the community in this direction.

Summary of key findings

- Collection of source segregated food waste without other household biowastes is not common in the Czech Republic
- There are some initiatives that may cause this to become more common, although current attention is more focused on green waste

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Appendix 6: Results of web-based survey on collection of source segregated domestic food waste in Denmark

Organisation of waste collection in Denmark

Overall responsibility for administration of waste management in Denmark is held by the Danish Ministry of the Environment (Miljøministeriet, www.mim.dk). There are 98 municipalities in 5 regions, and these are responsible for managing waste collection at a local level. Each municipality receives a certain amount of tax from the citizens and it is entirely up to the municipalities what their priorities are (waste collection, schools, roads, hospitals etc) as long as they are within the law. It is very common for the municipalities to either own or hire external organisations to handle the waste for them, which also means that several municipalities might use the same organisation and the disposal of the waste might be handled in several different municipalities.

As an example of this, there are 9 municipalities in Region Sjælland (Zealand), who together own a waste collection organisation by the name Kara/Noveren I/S, which is based in four different locations across 3 municipalities. These are shown by red marks on the map in Figure 6.1, while the green marks show waste disposal sites.

Roskilde (North): Incineration plant
Roskilde (South): Recycling plant
Kalundborg: Unknown plant

Holbæk: Handling of concrete and tiles, composting of garden waste and the Bio Plant; Bio Vækst A/S

Source: Kalundborg Kommune (Kalundborg Municipality) website

Figure 6.1. Map of 9 municipalities on Zealand

Another example is the case of Bornholm, which is an isolated island south of Sweden. Since any transport to the mainland of Denmark takes about 7-8 hours, they have to be able to dispose of waste themselves. Therefore this municipality is responsible for both collection and disposal of waste. Due to this, they have also concluded that collecting food waste from households is not possible, as they would have to invest in their own Bio Plant (source: Bornholm Kommune (Bornholm Municipality) website. Apart from Bornholm, it is not possible to state whether the municipalities are responsible for both collection and disposal.

Before 2007 there were 271 municipalities and although this structure changed 5 years ago, waste management practices and records have not yet changed in all cases. As far as food waste collection is concerned, this means that some municipalities only collect food waste in

part of their municipal area. This also affects the waste plans of the municipalities as they are set for a period of 4 to 8 years and some of them dated back to 2002.

Citizens of Denmark pay 39% tax, but also pay for collection of bins at the household. The following example is from the municipality of Holstebro:

- 1050 DKK per year for private households. This covers for the fees of having any bins on your property and being able to use the local municipality tip.
- 1250 DKK per year for private households. This covers for having the compulsory bins (residual waste, plastic waste, metal waste and paper waste) on your property and collection every fortnight.

(source: Holstrebro Kommune (Holstebro municipality) website)

Since collection of garden waste is optional, there is an additional payment to have it collected; the same system applies to large waste bins, which are commonly used if people are renovating or building things on their property. The householder must pay for bins, but many municipalities offer a discount on a sealed home composter for food waste, and some even give it to their citizens free of charge. There is no annual fee for either food waste or garden waste home composters.

In Denmark there are an estimated 250,000 summerhouses, which are located in dedicated areas. These are spread throughout the country, and permanent residence in a summerhouse is not permitted. Regardless of whether a municipality has food waste collection or not, this does not affect the summerhouse areas. It is common that these areas have residual waste bins and collection services in the summer period, even if food waste is not collected in the rest of the municipality.

Statistics, laws and targets about waste management in Denmark

In 2003, the government published a Waste Strategy which was to be fulfilled before 2012. The aim was to reduce the amount of waste going to landfill to a maximum of 6%, and increase the amount of recycled waste to a minimum of 65%, with the remainder going for incineration. There is no mention of food waste collection schemes in the Danish laws and targets on waste management, although these are obviously included within the aims for recycling. The Waste Strategy was set in 2003, and the aims were already fulfilled by 2009. Table 6.1 shows specific values achieved in 2009 and the targets for 2012.

The independence of the municipalities with respect to waste management causes some problems with respect to data collection, since the government only holds waste statistics for the entire country and not at a municipality level, and data must sometimes be obtained from each of the municipalities' websites independently. However, since multiple municipalities may use the same organisation to collect household waste (or as in at least one case, one municipality uses 6 different organisations to collect their waste), there are some cases where the data are inaccurate as the waste plan contains numbers from all the municipalities involved and not individually. There are also several municipalities which do not publish their waste plans online, and therefore data on household waste cannot be accessed in this way.

Table 6.1. Treatment of Waste in 2009 and aims for 2012 in percentage (source: Waste Statistics for Denmark 2009)

	Recycling Percent		Incineration Percent		Landfill Percent	
Source	2009	Objective 2012	2009	Objective 2012	2009	Objective 2012
Private households	42	33	52	60	4	7
- ***Domestiv waste***	12	20	88	80	1	0
- ***Bulky waste***	26	25	47	50	15	25
- ***Garden waste***	99	95	0	5	0	0
Service	46	50	46	45	6	5
Industry	58	65	18	20	23	15
Building and construction	96	90	1	-	3	-
Waste water treatment plants	54	50	43	45	3	5
Coal-fired power plants	97	90	0	0	3	10
Total	69	65	24	29	6	6

While the total amount of waste produced in Denmark continued to increase from 1994 to 2006, from 2006 to 2008 the amount remained steady and from 2008 to 2009 there was an 11% decrease in waste quantities. Overall, however, the waste amount has increased during the past 15 years. Table 6.2 gives the total tonnages by year and category.

Table 6.2. Total production of waste in Denmark 1994-2009 (source: Waste Statistics for Denmark 2009)

Total waste production	1000 tons									
	1994	1996	1998	2000	2002	2004	2006	2007	2008	2009
Private households	2.575	2.767	2.796	3.084	3.121	3.164	3.298	3.480	3.654	3.437
Domestic waste	1.662	1.655	1.702	1.676	1.700	1.692	1.715	1.721	1.665	1.659
Bulky Waste	606	639	572	730	655	687	741	778	713	601
Garden waste	286	401	438	519	517	500	598	649	536	616
Other	21	72	83	158	246	284	242	332	702	559
Service	656	851	955	1.119	1.357	1.833	1.974	2.159	2.224	2.026
Industry	2.309	2.632	2.783	2.948	2.311	1.855	1.936	1.690	1.662	1.457
Building and construction	2.433	3.088	2.962	3.223	4.044	4.496	6.113	5.767	6.009	4.970
Waste water treatment plants	1.156	1.212	1.251	1.476	1.011	819	814	819	813	799
Residues from coal-fired power plants	1.962	2.332	1.469	1.176	1.228	1.180	1.314	1.310	1.194	1.164
Other	14	30	18	5	34	14	10	9	20	19
Total	11.105	12.912	12.233	13.031	13.105	13.359	15.459	15.235	15.575	13.872

According to these Figure s, in 2009 each citizen of Denmark produced 624 kg of waste. 301 kg of this was domestic waste, 112 kg garden waste and 109 kg bulky waste. Of the 1.7 million tonnes of domestic waste produced in Denmark in 2009, only 12% was recycled, while 88% was incinerated and less than 1% was landfilled. While this means that the target for landfilling of domestic waste was met, the recycling goal was not. The government therefore demanded that the municipalities increase recycling from private households. The initiatives used could be recycling bins for paper, glass, metal or domestic food waste.

Methodology

A systematic search was carried out on the websites of each of the 98 municipalities responsible for waste collection in Denmark. The names and regions for the municipalities were obtained from the Danish Statistics agency website (Danmarks Statistik, www.statistikbanken.dk), together with information on the population, area and population density. Data on waste collection and the identification of those municipalities collecting

food waste either as a single material or co-mingled with green waste were found on the municipalities' websites. The search was carried out using the search engine google.dk and the most common method was to use the name of the authority together with the term "Affaldsplan" (waste plan), e.g. "Billund Kommune Affaldsplan".

Other Danish terms used for or found in searching are given below, with translations. It should be noted that Danish uses 3 extra letters which do not exist in the English language. These are, in alphabetic order: æ, ø and å (Æ, Ø and Å in capital letters). For transliteration of these letters into English, the following convention is used:

- Æ / æ : AE / ae
- Ø / ø : OE / oe
- Å / å : AA / aa

Search terms;

• Affald	Waste
• Affaldsplan	Waste plan
• Forbrændingsanlæg	Incineration plant
• Genbrug	Recycling
• Genbrugsstation	Recycling tip
• Husholdningsaffald	Household waste
• Kommune	Municipality
• Organisk affaldsanlæg	Organic waste plant (FW plant)
• Skraldespande	Waste bins

Different kind of bins / waste collections;

• Dagrenovation	Residual waste
• Glas	Glass
• Have affald	Garden waste
• Metal og dåser	Metal and cans
• Organisk affald/grønt affald	Food waste (directly translated: organic waste/green waste)
• Papir / pap / aviser	Paper / Cardboard /newspaper
• Plastik	Plastic
• Storskrald	Large waste container for generic waste

By looking in the waste plans for each municipality, in most cases it was possible to identify how much waste and recycling the municipality had in a certain year. If searching for the municipalities' waste plans did not produce any results, other terms were used as shown. By looking in the waste plan, it was almost always possible to identify whether the municipality was collecting food waste as this was often mentioned in some form. If this was not the case, the website was checked and if possible also the organisation handling their waste, to make sure no information was missed. For those municipalities that have food waste schemes, further information was gathered from the waste plan, the municipality website or the organisation website.

Results

Out of the 98 municipalities in Denmark, 16 (16.3%) had some form of food waste collection. 13 of these were for food waste only, while 3 were co-mingled with small amounts of green waste.

Table 6.3 shows the number of people provided with each type of FW collection service. 747,212 people (13.4% of the population) live in the 16 municipalities offering food waste collection schemes (FW only or with GW). This may not reflect the total number of people receiving this service, however, since in some areas the food waste collection schemes cover only part of the municipality; and in one case, home composting is compulsory for any household with a garden.

Table 6.3. Population of municipalities by type of service provision

	Population	**Percentage**
No separate FW collection (or NS)	1,205,248	21,6%
Green Waste Only	3,628,048	65,0%
With Green Waste	132,589	2,4%
Separate FW-only collection	614,623	11,0%
Total	5,580,508	100%

Of the 13 municipalities that have FW-only collection, 9 are located on Zealand, and 4 of these are in the capital regions around Copenhagen. Even though only 4 municipalities in this region have food waste collection schemes at present, several others stated that they are monitoring how these schemes are working. Some of these municipalities are due to prepare a new waste plan in 2012, and one specifically stated that it plans to start a food waste collection scheme in the near future. . The introduction of food waste collection thus appears to be an up-and-coming trend, especially in the capital region.

There were also 2 cases of municipalities who used to have food waste collection schemes, but stopped operation around 2004. This might be due to the cost, and the fact that very few municipalities had this type of scheme at this time. Despite this, many municipalities appeared to be working towards separate collections, especially in the two regions of Zealand and the Capital Regions.

In general the existing food waste collection schemes were in municipalities with larger cities (and therefore also higher population), but interestingly none of the 5 biggest cities in Denmark (Copenhagen, Aarhus, Odense, Aalborg and Esbjerg) have these schemes. In the case of Copenhagen the city's recycling percentage is only 10.3%, below the government's legal requirement (Waste statistics for Denmark, 2009); yet there is no mention in the cit'ys waste plan of an intention to invest in food collection schemes.

Table 6.4 shows some key characteristics of the municipalities that provide any form of food waste collection schemes.

Table 6.4. Key characteristics of municipalities with separate or combined FW collection

Local Authority	General waste									Separate FW collection?
Name		Area	Population	Population density	Household - total waste	Household - total waste	Household waste sent for recycling/composting/reuse	Household waste sent for recycling/composting/reuse		Type
		km2	no.	person/km2	Tonnes in total	tonnes/person-year	Tonnes in total	tonnes/person-year	% total	
1	4	5	6	7	8a	8b	9a	9b	10	13
Name of Municipality	Region	Area	Population	Population density	Waste	Waste		Recycling	Recycling %	
Kerteminde	Region South Denmark (Region Syddanmark)	205.8	23,793	116	16,527	0.695	8,420	0.354	50.9%	With GW
Nyborg	Region South Denmark (Region Syddanmark)	276.7	31,486	114	26,471	0.841	16,046	0.510	60.6%	With GW
Slagelse	Region Zealand (Region Sjælland)	567.9	77,310	136	62,308	0.806	32,321	0.418	51.9%	With GW
Billund	Region South Denmark (Region Syddanmark)	540.3	26,220	49	22,402	0.854	11,332	0.432	50.6%	FW only
Egedal	The Capital Regions (Region Hovedstaden)	125.8	41,821	332	36,602	0.875	22,242	0.532	60.8%	FW only
Fredericia	Region South Denmark (Region Syddanmark)	133.6	50,193	376	32,770	0.653	NS	NS	NS	FW only
Frederikssund	The Capital Regions (Region Hovedstaden)	247	44,345	180	39,863	0.899	22,431	0.506	56.3%	FW only
Greve	Region Zealand (Region Sjælland)	60.4	47,942	794	43,024	0.897	21,733	0.453	50.5%	FW only
Gribskov	The Capital Regions (Region Hovedstaden)	279.5	40,603	145	47,900	1.180	23,596	0.581	49.3%	FW only
Halsnæs	The Capital Regions (Region Hovedstaden)	121.8	30,980	254	33,172	1.071	18,631	0.601	56.2%	FW only
Holbæk	Region Zealand (Region Sjælland)	577.3	69,415	120	46,886	0.675	23,429	0.338	50.0%	FW only
Ikast-Brande	Region Mid Jutland (Region Midtjylland)	733.4	40,658	55	36,424	0.896	25,791	0.634	70.8%	FW only
Kalundborg	Region Zealand (Region Sjælland)	575.2	48,632	85	50,107	1.030	25,689	0.528	51.3%	FW only
Odsherred	Region Zealand (Region Sjælland)	354	32,640	92	45,631	1.398	25,242	0.773	55.3%	FW only
Ringsted	Region Zealand (Region Sjælland)	294.6	33,153	113	19,407	0.585	8,298	0.250	42.8%	FW only
Vejle	Region South Denmark (Region Syddanmark)	1058.8	108,021	102	83,976	0.777	NS	NS	NS	FW only

Note: The first 3 municipalities collected FW co-mingled with GW, and the remaining 13 are FW-only collections

The category GW only includes municipalities that offer to collect green waste at households. This is very common in Denmark, although there are many restrictions concerning the operation of the scheme. First, no food waste is allowed in the collection, and often the waste must be placed in clear plastic bags, so it is easy to tell what is inside. Most municipalities only gather green waste for 6-10 months of the year (not during the winter period).

The 3 municipalities categorised as With GW are those that state they accept a small amount of green waste in the food waste bins. It is not specified what 'small amounts' means.

Collection frequency and bins

While it is most common for bins to be collected fortnightly for both residual and food waste, the collection is not in the same week. This means that residual waste is collected in different weeks than food waste, and a special truck is often used for the food waste collection. In one case, however, food waste and residual waste was collected from the same bin: the residual waste had to be placed in sealed black bags, while the food waste was in sealed green bags.

a) Black bin for residual waste, green for food waste

b) Bin for large bin bags

c) Bin rack for the kitchen

Figure 6.2. Bin types

While some municipalities use wheeled bins for food waste collection (Figure 6.2a), others use sealed containers in which large bags are placed (Figure 6.2b). In one case, the householders were allowed to choose the size of their own bins. The wheeled bins are often partitioned, especially if the bin is for recycling, so that half is for paper and the other half for metal. This is also the case in some municipalities collecting food waste, where the bins are separated into two halves for residual waste and food waste. A very common trend across all of the municipalities is to ask people to put everything in sealed bags and in some cases the municipalities also pay for the bags provided for the food waste bins.

In a few cases, the municipalities offer a special bin rack (Figure 6.2c) to install under the kitchen sink: in Denmark this is the most common place for the bin to be kept. The stand has two small containers in it, one for residual waste and one for green waste. This is intended to make it easier for the household to sort the waste, and also to ensure that no food waste will go into the residual waste or vice versa.

Common separated waste collections in Denmark
Collection of mixed dry recyclables is uncommon in Denmark: there is no general bin for recycling of tin cans, cardboard, paper, milk bottles etc. These items are usually divided into separate bins, although not every municipality makes separation of all of these categories compulsory. The most common bins are residual waste and paper/cardboard bins. Other bins that may be required by the municipality include;

- Residual waste
- Organic waste
- Paper / Cardboard waste
- Metal waste
- Plastic waste
- Glass / bottle waste
- Garden waste
- Large waste container

The last two are never compulsory, but are offered by most municipalities.

Plastic and glass bottles and metal cans used for soda, beer, water, alcohol etc are often returned to the store, as the customer pays a fee for the material upon purchase which is paid back to the customer on return of the item, to encourage recycling.

The rules on what can be put in bins are extremely strict. Anything that has been in touch with food is not allowed in any recycling bin: for example a cardboard pizza box, regardless of how clean it is, is not allowed in the paper/cardboard bin, but instead belongs in the residual waste bin.

In large cities and nearby areas other options may be available recycling of domestic waste. These are called Environment Stations (miljøstationer). These are not tips, but a solution used by a number of municipalities in areas with high population density. The most common materials for recycling through these Environment Stations are paper, glass, metal, and batteries. They are often placed where people have easy access to them, such as the parking lot of a supermarket. In Sønderborg Kommune (Soenderborg Municipality), for example, there are a total of 420 of these containers.

Figure 6.3. Environment Stations in Soenderborg (picture from Sønderborg Kommune website)

Materials accepted and not accepted in Food Waste collection schemes

Table 6.5 summarises materials accepted and rejected in food waste collections.

Table 6.5. Accepted or rejected for FW collection schemes

	Bones	Eggshells	Paper / card	Shredded paper	Liquid	Oil / fat	Faecal	Plant	Biodeg bags	List accepted
Not specified	9	2	12	14	15	9	13	4	16	0
No	3	0	2	2	1	1	2	0	0	2
Yes	4	14	2	0	0	6	1	11	0	13

List of accepted materials for Food Waste only collections

- Billund Municipality: All raw and cooked food without packaging, bread and cake, meat, fish and fish bones, fruit and vegetables, used coffee and tea incl. Filters, flowers (not houseplants), eggshells, kitchen roll, small amounts of fat and sauce.
- Egedal Municipality: Fruit, vegetables, cake, bread, meat and fish without bones, rice, pasta, used coffee and tea with filters, kitchen roll, dairy products, small cardboard used for food, egg trays, paper used for lunchboxes, plants without the plastic pot, shells from eggs and nuts
- Fredericia Municipality: No list available.
- Frederikssund Municipality: Fruit, vegetables, potato peels, kitchen roll, coffee filters and used coffee, tealeaves and filters, plants (without the pot), bread, cakes, rise, pasta, pizza, meat without bones, fish, dairy products, eggshells, egg trays.
- Greve Municipality: No list available.
- Gribskov Municipality: Fruit, Vegetables, herbs, spices, food waste, meat, fish, eggs and eggshells, rice, pasta, bread, cake, cornflakes, dairy products, used coffee and tea including filters, kitchen roll, egg trays, pizza boxes and lunch box paper

- Halsnaes Municipalitry (Halsnæs): All raw and cooked food, anything eatable, bread, cakes, fish, chicken, kitty litter and straw (used for rabbits etc.), used coffee and tealeaves, meat and meat bones, kitchen roll, napkins, breakfast products, nutshells, dairy, eggs and eggshells, pasta, rice, plants without the plastic pot.
- Holbaek Municipality (Holbæk): Flowers and houseplants, bread and cake, fat, fish and poultry, fruit and vegetables, dung from small animals (hamsters etc.), used coffee and teabags, meat and meat bones, kitchen roll and napkins, food leftovers, nut and eggshells, dairy products, pasta and rice, egg trays made of cardboard.
- Ikast-Brande Municipality: Fruit and vegetables, used coffee and tea incl filters, nut and egg shells, rice and pasta, flowers, dairy products, meat, kitchenroll and eggstrays of cardbord.
- Kalundborg Municipality: Food leftovers (raw and cooked), meat and meatbones, fish, rice and pasta, fruit and vegetables, potatoes, fat, sauces, dairy products, bread and cakes, egg and eggshells, nuts and nutshells, used coffee and tea incl filters, kitchenroll, flowers and houseplants, soil from houseplants, dung and straw from small pets (no meateating animals)
- Odsherred Municipality: Flowers and houseplants (without the pot), all cooked food, bread and cakes, fish waste, used coffee and tea incl. Filters, kitty litter, meat waste, kitchenroll and luchbox food paper, dairy products, fruit and vegetables, rice and pasta, nut and egg shells
- Ringsted Municipality: Meat and fish, food leftovers, bread, fruit and vegetables, flowers and houseplants, used coffee and tea incl. Filters, eggshells
- Vejle Municipality: Bones, flowers, bread, berries, crisps, fish, poultry, fruit, oatmeal, vegetables, used coffee and tea incl. Filters, herbs, kitchen roll, dairy products, meat, nuts and nutshells, pasta, vegetable oil, houseplants, napkins, butter, straw from small pets, candy (without paper), egg, eggshells and trays of cardboard.

List of rejected materials for Food Waste only collections

Note that most of the rejected list is merely a guide for households on how to sort their waste, and therefore what you should put in your residual waste bin instead of a rejection for the Food waste bin. It is stated in the spreadsheet which of the municipalities this refers to.

- Billund Municipality: Milk/juice cartons, diapers, sanitary towels, plastic bags and foil, tin foil, Hoover bags, crockery, houseplants, animal faecal and kitty litter, tin cans, ashes from fireplaces.
- Egedal Municipality: Every type of GW
- Fredericia Municipality: No list available
- Frederikssund Municipality: No list available
- Greve Municipality: No list available
- Gribskov Municipality: No list available
- Halsnæs Municipality: Milk/juice cartons, dirty food boxes (pizza boxes etc.), plastic cutlery, diapers, Hoover bags, ashes)
- Holbæk Municipality: Diapers, food packaging, dirty paper and cardboard, plastic, glass, juice/milk cartons, ashes, candle lights, Hoover bags, chewing gum, pizza boxes.
- Ikast-Brande Municipality: Diapers, sanitary towels, tin foil, plastic or other things used for wrapping food, tin cans etc, milk/juice cartons, Hoover bags, ashes and cigarettes.
- Kalundborg Municipality: No list available
- Odsherred Municipality: All GW

- Ringsted Municipality: No list available
- Vejle Municipality: Tin foil, baking paper, food wrapping, sanitary towels, diapers, cigarettes and ashes, juice and milk cartons, cling film, hair, washing-up brushes, tooth brushes, cork, egg trays of plastic.

Summary of key findings

- Source separated collection of a wide range of materials is well established in Denmark with strong rules on categories of materials
- A number of municipalities already offer collections of food waste only or of food waste with small quantities of green waste, and there are signs that this trend is increasing
- In most cases detailed instructions are available on the materials accepted by the scheme and on the correct method of disposal for unacceptable materials, but there is some inconsistency between the information provided by different municipalities
- FW is usually collected fortnightly and GW is only collected in the summer period

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Appendix 7: Results of web-based survey on collection of source segregated domestic food waste in Estonia

Organisation of waste collection in Estonia

The population of the Republic of Estonia is 1.4 million in a territory of 45,227 km^2. The country is divided into 15 counties and has 226 local governments: 33 towns and 193 parishes (Estonia Ministry of Interior, 2012). Each local authority is responsible for waste management and categorisation in its own territory.

According to the national waste legislation, the local government has to confirm a plan regarding waste management and long-term use. The scheme must include the aims of the waste management plan for the following years. The local government sets waste management regulations which consist of rules for the local town or parish. The regulations also cover the areas of waste transfer, surveillance, health insurance and requirements regarding collection points. People have to act in accordance with the waste management regulations, which include exact information about different collection points within the local government's territory. Furthermore, the local authority sets the rules on waste logistics. If there are more than 1500 inhabitants in the territory, a formal waste transfer is mandatory. In Estonia 137 self-governments out of 226 are obliged to organise the transfer of waste. This mainly concerns the collection and transfer of household waste, but it is also possible to regulate the management of other types of waste. It is necessary to have an overview of the waste producers and the waste they have produced, and a database of waste producers must be made. (State Waste Program 2008-2013).

Local authorities' waste management plans must include a section that provides information about biodegradable waste collection, classifies various kinds of waste, clarifies the methods of management (collection points) and names all the landfills. The exact terms of the waste management and classification including conditions for waste transfer and responsibility (types of waste, minimum provision of containers etc) must be determined in the local authority's waste management regulations. The waste holder must be able to transfer biodegradable waste to the waste stations or separate compost collection points. The preferred option is to create composting sites and waste stations in co-operation with various self-governing structures, neighbour self-governments and other local enterprises dealing with waste management (e.g. sewage disposal plant). Since regional waste management projects are created in co-operation with the local authorities, or their development depends on other important decisions made within the local authority, all the issues must be solved during the project development stage. Regional projects have to be coordinated, to avoid ineffective investments (Self-Government 2012).

Waste management regulations are public and easily accessible in the facilities of self-governing authorities' or can be found on their websites.

Methodology

Comprehensive information about waste management in self-governing organisations can be obtained from the Ministry of Environment (Keskkonnaministeerium) website http://www.envir.ee, under the department of Waste and Waste Management. Each Estonian local authority also has its own website. In the Ministry of Environment's website can be found all the local authority's websites, linked with their waste management regulations and

contact details. Most of the websites include a separate environment section where is information on waste collection and transfer. Some of the self-governments have added information regarding this subject to various sections: economy, household management or to a separate link "for locals". Approximately 55% of the local authority websites offer a separate subject – Environment, which makes finding the necessary information about the documents and categorisation quick and easy.

A general web search was carried out using google.ee advanced search with 'Eesti' – (Estonia) as the region restriction. The keywords used were: "toidujäätmed" (food waste) + "kogumise" (collection) +" Eesti" (Estonia). The search was then repeated by adding + uksest ukseni/door to door. A further search was conducted to see if any food waste was collected separately for composting or anaerobic digestion, using the key words: "kompostimine", "anaeroobse lagundamise". Related terms found included: "biolagunevad jäätmed ", toit / köögijäätmeid "," kompostimine "," olmejäätmed ".

Searching for "collection system for biodegradable waste" in www.google.ee in Estonian, Google gives 1320 results. Google search offers self-governing bodies waste management plans for different years, legislation and the plans for waste stations.

In Estonia there are 2 main enterprises working in the field of waste transfer: Veolia Environmental Services (http://www.veolia.ee) and Ragn-Sells (http://www.ragnsells.ee), between which the market is divided. Besides these 2 companies, there are about 5 other enterprises that cover a smaller part of the market. The major companies' websites give detailed information about waste collection, categorisation and the importance of these activities.

The survey was carried out between January - April 2012.

Results

In accordance with EC directives the main goal is to decrease the amount of biodegradable waste going to landfill. Household waste transferred to landfills must not consist of biodegradable waste:
- over 45% by mass from 6 July 2010;
- over 30% by mass from 16 July 2013;
- over 20% by mass from 16 July, 2020:

Waste research carried out in 2006 found that household waste taken to landfills included 60-70% of biodegradable waste on a mass basis. At present about 40% of household wastes in the landfills are biodegradable wastes.

Amounts of biodegradable waste in 2011 are presented in Table 7.1. Waste code 20 01 08 consists mainly of food waste collected from households. Waste code 20 02 01is mainly garden and green waste. All collected biodegradable waste is reused, as compost is produced.

Table 7.1. Biodegradable waste in Estonia

Waste code	Type of Waste	Amounts (tonnes)
20 01 08	Biodegradable canteen and kitchen waste	12530
20 02 01	Biodegradable waste	1640
Total		14170

The websites of 226 self-governing bodies were searched for information on management of domestic food wastes and other biodegradable household wastes. These bodies differ from each other: bigger local authorities have very thorough rules, while those of smaller local authorities are more general; however all the required main points are brought out. The following types of waste are required to be categorised: paper and carton, packages, hazardous waste, biodegradable green waste, biodegradable kitchen and canteen or restaurant waste, problematic waste, burnable waste including wood and plastic, bulky waste, metals.

The system of biodegradable waste management depends on the type of place of residence:

1. Private house with its own composter or compost pile
- No need for transfer
- Waste is composted according to the regulations confirmed by the local authority.

2. Block of flats in the countryside has its own composter
- No need for transfer
- People take waste to their composter
- Housing association sets the rules regarding the compost in accordance with waste management legislations stating the types of waste which are to be taken to the composter.
- Waste is composted according to the legislations confirmed by the local authority.
- Inhabitants (housing association) assigns people responsible for cleaning and emptying the composter

3. Inhabitants or enterprise would like to give green waste or food waste for composting
- Possible to order a vehicle on a suitable time
- Possible to get help from or order a transfer
- Possible to take clean biodegradable waste to waste stations or composting sites at landfills by themselves

4. Inhabitants prefer to categorise biodegradable waste
- Dumpsters for collecting biodegradable waste
- People are not allowed to put organic waste to a regular plastic bag
- Waste must be unpacked, in a paper bag or a biodegradable bag
- Dumpsters can be rented from waste management companies
- Dumpsters have to be chosen in an optimal size according to the number of people living in the area and the collection intervals
- Waste transfer company transports biodegradable waste from dumpsters to waste stations or to the regional landfill's composting site (Biodegradable waste, 2013)

The survey results showed that 111 out of 226 bodies have organized the transfer of biodegradable kitchen and canteen waste together with mixed household waste transfer, i.e. biodegradable waste management (system no. 4). There is too little evidence about the biodegradable waste management systems no. 1 and 2, however, because of the absence of the corresponding data for all the locals who compost their food waste within their own territory. All the self-governing organisations waste management regulations specify that it is permissible to compost the biodegradable waste produced on site within ones property (Self-Government 2012).

Requirements for composting within one's property
Compost must be managed in such a way that it will not cause harm to people's health and environment or create problems with vermin. It is forbidden to compost waste that might damage the quality of the compost or make it useless. Green waste can be composted exposed to the weather in a composting bed which must be at least 3 m from the neighbours' land, unless the neighbours have agreed differently. Food wastes can only be composted in a closed compost tumbler.

Classification of biodegradable kitchen waste
Biodegradable kitchen waste dumpsters may be filled with:
Fruits and vegetables, their peels; meat and fish waste; food gone bad: bread, pastry, cheese, and other solid food wastes, domestic paper, napkins, coffee grounds, paper filters, tea bags, house plants and cut flowers.

Biodegradable kitchen waste dumpsters may not be filled with:
Liquids (cooking oil, sauces, milk, yogurt etc.), large bones, leaves, branches and plant waste, waxed and laminated cardboard, ash, cigarettes and other decomposable wastes.

Biogas production
Biogas production in Estonia is presented in Table 7.2. The quantity of biogas produced decreased slightly in 2010, but in the next few years is likely to increase again as the plants start to work properly. Biogas was mostly collected from landfills – 9.32 million m^3 in 2010, which is 71% of the whole production of biogas in Estonia during this year. 2.96 million m^3 of biogas (22% of Estonian production) was produced from wastewater sludges and 0.85 million m^3 of biogas was from liquid swine manure (6.5% of total Estonian biogas production). Production of biogas from wastewater sludges and liquid swine manure increased in 2010, but landfill gas production decreased. In 2010, 13 million m^3 of biogas was consumed in the Estonian market. At present however there are no biogas plants in Estonia that produce biogas from biodegradable canteen and kitchen waste.

Table 7.2. Biogas production in Estonia 2007-2010 (million m^3)

	2007	2008	2009	2010
Total biogas production	12.54	11.85	13.59	13.13
Biogas from wastewater sediments	2.64	2.84	2.69	2.96
Liquid swine manure based biogas	0.57	0.39	0.59	0.85
Landfill gas	9.34	8.62	10.32	9.32
% from wastewater sludges	21.0	23.9	19.8	22.5
% from liquid swine manure	4.5	3.3	4.3	6.5
% from landfill	74.5	72.8	75.9	71.0

The future of biogas production
New manure-based biogas stations are to be built near farms, not far from the homesteads so that heat produced from biogas can be utilised in the neighbouring houses and perhaps even within the whole hamlet. If everything goes according to plan, in 2012 Estonia will have 4 modern agricultural biogas stations. All 4 stations have received financial support from the European Regional Development Fund methods for renewable energy programme through Environmental Investment Centre (KIK) in 2009 and the deadline for realisation is this year (Maahlet, 2010).

A project for a biodegradable canteen and kitchen waste station was also presented to the Environmental Investment Centre, but did not receive financial support, and therefore could not be launched. In 2013 a waste incineration plant will be built close to Iru power plant, and it is therefore unknown how the amounts of waste will be divided. The project for a kitchen and canteen waste station was probably not funded because of fears that that when the incineration plant is opened, separate collection might decrease, especially regarding kitchen and canteen waste.

Summary of key findings

- Self-governing bodies organise waste management and sorting within their own territory, according to four different schemes including separate collection of biodegradable wastes.
- The definitions used for biodegradable waste effectively limit this to food waste in many cases
- 51% of local authorities have organised biodegradable waste collections
- In 2011 12,530 tonnes of food waste was collected
- There are at present no biogas plants in Estonia that produce biogas from biodegradable canteen and kitchen wastes.

References

Estonian Ministry of Interior http://www.siseministeerium.ee/15189
Local authorities' obligations in waste management, Ministry of the Environment http://www.envir.ee/989881
State's waste program 2008 - 2013 www.envir.ee/orb.aw/.../**RIIGI**+JÄÄTMEKAVA+2008-2013.pdf
Waste management in self-governments http://www.envir.ee/jaatmeinfo (Estonian map, if choosing the county, all self-government's websites can be found)
PDF: Biodegradable waste in 2013
Overview of the Estonian bio energy market in 2010 http://www.mkm.ee/public/Ylevaade_Eesti_bioenergia_turust_2010._aastal.pdf
Maaleht (2012) Will the production of electricity and heat out of manure be successful? http://www.maaleht.ee/news/maamajandus/maamajandusuudised/kas-sonnikust-elektri-ja-sooja-tootmine-jouab-edulooni.d?id=63997539

Appendix 8: Results of web-based survey on collection of source segregated domestic food waste in Finland

Background

Finland had a population of around 5.36 million in 2010 with annual growth of 0.37 % 1990–2010. Figure 8.1 depicts the size of local authorities in Finland in terms of population. There are 336 local authorities and the average population size is relatively small at about 16 000 inhabitants per authority in 2009. Eight local authorities exist with more than 100,000 residents. One third of the Finland's population live in these eight cities and about 1 million live in Helsinki. The average size of local authorities has increased in recent years because several authorities were merged together (Local Finland).

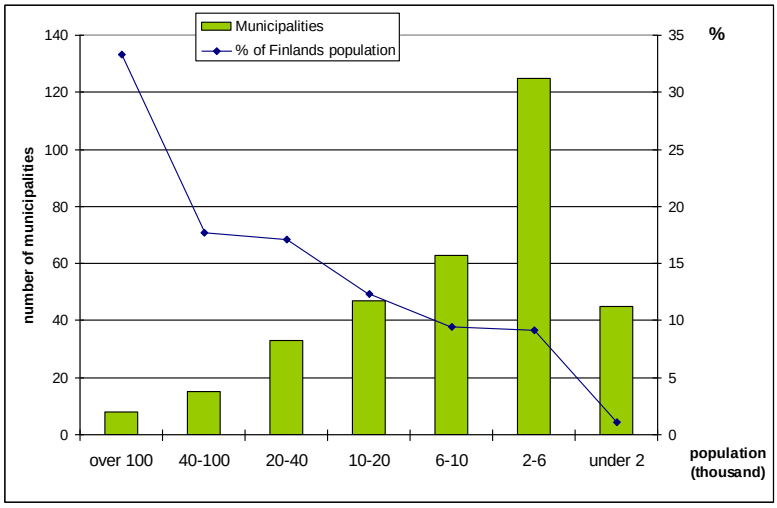
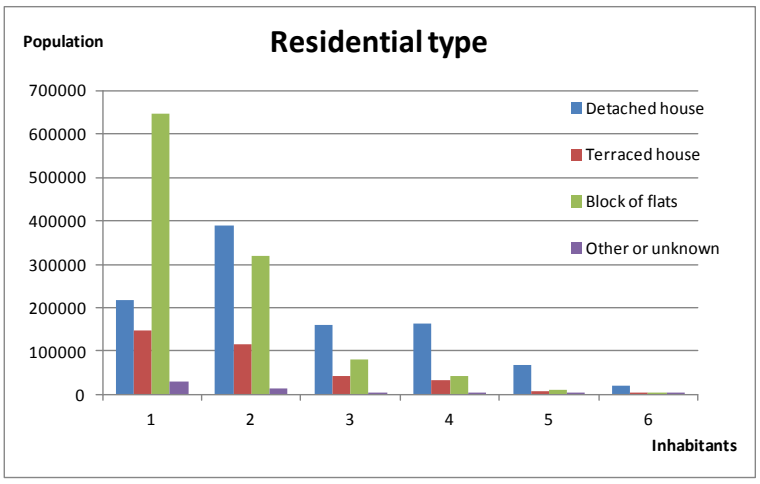


Figure 8.1. Population by local authorities in Finland in 2009 (Local Finland and Statistics Finland)



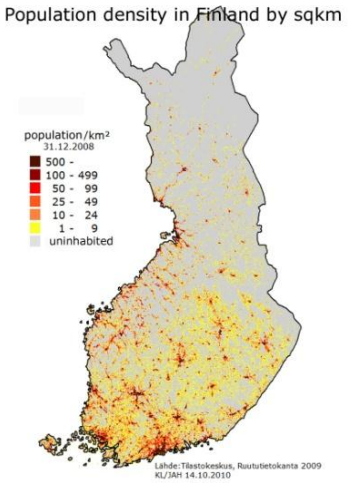


Figure 8.2. On the left the residential type (Statistics Finland) and on the right the population density in 2008 (Local Finland, http://www.kunnat.net/en/statistics/population-dencity-of-local-authorities/Documents/Population%20density%202008.jpg)

The population density of Finland in 1 Jan 2011 was 17.7 people per km^2 of land area (Figure 2). Compared to much of Europe, Finland is sparsely populated – the EU average population density is 114 people per km^2 of land area. There exists a north-south population gradient: the

concentration is high in the southern parts of the country and less dense in the north. The most densely populated local authority, Helsinki, has 2,730 residents per km^2 while the most sparsely populated local authorities in Lapland has only 0.2 residents per km^2 (Local Finland).

Organisation of waste collection in Finland

Administrative authorities
Finnish waste legislation is largely based on EU legislation. The owner of the property must organise the waste collection from his/her property. The contract is made either made with the waste management company or the municipality. Municipalities lay down the local regulations on waste management and the local authority monitors compliance with these regulations. Regulations vary between municipalities. The following are the key bodies in Finnish waste management:

- The Ministry of the Environment (Ympäristöministeriö) publishes waste strategic plans at national level. The Ministry also sets targets for environmental protection; drafts and develops environmental legislation; and oversees international co-operation (website of Finland's environmental administration http://www.ymparisto.fi)

- The Finnish Environment Institute (Suomen ympäristökeskus, SYKE) is a research institute and a centre for environmental expertise. SYKE produces and compiles environmental data, monitors all developments related to waste issues and develops new ways to improve waste management. The institute also provides experts to participate in the drafting of environmental legislation and supervises international waste shipments (website of Finland's environmental administration, www.environment.fi/syke).
-
- Centres for Economic Development, Transport and the Environment (Elinkeino-, liikenne- ja ympäristökeskus, ELY Centres) ensure that environmental legislation is observed in their respective areas. They also process environmental and waste permits for larger firms and operations, for example medium-sized industrial plants (website of ELY www.ely-keskus.fi/en)

Local authorities organise waste collection and disposal, and monitor waste management in general in their area. They also set down the local regulations on waste management, ensure that instructions on waste material are available, and issue waste permits to smaller firms and operations.

The waste act is implemented in municipalities as each municipality issues local waste management regulations. Compliance with the regulations is supervised by the local environmental authority. Regulations may vary in different municipalities depending on local infrastructure for material recovery. The municipal waste regulations require the segregation of waste.

In most high-rise buildings and in blocks of flats central containers are provided in the yard for segregated waste. Typical are bins for mixed waste, biowaste and paper: sometimes glass, metal and cardboard containers are also available. Detached properties usually have only a single container for mixed waste and home composting is widely carried out. Recyclable waste can be taken to local recycling points. Householders have the option to co-operate with

neighbours and use one waste container together. Detached family homes in particular are increasingly sharing containers.

Waste collection contract

Waste disposal in Finland is organised in two ways:
1. contract-based waste management and
2. council tendered waste management.

In contract-based waste management the customer makes a contract for waste collection and transport with a waste management company. In council-tendered waste management the municipality will tender its waste management. The lowest bidder will get the municipality's waste management as its responsibility and citizens will have a contract with the selected company.

Methodology

A web search was carried out on google.fi with the following search terms:
- "biojäte" ("biowaste")
- "biojätteen erilliskeräys" ("source segregation of biowaste").

Information was also gathered from the web sites of Finnish waste management companies. Many of the waste management companies are listed at www.jly.fi, the Finnish Solid Waste Association, FSWA, which represents Finnish regional and municipal waste management companies.

Results

Figure 8.3 shows the amount of source segregated biowaste in Finland from 2004 to 2010. It is clear that the amount of biowaste has been increasing over the years.

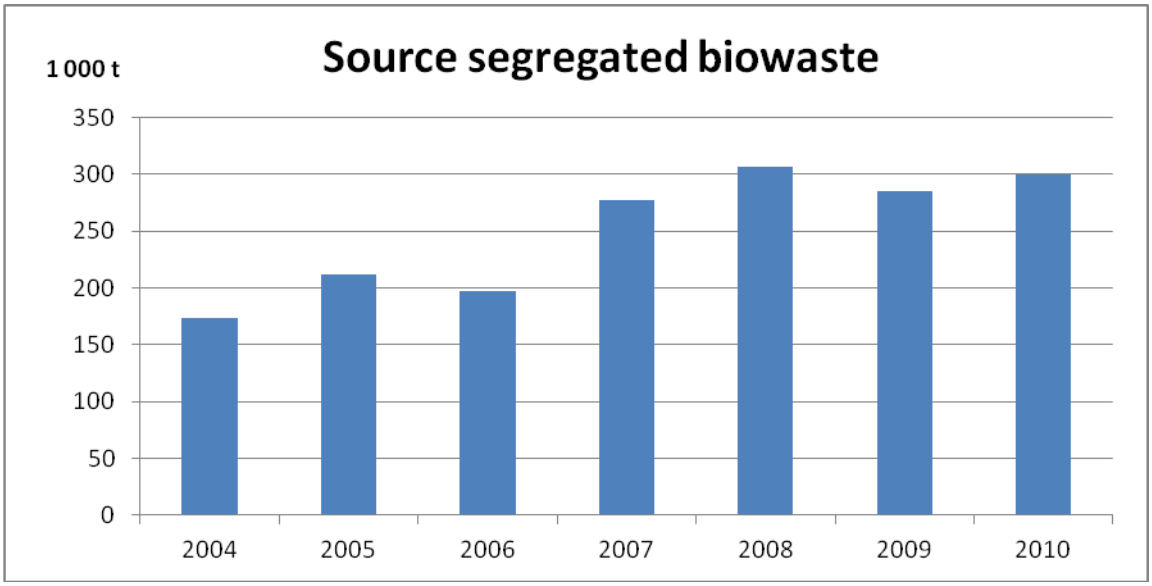


Figure 8.3. Source segregated biowaste in Finland 2005-2010 (Statistics Finland)

Detached households often practice home composting and this is encouraged by the local authority. In many authorities source segregated biowaste collections are now available. In

sparsely populated Lapland areas no biowaste collections are in place and there composting is recommended. If the householder has no composting option, organic waste may go into the residual waste stream. In authorities where waste is incinerated, the householder is allowed to leave biowaste in the residual waste, should composting not be possible. Most incinerators generate electricity. Biowaste is collected only from restaurants, grocery stores and canteens with more than 100 l/week of biowaste.

In some areas there are collections for kitchen waste including food waste and burnable energy waste as plastic and cardboard waste, e.g. food leftovers and other food waste, cardboard packages, plastic bottles and bags, paper towels and pet litters etc.

Kitchen waste is delivered to a biogas plant (Stormossen) where biowaste is mechanically separated from plastic and cardboard waste and used as a raw material of biogas. Plastic and cardboard waste is recycled (Botniarosk).

Biological waste includes food leftovers, vegetable and fruit peelings, eggshells, teabags, nappies, garden waste and dust. Biological waste is separated into 25-30 liter black plastic bags. Waste is treated with optic sorter and delivered to biogas plant. (Ekorosk)

Waste management companies

There are 66 waste management areas in Finland. Waste management is organised in three different ways. *Regional waste management companies* operate in area of several municipalities. *Public utility* is a company formed by local authority. It organise owner municipality's waste management. *The federations of municipalities* are formed by several municipalities. These companies organise the waste management in the all owner municipalities' areas. Most of the organisations are regional, but there are also a few federations of municipalities and public utilities.

Figure 8.4 shows FSWA's 35 members (green color). The member companies take care of the waste management of over 5 million citizens. It is over 90 % of the Finland's total population. FSWA is collecting data from its member companies. In white area is located the rest 31 waste management company, which aren't members of FSWA. In these areas local authorities organise the biowaste collection and disposal usually by themselves.

Table 8.1. List of Finnish municipalities with information on biowaste collections.

	Biowaste companies and municipalities which organise their biowaste collection by themselves	Biowaste collected	Who?	What?	Use	Management	Contract based (municipalities)	City's tentered (municipalities)	Mixed system (municipalities)	Population
1	Botniarosk Oy Ab	x	All	Kitchen waste	?	Biogas	x (8)			42134
2	Eko-Kymppi	x	4 or more apartments	Biowaste	Biodegradable bag or newspaper	Composting	x (9)			82073
3	Ekorosk Oy Ab	x	All	Biological waste	Black plastic bag	Biogas	x (9)			106337
4	Etelä-Karjalan Jätehuolto Oy	x	All in population centre	Biowaste	Biodegradable bag, newspaper, paper bag	Composting		x (8/10)	x (2/10)	132899
5	Hankasalmi	x	All in population centre							
6	Hartola	x	All (or composting)							
7	Hirvensalmi	x								
8	HSY	x	10 or more apartments	Biwaste	Biodegradable bag, newspaper, paper bag, cardb	Composting		x (5)		1082205
9	Itä-Uudenmaan Jätehuolto Oy	x	5 or more apartments	Biowaste	No instructions	Composting		x (5)		92587
10	Joutsa	x	All							
11	Jyväskylän kaupunki (Mustankorkea)	x	All	Biowaste	Bag of paper or biodegradable material	Composting		x		130816
12	Jämsän Jätehuolto liikelaitos	x	no data	Biowaste	No instructions	Composting	x (2)			25245
13	Jätekukko Oy	x	10 or more apartments	Biowaste	No instructions	Composting		x (18)		208738
14	Kangasniemi	x	all							
15	Keski-Savon Jätehuolto Oy	x	10 or more apartments	Biowaste	Newspaper or biodegradable bag	Composting		x (5)		49601
16	Kesälahti	no data								
17	Keuruu	x	all							
18	Kiertokapula Oy	x	10 or more apartments	Biowaste	Plastic or paper bag (NO biodegradable bags!!)	Bioethanol St1	x (4)	x (8)		335753
19	Kihniö	x	all							
20	Kitee	x								
21	Kuusamon Jätehuolto Oy	x	5 or more apartments							
22	Kolari	no								
23	Kymenlaakson Jäte Oy	x	Population centre's apartm	Biowaste	Biodegradable bags and packages	??	x (5)	x (3)		185254
24	Lakeuden Etappi Oy	x	10 or more apartments	Biowaste	Biodegradable bags and packages	Biogas		x (9)	x (2)	149289

1. Botniarosk Oy Ab
2. Eko-Kymppi (Kainuun jätehuollon kuntayhtymä)
3. Ekorosk Ab Oy
4. Etelä-Karjalan Jätehuolto Oy
5. HSY:n jätehuolto
6. Itä-Uudenmaan Jätehuolto Oy
7. Jyväskylän kaupunki
8. Jämsän Jätehuolto liikelaitos
9. Jätekukko Oy
10. Keski-Savon Jätehuolto
11. Kiertokapula Oy
12. Kymenlaakson Jäte Oy
13. Lakeuden Etappi Oy
14. Lapin Jätehuolto kuntayhtymä
15. Loimi-Hämeen Jätehuolto Oy
16. Metsäsairila Oy
17. Millespakka Oy
18. Napapiirin Residuum Oy
19. Nurmijärven kunta
20. Oulun Jätehuolto
21. Perämeren Jätehuolto Oy
22. Pirkanmaan Jätehuolto Oy
23. Porin Jätehuolto
24. Puhas Oy
25. Päijät-Hämeen Jätehuolto Oy
26. Rauman seudun jätehuoltolaitos
27. Rosk'n Roll Oy Ab
28. Rouskis Oy
29. Sammakkokangas Oy
30. Satakierto Oy
31. Savonlinnan Seudun Jätehuolto Oy
32. Stormossen Ab Oy
33. Turun Seudun Jätehuolto Oy
34. Vestia Oy
35. Ylä-Savon Jätehuolto Oy

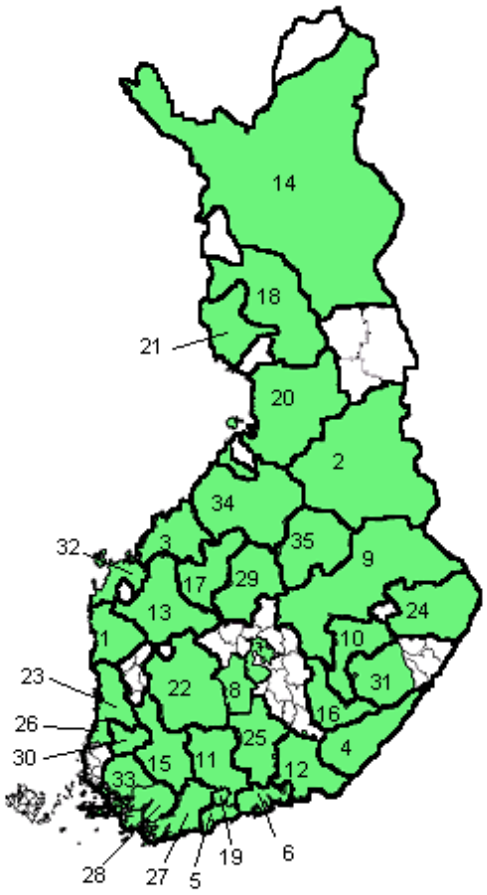


Figure 8.4. Waste management companies in Finland (FSWA, modified).

Sorting guidelines

Food waste is generally included in biowaste: source segregation of food waste only is not common. Biowaste collection regulations vary widely between waste management companies. Usually biowaste must be separated from other waste in properties of more than five apartments. It is possible to either compost biowaste in a garden composter or join the biowaste collection. Households which aren't located in a collecting area can use their garden composter for composting biowaste. Biowaste is wrapped in a newspaper, paper bags, or in a bio-decomposable plastic bag.

There is no single common list of materials accepted in collection. Instructions differ slightly from region to region (Table 8.2). Differences in instructions occur mostly for pet litter and faeces, pet bedding and cooking fat and oil.

Table 8.2. List of acceptable and unacceptable materials

Accepted
- Food waste and leftovers; cooked and uncooked
- Bones and carcasses
- Fruit and vegetable skins and peelings
- Gone off food
- Ground coffee grounds and filters
- Teabags and leaves
- Eggshells and shredded egg cartons
- Serviettes and kitchen paper

Sometimes mentioned and accepted
- Wooden ice-cream sticks and tooth picks, cork and wooden cutleries
- Dog hair
- Sauna whisk
- Cotton wool

Generally accepted
- Gardening waste (leaves, parts of plants and wilted flowers)
- Pet litter and faeces
- Pet bedding
- Biodegradable bags
- Large bones

Seldom accepted
- Solid cooking fat and oil (absorbed into kitchen paper)

Not accepted
- Plastic, metal, glass, ceramic
- Hazardous waste
- Ash
- Rubber, leather
- Liquids, e.g. milk, juice
- Textiles
- Nappies
- Disposable dust bags from vacuum cleaners
- Cigarette butts

Waste management systems

Biowaste collection regulations vary between waste management companies, but usually biowaste is collected from properties with five or more flats. Companies, stores, restaurants and canteens are being serviced if they produce more than 50 kg/week of biowaste. Other options are as follows:
- Residential properties with ten or more apartments
- Every properties, also individual detached houses can join
- Companies, stores, restaurants and institutional kitchens with > 20 kg/week biowaste
- Companies, stores, restaurants and institutional kitchens with > 100 l/week biowaste
- Companies, stores, restaurants and institutional kitchens with > 50 l/week biowaste
- Anyone can join

Biowaste bags
Biowaste is typically wrapped in newspaper, or put in a paper bag or in a biodegradable plastic bag. Instructions are available for householders how to wrap biowaste: examples of types of advice of how to fold a newspaper into bag can be seen in a video on http://www.youtube.com/watch?v=zU_6zmjPzmI (video, PJOY) and illustrated in Figure 8.5.

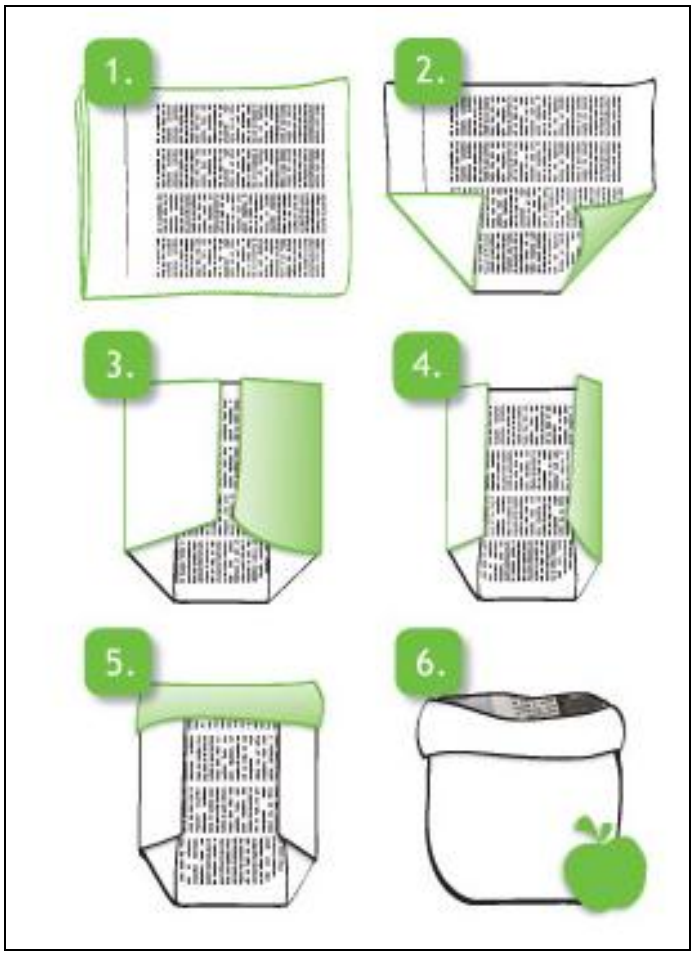


Figure 8.5. Instructions on how to fold up a newspaper bag (LHJ)

Bins. The colour of source segregated biowaste bins is brown and the symbol used id an apple (Figure 8.6). Two types of bins are common in Finland:

- Standardised bins of size 120 or 240 litres, but also other sizes are used – Figure 8.7
- Large, centralized collection bins, known by the brand name molok (http://www.molok.fi/eng/main.php?loc_id=33)

To keep the bin tidy a paper bag, a newspaper or a biodegradable plastic bag should be used.

Figure 8.6. The symbols for biowaste (FSWA, LHJ)

Figure 8.7. Left: biowaste collection bin. Right: Molok deep collection container.

Collection frequency

Domestic, residual waste bins are normally emptied once a week or at least once every two weeks. In winter bins may only be emptied every four weeks, provided that biowaste is collected separately. If required, the bins can be emptied more than once a week. During the summer months collection is normally once a week, and changes to fortnightly in winter. A deep collection container for biowaste may be emptied once every two weeks. Typical collection frequencies are:

- May–September: 1 week
- October–April: 2 weeks

Collection vehicles

In the LHJ area biowaste is collected using compactor trucks that service 200 to 300 bins in one tour. Also dual and multicompartment trucks for many different waste fractions are used in some areas.

Treatment

The most common treatment method for biowaste is composting. The end product is usually used for landscaping or for soil improvement. Biogas production is relatively rare but increasing. Biogas is usually used for heat and electricity production. The company ‘’St1 Biofuels’’ is producing bio ethanol for transportation from source segregated biowaste in an area that the Kiertokapula Waste Management Company serves.

The Turku Waste Management Company is collecting residual waste and generates electricity in an incinerator. Biowaste may also be incinerated. Part of the biowaste ends up in landfills together with the mixed waste fraction.

Figure 8.8. Biowaste bulletin in Finnish (http://www.ekjh.fi/Dokumentit/Oppaat/Biojateopas2011.pdf)

Summary of key findings

- Waste management is very localised in Finland. There are national guidelines, but practical advice is given locally.
- Source segregated biowaste collection is common in Finland.
- Composting is common for detached households.
- Flats and high rise building are typically serviced with segregated waste collections.
- In sparsely populated areas it is allowed to put biowastes into the residual waste, but composting is recommended.
- There is no single common list of materials accepted in biowaste collections – instructions differ slightly from region to region.

References

Finnish Solid Waste Association (FSWA). In Finnish: http://www.jly.fi and in English: http://www.jly.fi/jly0_eng.php?treeviewid=tree1_eng&nodeid=0

Local Finland. Association of Finnish Local and Regional Authorities. In English: http://www.localfinland.fi/en/Pages/default.aspx

Molok deep container system. http://www.molok.fi/eng/main.php

Statistics Finland. In English: http://www.stat.fi/index_en.html

The website of Finland's environmental administration. In English: http://www.environment.fi/default.asp?node=4032&lan=en

Examples of collection details:

EKO-KYMPPI:

Over ground containers:

Waste fraction	**Maximum collection frequency**	
	Summer time (1.5 -30.9)	Winter time (1.10 - 30.4)
Municipal solid waste	4 weeks	8 weeks
Residual waste (1-3 appartments)	8 weeks	8 weeks
Biowaste	1 week	3 weeks
Biowaste (1-3 apartments)	2 weeks	3 weeks
Dry and clean recyclable waste	when needed	

Under ground containers:

Waste fraction	**Maximum collection frequency**
Municipal solid waste	3 months
Biowaste	1 month
Dry and clean recyclable waste	when needed

http://www.eko-kymppi.fi/uploads/files/Jatehuoltomaaraykset.pdf?phpMyAdmin=DPAJMgW5dbcuv8NRb9FK8hBbvIf (28.3.2012)

PIRKANMAAN JÄTEHUOLTO OY:

Waste fraction	**Collection frequence**
Municipal solid waste, no biowaste	2 weeks
	Garbage sack, 240 l container or deep collection container 4 weeks
Municipal solid waste, incl. biowaste	1 week but 1.10-31.3 2 weeks
	Garbage sack, 240 l container 2 weeks; Low degree of filling 4 weeks
Biowaste	1 week but 1.10-31.3 2 weeks
	Deep collection container 2 weeks but 1.10-31.3 4 weeks
Cardboard	4 weeks
Other waste fraction	Local authority decides

http://www.tampere.fi/tiedostot/5dGWbGHDX/jatehuoltomaaraykset.pdf (3.4.2012)

ROSK'N ROLL (http://www.roskaraati.fi/@Bin/134066/JHM+hyv.28.4.2010+ml.+Karkkila.pdf 20.4.2012):

Waste fraction	**Collection frequency (max)**
MSW, excl. biowaste	2 weeks
MSW, incl. biowaste	4 weeks
Biowaste	1 week
Biowaste, deep collection container (1.4-30.9)	1 week
Biowaste <10 apartments (1.10-31.3)	2 weeks
Biowaste, deep collection container (1.10-31.3)	2 weeks
Biowaste, stored < +5 C	2 weeks

JYVÄSKYLÄ (http://www.jyvaskyla.fi/jate/astiat/tyhjennysvalit, 20.4.2012):

Waste fraction	**Collection frequency (max)**
Biowaste	
1-4 apartments	2 weeks
1-4 apartments (1.11-30.4)	4 weeks
< 5 apartments	1 week
Deep collection container	3 weeks
Dry waste	
All properties	4 weeks
Detached house	8 weeks (longer collection frequency possible with separate contract)
Summer cottages etc.	8 weeks
Recoverable waste	**16 weeks**
Cardboard	**8 weeks**

Appendix 9: Results of web-based survey on collection of source segregated domestic food waste in France

Organisation of waste collection in France

Decisions on how to organise household waste collections are made by the municipalities (sometimes grouped together as an association of local authorities or as a multi-purpose intercommunal syndicate). The municipality chooses whether and how rubbish is sorted, whether there is a door-to-door collection, and how frequently each waste is collected. This usually depends on the territory covered by the municipality (rural or urban) and on how much money is available to spend on waste management. Furthermore, the municipality can choose to carry out the waste collection using its own workforce or can ask a private company to do it.

If a member of the public wants to obtain information about waste collection, the easiest way is to look at the municipality's website. This usually provides information on the categories into which refuse must be sorted, which bins to use, how to ask for a bin and when the different collections occur.

Methodology

The two main national bodies providing information on waste management are the Ministère de l'Ecologie, du Développement durable, des Transports et du Logement (www.developpement-durable.gouv.fr); and the Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME), a public organisation under the joint authority of the Ministry for Ecology, Sustainable Development, Transport and Housing, the Ministry for Higher Education and Research, and the Ministry for Economy, Finance and Industry (www.ademe.fr). The websites of these organisations were searched for information on separate food waste collections.

A general web search was carried out using google.fr advanced search with 'France' as the region restriction and pages from the past year. The keywords used were: collecte + "déchets alimentaires" + France. The search was then repeated with "porte à porte" and commune added to the key words. The same searches were also conducted without date restrictions. Another search was conducted to see if any food waste was collected separately for anaerobic digestion, using the key words: commune + france + méthanisation + "déchets alimentaires". Related terms found included: déchets de cuisine, déchets organiques, déchets putrescibles, déchets fermentescibles, biodéchets.

A number of websites from randomly selected regions and départements and from large and small municipalities were also checked to see if they gave any relevant information not covered by the above search terms.

Results

The results indicated that there is as yet very little source separated collection of domestic food waste in France, other than in combination with green waste.

Neither of the official websites surveyed provides information on source separated food waste as a specific waste category: food waste is included in green or biowaste, and

government statistics do not provide any data on separate collections of domestic or other food waste.

With one exception, no references to food waste collections were found on the websites of individual municipalities: if local authorities are offering this service, they are not communicating about it through the Internet. As websites are a common way to disseminate waste management information to the public in France, this indicates that separate collection must be extremely rare. The only separate food waste collection in France seems to be for some canteens, cafeterias or restaurants. For example in Lille food waste is collected from all public establishments that have catering services (e.g. primary and secondary schools, high schools, universities, hospitals, old people's homes, councils) (MCB, 2009). Other school canteens compost their food waste themselves, as for example at the Collège Jean Zay in the département of Essonne (Actu-Environnement, 2010).

Vol-V Biomasse, a French anaerobic digestion company (www.vol-v.com) was also contacted and answered that as far as they know there are no schemes for source segregated domestic food waste collection in France.

A survey of French municipalities carried out in 2010 showed that 57% of the municipalities that offer seperate collection services for different fractions of household refuse collect mixed biowaste consisting of garden and kitchen waste (déchets de cuisine) (ADEME, 2011). This Figure takes into account both kerbside collection schemes operated by the municipalities, and material brought by members of the public to waste reception centres. In 2006, 3 million tonnes of biowaste were separately collected in France (MEDDTL, 2011a); this rose to 4.5 million tonnes in 2008, which represents 14% of organic municipal waste (AMF, 2011; MEDDTL, 2011b).

In 2007 a major national campaign (MODECOM) was carried out to characterise French household refuse (ADEME, 2009). It showed that 40% of the weight of non-recycled waste is biowaste, equivalent to 125 kg per inhabitant per year. Of this 7 kg is from unopened packaged food products. The campaign also showed that on average every inhabitant brings 50 kg of biowaste each year to a waste reception centre, equal to just over 3 million tonnes of biowaste for the whole of France. This implies that almost all of the biowaste collected is from people taking it themselves to waste reception centres.

The websites of some regions and départements were checked (Auvergne, Bretagne, Picardie, Rhône-Alpes; and départements Loire-Atlantique, Puy-de-Dôme, Rhône); but in most cases the data and information given were out of date and/or very general. The websites of some large and small cities were then checked (Amiens, Bordeaux, Ceyrat, Châlons-en-Champagne, Clermont-Ferrand, Cournon d'Auvergne, Lyon, Montpellier, Paris, Varennes-Jarcy). The information given on these was usually clear and practical but none of them declared collecting food waste separately from garden waste.

Most municipalities organising biowaste collection provide a special bin only for people owning a garden and enough space in front of their houses so the biowaste bin is not in the street. In most cases, the waste collected includes food waste, kitchen paper, tissues and garden waste. This mixed biowaste is collected once a week and in almost all cases is taken to composting plants with very little going to anaerobic digestion plants. In 2008, about 500 compost plants produced 1.8 million tonnes of compost (MEDDTL, 2011b) while only six anaerobic digestion plants were used for household biowaste in France (ADEME, 2010)

The département of Haut Rhin is the first département in France where biowaste is also collected from apartments or flats (Meyniel, 2011; Good Planet 2011). This collection covers 100,000 households including a mix of flats and houses with gardens, and is done via bio-plastic bags. In 2010 this permitted the valorisation of 4,000 tons of biowaste to compost. The survey of municipalities in 2010 (ADEME, 2011) indicated, however, that for 54% of them biowaste collection is not a priority. This suggests that the number of municipalities collecting any biowaste will not increase significantly and that separate collection of food waste is not planned in the near future.

Two systems for anaerobic digestion of household refuse are currently in use in France. The first one is based on household sorted biowaste and the second one on non-recycled residual household waste which therefore needs pre-treatment. In common with many countries there are some difficulties in achieving good quality sorting of refuse in France, and French municipalities do not appear to want to develop separate household biowaste collections. Thus the tendency is to go for the second option: most of the new anaerobic digestion plants planned by 2015 will run on residual household waste rather than source segregated material (ADEME, 2010). The websites of the three municipalities (Lilles, Le Robert and Calais) which have anaerobic digestion plants for biowaste were checked, and all operate on food waste mixed with green waste.

Summary of key findings

- Separate collection of source segregated household waste is almost unknown in France.
- Around 57% of municipalities currently collect mixed green waste and household biowastes.
- There is no immediate priority to increase this or to introduce source separated food waste collections.
- The département of Haut Rhin runs a collection service which accepts household biowastes from apartments or flats.

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Appendix 10: Results of web-based survey on collection of source segregated domestic food waste in Germany

Organisation of waste collection in Germany

Germany is divided into 15 federal states. The federal states collect detailed information about waste and recycling from local authorities (districts) within their state (Figure 10.1). A total of 401 districts (local authorities) exist across all 15 federal states. As in the UK, these local authorities can either be rural or city districts. The latter tend to be smaller in area but with higher population density. The districts carry the duty of domestic waste collection and waste disposal (Figure 10.2). Some local authorities (districts) have formed waste partnerships and thus the actual number of collection authorities is slightly lower than the total of 401 district authorities in Germany.

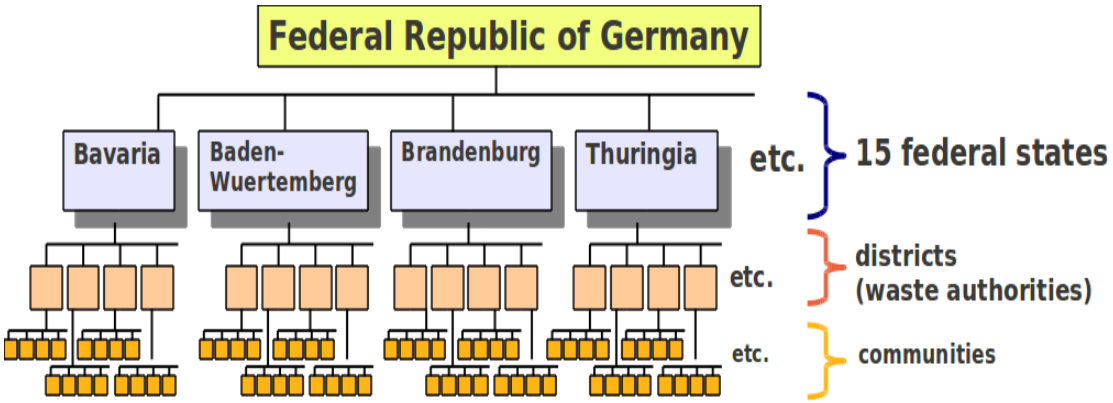

Figure 10.1. Structure of local and national government in Germany.

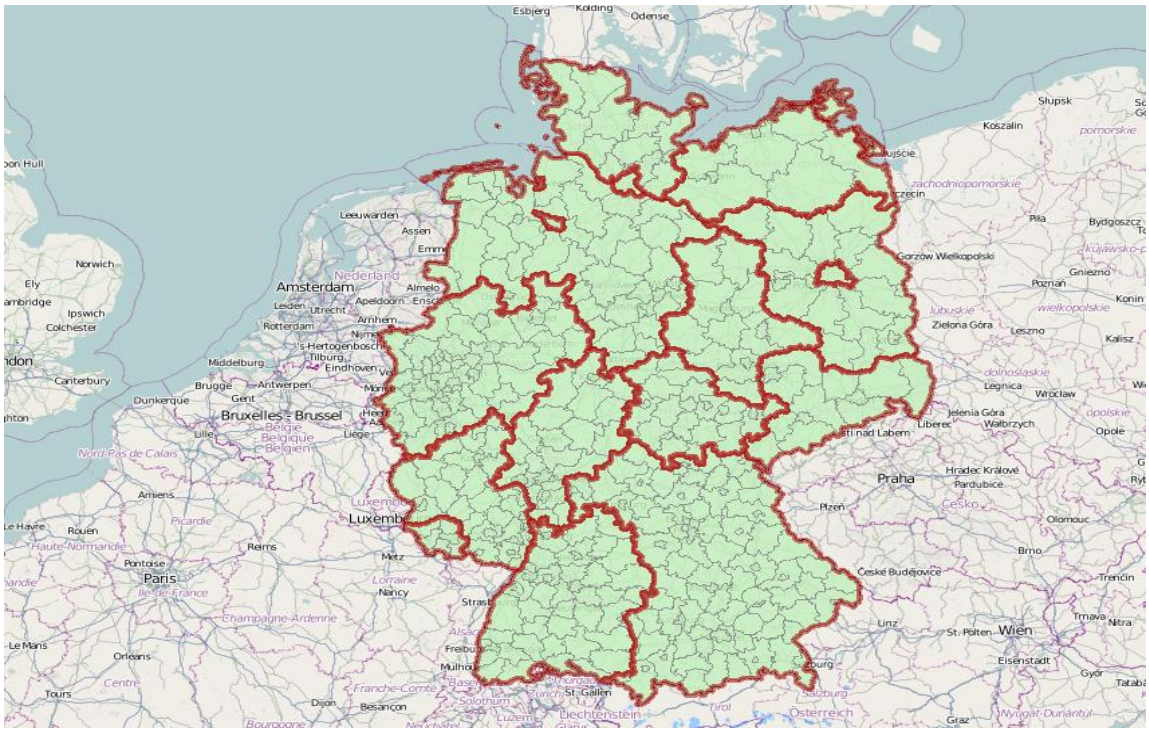

Figure 10.2. Map of the 15 federal states (bold red lines) in Germany and local authorities responsible for waste collection and disposal in Germany. Source www.geodatenzentrum.de and www.openstreetmap.org.

The following is the key legislation that controls waste disposal and recycling in Germany:
Closed Cycle Waste Management Act (KrW/AbfG Kreislaufwirtschaftsgesetz/ Abfallgesetz)
Technical Instructions on Waste (TA Abfall), which gives more detail of the above.

It is expected that by 2015 source separated collection of organic waste will be made mandatory for all local authorities in Germany. All 15 federal states in Germany are required to establish waste management plans, where the waste strategy for refuse and recyclables is documented (§29 of the Closed Cycle Waste Management Act KrW/AbfG).

Methodology

Food waste collection practices in Germany were investigated in four ways:
Using search terms as listed below.
Searching through local authority web pages for all 401 districts in the 15 Federal states to determine the existence and type of organic waste collections
Searching through local authority web pages for all 96 districts in the largest German state, Bavaria, and recording the collection practice from the web site.
Personal visit to selected local authorities in Bavaria.

Terms for used for food waste, and related terms found in the search, included the following: "Essensreste" (food waste), "Küchenabfall" (Kitchen waste); and also "Bioabfall" (biowaste), "Gartenabfall" (garden waste), "Organischer Abfall" (organic waste), "verrottbarer Stoff" (biodegradable material), Vergärung (anaerobic digestion), Kompost (compost), Biotonne (bio-bin), Braune Tonne (brown bin).

Total waste data are collected by the German government from the 15 federal states, and these central government data are available at from the Federal Ministry for the Environment, Nature Conserbvation and Nuclear Safety (Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit, BMU) at www.bmu.de/abfallwirtschaft/statistiken/doc/5886.php and www.bmu.de/abfallwirtschaft/statistiken/doc/3161.php. More detailed data from individual districts (who are responsible for waste collection) are collected by the 15 federal governments. For example, waste data for the state of Bavaria (the largest of the 15 federal states in Germany) are available at www.lfu.bayern.de and www.abfallbilanz.bayern.de.

Personal communications with Dirk Hennsen, an expert on organic waste collection practices in Germany, are listed in the Appendix.

The study was carried out between December 2011 and March 2012.

Results

Composting and anaerobic digestion plants in Germany

In the year 2008 a total of 289 composting plants for food and green waste and 665 composting plants for green waste only existed in Germany. A total of 969 large-scale anaerobic digestion plants existed in Germany in 2009. These plants digest commercial and private household organic waste. Note that these are non-farm digesters, and in parallel several thousand smaller on-farm digesters also exist processing animal slurries and manures, agro-wastes and energy crops (www.bmu.de/abfallwirtschaft/statistiken/doc/3161.php). In the

year 2008 a total of 11.82 million tonnes of organic wastes were processed in Germany. This includes municipal kerbside collected organic waste and green waste from household waste recycling centres. This waste was either composted or anaerobically digested (Figure 10.3). Out of these 11.82 million tonnes a total of 4.82 million tonnes was collected via the biobin, typically a 240-litre or 120 litre plastic bin that is collected from the kerbside.

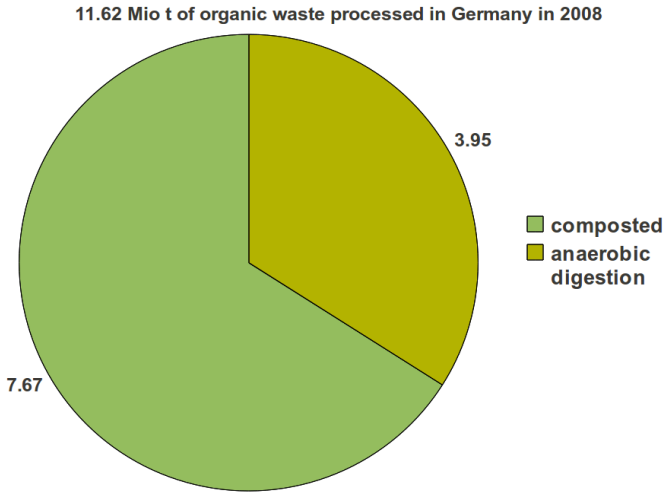

Figure 10.3. Treatment of organic municipal waste in Germany in 2008. After www.bmu.de/abfallwirtschaft/statistiken/doc/3161.php.

Organic waste collections in Germany

In 2011, there were organic waste collections in place in 301 local authorities. In approximately 100 of a total of 401 local authorities organic waste still goes into the residual waste stream (www.bmu.de). The total amount of organic waste collected by local authorities in Germany is 8 million tonnes for 80 million inhabitants and amounts to slightly more than 100 kg per capita per year (Figure 10.4), one of the highest rates in Europe together with the Netherlands, Belgium and Austria. Organic waste collections are less common in the eastern part of Germany, where population density is lower compared to the western part (Figure 10.6).

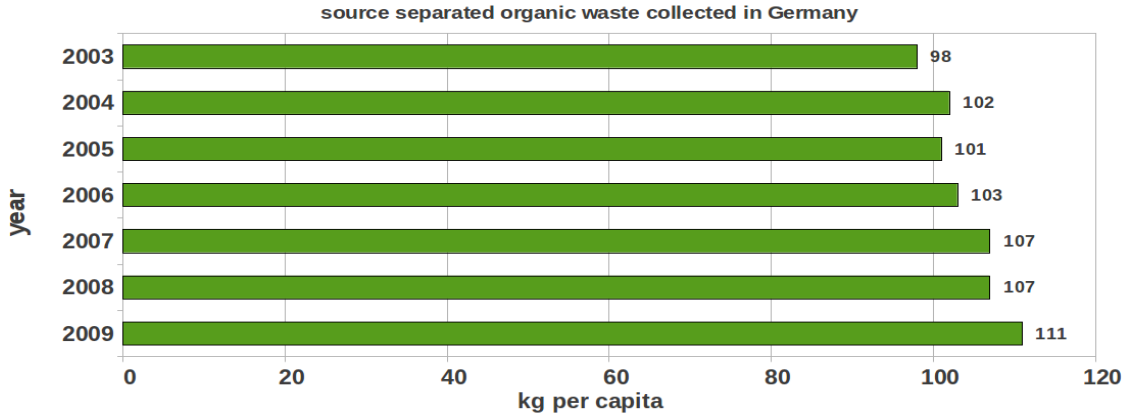

Figure 10.4. Average amount of organic waste collected in Germany per capita from 2003 to 2009. Source www.destatis.de.

The web survey of 401 waste collection authorities (both district and city councils) was used to identify those councils which had organic waste collections in place, and those without organic waste collections. The information was stored in a spreadsheet table in which:

- those councils with organic waste collections in place receive a ’1’
- those councils with no organic waste collections receive a ’0’
- councils with organic waste collections in (small) parts of the council receive a ’2’

The spreadsheet values are then attached to the map areas, and the value determines the colour of the council. The resulting map is shown in Figure 5on a European scale. This technique can easily be applied to other locations.

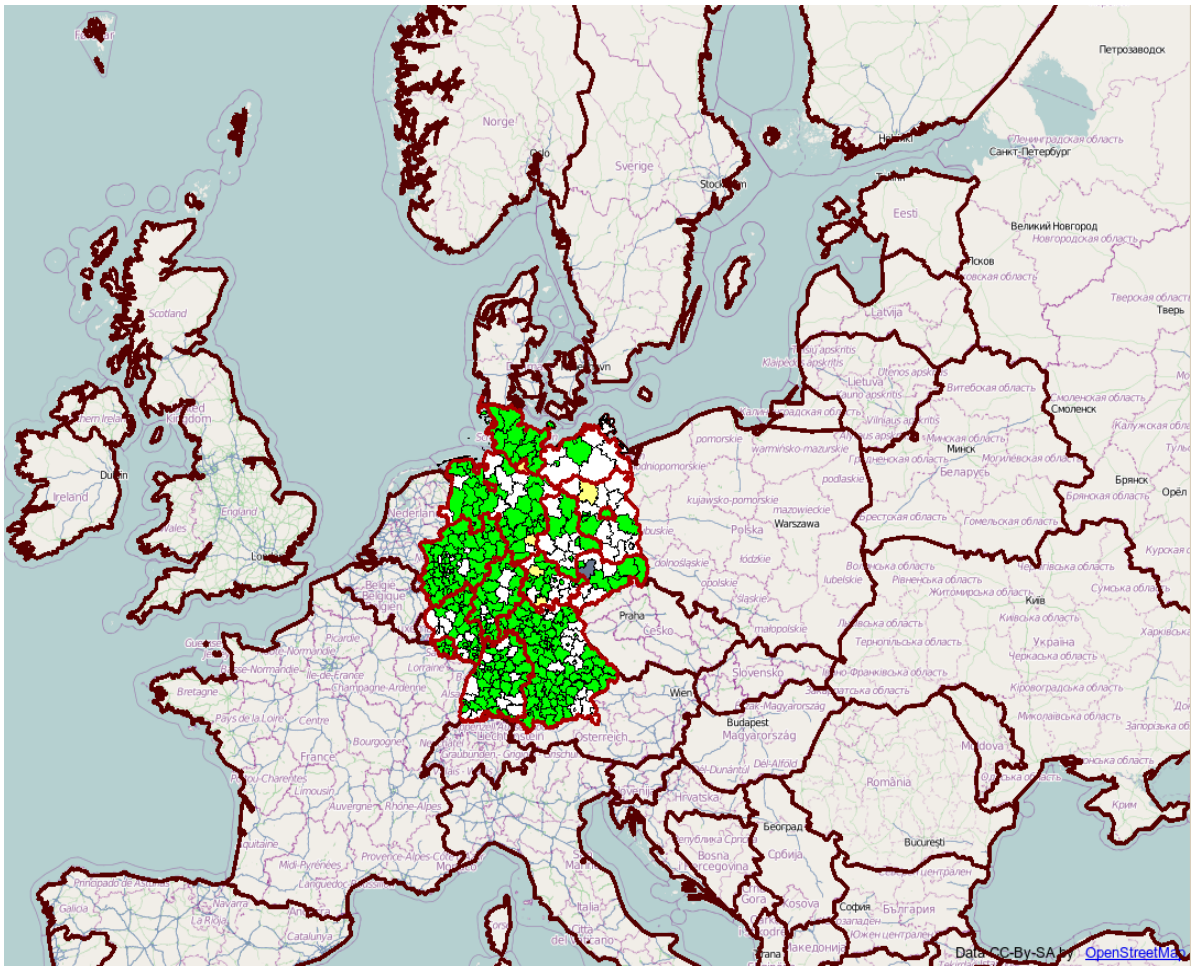

Figure 10.5. Result of 2011 web survey for Germany. Green: Organic waste collections in place. White: No organic waste collections in place. Yellow: Organic waste collections in parts of the council. EU country *.shp files from epp.eurostat.ec.europa.eu. Germany from www.geodatenzentrum.de.

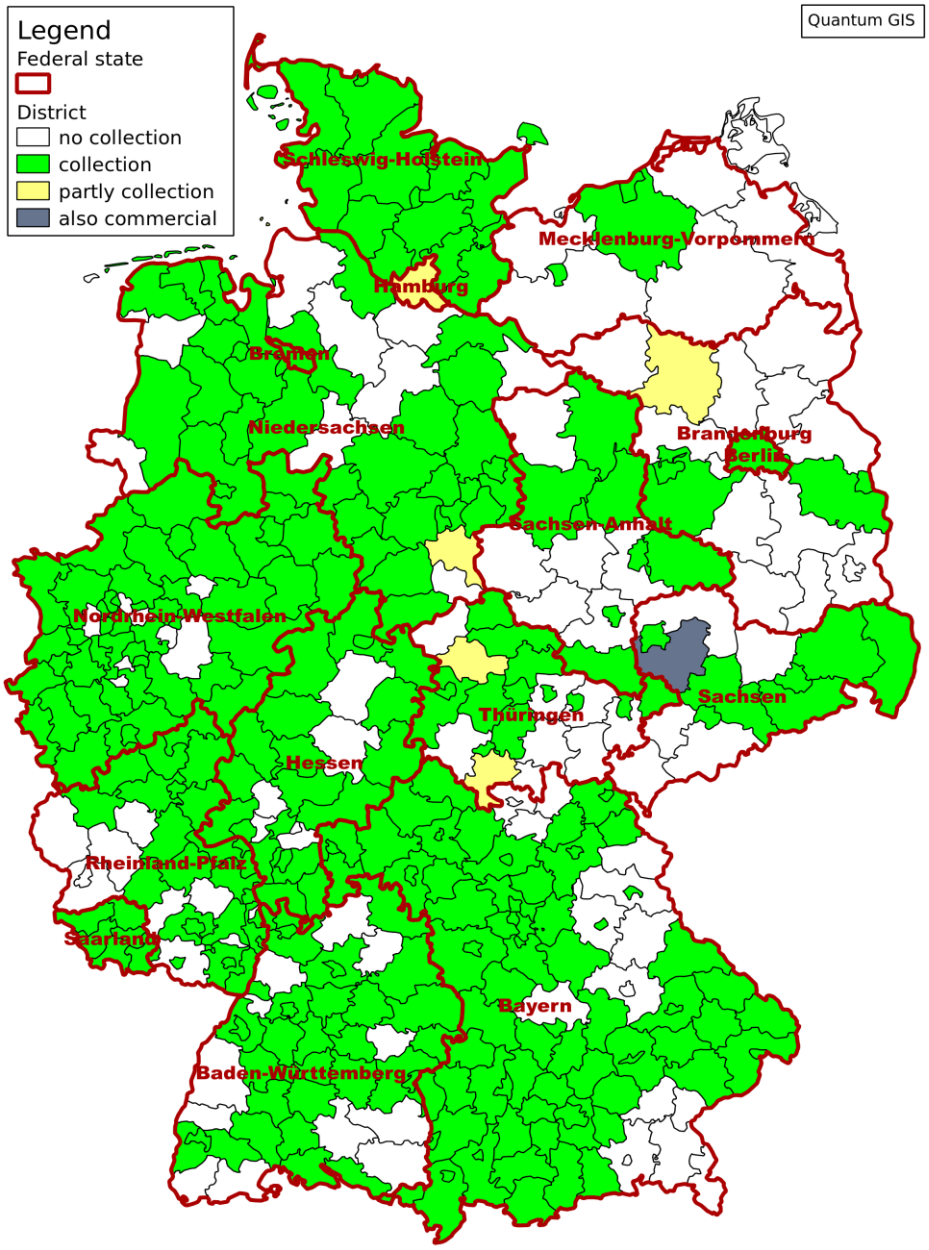

Figure 10.6. Status of organic waste collections in Germany in 2011. Green districts: Source separated, organic waste collections are in place. White districts: no organic waste collections in place. Yellow districts: Organic waste is collected in parts of the district. Adapted from Dirk Henssen at www.gab-online.de. Germany from www.geodatenzentrum.de.

Biobins (Biotonne)

The vast majority of organic waste collections in German city and district councils are carried using so-called biobins. These are standard plastic bins after DIN EN 840 of sizes 240l, 120l or sometimes 80 l, which are also typical for the residual waste collection. The colour of these bio bins is usually brown or sometimes green (Figure 10.7). The size differs from those e.g. in the UK where much smaller bins are widely in use in order to exclude woody garden waste and to minimise potential contamination with non food materials. An additional small bin may also be provided for kitchen use, however, which is similar in size to those used in food-waste only schemes elsewhere (Figure 10.7b).

a) Typical Biotonne, Munich 2011 b) Biotonne leaflet, Munich

Figure 10.7. Typical biobin ('Biotonne') in Germany.

Advice and rules for householders

Householders are typically allowed to dispose non-bulky garden waste into the biobin. A typical example of guidance from the City of Munich (www.awm-muenchen.de) specifies what can and cannot go into the biobin: (www.awm-muenchen.de/fileadmin/PDF-Dokumente/privatkunde/fb_bioflyer.pdf) (Figure 10.8). Acceptable items include:

1. uncooked fruit and vegetable residues
2. potato skin
3. egg shells
4. tea and coffee bags
5. withered flowers
6. pot plants (without the pot)
7. garden waste including grass, leafs, weed, shrubs
8. kitchen roll paper and paper serviettes
9. newspapers to soak up liquids

Items that should not go into the biobin in the city of Munich are

1. vacuum cleaner bags
2. ash
3. nappies and sanitary towels
4. meat, fish and bones
5. cat litter
6. cooked and liquid food scraps

Figure 10.8. Example of include/exclude advice for householders with a biobin in the City of Munich. Source www.awm-muenchen.de.

Organic waste collections in the federal state of Bavaria

To confirm that no food waste only collections exist in Germany and to provide more detail on the collection systems used, one federal state was examined in more depth. Bavaria, located in the South of Germany with the capital of Munich, is the largest federal state with the largest number of waste authorities. The federal state of Bavaria is divided into 71 district authorities and 25 city authorities, which gives a total of 96 administrative authorities responsible for waste collection and disposal within their boundaries. A few authorities have created waste partnerships with other authorities. Waste statistics for all 96 local authorities are collected by the state of Bavaria and are available online at www.stmug.bayern.de/umwelt/daten/abfallwirtschaft/index.htm. Figure 9 shows the status of biowaste collections in Bavaria. The following observations can be made:

- there are a total of 100 local authorities in Bavaria
- 62 local authorities have in place source separated biowaste collections in 2009;
- 16 local authorities do not have separate biowaste collections in place - represented by white colour in Figure 10.9; in these authorities biowaste is still going into the residual waste stream;
- six bring systems (hatched authorities in Figure 10.9) and 78 door-to-door systems (various shades of green in Figure 10.9) are in place in Bavaria
- two local authorities (city of Kaufbeuren and city of Landshut) have a pure bring system (hatched authorities with red boundary in Figure 10.9);
- four local authorities (districts of Augsburg, Neumarkt, Schweinfurt, and Miltenberg) have a bring system in place with additional large bins in recycling centres (hatched authorities in Figure 10.9).

A key finding is that only one authority (Neumarkt) out of 100 had a system in place that allowed food waste only using a biodegradable sack system.

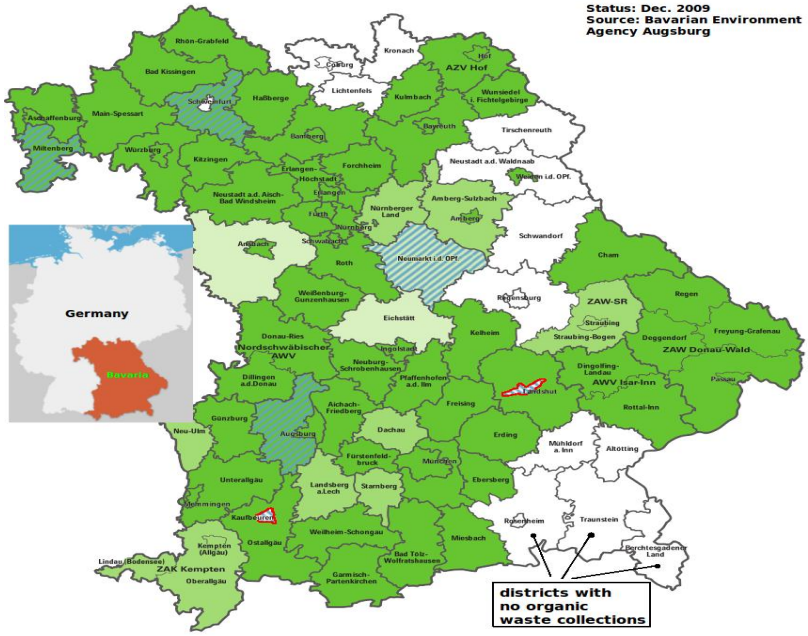

Figure 10.9. Organic waste collection coverage in the state of Bavaria, Germany in 2009. (a) Dark green districts have organic waste collections in place where 70 % and more of the population are served. (b) Medium green districts have organic waste collections in place where 20 to 70 % of the population are served. (c) Light green districts have organic waste collections in place where less than 20 % of the population are served. Source www.lfu.bayern.de.

The city of Rosenheim

The City of Rosenheim is one of the few local authorities in Bavaria with no source separated organic waste collections in place. A sticker on the residual waste bin gives advice on how to organise domestic recycling (Figure 10.10) but food waste is not mentioned. Green waste is meant to be taken to household waste recycling centres.

Figure 10.10. Sticker on a residual waste bin in the City of Rosenheim, Germany.

The city of Kaufbeuren

The city of Kaufbeuren is one of the smallest cities in Bavaria and has had organic waste collections in place for more than a decade. There are 203 bins with 80 l, 1530 bins with 120 l and 1239 bins with 240 l content, amounting to a total of 2972 bins for organic waste collection in 2010. The organic waste collected from these bins was 3358 tonnes in 2010. The number of inhabitants in Kaufbeuren 1 is 41912 and this amounts to a high 80 kg per person-year. There is a single organic waste collection vehicle. Bins and bin locations are shown in Figure 10.11. All organic waste goes to a composting plant.

Figure 10.11. Food waste collection in the City of Kaufbeuren. Top left: Organic waste collection vehicle. Top right: A section of the collection areas. Bottom: A 120-litre organic waste bin typical in Germany; placed on a public pavement.

Pay-as-you-throw system in the town of Gräfelfing

Gräfelfing is a town on the outskirts of Munich, and in administrative terms is part of Munich District, in the state of Bavaria. It has implemented a pay-as-you-throw system for both biowaste and residual waste. The system is somewhat eclectic with unusual performance Figure s, despite the advanced technology of such a system. Every household is furnished with a brown biobin - Figure 10.12, bottom left - and a grey residual waste bin. Both the residual waste bin and the organic waste bin have a transponder chip attached to them 2 and the waste collection vehicle uses this chip to identify the owner. The collection vehicle weighs the bin using calibrated weighing electronics built into the lifting mechanism - Figure 10.12, before and after the bin is emptied. The difference in weight of the bin is logged on a storage card in the vehicle computer. After the collection round is finished the contents of the storage card are emailed to the council waste officer and the weights are stored in a database. Later in the year every bin/bin owner is then charged according the mass of waste she/he has

[1]Source www.abfallberatung.bayern.de/koerperschaft.asp?gkz=762, accessed Dec 2011

[2]In this context, a transponder (short-for transmitter-responder) is a receiver-transmitter device fixed to the 240 litre plastic bin, that gives off a reply (signal) when electronically interrogated.

produced. Such a system is known as post-pay, weight-based accounting (rather than volume-based accounting). The system has the following advantages:

- residual waste is substantially reduced compared to non-metered waste collections
- the householder is encouraged and rewarded to produce less waste

However, there are also some issues with the PAYT system:

- organic waste yield per head is the lowest of all local authorities in Munich District.
- the collection vehicle fuel consumption per tonne collected is thus higher than in cases where organic waste is not metered.

The council waste office in Gräfelfing admitted that there are plans to take organic waste out of the metering system, or at least to reduce organic waste charges substantially in order to obtain more yield. 3

Organic waste door-to-door collection yields across the towns in Munich District are plotted in Figure 10.13. The PAYT system clearly comes out with the lowest organic waste yield of all towns in the district, at 34 kg of collected organic waste per head in the year 2009. For comparison, the towns of Grasbrunn and Sauerlach exhibit a much higher yield of 126 kg organic waste collected per head in 2009. Charging the householder by weight may be good for the residual waste stream, but at present it is unclear whether the low yield of organic waste in the PAYT scheme is due to reductions in the amount of household biowaste generated (e.g. in avoidable food waste); effective diversion through home composting of green waste and other low-risk materials; incorrect disposal of material by other routes; or a combination of these.

Figure 10.12. Top left: Organic waste collection vehicle from Gräfelfing with built-in weighing mechanism. Top right: Onboard computer located in the vehicle cabin to log weights per bin. Bottom left: All organic waste bins in Gräfelfing are all equipped with transponder chips. Bottom right: Back of the collection vehicle with weighing hardware.

[3]Personal communication with Thomas Leineweber, waste officer for Gräfelfing, October 2011.

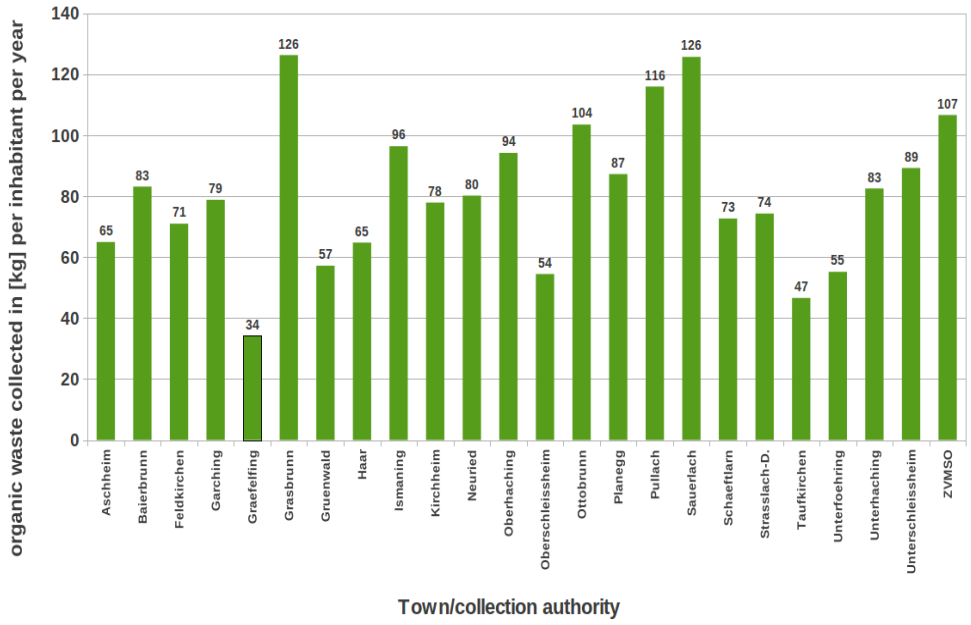

Figure 10.13. Amount of kerbside collected organic waste in various towns in the District of Munich in 2009. Units are kg of organic waste per inhabitant per year. Source www.landkreis-muenchen.de.

Neumarkt District

Out of 101 local authorities in Bavaria only Neumarkt District did not make use of large plastic bins (Figure 10.14). The district operates a biodegradable bag system which makes it almost impossible to include garden waste. All organic waste for the district goes to a composting plant.

Figure 10.14. Material collected from organic waste collections in Neumarkt District Council in Bavaria using biodegradable bags left at the kerbside. Photo by Walter Eglseer, waste officer, District of Neumarkt, 7 Dec 2011.

The council advises householders that the following ought to be put into these sacks (www.landkreis.neumarkt.de/hp2627/Abfaelle-von-A-Z.htm):

- kitchen waste
- food scraps
- meat scraps (but also into residual waste)
- vegetable scraps
- tea and coffee bags
- fruit peelings

On visual inspection it can be seen that this material is close to the types of waste collected in biowaste schemes that do not accept green waste.

Summary of key findings

- Organic waste recycling in Germany was introduced in the 1990s. From a survey of central government statistical sources and a more detailed survey of the state of Bavaria, looking at 100 local authority web sites and government statistics from this state, the following conclusions can be drawn:
- In 2011 more than three quarters of all local authorities in Germany have source separated food waste collections in place.
- Per capita organic waste collection yield has reached 100 kg per year, one of the highest in Europe, and the trend is rising.
- There are virtually no food waste only collections in Germany. Organic waste is typically collected together with garden waste and green waste.
- The vast majority of authorities employ bin sizes of between 80 and 240 litres for organic waste kerbside collections.
- Out of 79 authorities collecting organic waste in the state of Bavaria, all but one operated with large bins typically 240 or 120 litres in size. A single authority operated a food waste bag system (the District of Neumarkt).
- Organic waste yield varies substantially across districts. An advanced pay-as-you-throw system in Graefelfing near Munich achieved the lowest yield per person-year, leading to higher fuel consumption per tonne of waste collected.
- In 2015 source separated organic waste collections may become mandatory for local authorities in Germany.

Attachment

The following is an email from Dirk Henssen, who runs a long established German organic waste consultancy (www.gab-online.de). He confirms that all local authorities in Germany use standard plastic bins after DIN EN 840 for organic waste collections. At the beginning of the 1990s when organic waste collections were first introduced some authorities used 35 or 50-litre bins, but these have long been replaced by 240-litre bins:

From: Dirk Henssen [Dirk.Henssen@gab-online.de]
Sent: 22 March 2012 16:37
To: Gredmaier L.
Subject: Re: keine kleinen Biotonnen in Deutschland ?
Sehr geehrter Herr Gredmaier,

in Deutschland werden nahezu flaechendeckend fuer Restabfall- und Biogutsammlung MGB (Muellgrossbehaelter) nach DIN EN 840 verwandt. Diese gibt es von 120 und 240 Liter, neuerdings auch in 90 oder 60 l (durch einen eingezogenen Boden, dadurch u. U. problematisch wegen Standsicherheit. Die letzten Gemeinden haben ihre 35/50 l Behaelter in den letzten Jahren abgeschafft, ich kenne keine mehr.

Dear Mr Gredmaier
Virtually all local authorities in Germany operate with large bins after EN 840. These bins are of sizes 120 and 240 litres, and recently also in 90 and 60 litres, but this is problematic because of a raised floor in these bins. Authorities used to have 35 or 50 litre bins, but all of these smaller bins were abandoned in the last few years. I don’t know any councils operating small bins. Regards,

Mit freundlichen Gruessen

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Appendix 11: Results of web-based survey on collection of source segregated domestic food waste in Greece

Background

Greece has incorporated the 94/62/EC directive in its national legislation by the KYA (Κοινή Υπουργική Απόφαση-Joint Ministerial Decision) N^{o} 50910/2727/2003 which determines that the biodegradable matter of urban solid waste ending up in landfills must be by 16/07/2020 less than 35% of the total weight of the biodegradable urban solid waste produced in 1995 or of the year before 1995 for which Eurostat data exist (Hellenic-Government, 2003).

Organisation of waste collection in Greece

A general strategy for waste management is implemented by the Hellenic Ministry of Environment, Energy and Climate Change, while local authorities (municipalities and prefectures grouped together (Οργανισμός Τοπικής Αυτοδιοίκησης - ΟΤΑ: Local Self-Governance Authorities Association)) which can be in the form of associations or S.A. companies are responsible for transhipment, storage, recovery and disposal of urban solid waste, including household waste (E.E.D.S.A., 2011c). The area of responsibility for each OTA contains at least one "Solid Waste Management Unit" and each OTA is also responsible for collecting waste and allocating waste bins.

Methodology

The main sources of information on the web about waste management in Greece are the Hellenic Ministry of Environment, Energy and Climate Change (http://www.ypeka.gr) and the local OTAs websites when available. Information can also be obtained from the Hellenic Solid Waste Management Association (http://www.eedsa.gr), a scientific non-profit organisation providing information on solid waste management in Greece. The websites of these organisations were searched for information on separate food waste collections.

A general web search was also carried out using www.google.gr search engine with "Ελλάδα" as the region restriction and date restrictions for the last 3years. The keywords used were: αποκομιδή+ απόβλητα+ τροφίμων+ Ελλάδα. The search was then repeated with "πόρτα πόρτα" and δημοτικος added to the key words. The same searches were also conducted without date restrictions. Another search was conducted to see if any food waste was collected separately for anaerobic digestion, using the key words: δημοτική+ αποκομιδή+ Ελλάδα+ αναερόβια+ χώνευση+ απόβλητα+ τροφίμων.

The websites of six different national solid waste management bodies (Attiki, Thessaloniki, Western Macedonia, Eastern Macedonia and Thrace, Western Crete, Fokida (Αττική, Θεσσαλονίκη, Δυτική Μακεδονία, Ανατολική Μακεδονία και Θράκη, Δυτική Κρήτη, Φωκίδα)) and of 2 other large municipalities (Patrai, Larissa (Πάτρα, Λάρισσα)) which provided online information about waste management (covering a total of around 60% of the population) were also checked to see if they gave any relevant information not covered by the above search terms. In addition, emails were sent to the email addresses provided on their websites asking about their present and future plans for source segregated domestic food waste collection. The websites of other large municipalities (e.g. Ioannina (Ιωάννινα) (Ioannina, 2011), Heraklion (Ηράκλειον) (Heraklion, 2011)) were also checked, however no

information of any kind was possible to be obtained either from their websites or by using the email addresses provided.

The survey was conducted between 20/11/2011 and 20/12/2011.

Results

In 2006, domestic waste contributed 8% to the total waste (51,324,000 tonnes) produced in Greece (www.statistics.gr). A Eurostat survey covering the period 1995-2009 revealed that from the total municipal waste produced in 2009 in Greece, 81% was disposed to landfills, 18% was recycled and only 1% was composted (Blumenthal, 2011).

Household waste in Greece is almost exclusively disposed at central drop-off points. Even if regional planning includes collection of source segregated organic matter, this has not yet been implemented widely by any solid waste management operator (E.E.D.S.A., 2011b). Although a few municipalities have pilot applications for domestic composting, no mention is made of segregated food waste disposal (E.E.D.S.A., 2011b, Biocomposter, 2009). Greece also has 5 composting plants, of which only two are fully operating in the regions of Attiki and Western Crete (Bourtsalas et al., 2011).

From the web search, it seems that segregated source collection of food waste is not popular in Greece, as not a single governmental website was found referring to segregated collection of food waste. Most OTA's are only implementing recycling schemes and their websites are providing information about what to recycle, which bins to use etc.. When the biodegradable matter is mentioned, this is mainly to give instructions about mixed (garden and kitchen waste) composting in domestic bins (e.g. http://www.diaamath.gr/?page_id=872).

More precisely, the search of the local OTAs' websites and the email responds from the local authorities gave the following results:

Attiki (around 35% of the total population): Only packing materials are collected at source and recycled. No reference is made to food waste disposal (E.S.D.K.N.A., 2011).

Thessaloniki (around 10% of the total population): Mainly packing materials (paper, glass, aluminium and plastic) are recycled with no references to food waste or composting (S.O.T.A.N.TH., 2011). From personal communication (response attached) with the president of the local OTA Mr Zournas, it was confirmed that no segregated source collection of food waste is implemented in the area and there are no plans for managing food waste separately from other biodegradable waste. Also Mr Zournas informed us that some municipalities in Thessaloniki prefecture (e.g. municipalities of Pavlou Mela, Thermis, Sykewn and Kalamarias (Παύλου Μελά, Θέρμης, Συκεών, Καλαμαριάς)) are implementing pilot projects on green waste composting, in addition to their recycling projects.

Eastern Macedonia and Thrace (around 6% of the total population): The local OTA is promoting domestic composting, which however mixes food with garden waste (DI.A.A.MA.TH., 2011). From personal communication (email attached) with Mr Petalas from the waste management office of the local OTA it was confirmed that no project of segregated food waste collection is currently applied. Regarding the biodegradable matter of solid waste, the local OTA has distributed around 500bins for domestic composting to members of ecological organisations for distribution. As Mr Petalas mentions, the

biodegradable matter of solid waste will be treated without segregation, with composting systems for the period 2012-2015 and anaerobic digestion systems for the period 2015-2035.

Western Macedonia (around 3% of the total population): Mainly packing materials are recycled and no reference is made to food waste or composting (DI.A.DY.MA., 2011). From personal communication with Mr Grigoropoulos from the local OTA (email attached), we were informed that for this region no current or future plans exist for segregated source collection of any kind of biodegradable municipal solid waste. Mr Grigoropoulos also mentioned that as far as he is concerned, no coordinated projects exist in Greece regarding segregated source collection of any biodegradable materials, apart from a few pilot projects. However, he believes that this will soon have to change after incorporating the 2008/98/EC directive into the national legislation.

Western Crete (around 2% of the total population): Mainly packing materials are recycled and no reference is made to food waste disposing. Even if a composting plant operates in the region and there are plans for source segregated food waste, this has not yet been implemented. When implemented, this will include mixing food with garden waste (D.E.DI.S.A., 2011, Bourtsalas et al., 2011, Flemetaki et al., 2008). From personal communication with the manager of the local OTA (email attached) Mr Paterakis, the above information was confirmed. Mr Paterakis also told us that the composting plant is currently using a mixture of sewage sludge, branches and the organic waste originating from local fruit markets.

Patrai (around 2% of the total population): Mainly packing materials are recycled and no reference is made to food waste disposing (Patrai, 2011)

Larissa (around 1% of the total population): Mainly packing materials are recycled and no reference is made to food waste disposing (Larissa, 2011). From personal communication with Ms Haftiki from the Environment department of municipality of Larissa (email attached) we were informed that no segregated collection of any biodegradable waste is currently implemented in the region. The local OTA is only implementing a pilot scheme for collection of Category 3 animal by-products from local butcheries which are then delivered to a private company for fodder production.

Fokida (around 0.5% of the total population): Mainly packing materials, cooking oils, batteries, tyres and old vehicles are recycled and no mention is made to segregated food waste collection (Fokida, 2011).

Summary of key findings

- Source segregated food waste collections are not applied in any region in Greece nor there is a trend towards this
- Only a few pilot projects exist for segregated collection of green wastes
- When composted, organic matter originating from food waste is mixed with green and other kinds of biodegradable solid waste
- In 2009, recycling and landfill disposal accounted for almost 99% of the total management of municipal solid waste

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Appendix 12: Results of web based survey on collection of source segregated domestic food waste in Hungary

Organisation of waste collection in Hungary

According to hygiene and public health legislation, household waste collection and disposal in Hungary is compulsory for all residential properties (Complex Hatályos Jogszabályok Gyűjteménye, 2012). Waste collection is organised by regional private town-management or waste-management companies who generally cover the region's major cities and their surroundings. These companies must hold the Environment Agency's waste management permit which is issued by SÖVIT Környezetvédelmi Kft (www.kornyved.hu) (SÖVIT, 2012), the only organisation qualified to issue such permits. This organisation also supervises the regional waste management companies. The waste management companies specialise in collection of construction waste, packaging waste, electronic waste, household waste or plastic, paper and glass. The collecting companies provide containers (bins of different sizes) in residential estates for general household waste collection; however there are 'waste islands' at regular distances in all cities for the separate collection of paper, glass, plastic and metal cans. Every household pays a yearly 'household tax' to the local residential 'common representative' (who is generally responsible for a bigger residential area) who then organises the general household waste collection on their behalf. Home composters and garden refuse packs can be purchased separately by households from several waste management companies.

Methodology

A word specific search was carried out on google.hu with the intention of finding out the food waste habits in Hungary. The key words used in the search were "Szerves hulladék gyűjtés" (organic waste collection), "háztartási hulladék gazdálkodás" (household waste management), "élemiszer hulladék gazdálkodás" (food waste management), "élemiszer hulladék újrahasznosítás" (food waste recycling), "biohulladék" (organic waste), "járdaszéli szerves hulladék gyűjtés" (kerbside organic waste collection), "kerti hulladék" (garden waste) and several combinations of these words. No date restrictions were applied to the search: however it was obvious that the majority of web results were well out of date.

Szelektivhulladekgyujtes (http://szelektivhulladekgyujtes.lap.hu) is an independent and comprehensive website that collects under one umbrella all website links that are related to selective waste management. The main sections include 'Regional waste plants' and 'Waste collecting firms' or 'Waste collection firms by speciality'. All major regional waste collection and recycling companies' websites were checked (Internetes Cég Böngésző, 2012) to see if there was other information related to food waste collection that was not covered in the general search.

The survey was carried out between 23 February - 3 April 2012.

Results

Household organic waste collection and recycling is not widespread in Hungary. The Ministry of Environment and Water (KVVM, 2012) provides guidelines on household waste collection practices. The majority of the local government websites surveyed (several districts

in Budapest and also regional ones) do not provide information on separate food waste collection (Józsefváros Önkormányzat, 2012). Moreover, there are no government statistics that offer any data on separate collections of domestic or other food waste. Interestingly, however, apart from general waste collection, there is plenty of information on hazardous and green waste collections on the local government websites (FKF Kft. Szárazelemgyűjtés, 2012; FKF Kft. Zöldhulladék begyűjtés, 2012).

On the other hand, the majority of the private waste management companies' websites (those that engage in organic waste as well as other waste collection) provide comprehensive information on source separated food waste as a specific waste category as well as collection practices (Humusz Szövetség, 2012). These 'general' household waste management companies offer organic waste collection and recycling; yet in all cases, that is not their main business line. These also provide (at a cost) the containers and bags necessary for the separate collection of waste (be it organic or non-organic). Kerbside collection is also practiced for 'packaging-' and garden waste, specifically for those living in detached or semi-detached houses and not in residential areas (housing estates).

The collection and disposal of household waste in Budapest and its area is organised by FKF Ltd (http://www.fkf.hu), the biggest household waste management company in Hungary. Waste containers are offered by FKF Ltd to all households. Waste collection islands were also set up by the company in every district and sub-district of Budapest for paper, plastic, different coloured glass and metal can collections (FKF Kft. Szelektív hulladékgyűjtő szigetek, 2012).. For ease of collection of various types of household waste, the company's containers are coloured: yellow for plastic, white for white glass, green container for green and brown glass, blue contained for paper and grey for metal can collection. In harmony with the EU targets for minimising the decomposition of organic waste and the effect of greenhouse gases, in June 2006 FKF Ltd started the collection of organic waste (mainly greenery) in green areas of Budapest (FKF Kft. Zöldhulladék begyűjtés, 2012). In more than 1000 places in Budapest, and mostly in educational and public facilities, the company operates toxic waste collections specifically for used batteries (FKF Kft. Szárazelemgyűjtés, 2012). Bags for different types of waste (green waste, household waste) can be purchased from the website or by contacting directly the company. It seems that they are the only providers of selective bags nationwide as other companies advertise bags and containers that can be purchased solely from FKF Ltd.

Independent profit orientated companies such as SI-BIO Ltd (http://sibio.hu) (official website last updated by the web master in 2009) (Sio-Bio Kft. Szerves hulladék kezelés, 2012) offers the collection, transportation and environmentally friendly processing of household waste to a high-tech closed system processing and recycling bio-plant.

Biotrans Ltd (www.biotrans.hu) (Biotrans Kft. Ételhulladék elszállítás, 2012) has been engaged in collection of cooking and food waste, food residues (cooking oil) and expired food from canteens and food markets since 2005. Containers are provided to contracted partners. The company reports quarterly the quantities of waste generated to the regional 'Environmental Inspectorate and Animal and Food control station'.

Szelektiv (www.szelektiv.hu) (Szerves Hulladék – Szelektív hulladékgyűjtés, 2012), an online portal that encourages selective waste collection, provides advice and detailed information on best practices for waste resource collection and recycling. The company aims to environmentally educate nurseries and primary schools on the wide range benefits of waste

collection. Events and festivals were organised throughout the last three years (2009-2011) to raise awareness of selective waste collection, of accepted practices for toxic waste collection (batteries and pharmaceuticals) and nonetheless of the threats of global warming. ÖKO-pack Nonprofit Kft. (2012) also provides workshops and environment-conservation programs to companies and the wider population (children and parents).

A new innovation among members of the public and educational institutions in Bács-Kiskun county promotes environmentally conscious lifestyles in a medium-term project publicly launched in 2010 in order to fight air pollution, global warming and encourage compost recycling (Lefter et al., 2010). The initiative is running with the support of the EU and the New Hungary Development Plan from 1st September 2010 till the end of August 2013. There are six nurseries involved in the project and children are actively taking part in organic and inorganic waste collection, compost preparation (recycling) from biowaste and its use afterwards. The motivation behind such initiative is the exponentially increasing amount of waste and its dangers to the environment. The aim is to educate children and their parents to live in an environmentally friendly way in their home environments.

Summary of key findings

- Separate food (organic) waste collection and recycling is not common practice in Hungary.
- There are few mini programs initiatives for organic waste collection and preparation of compost for home use. These are mainly started by educational institutions, primarily by nurseries. Therefore it is recognised that environmental education must be started at a very young age.
- 80 per cent of the visited web pages that mention organic waste collection suggest that these were not updated on a regular basis.

Figure 12.1. Information on reasons to reduce food waste on the Okofitnesz website http://okofitnesz.hu/kihivas/elelmiszer-hulladek

Figure 12.2. Food waste definitions on http://okofitnesz.hu/kihivas/elelmiszer-hulladek

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Appendix 13: Results of web based survey on collection of source segregated of domestic food waste in Ireland

Organisation of waste collection in Ireland

The present web survey was intended to provide information on the level of household food waste collection in Ireland. The country has experienced a dramatic change in its waste management convention in the last decade. Historically, waste management in Ireland received little attention from central government and was seen as a local authority responsibility, and in the mid 1990s Ireland recycling rate was among the lowest in the EU (Ask about Ireland, 2011). Now Ireland is well advanced in achieving most of its recovery and recycling EU targets (McCool et al., 2012). At the moment, waste management policy in Ireland is set by the government through the Waste Management Acts 1996 to 2008 (Environmental Protection Agency, N.D.). The Environmental Protection Agency (EPA) is the body controlling and executing waste management regulations in Ireland and is responsible for preparing a National Waste Report (NWR) (McCool et al., 2012) which is the most important national report that informs policies, private sector investment and business planning.

Waste management policy in Ireland is set out in Changing our ways and Prevention and Recycling Waste: Delivering Change (EPA, 1998). With a comprehensive and flexible legislation framework in place, all local authorities can define and give effect to progressive waste management policies. Each local authority is required to prepare a detailed plan for the management of non-hazardous waste within their functional area (Dempsey and T.D., 1998). Waste collection in Ireland is in a period of rapid transition with many local authorities exiting the household collection market. At the start of 2012 the majority of waste was collected by private companies and only three local authorities (Waterford Co, Galway Co, Kerry Co) were collecting household waste at the kerbside. The system of waste collection in Ireland is one where the users choose their supplier of waste collection service (Hogg et al., N.D.). The report suggests that this situation creates uncertainties in terms of being able to command a part of the waste stream, and the nature of incentives facing households are likely to be responsible for the slower evolution in household waste recycling rates than might have been expected in the case where pay-by-use is in place and disposal cost have been high.

The waste collection service covers 71% of the dwellings in Ireland which can further be broken down to:
5% (59,135 dwellings) on single bin (black bin) service only;
61% (738,080 dwellings) on 2 bins service only (residuals bin and dry recyclables bin);
34% (410,879 dwellings) on a 3-bin service (residual bin, recyclables bin and organics bin).

Further information on collection services and different waste streams is available in the National Waste Report (2010). Information on waste management in Ireland and on current legislation and policies is published on Environmental Protection Agency website (http://www.epa.ie/). The local authorities web pages contain waste management plans, information on categories under which the waste should be stored, frequency of collections for each waste stream, detailed information on civic amenities (e.g. location, what type of waste they are dealing with) and how to register for a waste collection service.

Methodology

The main bodies providing information, statistics, legislations and policies in place for the waste management in Ireland are the EPA and the Department for Environment, Heritage and Local Government (DOEHLG) and their websites were searched throughout for information on food segregated waste collection in the domestic sector.

A general web search was carried out using www.google.ie advanced search with "Ireland" as the region restriction and pages for the past year. The used key word were "Food waste collection", then the search was repeated with "domestic", "kitchen" and "household" added to the key words. The same search was then repeated without a date restriction. Another search with key words "anaerobic digestion"+"food waste" was carried out to see if any domestic food waste has been processed through the anaerobic digestions in Ireland. Also, the websites of major waste management organisations were surveyed to see if any of them process food waste collected separately from households.

Since in Ireland most of the local authorities have grouped to regions to provide more a sustainable waste management service, a number of those regions were surveyed to see if they have any evidence of source segregated food waste collection. Finally, a number of leading waste management operators in Ireland were asked for any information on source segregated food waste collection schemes or trials in Ireland.

The survey was carried out between 05 - 20/03/2012

Results

The results of the present web survey indicate that despite the extensive production of food waste there is as yet very little of source segregated domestic food waste collection in Ireland, other than in combination with green waste.

The quantities of waste and detailed information on each waste stream in Ireland are given by the EPA in its National Waste Report (2010). The reported quantity of household waste managed for 2010 is 1,420,706 tonnes which is 5% less than that one reported in 2009. This Figure is taken as a sum of waste weight collected at kerbside (77.7%), brought by householders to bring banks and civic amenity sites (19.7%), and estimates of home composted waste (2.6%). The biodegradable managed waste accounts for 65% (or 923,459 tonnes) of the weight of the overall managed household refuse. It is estimated that the available organics (food and garden waste) in all domestic waste streams comprise 23% or 253,305 tonnes of produced organic waste. As the main source of information on waste management, the National Waste Report gives estimations of available organic waste but does not give any evidence of collection or treatment of household food waste only.

A further survey on the EPA web site did not reveal any information on food waste collection from the household sector. Food waste is collected together with garden waste from 35% of the dwellings in Ireland and the government initiatives (other than food waste prevention initiatives) to reduce food waste going to landfill include promoting home composting (where possible) or installation of food waste disposers (FWD). The National Waste Report (2010) estimates that 122,144 tonnes (or 48%) of the available food organic waste has been diverted from landfill by home composting, kerbside collection and bringing it to civic amenity sites. Most of the local authorities in Ireland provide home composters at subsidised rates for

people interested in composting their household waste. This is known to be one of the most cost-effective treatment options, since the composted waste is diverted from landfill without any cost for the government and the inhabitants reduce their bin waste, and hence collection fee. On the other hand, application of FWDs transfers the treatment of organic waste from the solid waste stream to the wastewater system, thus it has to be treated in wastewater treatment plant. The potential impact of FWD use on the wastewater collection and treatment system is examined in more detail in a report by EPA (Carey et al., 2008).

No references to segregated food waste collection in the domestic sector were found on the websites of the local authorities. The majority of websites contain detailed information on waste management practices, plans, targets, waste statistics, bring banks information, awareness and prevention programmes. None of the local authorities, however, provided information of segregate food waste collection separately from green waste. Local authority websites are a common way to publish waste management information to the public in Ireland, which indicates that segregated food waste collection is unlikely or very rare.

The waste management policy in Ireland unites the local authority in 10 regions which are responsible for preparation and updating of waste management plans for the period 2005-2010 (EPA, 2004). The plans are published on the local authorities' web sides and content statistics, data and recycling targets for each region. Those plans were also investigated but no evidence of source segregated food waste collection was found.

Several Irish waste management companies (www.greyhound.ie; www.greenstar.ie and www.countyclean.ie) were also asked about any information on food waste collection in Ireland but none of them has answered to the date.

Although no data is available on domestic food waste collection in Ireland, information on source segregated food waste collection in the commercial sector was found. On 1 July 2010 the Irish Government set food waste regulation (SI 508 of 2009). The regulation puts an obligation on all major sources of food waste (pubs, restaurants, canteens etc) to segregate it into a dedicated bin and ensure it is not mixed with other waste. For this purpose a brown bin collection service must be used so the collected food waste can be recycled by composting or other approved recycling process. Alternatively, the commercial food waste generator can bring the food waste directly to a food waste recycling plant or compost it on the premises where it is generated. At present the recycling rate of food waste generated by businesses is very low (10%) but it is estimated that this material can be recycled relatively easily and make a large contribution to diverting the food waste from landfill (Department of Environment Heritage and Local Government and Cre- Composting & Anaerobic Digestion Association of Ireland, N.D.).

A total of 28 active landfills accept municipal waste in Ireland and it is estimated that with the current fill rates, 15 of the landfills will use up their capacity within 3 years (McCool et al., 2012). This creates an urgent need for improving the waste infrastructure in Ireland while aiming for more sustainable and environment-friendly waste treatment. In 2010 twenty-four facilities (compost and anaerobic digestion) accepted municipal organic waste for recovery and 11 of them accepted biodegradable kitchen and canteen waste for recovery (compared to 8 in 2009). The main obstacle to increasing the anaerobic digestion plants in Ireland is the lack of support from the government and related agencies (Raunaigh and McGrory, 2011). Up until recently funding of up to 30% of the capital cost of an anaerobic digestion plant was available through the SEAI (Sustainable Energy Authority of Ireland). Now this has stopped

due to lack of funding from the government which makes projects much less attractive, and hence affects the prospect of collecting segregated domestic food waste. The major waste operator in Ireland (Greenstar, www.greenstar.ie) is currently building a network of small and large-scale anaerobic digestion plans so its webpage was investigated but no evidence of processing food waste (only) was found.

Summary of key findings

- Source segregated food waste collection from households is still in a very early stage in Ireland
- Around 35% of Irish households are provided with an organic (e.g. food and garden waste) collection service
- From 1 July 2010 the government in Ireland requires commercial premises to segregate their food waste into a dedicated bin
- With the current landfill rates the majority of the landfills in Ireland will use up their capacity within 3 years and Ireland will have to look for more sustainable and environmentally friendly options for dealing with its waste.

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Appendix 14: Results of web-based survey on collection of source segregated domestic food waste in Italy

Organisation of waste collection in Italy

Waste collection in Italy is the responsibility of each municipality ("comune"). Italy is divided into 20 regions, 110 counties ("provinces") and 8,094 municipalities, responsible for both collection and disposal of their respective waste. The municipalities may carry out collections by direct labour using their own employees, or may subcontract the collection service to an external organisation; in most cases in Italy the service is contracted out to companies (which can be private or owned, totally or in part, by the municipality). In the North-East of Italy it is common that these companies may consist of consortia, pooling together the resources of multiple municipalities.

In Italy the separate collection of different kinds of waste is enforced by law. The first big innovation in this direction was represented by the "Decreto Ronchi" (D.P.R. 22/97) in 1997. This law basically adapted to the Italian reality the indications given by three different laws of the European Union (91/156/CEE, 91/689/CEE and 94/62/CE). The core of this law basically consisted of four points:

- organizing all the services regarding the waste management;
- reduction of the amount of waste to be sent to landfill;
- implementing the so-called "4 Rs policy" (reduction, reuse, recycling and recovery);
- reduced production, and reclamation of packaging.

In 2006 the "Decreto Ronchi" was substituted with the D.P.R. 152/2006, commonly referred to as the 'testo unico per l'ambiente', which defines the separate waste collection as follows (art. 183):

"The appropriate collection in order to group together municipal waste into homogeneous fractions (including food waste) which are intended for reuse, recycling and recovery of materials. Food waste must be collected separately or with reusable containers or certified biodegradable bags". Besides food waste, other recyclable materials commonly separated are paper, glass, aluminum, plastic and garden waste.

This law also set the objectives to be achieved in terms of reduction of waste to landfill by separate collection:

- at least 35% by the 31st of December 2006;
- at least 40% by the 31st of December 2007;
- at least 45% by the 31st of December 2008;
- at least 50% by the 31st of December 2009;
- at least 60% by the 31st of December 2011;
- at least 65% by the 31st of December 2012.

People choosing to do home composting are also entitled to a discount on the tax for waste management (around 20%). However, for this discount to be applied, it needs to be approved by the single municipalities. Consequently, there is variability in implementation of this tax discount across the country.

The cost of household waste collection is covered through a waste management tax levied on each household, but an additional charge may be levied for garden waste or bulky items, depending on the municipality. The waste management tax calculation varies across municipalities. In some municipalities, the tax is charged on a flat rate based on the size of the householder’s home, while in others, there is a more detailed count of the number of

collections that each household needs. This is achieved either through the labelling and tallying of bins picked up on collection routes, or through designating specific bags which must be used for waste collection, and which can only be purchased from the municipality or its approved dealers (such as local shops). Wherever the door-to-door collection is adopted, the municipality is responsible for the supply of any container required to hold the waste that it has a statutory duty to collect, but is not required to provide additional lining materials. It is also not responsible for supplying equipment such as home composters or garden refuse sacks, although it may do so free of charge or at a subsidised rate depending on local policy.

Information on waste collection services is usually publicised on the municipalities' webpages. However, significant differences exist between the North and the South of Italy, with the latter tending to provide much less detailed information (if any). The separate collection of food waste (and more generally separate waste collection) is more widespread in the North than in the South. However, this may be influenced by the fact that it was exclusively an internet search, as the use of the internet also appears to be more widespread in the North than in the South. More collection schemes and information may exist in the South, but is not made available on the web.

In the biggest cities, street waste bins that serve a number of households via a bring system have traditionally been more common (especially in the outer neighbourhoods), but door-to-door collection is increasing in frequency, particularly for separate food waste, due to the recognition of a number of factors (Brook Lyndhurst, 2010):

- food waste makes a up a large proportion of the waste stream;
- it is the most putrescible fraction and therefore needs to be collected frequently, but this allows for less frequent collection of refuse for more cost-effective provision of services
- it is a dense fraction which effectively compacts itself, making compaction vehicles unnecessary
- it is possible to constrain the set-out of garden waste & therefore limit undermining of home composting
- door-to-door collection is less susceptible to contamination than the road container system
- the purity of collected food waste is high and can make high quality composts.

Methodology

A systematic search was carried out of webpages for the 516 municipalities with more than 20,000 inhabitants in Italy (belonging to all the regions and all the counties). In the North East of Italy, thanks to the presence of the aforementioned waste management consortia, it was possible to retrieve detailed records for 270 additional municipalities. The search was usually carried out by going to the main website of the municipality, finding the section dealing with waste management and looking for information on food waste collection. Further information was gathered from each website according to the headings shown in Table 14.1. These 786 municipalities accounted for 33,874,824, inhabitants, which represents 55.9% of the total Italian population.

As most municipalities in Italy now provide food waste collection to at least some of their residents, the search of the municipalities' webpages was sufficient for information gathering without requiring additional Google key word searches.

However, searching the websites of the regional agencies for the environment protection (ARPAs), data regarding household total and recyclable were retrieved for 15 Italian regions, excluding Valle d'Aosta, Trentino-Alto Adige, Lazio, Basilicata, and Sicilia. Of all the 8,094 Italian municipalities, 6,813 were covered, ac
counting for 51,554,887 inhabitants, which represents 85.0% of the Italian population.In 4,633 cases, moreover, data regarding household food and garden waste (and sometimes household composting) were also retrieved. This latter group represents 44.3% of the Italian population.

Table 14.1. Data collected in the survey.

					COMMENTS
Local Authority		Name	1	Comune	
		Code		Code Comune	
Local Authority Characteristics		Region	4	Region	
		Code		Code Region	
		Province		Province	
		Code		Code Province	
		Males		Total Males	
		Females		Total Females	
	Population	no.	6	Total Residents (01/01/11)	
Data characteristics				Source link	There may be more links in the comment variables
				Date of access	
				Reference Date	Usually a year
General waste	Household - total waste	tonnes/ person-year	8	Waste	For a more consistent analysis better to use variable (8)
	Household waste sent for recycling/composting/reuse	tonnes/ person-year	9	Recycling	For a more consistent analysis better to use variable (9)
		% total	10	Recycling %	For a more consistent analysis better to use variable (10)
Separate Food Waste (FW) collection?	Type	None / With Garden Waste / FW only	13		Mostly FW only
	Status	Opt-in / Compulsory / NS	14		Compulsory by law (even if some municipalities still struggle to enforce it)
	Comment		15		
Collection frequency	Separate FW Collections	Weekly / Fortnightly / Other / None / NS/ Number per Week	16		In Italy the frequency can be higher than once per week, more possible responses
	Residual waste collection	Weekly / Fortnightly / Other / None / NS/ Number per Week	17		In Italy the frequency can be higher than once per week
	Separate Recyclable Collection	Weekly / Fortnightly / Other / None / NS/ Number per Week	18		In Italy the frequency can be higher than once per week
	Separate Garden waste	Weekly / Fortnightly / Other / None / NS/ Number per Week	19		In Italy the frequency can be higher than once per week
	Comment		20		Used to explained all the double frequencies and the "other"
Materials	Bones	Yes / No/ NS	21		

	Eggshells	Yes / No/ NS	22		
	Paper/ card	Yes / No/ NS	23		Always collected separately. However, kitchen paper and tissues are accepted almost everywhere.
	Shredded paper	Yes / No/ NS	24		Always collected separately.
	Liquid	Yes / No/ NS	25		
	Oil / fat	Yes / No/ NS	26		Almost everywhere has separate collection
	Faecal	Yes / No/ NS	27		
	Plant	Yes / No/ NS	28		
	Biodeg bags	Yes / No/ NS	29		
	List accepted	Yes / No	30		
	Accept	Paste list from source	31		
	List rejected	Yes / No	32		
	Reject	Paste list from source	33		
	Comment		34		
Containers	Caddies (e.g. 5-10 litres)	Yes / No/ NS	35		
		size (litres)	36		Sometimes deduced from a picture
	Buckets (e.g. 10-25 litres)	Yes / No/ NS	37		
		size (litres)	38		Sometimes deduced from a picture
	Wheeled bins	Yes / No/ NS	39		
		size (litres)	40		Sometimes deduced from a picture
	Other bins	Yes / No/ NS	41		
		type	42		
		size (litres)	43		
	Biodegradable bags	Yes / No/ NS	44		
		User pays? Yes/No/ NS	45		
		Comment	46		
	Wrap in newspaper	Yes / No/ NS	47		Does not exist in Italy
		Comment	48		
Destination plant	Plant	Yes / No/ NS	49		Very seldom mentioned
		Name of the plant	50		
	Treatment type	Composting / AD / NS	51		
	Comment		52		
Information provided	Promote home composting?	Yes / No	53		
	Give reasons for collection?	Yes / No	54		
	Comment		55		Tax deduction is mentioned only where explicitly stated.
Para Data		Unique code			
	Population	no.	(6)	Total Residents	Data used for (8) (9) (10)
	Household - total waste	tonnes/ person-year	(8)	Waste	ARPA data
	Household waste sent for recycling/composting/reuse	tonnes/ person-year	(9)	Recycling	ARPA data
		% total	(10)	Recycling %	ARPA data
	Household food waste	tonnes/ person-year		Food waste	ARPA data
		% total		Food waste %	ARPA data
	Type	tonnes/ person-year		Compost	ARPA data
		tonnes/ person-year		Garden	ARPA data
	Reference	Year			ARPA data

Terms and synonyms for food waste noted in the research included the following:

"rifiuto alimentare" (food waste); "rifiuto organico domestico" (organic domestic waste); "rifiuto organico" (organic waste); "rifiuto putrescibile" (putrescible waste); "rifiuto umido" (wet waste); "frazione organica di rifiuti solidi urbani" (organic fraction of municipal solid waste); "frazione organica putrescibile" (putrescible organic fraction); "frazione umida" (wet fraction); "frazione biodegradabile" (biodegradable fraction); "mercatale" (market waste)

Results

Of the 786 websites examined, surveying municipalities with over 20,000 inhabitants, an estimated 83% of municipalities provide separate collection of food waste, with 68% offering food waste only collections.

On average, in Italy each person produces 479.5 kilograms of waste, of which 194.6 (more than 40%) are recycled. In terms of food waste, each person recycles 37.9 kilograms (35.5 for garden waste), as shown in Table 14.2.

Table 14.2. Average Wastes (in tonnes per person/year).

	Mean	Std. Dev.	Sample Size
General waste	0.479	0.20	6768
Recycling	0.195	0.13	6768
Food waste	0.038	0.04	4633
Garden waste	0.035	0.04	4526
Compost	0.0001	0.001	636

Charges. Bins and kitchen caddies are provided free of charge in most cases; some authorities charge for replacement containers. Most authorities also provide a starter pack of compostable liners free of charge; once these have been used new ones can be obtained for free or purchased, depending on the authority.

Optional or compulsory schemes. Although the websites did not explicitly state that participation in the food waste collection scheme was compulsory, it is compulsory for the councils to provide the service and for the households to use it (see aforementioned law). Often there are fines for people not complying with the rules set by the municipality, which are mentioned in the websites and collection calendars.

Frequency of collection. Frequency of collection is highly variable amongst municipalities, and collections may occur several times per week in the warmer regions of the South. Information provided on websites was also variable, with some websites stating their collection frequency for some streams but not others. Of the websites where information was provided, Table 14.3 shows the collection frequency for three different streams. Note that the 'Recyclables' stream includes a number of different materials which may be picked up at different frequencies in the same municipality.

Table 14.3. Collection Frequency (number of municipalities)

	FW		Residual Waste		Recyclables	
Once per 3-4 weeks	0	0%	0	0%	5	1%
Fortnightly	0	0%	26	5%	116	26%
Weekly	23	5%	330	62%	281	64%
Twice per week	287	58%	111	21%	31	7%
3-7 Times per week	184	37%	66	12%	8	2%
Total	494	100%	533	100%	441	100%

Materials collected. About half of the 786 websites examined provided information about separate collection (51%). Of these, almost all of them stated very clearly which materials were acceptable (92%). However, only 42% provided also a list of materials that should not be put in the food waste bins.

Paper and shredded paper are always collected separately from food waste. However, kitchen paper and tissues are accepted in food waste in most cases. Inconsistences in the data collected could arise from different interpretations by those collecting data (distinction between paper/card and kitchen paper). Oil/fat are also collected separately almost everywhere.

Table 14.4 shows materials explicitly listed as acceptable in different schemes. Bones and eggshells were explicitly mentioned in most cases, indicating that it was felt advice would be needed on this material.

Table 14.4. Selected materials specified as accepted in FW collections

	Yes	No	Not specified	No info	Total
Bones	463	97	82	142	784
Eggshells	577	11	54	142	784
Paper/ card	32	516	93	143	784
Shredded paper	31	492	117	144	784
Liquid	1	137	496	149	783
Oil / fat	3	424	205	152	784
Faecal	248	139	249	147	783
Plant	579	24	34	147	784
Biodegradable bags	459	13	166	146	784

Bags and liners. Compostable liners were provided by most municipalities as part of the service. However, few provided information about the eventual cost of new liners. Compostable liners are not provided where the food waste collection is done with communal street bins. Lining with newspaper or paper is uncommon in Italy. Most websites provide information on where the public can obtain new compostable liners. Also, it is worthy of mention that in Italy supermarkets are no longer allowed give clients non-biodegradable bags, so the biodegradable bags used instead may be another source of liners for the households.

Containers. Many municipalities provided a two-container system for food waste, including a small kitchen caddy and a larger outdoor caddy or wheelie bin.
Of all the websites providing information about containers (77%), 24% mentioned a caddy (5-7 litres), 39% a bucket (usually 25 litres), and 32% wheeled bins (usually 240 litres). However, very few gave information about the exact size of the containers.

Treatment process. Few municipalities mentioned how the waste would be treated. It is more common where consortia operate (it is mentioned on the website of the consortia). Table 14.5 shows the treatment processes used, where mention was made on the website.

Table 14.5. Waste treatment process type

	No. of municipalities	%
AD	70	36%
Composting	124	64%
Composting / AD	1	1%
Total	195	100%

Supporting information. 424 (54%) of the municipalities' websites promoted home composting. Some of them also explicitly mentioned tax reduction for people adopting it. 169 websites (22%) also provided supporting information on why home composting is important. Many websites presented entertaining graphics to encourage separate collection (e.g.Figure 14.1).

Figure 14.1. Example of separate collection advertisement in Trento (North-East, Trentino Alto Adige).

Summary of key findings

- An estimated 83% of municipalities with over 20,000 inhabitants in Italy provide a separate food waste collection, with 68% offering food-waste only collections.
- As yet there is no single common list of materials accepted in FW-only schemes, but a degree of consistency is emerging with only small differences between schemes.
- 2 or more times per week collection of food waste and weekly collection of residual waste is practiced in the majority of Italian municipalities.

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Appendix 15: Results of web-based survey on collection of source segregated domestic food waste in Latvia

Organisation of waste collection in Latvia

A residential home owner (landlord) of a detached house or a flat (in a high rise building) in Latvia has a duty to organize waste collection (Veidemane, 2007). Usually the landlord will sign a contract directly with a waste management company (Dzene, 2009). In some municipalities, however, the local government can take the responsibility for waste collection, transportation, handling and storage or it can choose a contractor to carry out waste management duties. Local government may also establish a joint service, which would include several local authorities (Veidemane, 2007). Most of the household waste in Latvia is collected using different size bins but in the old town of Riga (capital) places can be found where it is not possible to place a bin, and the waste has to be brought directly to the passing vehicle (Dzene, 2009).

The Ministry of Environmental Protection and Regional Development (MEPRD, Vides Aizsardzības un Reģionālās Attīstības Ministrija) is responsible for coordination of waste management information (VARAM, 2011). If a member of the public wants to obtain information about waste collection, the easiest way is to look at the website of the contractor. In order to find the waste management contractor in a particular location, it is best to look at the website of a particular local authority. The information provided can range from basic data (timetables and area of service) to more comprehensive details (the types of containers and services provided, recycling guidelines, etc.).

Methodology

The main national body providing information on waste management is the MEPRD (Vides Aizsardzības un Reģionālās Attīstības Ministrija, www.varam.gov.lv) and its established organisation the Latvian Environment, Geology and Meteorology Centre (Latvijas Vides, Geoloģijas un Meteoroloģijas Centrs, www.meteo.lv). The non-governmental body that provides information about waste management in Latvia is the Waste Management Association of Latvia (LASA, Latvijas Atkritumu Saimniecības Asociācija, www.lasa.lv), which is a national member of the International Solid Waste Association ISWA). These websites were searched for information on source separate food waste collections.

A general web search was carried out using google.lv advanced search with ‘Latvija’ – (Latvia) as the region restriction. The keywords used were: pārtikas atkritumu/food waste + savākšana /collection + Latvija/Latvia. Furthermore, the search was conducted to see if any food waste was collected separately for composting or anaerobic digestion, using the key words: ‘kompostēšanas’, ‘anaerobās pārstrādes’. Related terms found included: ‘bioloģiski noārdāmie atkritumi’, ‘virtuves atkritumi’. A number of websites were checked that included relevant information such as websites of waste management contractors, articles of Latvian universities. Also randomly selected departments of Local Authorities were checked to see if they gave any relevant information.

Results

It is stated in VARAM (2011) report that Latvia is divided into 10 waste management regions as seen in Figure 15.1.

Figure 15.1 Waste management regions in Latvia (Veidemane, 2007).

Latvia has a National Waste Management Plan for 2006 – 2012, which includes strategies for biodegradable waste treatment. This national plan is supplemented by regional plans. Veidemane (2007) states that these plans emphasise biodegradable waste from the food industry, parks and gardens more, compared to the kitchen waste. The source segregated food waste from the households is still collected as residual (communal) waste, which ends up in the landfill (Dzene, 2009). The communal waste from the households is only source segregated into plastics, glass and paper as seen in Figure 15.2.

Figure 15.2. Recycling containers in Latvia for plastics, glass, paper (Veidemane, 2007).

It is stated in the report by Dzene (2009) that around 54% of municipal waste is produced by households. In 2010 more than 0.57 million tonnes of municipal waste were collected. This amount also includes the source segregated biodegradable waste which accounts for 61 000 tonnes (Table 15.1). The latest investigations show, however, that the unsorted municipal waste still has 57% of organics (Dzene, 2009).

Table 15.1. Amount of collected biological and municipal waste in Latvia (LVGMC, 2011).

	Waste collected (tonnes)			
	2006	2007	2009	2010
Paper and cardboard	14,601	28,106	23,180	29,376
Biodegradable kitchen waste	50	93.5	10	-
Food oil and fat	240	319	190	307
Waste from marketplaces	546	235	647	654
Other biodegradable waste	17,608	20,635	21,910	30,760
Total biodegradable waste	33,045	49,387	45,940	61,060
Unsorted municipal waste	884,691	745,787	533,865	512,987
Total municipal waste	917,736	795,174	579,805	574,047

Note: A noticeable decrease of municipal waste from 2006 – 2010 could be due to the impact of economic recession.

There is no direct legislation requiring the treatment of biodegradable waste by composting or anaerobic digestion. Most biodegradable waste is still sent to the landfill. There are plans to build 50 new composting sites by 2012 (approx. 10% are established and working at present) (LASA, 2008). Separate biodegradable (food, green) waste collection is offered by waste management companies such as SIA ZAAO (www.zaao.lv/public/lat/par_sia_zaao/) and L&T Latvia (www.l-t.lv/en). This service is mainly provided for the public catering companies, food processing companies, hospitals, schools and other institutions. In addition, L&T Latvia offers to treat food waste arising in private households by using composting containers (See Figure 15.3).

Figure 15.3. Composting container (L&T, 2011)

The web-based survey has shown that there is a considerable amount of information about biogas potential in Latvia to generate 'green energy'. The location of existing anaerobic digestion plants is shown in Figure 15.4. However, no biogas is produced from household food waste.

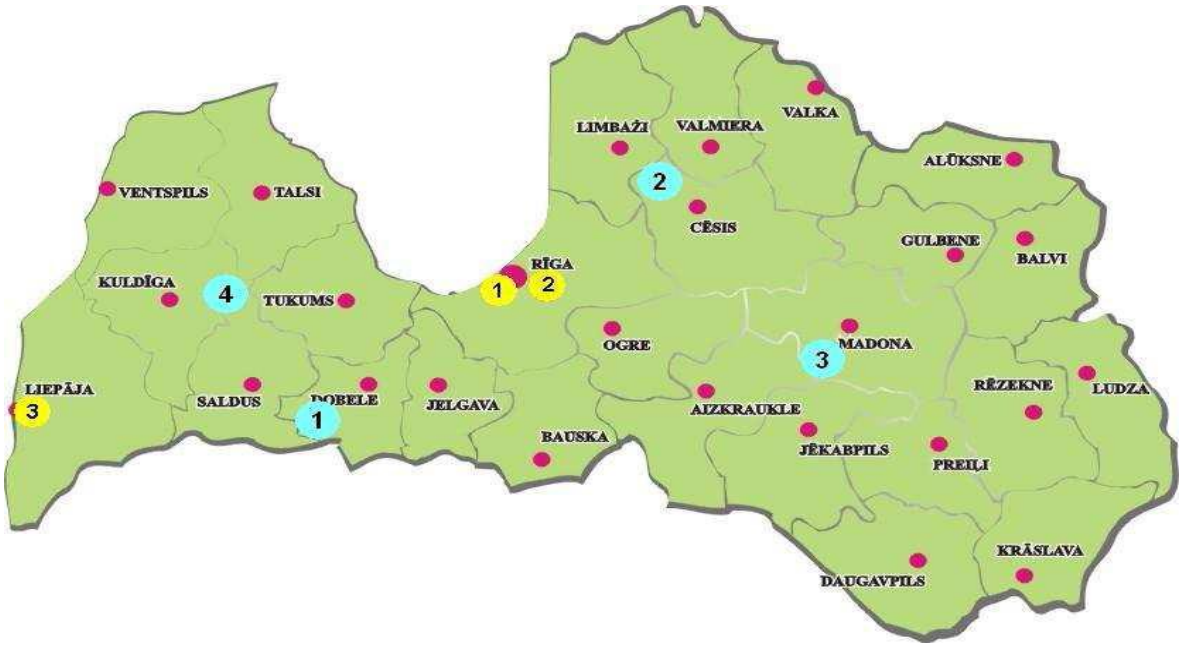

Figure 15.4. Existing anaerobic digestion plants (yellow), planned anaerobic digestion plants in 2008 (blue) (Dzene, 2009).

Existing:
1 – Company "Riga Water" wastewater treatment plant "Daugavgriva"
2 – Municipal waste landfill "Getlini"
3 – Municipal waste landfill "Kivites"

Planned:
1 – Scholastic research farm "Vecauce" of Agricultural University of Latvia
2 – Municipal waste landfill "Daibe"
3 – Kalsnava distillery
4 – Farm "Nogales"

The web-based search has also shown that in the year 2003 LASA started implementation of a new project 'Treatment of Biodegradable Organic Municipal Waste Using Composting Technologies'. The main goal of the project was to create and implement an optimal scheme for source segregated food waste in municipalities as well as to elaborate and apply appropriate composting technologies for high quality compost production from this waste (Bendere, 2006).

The source segregated food waste collection was implemented in two municipalities (Stopini and Kekava). Optimal routes for waste collection and transportation were calculated by using GIS program 'JS Latvia' (www.kartes.lv/lat/1400_js_latvia.php) taking into account the location of waste producers and the produced waste quantity.

Containers. The special 200-litre containers were used for biodegradable waste collection. The containers had an optimal circulation of air, which allowed reducing the odours. The containers were provided with labels containing the information what kind of waste must be sorted (Figure 15.5).

Figure 15.5. Containers with and without biodegradable bags (Bendere, 2006).

Collection. Several kinds of biowaste collection and transportation schemes were used during the project implementation:
- A full container was replaced with an empty one, which was cleaned and disinfected; special vehicles were used for the transportation (Figure 15.6).
- The biodegradable bags were replaced inside biowaste containers; full bags were collected into special transport without compressing (Figure 15.5).

Figure 15.6. Full container replacement (Bendere, 2006).

19 locations with 44 containers were established for source segregated biodegradable waste collection in Stopini and 16 locations with 39 containers in Kekava.

Treatment. Two composting technologies were investigated:
- Open-air composting in windrows and piles;
- Composting using a pilot equipment - experimental bioreactor designed for this project (Figure 15.7).

Figure 15.7. Left – open air composting; Right – Experimental in vessel composting plant (LASA, 2008).

Laboratory experiments. In order to improve field experiments, composting process was tested in a laboratory scale using solid-state bioreactor. The quality of compost was characterized by following parameters - pH, moisture content, total C, total N, C: N ratio. The compost quality was assessed by chemical, microbiological analyses, seeds germination tests, Toxkit microbiotests and IR spectroscopy (Bendere, 2006).

During the projects 600 tonnes of source segregated biodegradable household waste was collected. The content of the compost was investigated. Type and extent of pollution was analysed. The most cost effective option was analysed according to fuel usage, maintenance cost, labour cost, etc. At the end of this project it was colncluded that treatment in windrow is the most preferable option. However, the project was not extended due to a lack of financial instruments for such waste management schemes (private communication, Viduzs A. 2011).

Summary of key findings

- Source segregated food waste from the households is still not collected in Latvia.
- A pilot project on source segregated food waste collection has provided valuable knowledge and experience for waste management industry and related organisations.
- There is a need to establish financial instruments to promote source segregated food waste collection schemes.
- Consideration should be given to include food waste as an option for anaerobic digestion.

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Appendix 16: Results of web-based survey on collection of source segregated domestic food waste in Lithuania

Organisation of waste collection in Lithuania

Waste collection from households in Lithuania is organised by the Local Authorities. Local Authorities choose the type of waste collection scheme according to the area (urban or rural) that needs to be serviced. Approximately 75% of households in cities live in apartments or flats (Brazas, 2008), while the rest are in detached houses. The type of property influences the number and the capacity of the containers, the frequency of collection, etc.

Local Authorities can determine whether to organise waste collection themselves by establishing companies or to hire private contractors. During the period when Lithuania was in the Soviet Union all services were provided by the government. After Lithuania became independent, the government 'inherited' the management of this infrastructure, meaning that Local Authorities owned the waste management companies. Due to the huge resources required to maintain these services, in most cases the decision was made to privatise them. Now some Local Authorities own 100% of the local waste management company while in others it is partially or fully owned by private investors. According to the legislation Local Authorities still have the right to establish waste management companies: for example, KRATC (http://www.kratc.lt) is a waste management company newly established by 5 local authorities to serve the Klaipeda region. In some cities such as Vilnius there can be as many as eight waste management contractors. The disposal and treatment of the residual waste is managed by regional centres that are established by several Local Authorities.

The Ministry of Environment (Aplinkos Ministerija) is responsible for coordination of waste management information (LRS, 2011a). If a member of the public wants to obtain information about waste collection, the easiest way is to look at the website of the contractor. The information provided can range from the basic data (timetables and area of service) to more comprehensive data (the types of containers provided, recycling guidelines, etc.).

Methodology

The main national body providing information on waste management is Aplinkos Ministerija (www.am.lt) and its dependant organisation Aplinkos Apsaugos Agentūra (www.gamta.lt). The websites of these organisations were searched for information on source separate food waste collections.

A general web search was carried out using google.lt advanced search with ‘Lietuva’ – (Lithuania) as the region restriction. The keywords used were: maisto atlieku/food waste + surinkimas/collection + Lietuva/Lithuania. The search was then repeated by adding + nuo durų iki durų/door to door. Furthermore, the search was conducted to see if any food waste was collected separately for composting or anaerobic digestion, using the key words: ‘kompostavimas’ (composting), ‘anaerobinis pūdymas’, ‘anaerobinis skaidymas’ (anaerobic digestion). Related terms found included: ‘biodegraduojančios atliekos’ (biodegradable waste), ‘skaidžios atliekos’, ‘maisto/virtuvės atliekos’ (organic waste, kitchen waste), ‘komunalinės atliekos’ (municipal waste). A number of websites that included relevant information were checked such as online news portals, articles of Lithuanian universities, blogs and forums. Randomly selected departments of Local Authorities were also checked to see if they gave any relevant information.

The survey was carried out between 1-28 November 2011.

Results

It is stated in the legislation of the Lithuanian Republic that food waste arising from commercial activities such as food production, storage, schools, hospitals etc has to be collected. This waste cannot be mixed with other waste streams or landfilled. Food waste arising from commercial activities has to be collected in special containers and treated by composting or anaerobic digestion (LRS, 2011). The legislation does not define source segregated food waste collection from households. Food/kitchen waste from households is still collected as residual (communal) waste and ends up in the landfill. The communal waste from the households is only source segregated into plastics, glass and paper as seen in Figure 16.1.

Figure 16.1. Recycling container in Lithuania for plastics, glass, paper

It is stated in the Strategic Waste Management Plan (LRS, 2011b) that the Local Authorities have to organize communal waste collection in accordance with these clauses:

– Biodegradable waste has to be source segregated.
– Biodegradable fraction has to be treated in MBT, composting or anaerobic digestion facilities.
– Biodegradable waste has to be used for biogas production.
– The compost has to be used in different markets.
– The possible scenarios to process source segregated biodegradable waste with sewage sludge or agriculture waste have to be investigated.
– From this plan it can be seen that considerations were made regarding kitchen waste. However, still no source segregated food waste is collected from the households.

Brazas (2008) states in his study that there is approximately 1.3 million tonnes of communal waste arising each year. More than 50% of this amount is biodegradable waste (approximately 650 000 tonnes year^{-1}). Food waste takes the highest share of 35-40%. Paper/paperboard accounts for 15-20% and the rest is green waste. Composting sites in Lithuania are mainly established in major cities such as Vilnius, Kaunas, Klaipeda,

Druskininkai (KRATC 2011, KAUNO SVARA, 2011). Other composting sites are in the planning stage such as in Panevėžys. All composting sites in Lithuania mainly take green waste from households: in some cases green waste is composted together with sewage sludge.

The research by AAA (2010) indicates food waste destinations from different sectors as seen in Table 16.1. Since there is still no source segregated food waste collection in Lithuania the full amount arising is landfilled as communal waste. Food waste from the food industry is well sorted and is suitable for recycling; it is normally treated by composting or AD. Food waste from the food industry is also used as a feed for livestock in agriculture.

Table 16.1 Food waste generation sectors and relevant treatment destinations.

Sector of food waste generation	Amounts collected during 2010, (tonnes)	Disposal to Landfill, (tonnes)	Incineration, (tonnes)	Treated in composting or AD Facilities, (tonnes)	Use in agriculture, (tonnes)
Food Industry (Production)	175335	1706 (1%)	1485 (0.8%)	170878 (97.5%)	6139 (3.5%)
Public Catering (hotels, restaurants, etc.)	16 195	681 (4.4%)	-	15482 (95.6%)	-
Households	413330	413330 (100%)	-	-	-
Total	604860	415717 (68.7%)	1485 (0.2%)	186360 (30.8%)	6139 (1%)

The web-based search showed that there was a pilot study in Klaipėda region in 2010 (KRATC, 2011). The study aimed to investigate the potential of home composting in Lithuania. 270 households were provided with composting containers. The containers were used for composting green waste and source segregated food waste. The study showed good results and a high interest in the programme: 94% of 270 participants taking part in the pilot trial stated in an end-of-trial survey that there was a noticeable reduction in the amounts of communal waste, and expressed an interest in continuing (http://www.kratc.lt/). In 2012 there are plans to provide 10000 households with composting containers as seen in Figure 16.2. However, this study did not include residents from the flats.

Figure 16.2. Composting container.

KRATC also states on its web-page that the interest in the programme was so high that in the second trial (when 200/270 containers were distributed), it took only two weeks to have a full list of people who registered their interest to participate, compared to 70/270 in Neringa

town, which was a slow start. KRATC is still registering people who are interested in the programme and is preparing to provide up to 10000 containers in 2012. These good results could be explained in part by the fact that KRATC chose those properties who were paying for the communal waste services on time. This was done on the assumption that if the owner is managing his finances well the same sense of care will be shown for the composting process of food waste (http://www.kratc.lt/).

Brazas (2008) indicated possible options how the source segregated food waste could be collected from the flats. The author offered to provide large, frequently collected (covered) containers. In the same survey Brazas (2008) analyzed a case study of Šiauliai city. Different food waste generators were considered in order to estimate a viable (cost effective) option for a designed AD plant. However, the source segregated food waste from the households was excluded from the cost benefit analysis (only food waste from commercial sector was analyzed).

The web-based search also showed that one contractor in Vilnius is willing to collect source segregated FW from the households if the owner of the property orders the service (Atliekos, 2011). In addition, there are no available statistics online about operating AD plants in Lithuania.

Summary of key findings

- Source segregated food waste from households is still not collected in Lithuania
- A pilot study showed that home composting is a promising option. This study considered only privately owned households, however and did not include flats in which most of the population currently live.
- The Strategic Waste Management Plan states that biodegradable waste must be composted or treated in an AD plant. Most biodegradable commercial waste is treated in the composting facilities. The production of biogas from AD is at the experimental level and there is still a need for an infrastructure. In order for an AD plant to be viable in Lithuania, consistent FW collections are needed.

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Appendix 17: Results of web-based survey on collection of source segregated domestic food waste in Luxembourg

Organisation of waste collection in Luxembourg

Luxembourg is divided into 3 districts (Grevenmacher, Luxemburg, Diekirch) with 12 cantons and, since 2012, 106 municipalities (due to fusions of Clervaux, Park Hosingen, Ernztalgemeinde, Esch-sur-Sûre, Käerjeng, Schengen) (APC, 2011).

Luxembourg has collection systems for several types of recyclable waste, including biowaste (organic waste). Biowaste is defined as garden (green) waste **and** food (kitchen) waste (Grünabfälle und Küchenabfälle). Disposal of green waste is already possible in most of the municipalities: by 2010 the majority of compostable waste was collected in 7 major complexes. The two landfills for municipal waste are equipped with a separate collection station and have installations for the pre-treatment of the waste (shredding, sorting, homogenisation, organic stabilisation) (EURLEX, 2012). Anaerobic digestion is expected to become an important part of waste recycling. There are currently several biogas plants under construction or subjected to testing (GGDL, 2011). There are about 22 existing biogas plants in Luxembourg, operating on a variety of feedstocks. The municipality of Beckerich, for example, is aiming to become energy self sufficient by 2015. Their biogas plant produces appproximately 6000 m^3 biogas/day, resulting in about 4.5 kWh electricity/year and a similar amount of heat (JANZING, B, 2009).

Methodology

A general web search was carried out using google.com and google.lu. For each of the search engines the following key words were used:
biomüll luxemburg (biowaste)
biomülltrennung or biomüll trennung luxemburg (biowaste separation)
déchet biodégradable luxembourg (biodegradable waste)
déchets de cuisine Luxembourg (kitchen waste)
umweltministerium luxemburg (Environment Ministry)

The search was conducted without date restrictions, because key word research only resulted in the display of recent articles. German key words directed the user to German and French sites, including newspaper articles and government and industrial sites, as well as municipalities.

Results

32 municipalities (61.2 % of Luxembourg's population) collect kitchen and garden waste in the bio container (Biotonne) (Figure 17.1). A further 10 municipalities have weekly or fortnightly collection of seasonal garden waste. In some municipalities, garden and park waste has to be directly disposed at collecting points (GGDL, 2011).

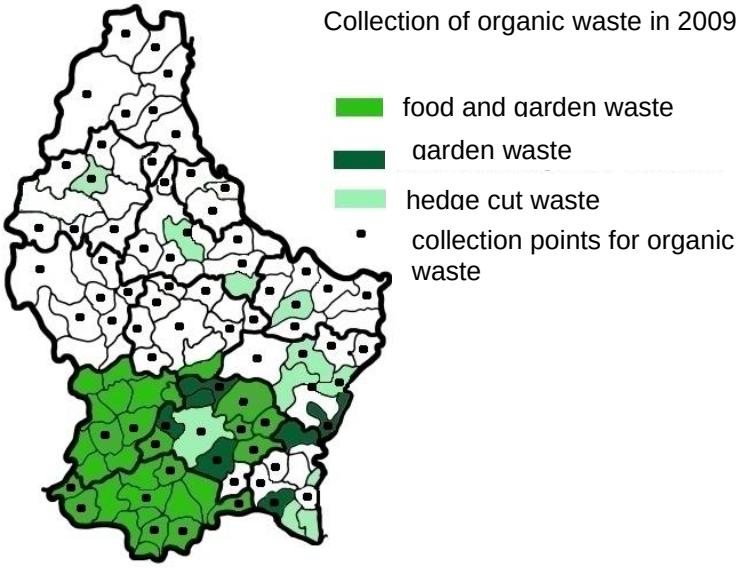

Figure 17.1 An overview of municipalities in Luxembourg with a collection of organic waste (GGDL, 2011).

Biowaste or 'Biomüll' in Luxembourg can contain garden waste (grass, leaves, moss, vegetable and fruit peels, flowers, plants, short hedge cuts) but also food left-overs such as bread, eggshells, fish, meat, teabags, coffee grounds. This is valid for all municipalities. Only materials unsuitable for anaerobic digestions such as soil and wooden hedge cuts must not be included into biowaste.

The inhabitants of the municipality Strassen, for example, can purchase 120-litre or 240-litre containers from the municipality. The weekly collection is free. In addition, every third Monday per month, big branches are collected, if they are reduced to 1.5 m and not heavier than 20 kg. Furthermore, inhabitants can deposit their organic waste at the 'Naturgasanlage Kehlen' (between Kopstal and Quatre Vents). This can also be done at the 'Recycling-Park' in Luxemburg city in der Rue du Stade, where they can deposit garden waste only. However, people are encouraged that the most efficient recycling form is to have a composter in the garden (ACS, 2011).
The pilot project „Minett-Kompost" (Syndicat intercommunal pour l'exploitation d'un centre de compostage régional à Mondercange; directed by SOVACOM s.à.r.l. and IGLux s.à.r.l.) had a great impact on the biowaste scheme (Figure 17.2). It was formed in 1994 by initially 16 municipalities. In this project, the population was informed about recycling and biowaste separation and the success rate of biowaste separation was measured. In parallel a biogas plant was constructed for recycling biowaste. It has a processing capacity of 20,000 tonnes/year (SIECCRM).

Figure 17.2 Municipality members of the 'Minett-Kompost' syndicate (SIECCRM).

Nevertheless, Luxembourg households are currently producing 700 kg/year house waste per capita, a relatively high amount compared to other European countries, which is mainly caused by a lack of biowaste separation and collection (MARX, L, 2012). Too often biowaste is still not separated from normal household waste, and makes 39% of the total waste weight. Municipalities with a biowaste container 'Biotonne' contributed to a weight of 66.9 kg/Ea, while municipalities without one produced almost double the weight (ILRES, 2009). In 2008, approximately 67.5 tonnes organic waste was collected and recycled, whereas still 46.5 tonnes remained in the residual waste (GGDL, 2011). At the moment, there are only around 30 municipalities (31 according to l'essentiel online (L' ESSENTIEL 2010), and half of the municipalities according to Marx (MARX, L, 2012)) offering biowaste separation (SMIRR, K, 2012).

According to an article in the l'essentiel (SMIRR, K, 2012) a new waste disposal act (Abfallgesetz) has recently come into effect to promote biowaste (Biomüll) separation. The new law enforces the obligation of the bio container (Biotonne) but biowaste separation is not compulsory and the biowaste container does not need to be displayed. Marcel Oberweis, a delegate and correspondent of the new waste disposal act, commented that the population cannot be forced to separate biowaste, and many households have their own garden compost. In fact, it is crucial to invite people to separate waste better in general. Whether or not the 'Biomüll-Tonne' is going to be introduced depends on the municipality (Kommune) (SMIRR, K, 2012). In the TNS-Ilres-Study (ILRES, 2009) about the use of the 'Biotonne' it was further shown that people living in flats are less likely to separate biowaste from residual

house waste due to a lack of space, less hygienic and the build up of odours (LUXEMBURGER WORT, 2010).

The new waste disposal act enforces the „pollueur-payeur"principle, that whoever produces waste has to pay for it. Fees vary accordingly to the amount of waste produced and to cover the waste disposal costs, without additional help of the municipal. Other municipalities will charge depending on the frequency of waste collection or size of container, but not the weight (SMIRR, K, 2012). The EU-Directive 2008/4 has enforced that until 2020, Luxembourg has to recycle at least 50% of house waste. In 2010, Luxemburg reached 42% (L' ESSENTIEL 2010).

Summary of key findings

- In all municipalities, biowaste includes garden waste as well as food waste.
- About 30 municipalities have a 'Biotonne' or bio-bin for biowaste; the collection service, however, varies between municipalities.
- Currently, organic waste still makes up 39% of household waste
- Households living in flats are shown to be less efficient in separating biowaste.
- Luxembourg is aiming to increase its biowaste separation in the next 8 years and to increase the number of biogas plants.
- There is no evidence of separate collection of green waste and food waste and no evidence of intention to introduce this in future.

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Appendix 18: Results of web-based survey on collection of source segregated domestic food waste in Malta

Organisation of waste collection and treatment in Malta

The primary waste management entity in Malta is WasteServ, a limited liability company established by the Maltese government in 2003. It has overall responsibility for waste management in Malta, and is 'responsible for organising, managing and operating integrated systems for waste management including integrated systems for minimisation, collection, transport, sorting, re-use, utilisation, recycling, treatment and disposal of solid and hazardous waste' (MRRA, 2009a). It is an autonomous government entity but is intended to allow for private sector development, acting as the 'operator of last resort' (MRRA, 2009a).

Waste collection at the householder level is the responsibility of the local council, of which there are 68 in Malta. The collection is carried out by private operators under contract to the municipality. There has also been effort to group the localities into regions, to enable a more rationalised and cost effective collection of MSW (MRRA, 2009b). Two national recycling schemes, GreenPak and Green MT operate collection infrastructure and services for recyclables, delivered through local councils.

Methodology

General information on waste management in Malta was obtained from WasteServ's website, www.wasteservmalta.com and the Ministry for Resources and Rural Affairs (MRRA) which has published a Waste Strategy for Malta in 2001 (MRRA, 2001) and first update in 2009 (MRRA, 2009). Other national bodies whose websites and documents were consulted were the Malta Environment and Planning Authority (MEPA) www.mepa.org.mt; the MRRA's own site www.mrra.gov.mt; those of individual local councils; recycling schemes Green Pak http://www.greenpak.com.mt/ and Green MT http://www.greenmt.org.

A list of all the local councils in Malta was obtained from the Maltese government's website http://www.gov.mt/index.asp?l=2, and their web pages within the site were examined for householder information on waste management. Web searches were also conducted in Google using each local council's name as key word, to find councils' related websites.

Google searches were also conducted using the following terms, with Malta as the region restriction: Waste management; home composting; organic waste; food waste; kitchen waste; waste audit 2009, 2010, 2011; waste strategy 2009, 2010, 2011; Green Pak; Green MT; WasteServ; water services.

WasteServ was contacted by email to confirm the findings of the web searches. Two former and current residents of Malta were also contacted by phone and email to confirm the situation in their neighbourhoods.

All research was conducted during the month of November 2011.

Results

There is currently no domestic food waste-only collection in Malta. Kerbside collection of refuse is provided multiple times per week, with frequencies of four to seven collections per

week (as noted on various councils' websites and confirmed by residents). Source-segregation of wastes is in its early stages; weekly kerbside recycling collection has been introduced in the past few years in most local councils, but householder participation has not yet reached a high level. As of 2009, this initiative was estimated to be collecting 27% of available recyclables in the waste stream (MRRA, 2009).

There are now 1000 bring sites in the country where containers are provided for recyclable materials including cardboard, paper, glass, metal and plastic (WasteServ, 2011).

Civic amenity sites, of which there are 5 currently operational, do accept garden waste in addition to a number of other waste streams including recyclable cardboard, paper, glass, metal and plastic, edible and lubricant oils; furniture and white goods; batteries and other household hazardous waste; e-waste; household construction waste; and tyres (MRRA 2009a). No food waste is accepted at these sites (WasteServ, 2008).

Home composting is encouraged; WasteServ offers subsidized bins for purchase by householders at a cost of €30 each. However there is currently little home composting (Boehmer et al., 2008). Some households dispose of food waste by in-sink disposers; however the most common disposal of household food waste is in mixed refuse (MRRA 2009a; Chanel, 2011 *pers.comm.*).

There is one anaerobic digestion plant in the country; this is part of the Sant' Antnin Mechanical-Biological Treatment (MBT) facility. In addition to the digester, the facility includes a Materials Recovery Facility (MRF) sorting mixed recyclables collected from kerbside recyclable and bring-in sites around the islands, and a Mechanical Treatment plant where mixed refuse is mechanically sorted into organic and non-organic fractions. The non-organic fraction, after recovery of metals, is converted to refuse-derived fuel (RDF), some of which is currently exported for combustion, and some baled and stored in anticipation of the construction of an RDF combustion facility on the island. The organics are feedstock for the anaerobic digester. The digestate is dewatered and used for landfill rehabilitation and other WasteServ rehabilitation projects (WasteServ, 2011).

The Sant' Antnin facility is designed for 35,000 tpa of organics; this is the amount determined to be recoverable from the waste stream (MRRA, 2005/2009). The capacity for recyclabes is 36,000 tpa (Cordina, 2011); the facility's overall capacity is equal to one third of Malta's waste (Yousif, 2009).

The 2009 Waste Strategy consultation document also suggests that the government should legislate in favour of separate collection and disposal of catering waste to the Sant' Antnin facility (MRRA, 2009); currently there is some separate collection from hotels, but not restaurants (Chanel, 2011 *pers.comm.*). The strategy consultation document also recommended the development of two more MBT plants, which would potentially also treat animal manures and sewage sludge from the plants' catchment areas.

A scheme for the collection of used cooking oil from food establishments, for conversion to biodiesel, has also been introduced, with three private companies working on the island (Yousif, 2009).

Malta's two previous landfills were closed in 2004, and replaced by two new engineered landfills with gas collection and utilisation (generators to be installed in 2010 and 2013). The

long-term plan is to avoid the building of new landfills in favour of energy generation from waste via incineration and anaerobic digestion (Yousif, 2009).

Summary of key findings

- There is no separate collection of food waste or organic waste from households in Malta.
- A limited number of civic amenity sites (5) do provide yard waste disposal, but not food waste disposal.
- Home composting is recommended but not widely practised.
- Although separate collection of organics from catering facilities has been recommended in the waste strategy, implementation thus far is limited to hotels only.
- There is one anaerobic digestion facility for organic waste in the country; this is part of a mechanical-biological treatment (MBT) plant processing mixed waste.
- Two additional MBT plants have been proposed, that may potentially also process other organic waste streams such as animal manures, fishery waste and sewage sludge.

Acknowledgements

Thanks to Chanel Marie Brincat of WasteServ Ltd., and Kristine Viger and Claire Mifsud, former and current residents of Malta, for providing information.

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Maltese Waste Management Wasteserv http://www.wasteservmalta.com/
- Civic Amenity sites http://www.wasteservmalta.com/facilities.aspx?id=116
- Home composting http://www.wasteservmalta.com/wastemanagement.aspx?id=108
- San Antnin http://www.wasteservmalta.com/sanantnin.aspx
Government of Malta http://www.gov.mt/index.asp?l=2 and local councils nested on this webpage (68 in total), at http://www.gov.mt/frame.asp?l=2&url=http://www.lc.gov.mt
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Malta Wastewater http://www.wsc.com.mt/(S(eqpk2x552ppql545opuvgobg))/default.aspx?MLEV=15&MDIS=20
Water Services Corporation www.wsc.com.mthttp://www.wsc.com.mt/(S(gmnaygu3s5uwj24530x2ti45))/default.aspx?MLEV=4&MDIS=15
Valetta tourism http://www.malta.com/en/about-malta/city-village/valletta

Appendix 19: Results of web-based survey on collection of source segregated domestic food waste in the Netherlands

Organisation of waste collection in the Netherlands

Waste collection in the Netherlands is the responsibility of local authorities; local authorities (LA) can be a large(r) city council, one municipality or a group/cluster of smaller municipalities that form a cooperation. These cooperating municipalities have set up agreements per region and jointly hire a waste collector. Local authorities may also carry out collection by direct labour using their own employees, or may subcontract the collection service to an external organisation. The first is often the case in the larger and medium sized cities, the latter often by cooperation bodies set up by multiple municipalities. In total of approximately 300 organisations are active in the collection of household waste.

Table 19.1. Waste collection % by way of organisation in 2010

Organisation	Number
Service by city/municipality	37
Arrangement by cluster of municipalities	24
Private waste collectors	39
Total	100

Source: CBS

The waste collector is responsible for collection of household waste streams in a specific region. In most cases the waste collector selects the company that takes care of treatment and disposal of the waste streams. In a number of cases the collector and treatment provider are one and the same company. Some companies do not collect household waste but only corporate waste streams, often hired by corporate companies.

The cost of household waste collection is covered as part of a general local tax levied on each household. In several LAs the local tax has been replaced by the so called diftar, differential tariffs per type of waste.

An additional charge is levied for disposal of bulky items, at the discretion of the LA. This waste is collected when called for by the client or may be disposed to a civic amenity site where citizens can deliver their waste, for example beds, construction material and old electrical equipment.

Concerning household waste, the LA is responsible for the supply of any container required to hold the waste that it has statutory duty to collect, but is not required to provide additional lining materials. It is also not responsible for supplying equipment such as home composters or garden refuse sacks, although it may do so free of charge or at a subsidised rate depending on local policy. For example the Gouda city council organizes extra collecting of garden cutting waste free of charge in the cutting season. This is different per city or region.

Many town centres in medium size and larger cities are still being discharged of separate waste collection for practical reasons. There is no or not enough space to store containers required for separate waste collection. The same issue can be found in large apartment buildings. There is a growing trend, however, to build large-size collective underground storage containers in these areas, where the regular collection of separate waste will be replaced by this compulsory form of waste disposal.

Figure 19.1. Underground containers. Source: http://milieukrantonline.nl

The starting point and standard for the Dutch waste treatment policy is the so called 'Ladder of Lansink'. Ad Lansink, after whom it was named, was a Dutch politician who developed this standard and brought it into parliament for voting in 1979. The policy sets priorities and ranks the most environmental friendly waste treatment systems. Governmental policies and regulations should be focussed on achieving waste to move up the ladder into better ways of treatment. The Ladder of Lansink consists of 4 steps:

- prevention
- recycling
- combustion
- disposal (landfill)

Household waste collection in the Netherlands is recorded in the National Waste Policy Plan II ('Het tweede Landelijk afvalbeheersplan (LAP), www.LAP2.nl). The LAP is based on the above described Ladder of Lansink and has taken effect in 2009 and will stay valid until 2021. Main goals to achieve are:

1. Stimulation of waste separation by citizens.
2. Increase household waste recycling from 51% in 2006 to 60% in 2015.
3. Reduce the disposal of flammable waste.
4. Reduce environmental impact of waste with 20% by 2015 for the following waste streams:

- Paper and card
- Textile/clothing
- Construction and demolition waste materials
- Organic waste (garden) / food ("Groente Fruit en Tuinafval", GFT)
- Aluminium
- Plastic
- Larger household waste

Food waste and garden waste (GFT) of household origin are collected in one waste stream in the Netherlands, normally in a green container, a so-called KLIKO. Kliko is a brand name used by the Craemer company (www.craemer.com). Originally the acronym comes from the company names Klinkenberg en Koster. At the end of the 1950s these two family businesses sold the first household garbage lorries and named the containers they produced for household usage Kliko.

The Kliko's have different colours: grey for general household waste, green for organic waste and grey with a blue lid for paper and cards. However, the latter are not commonly used in the Netherlands as most paper and card waste is collected in communal containers located at certain spots in the cities and villages. The same goes for glass and textiles which are also collected in special communal collection containers.

Source: http://www.kliko.nl

Figure 19.2. Examples of Glass, paper and textile containers.
Source: http://mcbmilieuentechniek.nl/products

In the past few years plastic separation has become a 'hot' item in the Netherlands. As in other waste streams the municipalities are free concerning the way they organize the process and not all are doing it yet. But a growing number of municipalities do collect plastic separately and collection is done by biweekly collection in plastic bags delivered free of charge, and in some areas with containers.

The central governmental body responsible for waste management is the Department for Infrastructure and Environment (Ministerie voor Infrastructuur en Milieu, http://www.rijksoverheid.nl/ministeries/ienm). All legislation and rulings come from this department. The day to day responsibilities have been delegated to the local authorities.

Information on waste collection services is widely publicised on local authority Webpages. Almost all collectors and waste treatment companies maintain websites with clear and up to date information about their activities as well.

Methodology

A systematic search was carried out of relevant webpages, with the aim of identifying who manages and offers the collection of source segregated food waste and green wastes (GW). The starting point was the website of the branch organisation ('Vereniging Afvalbedrijven" = Association of waste companies; www.verenigingafvalbedrijven.nl) which includes all commercial enterprises in the waste collection and waste processing industry. The next website explored was the site of the NVRD (Koninklijke Vereniging voor Afval- en Reinigingsmanagement). This acronym stands for the association of the Dutch local authorities responsible for public areas and the collection of waste, as well as the companies (often municipality organisations) that operate the waste and cleaning activities.

Other webpages explored were the sites of the CBS (Central Bureau for Statistics) which are: www.CBS.nl and www.statline.cbs.nl. The website initiated by the government (www.GFT-afval.nl) provides a lot of information on the waste streams.

The site www.LAP2.nl contains national guidelines, policies and plans. Another site explored was www.compendiumvoordeleefomgeving.nl which explains and evaluates the information and numbers provided by the Central Bureau of Statistics, the PBL (Planning Agency for the environment) and the University of Wageningen. These main websites led to many other websites providing information on this research.

In addition a general web search was carried out using google.com with the search term ‘Afval' (Waste), GFT ("Groente Fruit en Tuinafval", Garden Waste), Voedselafval (Food Waste) and KLIKO, the waste containers that became a brand name in the Netherlands. Another interesting site is www.afvalonline.nl a commercial publishers providing news, annual reports and relevant waste market information. A part of the information is freely accessible.

Local authority area and population data was obtained from CBS (2009, 2010); 2011 is not yet available. Tonnages of household waste collected and tonnages sent for recycling, composting or re-use in 2010 were taken from the same sites mentioned above. The main websites used are included in the appendix of this report with the links.

Results

Dutch citizens produce 537 kg of household waste per person on a yearly basis. 269 kg of this waste is being offered separated to the collecting companies (by private households). Of this 269 kilo, 67 kg are delivered to designated areas in a municipality (construction waste, refrigerators, beds etc.) and separated on the spot. 202 kg are separated by the household and delivered in containers and collected separately.

Table 19.2. Average waste per person per year in the Netherlands in 2010

Waste	Total kg/person-year
Total waste	537
Separated	269
Separated delivered to designated collection areas (large size waste)	67
Other (separated) waste streams	202
Garden and Food waste (GFT) (Incl. in Other separated waste streams)	76

Source: http://www.milieucentraal.nl/ and the sites of CBS (Central Bureau for Statistics)

This means that for each person every year 268 kg are not separated and are delivered to waste treatment companies to be destroyed in incinerators. Official sites state that in total each person creates 160 kg of food and garden waste per year but that only 76 kg is being collected separately. This means that 84 kg of organic waste are being combusted.

Organisation of collection and processing of waste was already the responsibility of the LA. Since the introduction of the governmental guidelines in LAP (the national policy), however, LAs are free in how they organize the collection process. Officially municipalities are still obliged to collect waste streams separately, but via an imposed discretional measure the LA may decide to choose differently. This enables municipalities to choose different means of waste collection for town and city centres or even sometimes entire large cities. The reason is mainly practical, no space to store containers for separate waste collection in most household

situations in the area. For example the city of Rotterdam decided to postpone the separate collection of Garden/Food Waste (GFT) and chose for sorting waste streams afterwards at the dumping ground or waste treatment company site.

The result is that in areas with higher urban density the amount of separate GFT collection is lower than in areas with lower urban density. Below a brief explanation of urban density parameters in the Netherlands.

A: Degree of urban density

In the Netherlands the standard is to collect waste streams separately. The set up of waste collections depends on the degree of urban density. The branch organisation NVRD carries out a benchmark survey every year. This survey shows how Urban Density relates to the amount of GFT collected separately. The CBS (Central Bureau of Statistics) defines 5 different classes of urban density, which are shown and explained in Table 19.3:

Table 19.3. CBS classes of urban density

Class	Description	Density	Population	
			year	*no. of people*
1	High Urban ("zeer sterk stedelijk")	> = 2500 households per km²	2009	3 220 540
			2010	3 291 210
			2011	3 357 780
2	Rather Urban ("sterk stedelijk")	1500 – < 2500 households per km²	2009	3 850 580
			2010	3 915 540
			2011	3 945 740
3	Medium Urban ("matig stedelijk")	1000 – < 1500 households per km²	2009	3 013 780
			2010	3 015 000
			2011	3 030 250
4	Low Urban ("weinig stedelijk")	500 – < 1000 households per km²	2009	3 169 870
			2010	3 153 950
			2011	3 140 230
5	Rural "niet stedelijk"	< 500 households per km²	2009	3 231 010
			2010	3 199 290
			2011	3 181 800

Source: CBS, 2008 – © Centraal Bureau voor de Statistiek, Den Haag/Heerlen 17-4-2012

The cost of household waste collection is covered as part of a general local tax levied on each household. For example in the second largest city of the Netherlands the tariff for waste collection per year in 2012: € 315.40 (approx. 259 GBP) per household. In a medium-sized town like the famous cheese town Gouda, a household of multiple people pays € 336. In several LAs the local tax has been replaced by the so called 'diftar', differential tariffs per kilogramme type of waste.

This system has been set-up to stimulate the separation of waste and effectively means that separated GFT waste is cheaper when collected compared to general unseparated household

waste. The trend of municipalities using a diftar system is a bit unclear and also depends on the national waste policies that have become less strict in the past few years. The Waste discussion group (Afval Overleg Orgaan) reported that in 2003 approx. 140 municipalities used a diftar-system, covering >1,3 million households (3,5 million people) 21% of the inhabitants of the Netherlands. According to Wikipedia 17.4 % of the Dutch lived in a diftar using municipality. In 2000 only 9.7 % of the Dutch lived in a diftar using municipality.

Figure 19.3 shows the urban density classes in relation to provided GFT collection. The blue columns are areas with general local tax for waste collection, the red bar represents the diftar set-up. The height of the diftar charge is determined by each LA.

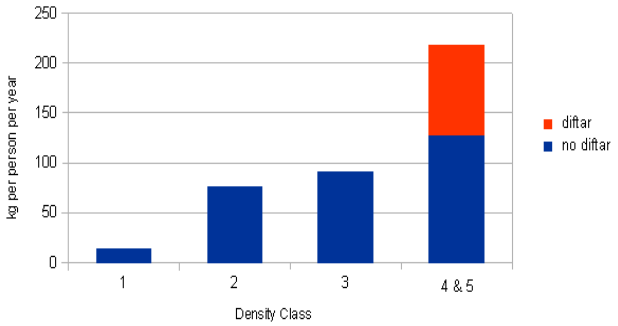


Figure 19.3. GFT collection in different urban density classes

Table 19.4. Data for Figure 19.1

Group	GFT collection in no-diftar-area (in kg per person per year)	GFT collection in diftar-area (in kg per person per year)
Density Class 1	14	-
Density Class 2	76	-
Density Class 3	92	-
Density Class 4&5	127	92

Source: NVRD Benchmarking report 2010

Based on the values above it can be concluded that approximately 20% the Dutch population of 16.6 million people live in areas with modestly organized GFT collection. 24% of the population have a medium level of separated GFT collection and just over half of the population (located in Medium & low urban and rural areas) have a dedicated and effective form of separated GFT collection.

The whole population is aware of the separate GFT waste collection, but mainly due to practical reasons of storage and processing the waste streams in town centres and large cities, these municipalities chose other ways of waste collection which results in 44% of Dutch inhabitants not having practical ways of separate GFT collection. However, some of these municipalities do separate the waste after collection.

Table 19.5. Population of LAs by type of GFT service provision

GFT collection	Population	%
Modest level of organized separate GFT waste collection (Urban density class 1&2)	7,303,520	44
Medium organized GFT collection (Urban density class 3)	3,030,250	18
Affective level of GFT waste collection (Urban density class 4&5)	6,322,030	38
Totals	16,655,800	100

Source: CBS

All municipalities are obliged to collect separate types of waste every fortnight. In municipalities without separated waste streams the garbage is collected every week. This is common practice in the entire Netherlands. The municipalities are obliged to provide a scheme for waste collection. Most have this on their website and often also distribute printed schemes from door to door or in local newspapers.

The Netherlands are divided into 12 regions ('provincies'). Table 19.6 shows the total amount of household waste and the separate amount of GFT per region and per inhabitant of the region. Also included in the table is the so called bulky garden waste ('Grof tuin afval'), which is too big to be collected in common containers and therefore needs to be brought for disposal at a civic amenity site.

A list of all 535 Dutch municipalities has been included at the end of this report, showing the total amount of household waste per inhabitant and the amount of separately collected GFT waste for 2010.

Table 19.6. Household and GFT collection per inhabitant region

Household and GFT collection by region

	Total waste	**GFT**	**Bulky garden waste**	
Regions	*in kg per person per year*			*population in 2010*
Total in the Netherlands	535	76	27	16 578 604
Groningen	551	82	29	576 717
Friesland	632	119	54	646 349
Drenthe	608	133	33	490 902
Overijssel	497	81	23	1 130 576
Flevoland	511	66	16	387 900
Gelderland	506	101	25	1 999 416
Utrecht	528	78	22	1 221 014
Noord-Holland	515	57	15	2 670 428
Zuid-Holland	525	50	13	3 507 022
Zeeland	734	108	44	381 431
Noord-Brabant	553	81	47	2 444 537
Limburg	516	76	51	1 122 312

Source: CBS

B: Materials collected

The Dutch government provides a list of waste materials allowed in the separate GFT collection, which is valid for the entire country:

- Vegetable, fruit and potato peelings (schillen en resten van groenten, fruit en aardappelen)
- All food waste
- Meat and fish (including bones and shells) (Vlees, vis, incl. botten, graten en schelpen)
- Nut shells, egg shells and other nut waste (pindaresten, notendoppen en eierschalen);
- Vegetable oils, fats (plantaardige olie en gestold vet);
- Tea bags, coffee grounds and filters (theezakjes en filters met koffiedik);
- Bread and cheese crusts without plastic (brood en kaaskorsten (zonder plastic));
- Weeds, small garden waste –grass, cutting and leafs (onkruid, klein snoeiafval, gemaaid gras en bladeren);

- Flowers and houseplants (snijbloemen en kamerplanten);
- Manure of small pets, when with straw or fillings from catbins when it carries an eco label (mest van kleine huisdieren met stro, kattenbakvulling metmilieukeur).

Materials listed as acceptable in almost every case included raw and cooked meat and fish; dairy products such as cheese; bread, pasta and rice; fruit/vegetable waste; tea and coffee grounds; and generic materials such as plate scrapings.

To assist the public in understanding how to separate waste a central website is being provided with an alphabetical listing on all possible materials with a link to the waste stream (i.e. container) the material should be collected. For example potato peelings, click on the word and the system will say GFT container.

C: Bags and Bins (Containers)

Areas where no separated waste collection is practised have two ways of waste collection. Most commonly used is the grey bag (vuilniszak), which should be put on the pavement in front of the house for pick-up by a garbage truck on the weekly collection day. The other way, which is growing in popularity and rapidly becoming a common method of waste collection, is the use of underground containers. This system does allow separated waste collection, for example in apartment buildings.

In most areas with separate waste collections two different containers have been distributed to the households, one for general household waste (most commonly of a grey colour) and a liner for GFT, normally a green container. Every week one of the two gets emptied by a garbage truck to collect the specific waste stream.

In some apartment buildings, especially senior citizen housings, small kitchen bins are distributed for food waste and small garden and plant waste.

All of the LA websites provide information on the type of containers and bins used in the area. The commonly used container, the 'KLIKO' is in line with European Standard EN 840-1, from 2004: Mobile waste containers (Figure 19.4). Containers with 2 wheels with a capacity up to 400 l for comb lifting devices, dimensions and design.

Figure 19.4. Typical collection container Source : Wikipedia

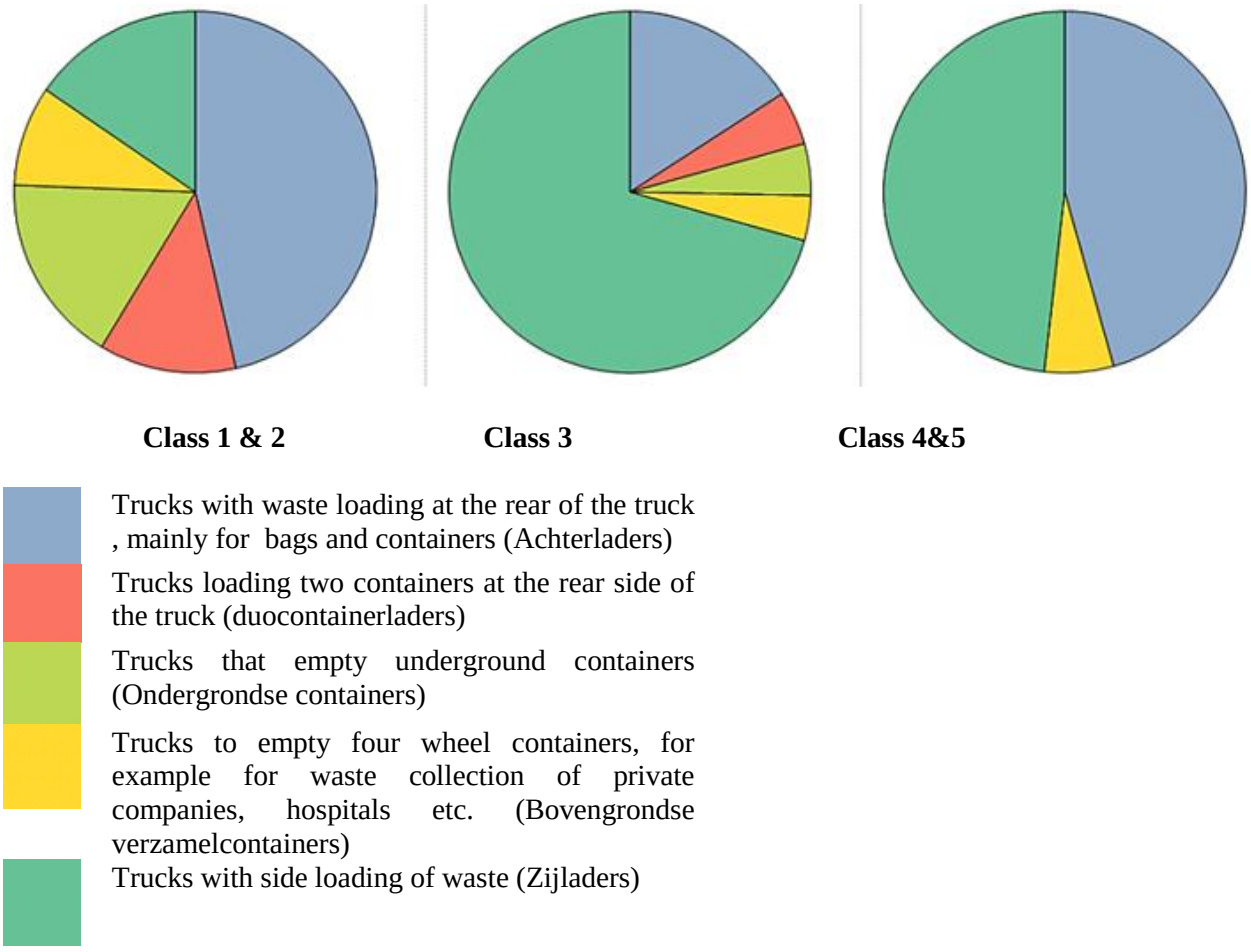
D: Collection vehicles

70% of the Dutch market is serviced by garbage collection trucks from company Geesink Norba. They have a cooperation and partnership design agreement with collector Gansewinkel. A year ago (March 2011) the other large waste collector company Sita also ordered their trucks from Geesink Norba.

The trucks used are related to the way the waste streams are collected. As said before, the way of collection of waste streams is related to the urban density in the areas/regions.

Figure 19.5 shows the split of collection methods and thus the trucks used for the collection of GFT-waste per urban density class.

Figure 19.5. Waste collection per urban density class



Source: NVRD Benchmark report 2010

From Figure 19.5 it can be concluded that in areas with urban density classes 1&2 (= high urbanisation) all waste collections occur, but that there is a clear preference for lorries with loading via the rear site of the truck.

In urban density class 3 areas (medium urbanisation), lorries with side loading are the most common way of waste collection. In areas with low urban density, class 4&5, rural or low urbanisation, show an almost 50:50 balance between rear loading Lorries and side loading trucks.

Figure 19.6 shows some examples of types of refuse collection vehicles used. Pictures were taken from the websites of the lorry production companies Haller and Geesink Norba and one from the website Stadskrant Veghel.

Lorry with side loading
Source picture: Haller

Lorry with rear loading facility
Source picture: Geesink Norba

Duo container lorry
Source: http://veghel.kliknieuws.nl/nieuws/80274/Harde

Lorry to empty four wheel containers
Source: Geesink Brochure

Figure 19.6. Types of collection vehicles

E: Treatment process

Processes used for GFT waste treatment are anaerobic digestion (AD) and composting, performed in installations/operations at regional sites. All installations are capable of running (aerobic) composting processes, but not all can run an anaerobic digestion process.

With the exception of Lelystad, the majority of the country decided to use aerobic composting of GFT in large halls when separated waste collection became widespread in the 1970s. The majority of treatment installations (88%) in the Netherlands currently use a composting process. Only 8% used anaerobic digestion, which shows that this method is still in its infancy in the Netherlands. But interest appears to be growing rapidly, with several organisations reporting that they are investigating this method.

For anaerobic digestion the most recent and complete data found in the survey dates from 2010; for composting this was 2009. It was therefore decided to use the data from 2009 to provide the best comparison. In 2010 two more locations started to use the anaerobic digestion process. Table 19.7 gives and overview of installations by process, followed by a more detailed overview by region in Table 19.8.

Table 19.7. Summary GFT waste treatment by by process in 2009

Process	No. Installations	%
AD	1	4
Composting	20	88
AD and composting	1	4
Not specified	1	4
Total	23	100

Source: De Informatieman

Table 19.8. GFT waste treated by anaerobic digestion and composting per installation 2009

Region	Waste Treatment Site	GFT waste	AD	GFT Composting	AD % of total GFT	Composting % of total GFT waste
		in ktonnes			*%*	
Groningen	Oost-Groningen Afval Recycling (OGAR)	31	-	31	-	100
	Composteeringsinrichting Usquert	11	-	11	-	100
Friesland	Orgaworld compostering Drachten	68	-	68	-	100
Drenthe	Attero Noord	146	-	146	-	100
Overijssel	Twence Compostering	68	-	68	-	100
Gelderland	AVR Afalverwerking	14	-	14	-	100
	VAR biogeen afd. Composteren	207	53	154	26	74
Flevoland	Orgawold vergisting Biocel	27	27	-	100	
	Orgaworld Compostering Lelystad B.V.	34	-	34	-	100
Noord-Holland	HCVcompostering locatie Middenmeer	55	-	55	-	100
	De Meerlanden compostering B.V.	26	-	26	-	100
	HVCcompostering locatie Purmerend	72	-	72	-	100
Zuid-Holland	AVRAM	0	-	-	-	-
	GTF Compostering Bergschenhoek	6	-	6	-	100
	GTF Compostering Europoort	71	-	71	-	100
	GTF Compostering Alphen aan den Rijn	58	-	58	-	100
Zeeland	GTF Compostering Vlissingen-Oost	52	-	52	-	100
Noord-Brabant	Attero Zuid, locatie Moerdijk	84	-	84	-	100
	Van Kaathoven Compostering Bladel B.V.	11	-	11	-	100
	Van Kaathoven Compostering St. Oedenrode B.V.	26	-	26	-	100
	Attero Zuid, locatie Deurne	48	-	48	-	100
Limburg	Attero Zuid, locatie Maastricht	76	-	76	-	100
	Attero Zuid, locatie Venlo	66	-	66		100
Imported GFT wast		5				
Total GFT-waste processed		1.257	80	1.177	6	94

Source: 'Afvalverwerking Nederland, gegevens 2009 en 2010'

Table 19.9. GFT waste treated by anaerobic digestion per installation/site in 2010

Region	Installation/site	GFT Waste	GFT treated with AD	GFT composting	% AD	% Composting
Overijssel	Natuurgas B.V.	12	12	-	-	100
Gelderland	VAR biogeen afd. Composteren	199	52	147	26	74
	Orgawold vergisting Biocel	25	17	8	68	32
Limburg	Attero Zuid, locatie Venlo	73	73	-	100	-
Total		309	154	155		

Source: 'Afvalverwerking Nederland, gegevens 2010'

Summary of key findings

- Food waste and garden waste (GFT) of household origin are collected in one waste stream in the Netherlands
- Collection systems are well established and widespread
- Local authorities are responsible for collection but have freedom to decide how this is done and may base decisions on practical factors e.g. lack of space to store containers for separate waste collection in most households in the area
- The amount of separate GFT collection is therefore lower in high density urban areas than in areas of lower density
- Detailed information is available on the quantity of GFT collected per area
- Materials accepted as GFT are defined centrally by the Netherlands government
- Materials accepted are compatible with those in FW-only collections in many cases
- The majority of collected waste is still treated by aerobic composting; anaerobic digestion is still uncommon but appears to be growing rapidly

Attachment 19.A

References / Links - This appendix includes links checked, not all information has been used in the report.

Waste Policies (Afvalbeleid)

- Targets waste treatment policy (doelstelling afvalbeleid)
http://www.rijksoverheid.nl/onderwerpen/afval/documenten-en-publicaties/toespraken/2011/08/25/presentatie-van-meer-waarde-uit-afval.html

- National Waste Policy Plan II ---> Landelijk Afvalbeheer Plan (LAP)
http://www.lap2.nl/
http://www.milieucentraal.nl/themas/afval-heb-je-zelf-in-de-hand/afvalscheiding

Amounts of waste (Afvalhoeveelheid)

- Total amounts of waste per inhabitant per municipality (Gemeentelijk afval – heel NL) 1993-2010 http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=7467&HD=120411-1047
- Total amounts of waste per inhabitant divided by waste stream– (gemeentelijk afval – heel NL) –1993-2010) http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=7467&D1=0-24,84-108&D2=0&D3=a&HD=080714-1224&HDR=G1,G2&STB=T
- Totale amounts of waste streams vs household waste (afvalstroom vs. huishoudelijk afval) – 2004?
http://www.cbs.nl/nl-NL/menu/themas/natuur-milieu/beschrijving/afvalstoffen.htm
- Decrease household waste due to waste separation (afname huishoudelijk afval door scheiding) – 1985-2000-2010
http://www.compendiumvoordeleefomgeving.nl/indicatoren/nl0140-Afval-van-huishoudens.html?i=1-4
- Increase/Decrease household waste – toename/afname huishoudelijk afval – grafiek – 1950-2007-2010
http://www.compendiumvoordeleefomgeving.nl/indicatoren/nl0144-Afval-van-huishoudens-per-inwoner.html?i=1-4
- Composition household waste (samenstelling huishoudelijk afval – – 1940-1958-1980-1990-2000-2009)
http://www.compendiumvoordeleefomgeving.nl/indicatoren/nl0141-Samenstelling-restafval-huishoudens.html?i=1-4
- Separate waste streams, collected (gescheiden ingezameld afval) grafief – 1985-2010
http://www.compendiumvoordeleefomgeving.nl/indicatoren/nl0143-Gescheiden-ingezameld-afval-huishoudens.html?i=1-4

Waste Collection (Afvalinzameling)

- *Allowed materials in separate GFT collection*
http://www.rijksoverheid.nl/onderwerpen/afval/vraag-en-antwoord/welk-afval-mag-in-de-GFT-bak.html

- National explanation list in alphabetical order per material leading to the notification in which waste stream a material should be disposed
http://www.afvalscheidingswijzer.nl/Afvalscheidingswijzer/afvalscheidingswijzer/trefwoorden/zoek?init=true

- *Containers (* European standard EN 840)
http://www.nen.nl/web/Normshop/Norm/NENEN-84012010-Ontw.-en.htm

- *Underground containers*

http://afvalonline.nl/bericht?id=14461
http://www.ondergrondsecontainer.nl/

- *Garbage trucks (Vuilniswagens)*

http://afvalonline.nl/artikel?id=6919
http://www.qwadvies.nl/www.qwadvies.nl/Artikelen_en_co/Artikelen/2005/7/5_Geesink_Norba__bakens_verzet(advertorial).html) & http://afvalonline.nl/bericht?id=14061

Recycling (Afvalhergebruik)

- http://verenigingafvalbedrijven.org/php/admin/show_artikel.php?id=2914
- http://www.nd.nl/artikelen/2012/maart/27/nederland-in-top-hergebruik-afval

Waste treatment companies (Afvalverwerkers)

- rijksoverheidsdocumentatie Afvalverwerking in Nederland 2009/2010

http://www.GFT-afval.nl/download/WAR_Afvalverwerking_Nederland2009_augustus2010.pdf

- GFT ZONDER GRENZEN (over import van o.a. Duits afval)

http://www.verenigingafvalbedrijven.nl/downloads/afvalforum_november_2005.pdf

Branche organisations (Branche organisaties)

- Brancheorganisation for 90% of the Dutch waste collection market, 80% of the market for combustion and 80% of composting companies are being represented in: http://www.verenigingafvalbedrijven.nl

- NVRD (500 members representing 90% of all municipalities and 100% of LA owned companies operating waste treatment and municiapl cleaning. Other professional companies in the branche are members as well) http://www.nvrd.nl

Biogas

- Sustainable energy and potential of biogas

http://www.technischweekblad.nl/rubrieken/energieserie/kunnen-we-overschakelen-op-duurzame-energie.137804.lynkx

Attachment 19.B – Amounts of total waste and GTF waste per municipality in The Netherlands

List of all 535 Dutch municipalities, showing the total amount of household waste per inhabitant and the amount of separately collected GFT waste for 2010. Where no numbers are included, the data for that specific municipality was not available.

Municipality	Total waste	GFT waste	*Municipality*	Total waste	GFT waste
	kg per person-year			*kg per person-year*	
Aa en Hunze	682	208	**Asten**		51
Aalburg			**Axel**		
Aalsmeer	543	105	**Baarle-Nassau**	564	138
Aalten	412	61	**Baarn**	545	117
Ter Aar			**Barendrecht**	551	45
Abcoude	517	101	**Barneveld**	558	140
Achtkarspelen	671	184	**Bathmen**		
Akersloot			**Bedum**	598	133
Alblasserdam	591	69	**Beek (L)**	456	57
Albrandswaard	542	82	**Beemster**	554	119
Alkemade			**Beesel**	439	63
Alkmaar	486	59	**Bellingwedde**	619	146
Almelo	525	97	**Bemmel**		
Almere	469	37	**Bennebroek**		
Alphen aan den Rijn	540	58	**Bergambacht**	546	114
Alphen-Chaam	578	137	**Bergeijk**	348	45
Ambt Montfort			**Bergen (L)**	658	
Ameland			**Bergen (NH)**	605	140
Amerongen			**Bergen op Zoom**	678	84
Amersfoort	536	70	**Bergh**		
Amstelveen	478	36	**Bergschenhoek**		
Amsterdam	450	0	**Berkel en Rodenrijs**		
Andijk	685	160	**Berkelland**	531	109
Angerlo			**Bernheze**	443	36
Anna Paulowna		142	**Bernisse**	668	113
Apeldoorn	461	118	**Best**	576	117
Appingedam	646	128	**Beuningen**	414	57
Arcen en Velden			**Beverwijk**	500	60
Arnhem	532	56	**het Bildt**	633	167
Assen	527	111	**De Bilt**	614	122
Binnenmaas	611	127	**Cranendonck**	536	48
Bladel	399	48	**Cromstrijen**	614	129
Blaricum	542	92	**Cuijk**	587	165
Bleiswijk			**Culemborg**	518	99
Bloemendaal	567	117	**Dalfsen**	401	67
Boarnsterhim	722	153	**Dantumadeel**		
Bodegraven	548	96	**Dantumadiel**	631	129
Boekel	637	164	**Delft**		
Ten Boer		135	**Delfzijl**	715	62
Bolsward	622	123	**Denekamp**		
Borculo			**Deurne**	346	55
Borger-Odoorn	418	51	**Deventer**	503	88
Borne	568	139	**Didam**		
Borsele	762	149	**Diemen**		10
Boskoop	559	107	**Dinkelland**	608	153
Boxmeer	625	166	**Dinxperlo**		
Boxtel	609	82	**Dirksland**	482	122
Breda	582	63	**Dodewaard**		
Breukelen			**Doesburg**	530	50
Brielle	631	96	**Doetinchem**	557	102
Bronckhorst	499	163	**Dongen**	684	144
Brummen	411	88	**Dongeradeel**	609	121
Brunssum	489	69	**Doorn**		
Bunnik	586	125	**Dordrecht**	549	51
Bunschoten	630	75	**Drechterland**	666	138
Buren	518	99	**Driebergen-Rijsenburg**		
Bussum	542	92	**Drimmelen**	470	93
Capelle aan den IJssel			**Dronten**	528	116
Castricum	568	128	**Druten**	430	193
Coevorden	783	124	**Duiven**	646	66

Municipality	Total waste	GFT waste	*Municipality*	Total waste	GFT waste
	kg per person-year			*kg per person-year*	
Echt			**Goedereede**	599	146
Echteld			**Goes**	702	87
Echt-Susteren	461	47	**Goirle**	539	98
Edam-Volendam	660	96	**Gorinchem**	600	75
Ede	526	107	**Gorssel**		
Eemnes	490	130	**Gouda**		
Eemsmond			**Graafstroom**	518	113
Eersel	389	49	**Graft-De Rijp**	397	64
Eibergen			**Grave**	640	164
Eijsden	470	35	**'s-Graveland**		
Eindhoven	539	80	**'s-Gravendeel**		
Elburg		153	**'s-Gravenhage**	472	11
Emmen		138	**'s-Gravenzande**		
Enkhuizen	594	56	**Groenlo**		
Enschede	462	71	**Groesbeek**	441	190
Epe	603	145	**Groningen**	442	38
Ermelo	375	99	**Grootegast**	547	79
Etten-Leur	525	81	**Gulpen-Wittem**	574	177
Ferwerderadiel	679	144	**Haaksbergen**		108
Franekeradeel	601	105	**Haaren**	389	23
Gaasterlân-Sleat	730	182	**Haarlem**	495	39
Geertruidenberg	528	98	**Haarlemmerliede en Spaarnwoude**		79
Geldermalsen	519	99	**Haarlemmermeer**	517	100
Geldrop			**Haelen**		
Geldrop-Mierlo	461	53	**Halderberge**	720	144
Gemert-Bakel	621	170	**Hardenberg**	406	56
Gendringen			**Harderwijk**	497	105
Gennep	515		**Hardinxveld-Giessendam**	643	85
Giessenlanden	539	118	**Haren**	400	80
Gilze en Rijen	623	71	**Harenkarspel**	564	130
Harlingen	616	106	**Hoogezand-Sappemeer**	392	1
Hattem	406	75	**Hoorn**	578	68
Heel			**Horst aan de Maas**		15
Heemskerk	448	84	**Houten**	539	90
Heemstede	622	111	**Huizen**	539	92
Heerde	396	58	**Hulst**	725	104
Heerenveen	604	67	**Hummelo en Keppel**		
Heerhugowaard	578	94	**Hunsel**		
Heerjansdam			**IJsselstein**	505	58
Heerlen	505	68	**Jacobswoude**		
Heeze-Leende			**Kaag en Braassem**	571	125
Heiloo		135	**Kampen**	380	31
Helden			**Kapelle**	596	113
Den Helder	569	83	**Katwijk**	512	94
Hellendoorn	571	119	**Kerkrade**	571	75
Hellevoetsluis	566	73	**Kessel**		
Helmond	555	99	**Kesteren**		
Hendrik-Ido-Ambacht	655	45	**Koggenland**	612	111
Hengelo (Gld)			**Kollumerland en Nieuwkruisland**	652	160
Hengelo (O)	572	93	**Korendijk**	561	129
's-Hertogenbosch	586	11	**Krimpen aan den IJssel**	739	
Heumen	445	186	**Laarbeek**	551	64
Heusden	514	69	**Landerd**	642	149
Heythuysen			**Landgraaf**	496	77
Hillegom			**Landsmeer**	592	82
Hilvarenbeek	499	40	**Langedijk**	533	103
Hilversum	542	92	**Lansingerland**		91
Hof van Twente	574	110	**Laren (NH)**	542	92
Hontenisse			**Leek**	448	64
Hoogeveen	606	119	**Leerdam**		

Municipality	Total waste	GFT waste	*Municipality*	Total waste	GFT waste
	kg per person-year			*kg per person-year*	
Leersum			**Maasbracht**		
Leeuwarden	534	70	**Maasbree**		
Leeuwarderadeel	566	144	**Maasdonk**	411	20
Leiden		26	**Maasdriel**	518	99
Leiderdorp	483	66	**Maasgouw**	483	84
Leidschendam			**Maasland**		
Leidschendam-Voorburg	502	67	**Maassluis**	512	48
Lelystad	584	85	**Maastricht**	455	89
Lemsterland	679	93	**Margraten**	499	48
Leudal	544	93	**De Marne**	675	103
Leusden	628	76	**Marum**	565	57
Lichtenvoorde			**Medemblik**	612	106
Liemeer			**Meerlo-Wanssum**		
De Lier			**Meerssen**	619	206
Liesveld		105	**Meijel**		
Limmen			**Menaldumadeel**	691	191
Lingewaal	518	99	**Menterwolde**		164
Lingewaard	399	50	**Meppel**	520	116
Lisse	502	88	**Middelburg (Z)**	557	88
Lith	628	80	**Middelharnis**	494	101
Littenseradiel		150	**Midden-Delfland**	483	138
Lochem	519	140	**Midden-Drenthe**	726	183
Loenen		113	**Mierlo**		
Loon op Zand	649	114	**Mill en Sint Hubert**	644	166
Loosdrecht			**Millingen aan de Rijn**		195
Lopik	609	108	**Moerdijk**		75
Loppersum	645	185	**Monster**		
Losser	606	124	**Montferland**	539	89
Maarn			**Montfoort**	504	128
Maarssen	506	89	**Mook en Middelaar**	397	65
Moordrecht			**Oirschot**	476	41
Muiden	542	92	**Oisterwijk**	481	101
Naaldwijk			**Oldambt**	667	158
Naarden	542	92	**Oldebroek**		186
Neder-Betuwe	518	99	**Oldenzaal**	557	109
Nederhorst den Berg			**Olst**		
Nederlek	611	91	**Olst-Wijhe**	355	54
Nederweert	558	34	**Ommen**	512	126
Neede			**Onderbanken**		
Neerijnen	518	99	**Oost Gelre**	426	48
Niedorp	628	151	**Oostburg**		
Nieuwegein	491	68	**Oosterhout**	626	98
Nieuwerkerk aan den IJssel			**Oostflakkee**	546	140
Nieuwkoop	523	119	**Ooststellingwerf**	673	54
Nieuw-Lekkerland	489	120	**Oostzaan**	403	49
Nijefurd		155	**Opmeer**	636	122
Nijkerk	471	50	**Opsterland**		45
Nijmegen	475	90	**Oss**	659	104
Noord-Beveland	889	159	**Oud-Beijerland**	547	86
Noordenveld	631	159	**Oude IJsselstreek**	516	129
Noorder-Koggenland			**Ouder-Amstel**	468	28
Noordoostpolder	597	106	**Ouderkerk**	578	111
Noordwijk	456	39	**Oudewater**	529	143
Noordwijkerhout	521	113	**Overbetuwe**	566	81
Nootdorp			**Papendrecht**	543	66
Nuenen, Gerwen en Nederwetten	577	78	**Peel en Maas**	482	120
Nunspeet		156	**Pekela**	619	183
Nuth	520	80	**Pijnacker**		
Obdam			**Pijnacker-Nootdorp**	490	95
Oegstgeest	437	82	**Purmerend**	600	29

Municipality	Total waste	GFT waste	*Municipality*	Total waste	GFT waste
	kg per person-year			*kg per person-year*	
Putten	317	51	**Schagen**		102
Raalte	391	58	**Scheemda**		
Ravenstein			**Schermer**	515	143
Reeuwijk		127	**Scherpenzeel**	444	141
Reiderland			**Schiedam**	509	21
Reimerswaal	903	108	**Schiermonnikoog**		
Renkum	605	82	**Schijndel**	569	157
Renswoude	530	102	**Schinnen**	484	58
Reusel-De Mierden	395	38	**Schipluiden**		
Rheden	573	128	**Schoonhoven**	498	80
Rhenen	526	108	**Schouwen-Duiveland**	776	157
Ridderkerk	605	79	**Sevenum**		
Rijnsburg			**Simpelveld**	494	88
Rijnwaarden	408	49	**Sint Anthonis**	629	165
Rijnwoude		114	**Sint-Michielsgestel**	488	36
Rijssen			**Sint-Oedenrode**	446	39
Rijssen-Holten	710	98	**Sittard-Geleen**	430	46
Rijswijk (ZH)	497	43	**Skarsterlân**	691	170
Roerdalen	479	42	**Sliedrecht**	534	87
Roermond	567	65	**Slochteren**	657	145
Roggel en Neer			**Sluis**	934	142
De Ronde Venen	560	96	**Sluis-Aardenburg**		
Roosendaal	647	107	**Smallingerland**	596	146
Rotterdam	516	1	**Sneek**	581	100
Rozenburg			**Soest**	577	117
Rozendaal	559	190	**Someren**	433	53
Rucphen	634	160	**Son en Breugel**	700	151
Ruurlo			**Spijkenisse**	610	54
Sas van Gent			**Stadskanaal**	699	80
Sassenheim			**Staphorst**	304	44
Stede Broec	606	99	**Valkenburg aan de Geul**	531	158
Steenbergen	702	134	**Valkenswaard**		55
Steenderen			**Veendam**	625	123
Steenwijk			**Veenendaal**	512	86
Steenwijkerland	418	49	**Veere**	992	110
Stein (L)	427	58	**Wieringen**		165
Strijen	555	157	**Veghel**	452	42
Susteren			**Veldhoven**	524	104
Swalmen			**Velsen**	463	65
Terneuzen		110	**Venhuizen**		
Terschelling		171	**Venlo**	547	106
Texel		105	**Venray**	497	45
Teylingen	559	84	**Vianen**	559	102
Tholen	768	99	**Vlaardingen**		17
Thorn			**Vlagtwedde**	733	134
Tiel	518	99	**Vlieland**	1502	-
Tilburg	459	47	**Vlissingen**	651	63
Tubbergen		35	**Vlist**		115
Twenterand	491	64	**Voerendaal**	498	101
Tynaarlo	384	57	**Voorburg**		
Tytsjerksteradiel	650	157	**Voorhout**		
Ubbergen	480	116	**Voorschoten**	474	92
Uden	559	115	**Voorst**	634	174
Uitgeest		105	**Vorden**		
Uithoorn	531	-	**Vriezenveen**		
Urk	410	46	**Vught**	410	69
Utrecht	481	28	**Waalre**	579	124
Utrechtse Heuvelrug	568	147	**Waalwijk**	414	24
Vaals	483	74	**Waddinxveen**	539	87
Valkenburg (ZH)			**Wageningen**	481	67

Municipality	Total waste	GFT waste	*Municipality*	Total waste	GFT waste
	kg per person-year			*kg per person-year*	
Warmond			**Wormerland**		91
Warnsveld			**Woudenberg**		
Wassenaar	633	146	**Woudrichem**	454	58
Wateringen			**Wûnseradiel**		126
Waterland	610	84	**Wymbritseradiel**	643	159
Weert			**Zaanstad**	480	57
Weesp	542	92	**Zaltbommel**	518	99
Wehl			**Zandvoort**	558	70
Werkendam	463	70	**Zederik**	544	120
Wervershoof	625	111	**Zeevang**	657	128
West Maas en Waal	517	154	**Zeewolde**	486	98
Wester-Koggenland			**Zeist**	548	98
Westerveld	761	199	**Zelhem**		
Westervoort	480	67	**Zevenaar**	533	80
Westland	548	96	**Zevenhuizen-Moerkapelle**		
Weststellingwerf	632	130	**Zijpe**	665	176
Westvoorne	703	163	**Zoetermeer**	473	53
Wierden	528	109	**Zoeterwoude**		51
Wieringermeer	662	112	**Zuidhorn**	504	42
Wijchen	517	120	**Zuidplas**	501	52
Wijdemeren	542	92	**Zundert**	600	172
Wijk bij Duurstede	552	102	**Zutphen**		
Winschoten			**Zwartewaterland**	324	49
Winsum	542	153	**Zwijndrecht**		
Winterswijk	535	94	**Zwolle**	524	67
Wisch					
Woensdrecht					
Woerden	515	83			
Wognum					
De Wolden	765	200			

Appendix 20: Results of web-based survey on collection of source segregated domestic food waste in Poland

General

The most important waste legislation in Poland is described in five main Acts:
1. Act of 27th April 2001 - Environmental Protection Law (J. of L. of 2008 No. 25, item 150, with later amendments)
2. Act of 27th April 2001 on waste (J. of L. of 2001 No. 62, item 628, with later amendments)
3. Act of 11th May 2001 on packaging and packaging waste (J. of L. No. 63, item 638, with later amendments)
4. Act of 11th May 2001 on economic operators' obligations in the scope of managing certain types of waste and on the product and deposit charges (J. of L. of 2007 No. 90, item 607)
5. Act of 11th July 2011 the act of maintaining cleanliness and order in municipalities and certain other laws (J. of L. of 2011, No 152, item 897) (http://isap.sejm.gov.pl/).

These laws have been developed taking into account European directives and in accordance with European Union legislation. In accordance with EU directive 94/62/EC and the National Waste Management Plan 2014 (Krajowy Plan Gospodarki Odpadami 2014) (KPGO 2014, 2011) the biodegradable matter of urban solid waste ending up in landfills must by 31 December 2013 be less than 50% of the total weight of the biodegradable urban solid waste produced in 1995 and by 31 December 2020 less than 35% of the total weight of the biodegradable urban solid waste produced in 1995.

Organisation of waste collection in Poland

A general strategy for management of the following types of waste is defined in the National Waste Management Plan KPGO 2014 (2011): household waste, biodegradable household waste, hazardous waste, waste with PCB, waste oils, waste batteries and accumulators, medical and veterinary waste, end of life vehicles, waste electrical and electronic products, wastes containing asbestos, unwanted pesticides, old tires, waste from construction and redecoration of buildings and road infrastructure, municipal sewage sludge, packaging waste and other non-hazardous waste from the municipal sector. This document is prepared at the ministerial level. Each of the 16 regions then prepares a Provincial Waste Management Plan based on the National Waste Management Plan and including information about the type, amount and sources of waste for recovery or disposal, waste holders engaged in the collection, recovery or disposal, deployment of existing installations for collection, recovery or disposal and problems in the field of waste management.

According to the Eionet European Topic Centre on Sustainable Consumption and Production Country fact sheets on waste policies (Eionet, 2009), the National Waste Management Plan sets the following objectives and targets for biodegradable municipal waste:

"According to the targets established in the scope of waste recovery and recycling:
· selective collection and taking of the following fractions of municipal waste is required:
- garden and park wastes
- paper and cardboard (including packaging, newspapers, journals, etc.)
- kitchen waste

· development of selective collection and sorting of municipal waste. The activities in the scope of establishment of supra-municipal and municipal schemes for recovery and disposal of municipal waste with special regard to biodegradable waste;
· well organised waste collection system and proper financial incentives (lower payments for separated waste);
· the implementation of a system of waste collection with the use of "at the source" method and deliveries to a composting plant."

In principle there is thus a general obligation to collect kitchen waste, but in practice this is not yet widely implemented

In general, each property owner should have a signed contract to receive municipal waste from the area of his property with company licensed to operate in the municipal waste collection. The authorization shall specify the recovery or disposal of municipal waste in accordance with the Provincial Waste Management Plan. Receiving the waste can be also a communal organizational unit which is exempt from obtaining permission, but must fulfil the requirement for companies in this area. Interests operating in the municipality are required to provide the authority with information on concluded agreements with property owners. The register of these agreements is held by the municipality. Moreover, these entities are required to submit reports to the authorities concerning the management of municipal waste. If in the area of a municipality there are no companies receiving municipal waste from property owners they must arrange for collection of municipal waste for all residents of the municipality. Household waste should be collected and received in a selective way in accordance with the requirements specified in the rules of cleanliness and order in the district adopted by the municipal council.

Methodology

The main organizations providing information on waste management in Poland are the Ministry of Environment Republic of Poland (Ministerstwo Środowiska Rzeczpospolita Polska, http://www.mos.gov.pl) and the Central Statistical Office (Główny Urząd Statystyczny, http://www.stat.gov.pl/gus). These two sources were the main ones used for information about the amount and type of food waste recycling.

Keyword searches were carried out on google.pl. The keywords used were: "*zbiórka odpadów organicznych*" (organic waste collection), "*recykling odpadów żywnościowych*" (food waste recycling), "*odpady organiczne*" (organic waste), "*odpady kuchenne*" (kitchen waste), "*odpady zielone*" (green waste), "*bioodpady*" (biowastes). These keywords were used all together and in different combinations.

The survey was carried out between 21 - 26 April 2012.

Results

In practice, municipal wastes are collected in bags or bins, depending on the type of building. In cities with multi-family buildings, household wastes are collected in large bins of different sizes. Additionally next to apartment blocks, schools, hospitals and other public places colour coded containers are located for selectively collected waste (blue bins for paper, yellow bins for plastic, white for colourless glass, green for coloured glass and red for metal). In this case kitchen wastes are collected with other, non-classified household waste. In places with

detached houses, in villages, municipal wastes are collected in smaller containers (120 or 240 litres) and separately in coloured bags. In addition, as in the cities, large containers for selectively collected wastes (paper, glass, metal and plastic) are located in the key places such as offices and schools. Wastes from villages are characterized by a lower content of kitchen and garden waste, because of the use of home composters. In some municipalities biowaste containers have been introduced, which collect biodegradable waste such as remains of fruit and vegetables, grass, etc. These schemes are only at a pilot phase, however.

According to data from the Central Statistical Office, 6,896,000 tonnes of municipal waste and 85,000 tonnes of biodegradable waste from households was selectively collected in Poland in 2010. This means that biodegradable waste from households collected selectively in 2010 accounted for about 1.23% of the total waste collected. This material includes fruit and vegetable peelings, eggshells, tea and coffee grounds as well as weeds, grass, leaves and branches, so it does not consist of kitchen waste only. Organic waste probably constitutes about 30% of household municipal waste.

Collection of biodegradable waste from households in Poland is in the initial stage. In semi-detached houses on site processing is often carried out, because people have gardens and plots for disposal and use their own biodegradable waste as a compost. This reduces the amount of waste exported to landfill and also retains the full value of the waste as a fertilizer. Food waste is more of a problem in multi-family buildings. In cities, people throw away all biodegradable waste with other municipal waste. Organic waste collection in urban areas is rarely encountered. In the web survey, only a few communities were found in which it seems biodegradable wastes are actually collected. Unfortunately, on these pages it was not possible to find information on when the biodegradable waste collections began.

BIAŁYSTOK
http://www.mpo.bialystok.pl/content/view/83/49/
Biodegradable wastes are collected in 80 and 120 litre bags. The information indicates that in this city biodegradable wastes are collected only in special circumstances, when the householder buys special bags for this. The company writes: "Forget about the problems of storage of grass clippings, leaves redundant, stale fruit and vegetables. Take care of your garden." Normally they collect plastic, paper and glass, and if the customers request it they receive bags for biodegradable waste.

ŁÓDŹ
http://mpolodz.pl/pl/sortowanie-odpadow.html
Biodegradable wastes are collected in white bags. On this Łódź website it is stated that biodegradable wastes are actually collected from households once every two weeks and transported to a composting plant in Łódź then converted to compost.

PASŁĘK
http://www.pukpas.ubf.pl/viewpage.php?page_id=9
Biodegradable waste are collected in bags and bins. On the Pasłęk website it is stated that biodegradable wastes are collected from residents twice a month. In addition, on this page there are some statistics: in 2011 this company collected biodegradable waste from 450 households, with a total of 82.3 tonnes per year.

Table 20.1. List of acceptable and unacceptable items for Łódź

BIAŁY oznaczony "MOKRE-BIO" Do worka białego WRZUCAMY: • odpady kuchenne tj. resztki owoców i warzyw, • liście, • fusy od herbaty i kawy wraz z filtrami, • skorupki od jaj. Do worka oznaczonego bia?ego NIE WRZUCAMY: • resztek mięs, • resztek wędlin, • resztek ryb, • kości.	**The WHITE bag is designated "WET – BIO"** In this bag we **THROW AWAY**: • kitchen waste i.e. fruit and vegetable residues • leaves • tea and coffee grounds with filters • egg shells We **DO NOT THROW AWAY** in the white bag • leftover meat • leftover ham • left-over fish • bones

Table 20.2. List of acceptable and unacceptable materials for Pasłęk

Do pojemników „Bio" wrzucamy	**In the "Bio" container we throw away**
odpady po owocach i warzywach	wastes from fruits and vegetables
resztki ugotowanych warzyw	leftover cooked vegetables
obierki owoców i warzyw	fruits and vegetable peels
resztki owoców cytrusowych	citrus fruits peel
skórki od bananów	banana skins
resztki jedzenia natury roślinnej	other food leftovers
fusy po kawie, herbacie razem z filtrem papierowym	tea and coffee grounds with paper filter
stary chleb	old bread
zmarniałe kwiaty doniczkowe,	dead flowers
stara ziemia do kwiatów	old flowers - soil
zwiędłe kwiaty cięte	wilted cut flowers
ścięta trawa	grass cuttings
chwasty	weeds
liście	leaves
ścięte gałązki z drzew, krzaków i żywopłotów	cut branches from the trees, bushes and hedges
owoce spadłe z drzew	fallen fruits from trees
Do pojemników „Bio" nie wrzucamy	**In the "Bio" container we do not throw away**
zepsutej żywności	rotten food
mięsa	meat
kości	bone
resztek jedzenia w płynie	food leftovers in gravy or sauce
bardzo tłustych lub mocno solonych resztek jedzenia	very greasy or heavily salted food leftovers
odchodów zwierzęcych	animal faeces
popiołu z kominka lub pieca	ash from the fireplace or stove
papierosów oraz niedopałków	cigarettes and cigarette butts
roślin i owoców zaatakowanych różnymi chorobami	plants and fruit infested with various diseases
resztek metali, plastiku i folii aluminiowych	residual metal, plastic and aluminum foil
materiałów sprzężonych (pieluchy jednorazowe, kartony po mleku)	conjugated materials (disposable nappies, milk cartons)
pełnych woreczków z odkurzacza	bags full of dust
podściółki dla kotów	cat bedding
torebek plastikowych	plastic bags

Ecoclean, Promarol-Plus, EkoVita, Saria, Jasta are companies that can be found on the first three pages of a google search, after entering the main keywords "odpady kuchenne" (kitchen waste) in the google.pl browser. The links that appear after entering key words are only

company websites, however, for companies are concerned with processing of biodegradable waste or suggest how to collect these wastes.

Based on the website review, it can be concluded that the biowaste collection in Poland is very rare. There are many pages of theoretical advice but few actual schemes.

Summary of key findings

- In Poland at present there are only a few pilot projects connected with collection of biodegradable waste.
- Household biowastes are collected only for own use or as mixed municipal waste.
- When waste is composted, organic matter originating from food waste is mixed with green and other kinds of biodegradable solid waste.
- About 90% of the web pages visited are informational and educational rather than describing specific initiatives or available options.

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EkoVita – Nowoczesne zarządzanie odpadami (EkoVita - Contemporary waste management), available: http://www.ekovita.pl/, accessed on 24/04/2012,

Główny Urząd Statystyczny (Central Statistical Office), available: http://www.stat.gov.pl/gus, accessed on 24/04/2012.

Internetowy System Aktów Prawnych (Law Acts Internet System), available: http://isap.sejm.gov.pl/, accessed on 24/04/2012.

Jasta – Zakład Przetwórczy (Jasta - The processing plant), available: http://www.jasta.net.pl , accessed on 24.04.2012.

Jędrczak Andrzej, Biologiczne przetwarzanie odpadów (Biological waste treatment), Wydawnictwo Naukowe PWN, 2008.

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Kompostowanie i mechaniczno-biologiczne przetwarzanie odpadów (Composting and mechanical biological waste treatment), available: http://www.kompostowanie.opole.pl/Kompostowanie_i_mechaniczno.pdf, accessed on 24/04/2012.

Krajowy Plan Gospodarki Odpadami 2014 (National Waste Management Plan) available http://www.mos.gov.pl/kategoria/3340_krajowy_plan_gospodarki_odpadami_2014/, accessed on 25/04/2012.

Krajowa strategia ograniczania ilości składowanych odpadów biodegradowalnych (National strategies for reducing the landfill of biodegradable waste), Łódź, October 2005.

Kulczycki Jerzy, Cichocki Paweł, Czarnecki Krzysztof, Nowicki Jakub, Pilotażowy Program Zbiórki Odpadów Organicznych - kuchennych i zielonych dla Miasta Poznania (Kitchen and green - organic waste collection pilot programme - for Poznań), Poznań, December 2006.

Miejskie Przedsiębiorstwo Oczyszczania - Białystok (Municipal Treatment Company – Białystok), available: http://mpo.bialystok.pl/, accessed on 24/04/2012.

Miejskie Przedsiębiorstwo Oczyszczania – Łódź (Municipal Treatment Company – Łódź), available: http://mpolodz.pl/pl/sortowanie-odpadow.html, accessed on 24/04/2012.

Ministerstwo Środowiska Rzeczpospolita Polska (Ministry of Environment Republic of Poland), available: http://www.mos.gov.pl, accessed on 24/04/2012.

Promarol-Plus – Zakład Utylizacji Odpadów (Promarol-Plus - Waste Disposal Facility), available: http://www.promarol-plus.pl/pl/uslugi/odpady-kuchenne, accessed on 24/04/2012.

Przedsiębiorstwo Usług Komunalnych w Pasłęku (Municipal Services Company in Pasłęk), available: http://www.pukpas.ubf.pl/viewpage.php?page_id=9, accessed on 24/04.2012.

Saria, available: http://www.saria.pl/, accessed on 24/04/2012.

Wytyczne dotyczące wymagań dla procesów kompostowania, fermentacji i mechaniczno-biologicznego przetwarzania odpadów (według stanu prawnego na dzień 15 grudnia 2008 r.) (Guidance on requirements for the processes of composting, digestion and mechanical-biological waste treatment (according to legal status at 15 December 2008), Ministerstwo Środowiska Rzeczpospolita Polska (Ministry of Environment Republic of Poland), Warsaw, December 2008.

Appendix 21: Results of web-based survey on collection of source segregated domestic food waste in Portugal

Introduction

Nearly 5,184,000 tonnes of Municipal Solid Waste (MSW) were produced in Portugal in 2010, equivalent to nearly 1.4 kg per person-day (Figure 21.1) (APA, 2011).

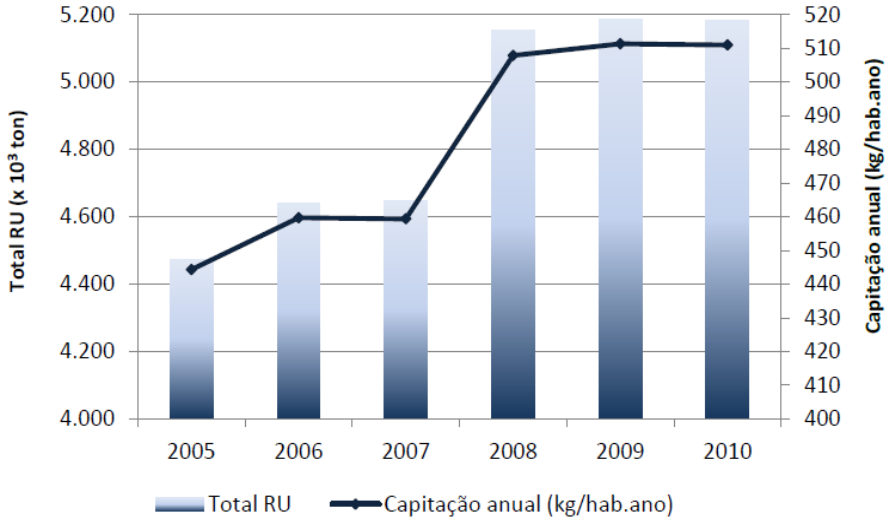


Figure 21.1. MSW production in Portugal. Source: APA, (2011)

Around 62.7 % of all MSW produced in mainland Portugal goes to landfill, 19.9 % is incinerated with energy recovery and 10.0 % recovered though separate collection. Only 7.4 % of all waste is sent for organic recovery (APA, 2011).

Decree-Law No. 183/2009 of 10 August 2009, which transposes the Landfill Directive into Portuguese legislation, establishes the legal framework for landfilling and the technical characteristics and requirements for the design, licensing, building, operation, closure and post-closure of landfills. It sets targets for reducing landfilling of biodegradable waste by 50 % by weight in 2013 and by 35 % in 2020 using 1995 as the benchmark (EEA, 2011).

Taking this into account the strategic national waste plan for the years 2007-2016 (PERSU II) established that the organic valorisation technologies (anaerobic digestion and / or composting) should be implemented considering the implementation of selectively collected food waste schemes. Due to the financial constraints of these selective schemes, and in order to ensure the collection of a sufficient quantity of biodegradable waste to fulfil the targets for reducing the landfilling of biodegradable waste, the PERSU II considered that in the first phase of operation these plants will receive organic waste from the mixed MSW collection (though the implementation of Mechanical Biological Treatments – MBT), alongside the progressive increase in the quantity of food waste selectively collected.

This discussion indicated the necessity of differentiating in time the successive increases, as well as to ensure that, at least initially, these new units were supplied in full capacity, using organic matter recovered through processes of mechanical treatment of MSW (Mechanical Biological Treatments – MBT).

Methodology

Possible terms for food waste include "Restos alimentares", "restos de alimentos", "resíduos alimentares", "resíduos de alimentos", and "lixo alimentar" (all = food waste), and "lixo de cozinha" (kitchen waste). Related terms are "resíduos orgânicos" and "lixo organico" (organic waste); and "resíduos putrecíveis", "resíduos biodegradáveis", "lixo biodegradável" (biodegradable waste). A web-based survey was carried out using the terms "recolha selectiva de orgânicos" (selective collection of organic waste) and "recolha de organicos" (organic waste collection).

In addition, based on the data presented in the annual report from the Portuguese Environmental Agency for 2010 (APA, 2011) several Portuguese waste management companies were considered in order to check the existence of selectively food waste schemes. These were Amarsul (www.amarsul.pt), Algar (www.algar.com.pt), Lipor (www.lipor.pt), Valorsul (www.valorsul.pt) and Tratolixo (www.tratolixo.pt). This choice was also informed by information on systems that had considered implementation of a selective food waste collection scheme in their project phase, as reported by Bento dos Santos, F. and Cabeças A.J., 2011 (Table 1).

Table 21.1. Waste Companies in Portugal (Multi-municipal Systems)

System	Technology	Start Up	Capacity (mechanical treatment) Tonnes	Capacity (biological treatment) Tonnes
ALGAR (S.Brás)	MBT /AD	2011	25000 (MSW) **10000 (OFMSW)**	10000 (MSW) **10000 (OFMSW)**
ALGAR (Portimão)	MT	2012	80000	-
AMARSUL (Seixal)	MBT /AD	2011	104000 (MSW) **20000 (OFMSW)**	40000 (MSW) **20000 (OFMSW)**
AMARSUL (Setúbal)	MBT / C	1993 2006 (revamping)	58000	24500
AMARSUL (Palmela)	MT	2011	120000	-
ERSUC (Aveiro)	MBT /AD	2011	190000	63000
ERSUC (Coimbra)	MBT /AD	2011	190000	63000
Resiestrela (Cova da Beira)	MBT / C	2001 2011	30000 50000 (2nd phase)	16000 30000 (2nd phase)
Resinorte (Riba D'Ave)	MBT / C	1995 2011 (MT)	- 175000 (2nd phase)	60000 125000 (2nd phase)
Resinorte (Vila Real)	MT	2012	40000	-
Resinorte (Boticas)	MT	2012	40000	-
Suldouro (V.N. Gaia)	MBT /AD	2011	43000	20000
Valnor (Avis)	MBT /AD + C	2008 (MT+C) 2009 (extension) 2011 (AD)	100000 100000 100000 (2nd phase)	10000 25000 45000 (2nd phase)
Valorlis/Valorsul (Leiria)	MBT /AD	2010	50000	20000

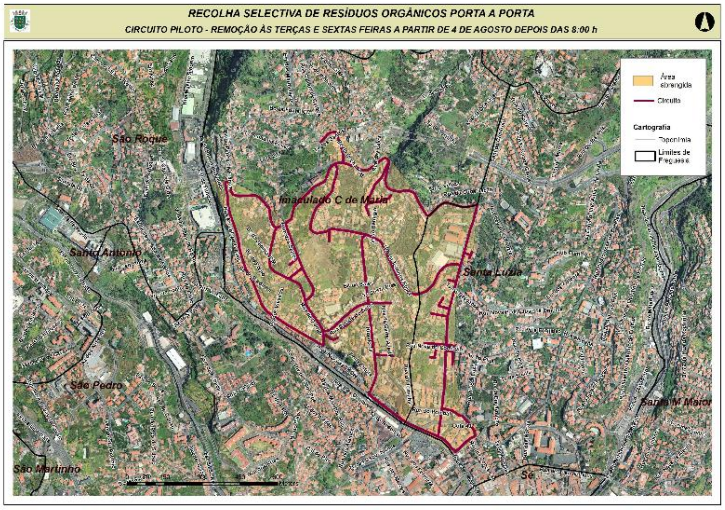
MBT – Mechanical Biological Treatment; DA – Anaerobic Digestion; C - Composting

A questionnaire was also prepared and sent by email to the technicians of the respective companies (appendix 1). This approach was chosen due to the fact that the information presented in the official websites was limited and/or difficult to find without orientation. The answers and data received from each company are reported in Appendix 2.

Results

A web search with the term "restos alimentares" found nothing related to separate collection schemes with collection schemes. Searching with "recolha selectiva de orgânicos" found the following:
http://lisboalimpa.cm-lisboa.pt/index.php?id=520
Municipality of Lisbon - makes reference to selective organic collection in Lisbon area – program +Valor
http://www.cm-loures.pt/doc/Ambiente/ciclo_debates/Recolha_SMASLoures.pdf
Municipality of Loures - makes reference to selective organic collection in Loures area – program +Valor
http://www.cm-porto.pt/gen.pl?p=stories&op=view&fokey=cmp.stories/2280
Municipality of Oporto - makes reference to the organic collection in Oporto area- program 5 stars operation
http://www.valorambiente.pt/gestao-residuos/valorizacao-organica
Selective waste collection in Madeira island promoted by the waste company Valorambiente – planned, not in operation

Searching with "recolha de organicos" found the following:
http://www.valorsul.pt/pt/valorizacao-organica/programa-plusvalor/a-recolha-em-cada-area.aspx (Valorsul scheme)
http://www.valorsul.pt/pt/valorizacao-organica/programa-plusvalor/a-recolha-em-cada-area.aspx (LIPOR scheme)
http://www1.cm-funchal.pt/ambiente/index.php?option=com_content&view=article&id=261&Itemid=293
(A pilot trial door-to-door organic collection implemented by the municipality of Funchal, capital of Madeira island) (see Figure 21.2).



Mapa dos Circuitos de Remoção

ONDE POSSO ADQUIRIR O CONTENTOR?

Os contentores de 50, 120 e 240 litros, específicos para este serviço podem ser adquiridos no CIAC – Centro de Informação Autárquico ao Consumidor, na Rua 5 de Outubro, junto ao edifício da CMF ou no Departamento de Ambiente (Edifício dos Viveiros) sito à Rua Mestre Sidónio nº 28.

QUANTO ME VAI CUSTAR O CONTENTOR?

Os contentores são vendidos a um preço simbólico. Consulte a Tabela de Taxas e Outras Receitas Municipais 2011 (Artigo 7º).

ESTE É UM DOS CONTENTORES UTILIZADOS PARA A RECOLHA SELECTIVA PORTA A PORTA DE RESÍDUOS ORGÂNICOS

Este contentor destina-se exclusivamente à recolha selectiva de resíduos orgânicos e está devidamente identificado com o código da Rua, o nº de Polícia e um código próprio – RSO. As infracções serão punidas com elevadas coimas.

Consulte os resíduos que devem ser depositados neste contentor

ONDE POSSO OBTER MAIS INFORMAÇÕES SOBRE ESTE SERVIÇO?

Tem à sua disposição os seguintes contactos:
- Linha do Ambiente 1 – 291 230 821;
- Linha do Ambiente 2 – 291 751 871;
- Fax: 291 745 072;
- Departamento de Ambiente (CMF) – 291 743 431 (extensão 35);
- Site: www.cm-funchal.pt/ambiente
- email: ambiente@cm-funchal.pt e linha.ambiente@cm-funchal.pt

Figure 21.2. Pilot scheme in Funchal (http://www1.cm-funchal.pt/ambiente/index.php?option=com_content&view=article&id=261&Itemid=293)

The results of both the web search and survey questionnaire confirmed that only 3 companies in Portugal have implemented food waste selective collection schemes, namely Lipor, Valorsul, and Tratolixo. Although Amarsul and Algar have considered in their project phase schemes for collection of 20,000 tonnes and 10,000 tonnes, respectively, these were never implemented. Algar stated that the municipalities did not show much enthusiasm, in terms of economic constraints, to implement selective collection schemes and so they do not know if they are going to be implemented. In Amarsul the process line for the treatment of OFMSW selectively collected was converted to receive the fraction < 80 mm from a MBT plant.

The principal characteristics of the companies that implemented selective OFMSW collection schemes are presented below.

Lipor

LIPOR – Inter-municipal Waste Management of OPorto – is the entity in charge of the management, recovery and treatment of the Municipal Solid Waste (MSW) produced by the eight partner municipalities: Espinho, Gondomar, Maia, Matosinhos, Porto, Póvoa de Varzim, Valongo and Vila do Conde. It was created as a Municipalities' Association in 1982, and since then has implemented an integrated waste management, system through the recovery, extension and construction of infrastructures (Lipor 2012).

Every year LIPOR treats about 480,000 tonnes of MSW produced by 1 million inhabitants. In accordance with current management concepts for MSW, which promote the adoption of integrated systems and minimization of the deposition of waste in landfill, Lipor developed an integrated strategy of valorisation, treatment and confinement of MSW, based on three components: Multi-material Valorisation, Organic Valorisation and Energy Valorisation and a Sanitary Landfill (Lipor, 2012). Information on the sources of organic waste and types of collection is summarised in Table 2.

Valorsul

Information on the sources of organic waste and types of collection is summarised in Table 3 (and see also deliverable D2.4).

Figure 21.3. Separate collections service of Valorsul

Tratolixo

TRATOLIXO is an inter-municipal company with the mission to ensure treatment of the MSW produced in the municipalities of Cascais, Mafra, Sintra and Oeiras. This represents

9% (480000 tonnes) of the waste produced in Portugal and covers 831,178 inhabitants (8% of the total population of Portugal).

In order to promote the diversion of the deposition of organic waste in landfill TRATOLIXO built an MBT facility that consists in an AD followed by a composting process. This plant will receive 200 000 tonnes of waste annually and includes a line for processing biodegradable waste from selective collection, with the capacity of 40 000 tonnes. Information on the sources of organic waste and types of collection is summarised in Table 21.2.

Table 21.2. Source of SC-OFMSW and type of collection for LIPOR

Population (8 municipalities)	Espinho Gondomar Maia Matosinhos Porto Póvoa de Varzim Valongo Vila do Conde	
(Total producers)	~1755 collection points/large producers (canteens, markets, restaurants, supermarkets) ~75 collection points/large producers (green waste)	
Targeted material (e.g. general organic wastes, domestic food waste only, food waste and packaging, general organic wastes)	Organic waste separately collected – biowaste (food waste and garden waste).	
Organisation operating collection	Municipalities	
Collection type (e.g. individual household, communal bins)	Communal bins – 50, 80, 140, 240 and 800 litre Big containers for markets and industries – 15 m3 (In both cases only bins are provided, not bags)	
Material type	Separate collection of the organic fraction of MSW (SC-OFMSW)	
Type of vehicle used	15 m^3, waste collection vehicles with double lifting system and compaction or trucks with ampliroll system for big containers – metal box)	
Local and national regulations affecting collection and disposal	Protocols signed between Lipor and the Municipalities to ensure the municipality is responsible for separate collection of organic waste. Contract signed with private companies. There is no national/local regulation that requires separate collection: the decision was made by Valorsul.	
Quantities collected (nominal capacity 60000)	**2010**	**2011**
Food waste	25.975	26.845
Green Waste	18.788	17.716
Total (tonnes)	44.763	44.561
Communication campaign	Programme "Operação 5 estrelas" (meaning five stars operation in Portuguese)	
Tariff	Free; in case of discharge not acceptable a tax/tonne is applied	

Table 21.3. Source of SC-OFMSW and type of collection for VALORSUL

Population (3 municipalities)	Lisbon Loures Amadora
(total producers)	~2565 collection points/large producers: Lisbon Municipality - 1871 Loures Municipality - 531 Amadora Municipality – 163 ~276 familiar buildings/ in 3 locations
Targeted material (e.g. general organic wastes, domestic food waste only, food waste and packaging, general organic wastes)	Organic waste separately collected on large producers like restaurants, canteens, markets, supermarkets and others. There are also two collection circuits [b] that include household waste.
Organisation operating collection	Municipalities of Lisbon, Amadora and Loures/Odivelas and private companies
Collection type (e.g. individual household, communal bins)	Communal bins - standard 1000, 660, 340, 240, 140, 90 litre Households bins: standard 120 litre (In both cases only bins are provided, not bags)
Material type	Separate collection of the organic fraction of MSW (SC-OFMSW)
Type of vehicle used	15 m^3, waste collection vehicles with double lifting system and compaction
Local and national regulations affecting collection and disposal	Protocols signed between Valorsul and the Municipalities to ensure the municipality is responsible for separate collection of organic waste. Contract signed with private companies (like EGEO and MARL - Lisbon Wholesale Market). There is no national/local regulation that requires separate collection: the decision was made by Valorsul.

Sources	**Responsible for collection**	**2008**	**2009**	**2010**	**2011**
Municipal collection	Amadora	1953	2057	2073	1963
	Lisbon	19294	19780	19293	19307
	Loures/Odivelas	2556	2546	2494 [a]	2058 [a]
Private entities	Lisbon Wholesale Market and other private operators	10645	10298	12034	14153
Total (tonnes)		34448	34680	35893	37481

AD Reception	**Type of Waste**	**Collection Schedule**
Wet line	Waste with lower contaminants (includes markets, canteens) – defined by contract as < 5% average	13h00 - 21h00
Dry line	Waste more contaminated (mainly restaurants, supermarkets) – defined by contract as < 11% average	23h00 - 07h00
Communication	Programme "+ Valor" (meaning "more value" in Portuguese)	
	http://www.valorsul.pt/pt/valorizacao-organica/programa-plusvalor/as-regras-de-separacao-de-residuos.aspx	
Tariff	http://www.valorsul.pt/pt/clientes/quanto-custa-depositar-os-residuos-na-valorsul.aspx	

Table 21.4. Source of SC-OFMSW and type of collection

Population (3 municipalities)	Cascais Mafra (only a pilot area)
(total producers)	~136 collection points/large producers
Targeted material (e.g. general organic wastes, domestic food waste only, food waste and packaging, general organic wastes)	Organic waste separately collected on large producers.
Organisation operating collection	Municipalities Cascais and Mafra (3 circuits, two circuits in Cascais and one in Mafra)
Collection type (e.g. individual household, communal bins)	Communal bins - standard 660 and 50 litre (only bins are provided, not bags)
Material type	Separate collection of the organic fraction of MSW (SC-OFMSW)
Type of vehicle used	15 m^3, waste collection vehicles with double lifting system and compaction
Local and national regulations affecting collection and disposal	Admissibility Regulation for Municipalities Multimaterial Waste Collection that defines rules for municipal delivery of multimaterial waste collection on TRATOLIXO MSW treatment unit, including OFMSW selectively collected.
	2011
Total (tonnes)	1938
Communication	Municipalities are responsible for the communication campaigns
Deposition instructions	http://www.emac-em.pt/cache/bin/XPQpLQAXX13157_KlKf17Z0ZKU.pdf
Tariff	Admissibility Regulation for Municipalities Multimaterial Waste Collection is being reviewed at the present time. However, the current tariffs are: 0 €/t for OFMSW

Summary of key findings

- Only 7.4 % of all MSW in Portugal is currently sent for organic recovery
- 3 companies in Portugal have implemented food waste selective collection schemes
- Implementation of other schemes is delayed by economic considerations and the likely focus in on collection from larger producers.
- Meanwhile plants for valorisation of organic waste through compositing or anaerobic digestion will receive organic waste from the mixed MSW collection

References

Bento dos Santos, F. and Cabeças A. J. (2011) Potencial de produção e valorização energética de Combustíveis Derivados de Resíduos pelas empresas do grupo EGF. 7ªas Jornadas Técnicas Internacionais. Porto, 24-26 Outubro 2011.

http://www.eea.europa.eu/soer/countries/pt/soertopic_view?topic=waste

http://www.apambiente.pt/politicasambiente/Residuos/gestaoresiduos/RU/Documents/Relat%C3%B3rio%20RU_2010.pdf

Appendix 22: Results of web-based survey on collection of source segregated domestic food waste in Romania

Organisation of waste collection in Romania

The Ministry of Environment (Ministerul Mediului si Padurilor, http://www.mmediu.ro) develops national policies in the waste management field. It is the state authority for the following functions: strategy, regulation, administration and representation. The Ministry develops strategies in the waste management field and initiates / approves legal standards and norms for waste management.

The National Environmental Protection Agency (NEPA) (http://www.anpm.ro) is the technical body subordinated to the Ministry of Environment, with the following functions: technical support for legal norms, strategies and policies, legislation implementation, coordination of the activities for strategies and policies implementation, representation and permitting.

The Directorate for Waste and Dangerous Chemicals within NEPA coordinates and monitors implementation of legislation in the waste management field. It assures technical support for the initiation of legal standards and norms.

- 8 Regional Environmental Protection Agency (REPA) are established. REPAs are subordinated to NEPA. They accomplish at the regional level the NEPA's responsibilities.
- There are 42 County Environmental Protection Agencies. County EPAs which are subordinated to NEPA. They collect primary information related to waste generation and management and accomplish at the county level NEPA's responsibilities.
- The National Environmental Guard (NEG) is the specialised body of the Ministry of Environment, with responsibilities for inspection and control.

Legislation

Romania has adopted the Directive 94/62/EC, modified and completed by the Directive 2004/12/CE, in its national legislation by Government Decision HG 621/2005, modified and completed by HG 1872/2006. According to this, Romania is obliged to accomplish its annual recycling goals / target / obligations, increasing progressively till 2013. The biodegradable fraction of municipal solid waste (MSW) deposed in landfills must by 2013 be less than 50% of the biodegradable MSW deposed in 1995

- Emergency Ordinance No. 78/2000 on waste regime, modified and approved by Law No. 426/2001, modified by Emergency Ordinance 61/2006, approved by Law 27/2007 transposes Directive 2006/12/EC
- Governmental Decision 1470/2004 on the approval of National Waste management Strategy and National Waste Management Plan it approves National Waste Management Strategy (NWMS) for 2003 – 2013 and National Waste Management Plan (NWMP) for 2004 – 2009.
- Law 211/2011 on the status of waste transposes the new Waste Directive 2008/98/CE.

General objectives according to the Directive 1999/31/CE on the landfill of waste and to the Directive 1994/62/EC on packaging and packaging waste.

Specific targets for avoiding landfill disposal of biodegradable municipal waste – provided by Governmental Decision 349/2005 on the landfill of waste:

- reducing the quantity of landfilled biodegradable municipal waste to 75% from the quantity generated in 1995, by 16 July 2006;
- reducing the quantity of landfilled biodegradable municipal waste to 50% from the quantity generated in 1995, by 16 July 2009;
- reducing the quantity of landfilled biodegradable municipal waste to 35% from the quantity generated in 1995, by 16 July 2016.

For the attainment of targets foreseen in art. 5(2) (a) and (b) of the Directive 1999/31/CE, Romania has applied the paragraph 3 of art. 5(2) of the Directive on the possibility of postponing the attainment of targets by a period of 4 years, by 16.07.2010 and by 16.07.2013, respectively. The third target will be attained by the date set out in the Directive - 16.07.2016.

Waste Prevention. General rules for waste prevention are set in the Emergency Ordinance 78/2000, with its amendments, as follows. Products' producers and the companies with activities that generate waste are obliged to:

- adopt, from the design phase, solutions and technologies for reducing waste generation as much as possible;
- take all necessary measures in order to reduce as much as possible the quantities of waste generated by existing activities;
- design new technologies and activities in order to reduce as much as possible the quantity of waste generated by these activities;
- pack goods in appropriate ways in order to prevent their damage and transforming into waste;
- to totally recover by-products if this is feasible from technical and economic point of view.

Strategy

Romanian strategy for avoiding landfilling of biodegradable waste is contained in the National Waste Management Plan. Measures for the Reduction of biodegradable waste are planned, as follows:

- Composting (aerobic digestion) – after separate collection of
- Anaerobic digestion with biogas production
- Mechanic-biological - after mixed collection
- Reduction of biodegradable waste by separate collection of organic matter (especially green waste) from waste (in less dense urban areas,)

Demonstration facilities should be developed (pilot projects):

- Compost plants: 5,000-10,000 tonnes/year, max. 50,000 tonnes/year each planned
- Total biodegradable waste composting capacity: 680,000-1,000,000 tonnes/year.
- Non-selective collection of biodegradable waste in high density of population areas.
- Mechanical-biological treatment plants: 100,000 tonnes/year
- Building of demonstrative composting and BMT plants.

The results of pilot projects will be used to extend the system.

Information on organisation of waste collection in Romania

Romania has:

- a National Strategy for Waste Management (Strategia Nationala de Gestionare a Deseurilor – SNGD)
- a National Plan for Waste Management (Planul National de Gestionare a Deseurilor – PNGD)

- 8 Regional Plans for Waste Management, for the 8 EU regions (Planurile Regionale de Gestionare a Deseurilor – PRGD)
- 42 County Plans for Waste Management (Planurile Judetene de Gestionare a Deseurilor – PJGD).

The most important national bodies providing information about waste management and waste legislation are the Ministry of Environment and Forests and the National Environmental Protection Agency. Each one of the 42 Environment Agencies in the counties has its own website, as do the main municipalities. Waste collection is organized by public companies of the local authority or by private contractors in medium and large municipalities. According to Romanian legislation, the responsibility for the collection and management of municipal waste belongs to the municipalities. The municipalities have to implement at least the national regulations on separate waste collection and eventually supplementary local decisions.

Methodology

A general web search was carried out using www.google.ro search engine with "Romania" as the region restriction and date restriction for the last 2 years. The keywords used were:
- Colectare + deseuri + bucatarie (kitchen waste collection)
- Colectare + deseuri + alimentare (food waste collection)
- Colectare deseuri menajere biodegradabile (collection of biodegradable domestic waste)
- Colectare separata deseuri alimentare menajere (separated collection of domestic food waste)

The search was then repeated with "usa la usa" (door to door) added to the key words.

Another search was made to see if any food waste was collected separately for anaerobic digestion, using the key words:
- Separarea la sursa deseuri alimentare menajere (source separated domestic food waste)
- Fermentare anaeroba deseuri alimentare menajere (domestic food waste anaerobe digestion)

A further search was carried out to see if any food waste and green waste (biowaste) was collected separately for composting, using the key words:
- Bio-deseuri Romania (biowaste Romania)
- Compostare bio-deseuri Romania (biowaste composting Romania)

Another search was made using the key words
- "Statii de sortare deseuri municipale" → Sorting plants for municipal waste

The site of the most important national bodies providing information about waste management and waste legislation, the Ministry of Environment and Forests (Ministerul Mediului si Padurilor) (www.mmediu.ro) and the National Environmental Protection Agency (Agentia Nationala pentru Protectia Mediului) (www.anpm.ro) were checked for actual waste management legislation..

The websites 5 big private waste operators, 7 big cities including Bucharest and of the 6 districts of Bucharest ("sectoare") were also checked in order to see if they gave any relevant information.

The survey was conducted between 15/03/2012 and 20/04/2012.

Results

No schemes for separate domestic food waste collection exist today in Romania, and it was difficult to find any information on this topic. Searching for separate collection of municipal waste leads to information on recyclable packaging waste only (paper, metal, plastic, glass).

Ministry of Environment and Forests = Ministerul Mediului si Padurilor (www.mmediu.ro)
http://www.mmediu.ro/protectia_mediului/gestiune_deseuri/fluxuri_deseuri/CarteaVerde-gestionare-bio-deseuri.pdf:
The homepage of the Environment Ministry contains, under "biowaste" (bio-deseuri) only a mention about the EU Green Card

http://www.mmediu.ro/legislatie/acte_normative/gestiune_deseuri/2011-proiect_lege_deseuri_draft_final_guvern.pdf:
The draft of the new Waste Law 211/2011 includes only the following few references to biowaste (bio-deseuri):

"Biowaste
Art. 31
(1) The authorities of the local public administration - based on art. 4, par. (1) – (3) and art. 20, have following responsibilities:
a) to make a separate collection of the biowaste for composting and fermenting the biowaste;
b) to treat the biowaste in a manner, which ensures a high level of environment protection;
c) to use materials, which are safe for the environment and which are manufactured from biowaste;
d) to promote the individual composting in households;
(2) the biodegradable waste coming from parks and gardens have to be separately collected and transported to the composting plants or on individual composting platforms.
(3) In case in which the separately collected biowaste contain dangerous substances, then the treatment of such biowaste is prohibited in composting plants."

National Agency for Environmental Protection
The most useful and credible information concerning biodegradable waste is on the website of the National Agency for Environmental Protection = Agentia Nationala de Protectia Mediului (www.anpm.ro).

http://www.anpm.ro/Mediu/raport_privind_starea_mediului_in_romania
The Annual Report on The Environment Situation in Romania, 2010 – Cap. 6. Waste Management
(Raport anual – Starea factorilor de mediu in Romania, 2010 – Cap.6. Managementul Deseurilor)

In 2009, the total amount of collected municipal solid waste was 6.93 million tonnes.

About 63% of the 20 million total inhabitant of Romania have access to municipal waste service. This is 84% in urban area and only 38% in rural area.
In 2009, the total collected household waste was 5.28 million tonnes (76.19% of the total collected municipal solid waste). In the regions with no waste collection, the waste generation index is 0.9 kg/person-day in urban area and only 0.4 kg/person-day in rural area.
The calculated amount of generated but not collected MSW was 1.5 million tonnes 2009.
In 2009 biodegradable waste was 57% of the total quantity of MSW.

The traditional form for domestic waste collections is as mixed waste.
In 2009, 95% of the collected domestic waste was collected in traditional manner – mixed. Separate collection is in the beginning phase, but will be extended.

In 2009, 95% of the collected domestic waste was landfilled

Management of MSW
Non EU conform landfills are closed and new modern landfills are built with EU financing.
2010 Romania had 70 transfer and sorting stations.

Bio-degradable waste
In order to achieve its national targets for reducing the landfilled organic waste, in Romania were build:
- *platforms for green waste composting;*
- *sorting plants for recyclable waste*
- *composting plants near landfills.*

1995 → 4.8 million tonnes
2008 → 3.65 million tonnes (24% reduction)
2009 → 3.60 million tonne (25% reduction)

The municipalities have focused on the easy and cheap composting possibilities for biodegradable waste, especially in rural areas (backyard composting).

In 2011 in Romania 60 composting stations were built for bio-degradable MSW.

The national target for 2010 – to landfill a smaller biowaste quantity of 75% compared to the quantity of 1995 – was reached already in 2009.

Private waste collection company websites

The websites of five big private waste collection companies were also searched for information on separate food waste collection:

SUPERCOM – 2. district of Bucharest (www.supercom.ro – under construction)
ROSAL – 3. district of Bucharest, Ploiesti, Cluj, Suceava, Baia Mare (www.rosal.ro)
REBU – 4th district of Bucharest (www.rebu.ro)
URBAN – Brasov (www.urbansa.ro)
COMPREST – Brasov (www.comprest.ro)

No mention of food waste collection was found, again indicating that no source separated food waste is actually collected from the households.

Sorting plants for MSW
Eventually the biodegradable fraction from the sorting plants will be processed in an AD → biogas → cogeneration (Waste to Energy) scheme, but no information concerning the "Waste to Energy" concept (WTE) could be found on the internet: only short articles or Youtube films on sorting plants. According to the results of the internet research, at least three sorting plant pilot-projects for MSW are in operation now in Romania.
- Sibiu: – Municipal Sorting Plant for MSW – started in September 2010, serving 20 villages near Sibiu - Transylvania, financed by PHARE
- Brasov: – Private Sorting Plant for MSW – started in October 2011, capacity of 30.000 tonnes/year – Private investors are LAFARGE CIMENT ROMANIA and waste management operator URBAN
- Bucharest: – Private Sorting Plant for Municipal Solid Waste – investor SUPERCOM – started in January 2012; www.youtube.com/watch?v=I_1mJUyMSzY

On the other hand, the Report of the National Environment Agency contents a list of 70 sorting plants.

City of Bucharest
The Municipality of Bucharest decided in 2011 to introduce the separate collection of paper, plastic and metal. The separate collection of glass will be introduced 2012. No references to food waste or composting were found.

Figure 22.1. Roadside recycling containers

The websites of the City Hall of Bucharest, including the 6 Sectors of Bucharest were searched with no result on separate collection of domestic food waste:
www.primaria-bucuresti.ro
www.pmb.ro
www.primariasector1.ro
www.ps2.ro
www.sector3primarie.ro
www.ps4.ro
http://www.ghidulprimariilor.ro/business.php/PRIMARIA-SECTORULUI-5-BUCURESTI/152567/
www.primarie6.ro

A requirement for separate collection of package waste was introduced in Bucharest in 2011. Waste producers have the obligation to separate package waste collection. If there is no separate collection, they have to pay 50% more.

Next 7 biggest cities of Romania

The websites of the next 7 biggest municipalities (Cluj, Brasov, Iasi, Timisoara, Constanta, Arad, Satu-Mare) were also checked; however no relevant information related to domestic food waste could be obtained from their websites, excepting Brasov and Arad. Only packaging materials – plastic, paper and glass - are collected at source and recycled. No reference is made to domestic food waste collecting.

www.primariaclujnapoca.ro
Waste producers, households, institutions and companies are obliged to implement separate package waste collection. If there is no separate collection, they have to pay 25% more.

www.brasovcity.ro
Regulations for public cleaning and waste management system / Section 3 / art.29 (1).
"If biodegradable organic waste shall be composted, then the infrastructure for separate collection must be available."

www.primaria-iasi.ro	no reference to food waste collection or disposal
www.primariatm.ro	no reference to food waste collection or disposal
www.primaria-constanta.ro	no reference to food waste collection or disposal
www.primariaarad.ro	no reference to food waste collection or disposal

www.newsar.ro/implementarea-sistemului-selectiv-integrat-de-colectare-a-deseurilor
(Arad):

An exception is the city of Arad, where separate waste collection has been implemented since September 2011. A total of 642 1100-litre containers for packaging waste (paper – blue container; glass – green container; plastic and metal – yellow container) and 25,000 120-litre bins for biodegradable waste have been distributed. A sorting plant with a capacity of 9 tonnes hour^{-1} is in operation in the region of Arad, but as yet there is no transfer station and composting plant. There is a new building permit for the composting plant in the Western Region of Romania and it will be built soon (telephonic information from the City Hall Arad - Environment Department / 23.04.2012).

www.satu-mare.ro
Satu-Mare:

Figure 22.2 Collection containers for dry and wet waste fractions

In 2011 the NW municipality of Satu-Mare implemented a dual system for the separate collection of MSW – a dry and a wet fraction. No references were found to food waste or composting.

Summary of key findings

- Source segregated domestic food waste collection is not yet implemented in any region of Romania. Only one governmental website was found referring to separated collection of domestic food waste.
- Every county can decide its preferred solution for biodegradable municipal waste (individual composting, centralised composting, MBT) and the treatment capacities.
- In 2010, recycling and landfill disposal contributed to almost 99% of the total municipal waste management. Only 1% of the total MSW of Romania is separately collected.
- 70 waste transfer and sorting plants and 60 composting stations for MSW were built by 2010-2011.
- The national target for 2010 – to landfill a smaller biowaste quantity of 75% compared to the quantity of 1995 – was reached already in 2009.
- In order to reach the goals for 2013 and 2016, Romania must improve the separate collection of food waste and the infrastructure.

Appendix 23: Results of web-based survey on collection of source segregated domestic food waste in Slovakia

Organisation of waste collection in Slovakia

Waste management in the Slovak Republic is governed by the Law on Waste (§ 39 of the Law on Waste n.223/2001 Collection of Laws), together with the waste management plan and also the individual municipal ordinance in each municipality. According to §2.14 biodegradable waste from householders is defined as municipal waste. Annex no. 1 of Decree no. 284/2001 Collection of Law deals with biodegradable kitchen and canteen waste.

On 22 February 2012 the government approved a new Waste Management Plan in the Slovak Republic. This management plan is valid for five years. This serves as guidance for regions and municipalities who are responsible for organising waste collections. The Slovak Republic is geographically divided into 8 regions and 79 districts. In every one of the eight regions a Regional Environmental Authority exists which controls and monitors waste management in the region. The districts run District Offices which are involved in waste collection and disposal.

Figure 23.1. The 8 regions of Slovakia

The basic principle applied in Slovakian waste management is the "polluter pays" principle, as stated in the Waste Act § 18 subsection 4. The costs of activities targeting waste collection and disposal need to be met by the waste generator. The new Waste Framework Directive established the following goals for the management of organic waste in Slovakia:

- Processing of organic waste needs to be achieved with low environmental impact.
- If source separate collection of organic waste are in place, it needs to be processed by either composting or anaerobic treatment.

The Waste Management Plan encourages source separate collection of kitchen and canteen waste and biodegradable waste from public and private green spaces and gardens. Government Resolution no. 904/2010 from 15 December 2010 introduced a compulsory reduction of the amount of organic waste going to landfills. The year of implementation of the redirecting organic waste from landfills is 2013, i.e. by this time municipalities have to

make provisions for source separate collection of domestic organic waste, not just for green waste.

The local waste authority collects the necessary tax from citizens and this finances waste collection and disposal. To keep taxes low it is common that waste disposal is cross-subsidised from other areas of council income.

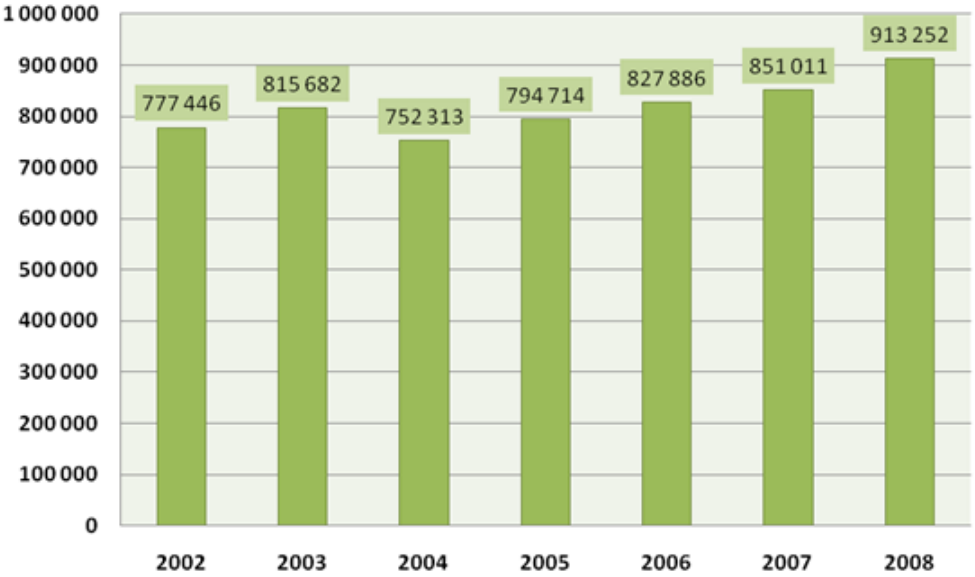


Figure 23.2. The development of biodegradable waste in Slovakia in tonnes.

Methodology

The following terms were entered in the browser google.sk:

- potravinový odpad (food waste)
- biologicky rozložitelný odpad (biodegradable waste)
- záhradný odpad (garden waste)
- separovanie odpadov (separation of waste).

The survey was conducted between 12 - 20 April 2012.

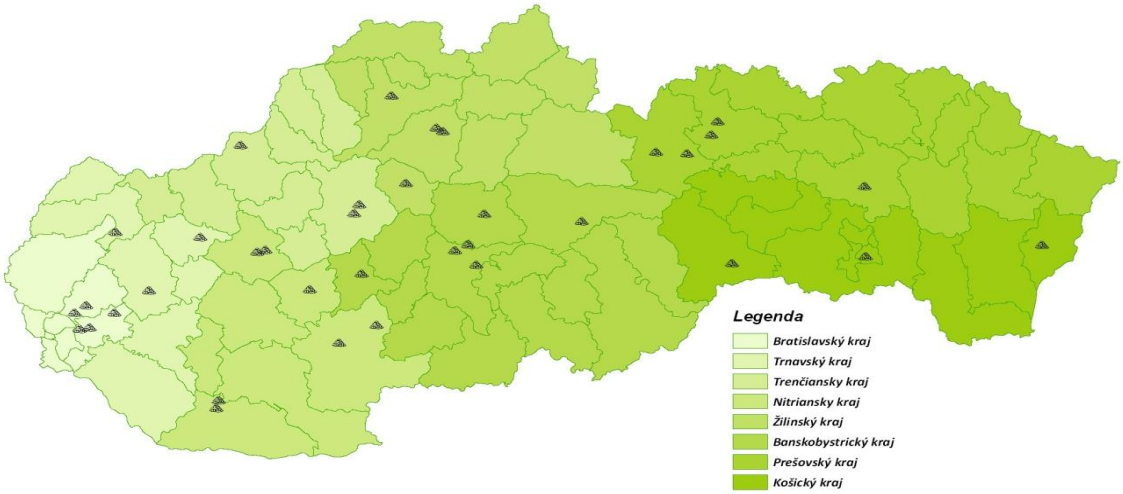


Figure 23.3. Location of composting facilities for biodegradable waste in Slovakia

Results

Source-separate collection of plastics, metals, glass and paper is very common across waste authorities. Separate collection and recycling of food waste from households in Slovakia is, however, not yet common. For example, the greatest organic waste yield is achieved in Pezinok with 21 kg organic waste per person per year. Source separate collection of biodegradable waste (green waste) from gardens, parks and cemeteries is widely practiced in many authorities in Slovakia, but not all. For example the town of Piestany and Sered collected domestic organic waste from 4 July to 31 October in 2011, every Monday before 8a.m. with brown bins that are left at the kerbside.

The city of Žiar nad Hronom has a time table for collection of biowaste as well as used cooking oil on their website. Biowaste collection is carried out for householders using a sack system once a month. Cooking oil is collected once or twice per month with oil containers of size 220 litre distributed around the city on public places.

The city of Bratislava reports on its web site that organic waste collections will be introduced on Monday 23 April 2012 in the Old Town. The service is free. Cooking oil is collected using 220 litre containers once or twice a month.

The city of Košice city introduced organic waste collections in November 2010 in a part of the town called Bernátovce. In Kosice, a company called KOSIT collects organic waste and green waste.

From 2012 onwards the city of Prešov provides organic waste collections from May to October including grass and leaves through the technical services company Prešov. Collections take place fortnightly.

The city of Žilina is an example where no organic waste is currently collected.

The city of Nitra operates the utility company Nitrianské which collects biodegradable waste (grass and leaves).

Banska Bystrica collects organic waste in 240 litre containers but asks not fill the containers with more than 40 kg.

Waste companies
Slovakia has 138 towns and 2981 villages. Companies operating in Slovakia in the field of waste management are the following:

The company A.S.A. Slovakia operates in the following cities: Bratislava, Trnava, Dunaj Streda, Zohor, Modra, Malacky, Šaštín guards, Gbely and others. According to the website of the company currently serves in 1074 towns and cities, nearly 2.6 million people in Slovakia. ASA collects in 32% of villages and towns in Slovakia, and they serve 560 000 inhabitants in a total of 350 communities and cities.

The company also provides environmental education for schools, with a theme based on "contest with Mr Garbage".

The company Marius Pedersen operates in the following regions of Slovakia: Trencin, Bratislava, Pezinok, Hlohovec, Nitra, Left, Šamorín, Piestany, Nove Mesto, Stara Tura, Nováky, Zvolen, Banska Bystrica, Great Krtíš, High Tatras, Kežmarok, Poprad, Kosice, Sabinov and Vranov. Among other things the company manages organic waste composting.

The company KOSIT provides services in waste management for approximately 260000 residents of eastern Slovakia, and for about 500 businesses. It runs collection points and centres for green waste. The company also organises educational projects in nurseries e.g in the Kindergarten Hedgehog Separka.

The website "separujodpad.sk" asks householders to include the following materials in organic household waste:
- fruit and vegetables
- crushed egg shells
- tea bags
- filter coffee
- bread, but also
- food contaminated paper, which cannot be used to produce recycled paper.

Householders are advised not to mix green garden waste with kitchen waste, as in the subsequent biological treatment a quality compost will be produced.

An example of an organic waste collection cycle together with typical plastic bins is shown in Figure 23.4. An example of a biodegradable bag for householders is shown in Figure 23.5. The bags are filled up and placed in a larger 120 litre organic waste bin with lid – Figure 23.7.

Figure 23.4. Separating out waste streams in the household.

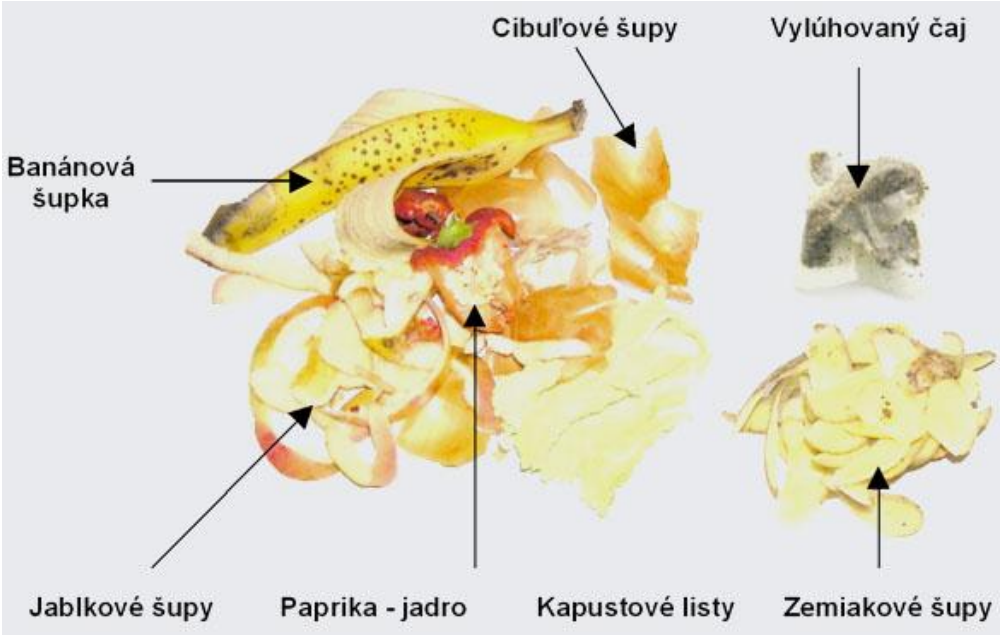


Figure 23.5. Explaining biodegradable kitchen waste to householders.

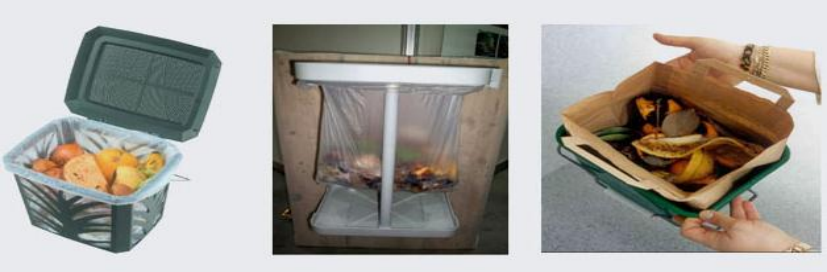


Figure 23.6. Collection caddy, plastic and paper bags

Figure 23.7. Biowaste bins of size 120 litre.

Source, Figure s 23.4-23.7: http://www.separujodpad.sk/index.php/obcan/ako-separovat/bio-odpad/kuchynsky-odpad.html

An association of towns and municipalities of Slovakia, in cooperation with MUNTech, Ltd. is implementing the project "Environmental education of governments and citizens of the Slovak Republic for the separation of municipal waste." The project aims to raise environmental awareness in the separation of municipal waste among citizens and local politicians and officers. The scope of the project is national in nature and is applied in the form of seminars and campaigns in various regions of Slovakia.

Figure 23.8. Biogas station in Rozhanovce (East Slovakia)

Mechanical-biological treatment and construction of infrastructure facilities is in its infancy in the Slovak Republic. The first plant for mechanical-biological treatment began operating in the Bratislava region recently and the second will start in early 2011 in Trnava. Five more facilities are in the planning stage. The Slovak Republic is currently operating four incineration plants.

Amount of organic waste
The Slovak Republic is geographically divided into 8 regions: Bratislava, Banska Bystrica, Kosice, Nitra, Presov, Trencin, Trnava, Zilina. The regions are subdivided into 79 districts.
According to the portal cms.enviroportal.sk organic kitchen and canteen waste in 2010 was as follows:

The total production of food waste was 1527 tonnes. The region of Banska Bystrica contributed 35.85 tonnes or 2%, the Bratislava region 1354.30 tonnes which is 89%, Presov 25.8 tonnes which is 6%, Trnava 17.90 tonnes which is 1%. These data originate from enviroportálu (see references). This site also provides data on the amount of biodegradable waste from gardens and parks, including green waste from cemetries in 2010.
Data on the occurrence and treatment of waste are published in the annual reports on the state of the environment issued by the Ministry of Environment (under § 33b of Act 17/1992 Coll. as amended), as well as in publications of the Statistical Office (waste in Slovakia).

Food waste from large canteens is not classed as domestic food waste.

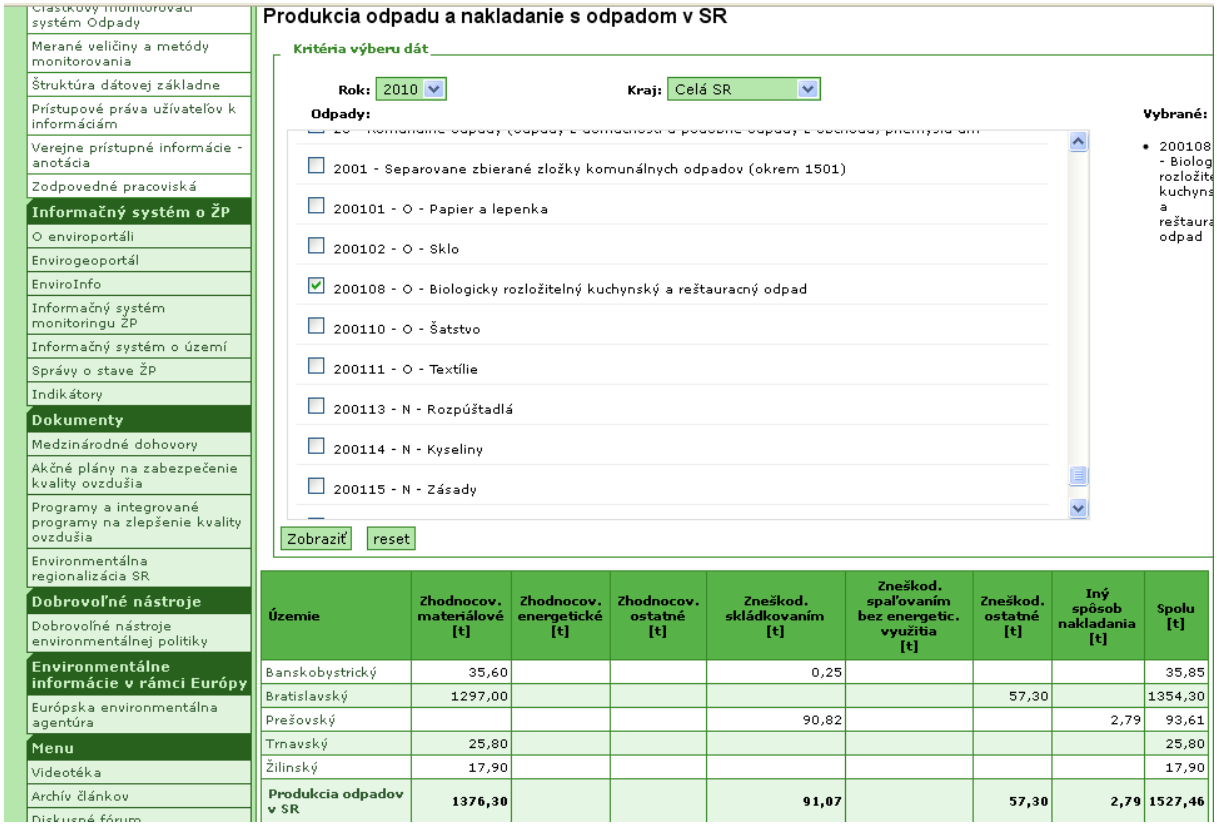
The total biodegradable waste production in 2010 was 94035 tonnes and where
- the Bratislava region produced 20453 tonnes
- Banska Bystrica produced 6752.5 tonnes
- Košice produced 11529.5 tonnes
- Nitra produced 18049 tonnes
- Prešov produced 8255.8 tonnes
- Trencin produced 7701 tonnes
- Trnava produced 14667 tonnes
- Žilina region produced 6627.2 tonnes.

Data from the year 2011 are not yet published.

Table 23.1. Kitchen waste and total biodegradable waste generated and reported in 2010.

	Kitchen and canteen waste (tonnes)	Total biodegradable waste (tonnes)
Zilina region	17.9	6627
Banská Bystrica region	35.8	6752
Trencin region	-	7701
Presov region	93.6	8256
Kosice region	-	11530
Trnava region	25.8	14667
Nitra region	-	18049
Bratislava region	1354.3	20453

200201- Food and canteen waste



Produkcia odpadu a nakladanie s odpadom v SR

Kritéria výberu dát

Rok: 2010 Kraj: Celá SR

Odpady:

- 2001 - Separovane zbierané zložky komunálnych odpadov (okrem 1501)
- 200101 - O - Papier a lepenka
- 200102 - O - Sklo
- 200108 - O - Biologicky rozložitelný kuchynský a reštauracný odpad
- 200110 - O - Šatstvo
- 200111 - O - Textílie
- 200113 - N - Rozpúšťadlá
- 200114 - N - Kyseliny
- 200115 - N - Zásady

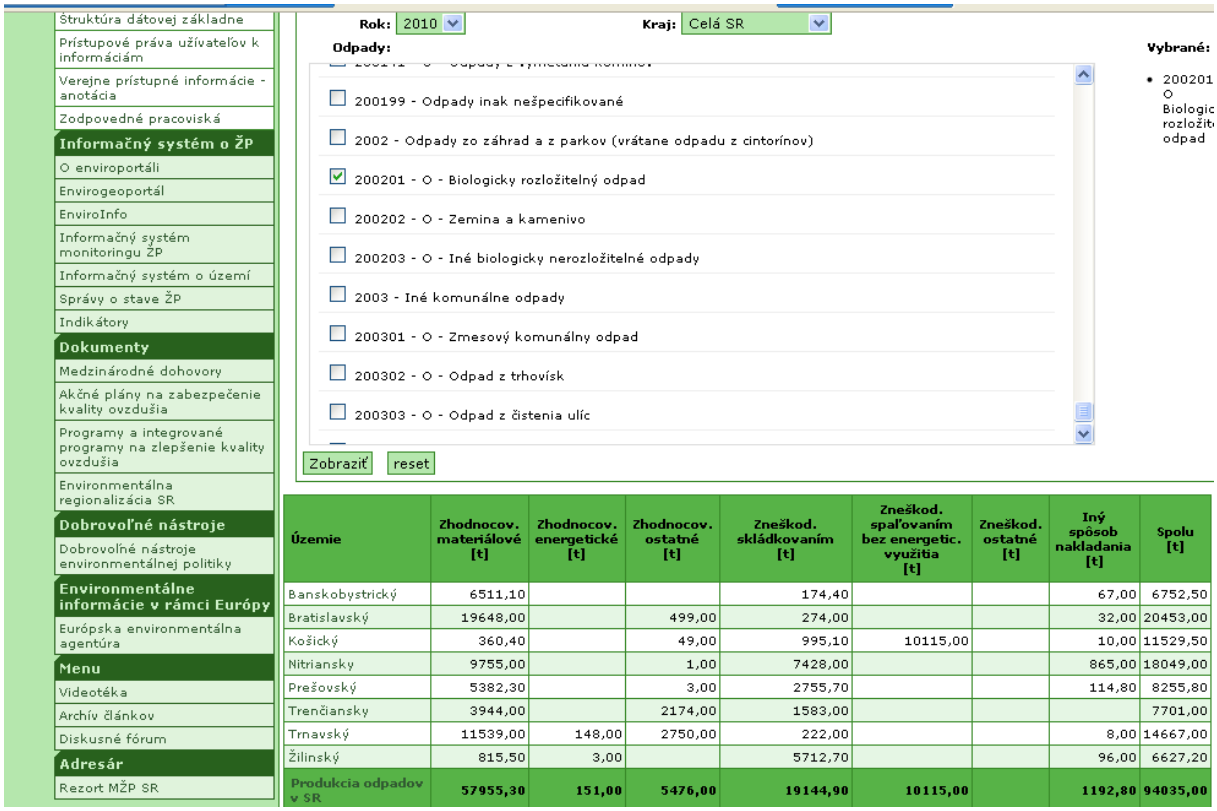
Vybrané:

- 200108 - Biolog rozložite kuchyns a reštaura odpad

Zobraziť reset

Územie	Zhodnocov. materiálové [t]	Zhodnocov. energetické [t]	Zhodnocov. ostatné [t]	Zneškod. skládkovaním [t]	Zneškod. spaľovaním bez energetic. využitia [t]	Zneškod. ostatné [t]	Iný spôsob nakladania [t]	Spolu [t]
Banskobystrický	35,60			0,25				35,85
Bratislavský	1297,00					57,30		1354,30
Prešovský				90,82			2,79	93,61
Trnavský	25,80							25,80
Žilinský	17,90							17,90
Produkcia odpadov v SR	**1376,30**			**91,07**		**57,30**	**2,79**	**1527,46**

200201- Biodegradable waste



Rok: 2010 Kraj: Celá SR

Odpady:

- 200199 - Odpady inak nešpecifikované
- 2002 - Odpady zo záhrad a z parkov (vrátane odpadu z cintorínov)
- 200201 - O - Biologicky rozložitelný odpad
- 200202 - O - Zemina a kamenivo
- 200203 - O - Iné biologicky nerozložitelné odpady
- 2003 - Iné komunálne odpady
- 200301 - O - Zmesový komunálny odpad
- 200302 - O - Odpad z trhovísk
- 200303 - O - Odpad z čistenia ulíc

Vybrané:

- 200201 O Biologic rozložit odpad

Zobraziť reset

Územie	Zhodnocov. materiálové [t]	Zhodnocov. energetické [t]	Zhodnocov. ostatné [t]	Zneškod. skládkovaním [t]	Zneškod. spaľovaním bez energetic. využitia [t]	Zneškod. ostatné [t]	Iný spôsob nakladania [t]	Spolu [t]
Banskobystrický	6511,10			174,40			67,00	6752,50
Bratislavský	19648,00		499,00	274,00			32,00	20453,00
Košický	360,40		49,00	995,10	10115,00		10,00	11529,50
Nitriansky	9755,00		1,00	7428,00			865,00	18049,00
Prešovský	5382,30		3,00	2755,70			114,80	8255,80
Trenčiansky	3944,00		2174,00	1583,00				7701,00
Trnavský	11539,00	148,00	2750,00	222,00			8,00	14667,00
Žilinský	815,50	3,00		5712,70			96,00	6627,20
Produkcia odpadov v SR	**57955,30**	**151,00**	**5476,00**	**19144,90**	**10115,00**		**1192,80**	**94035,00**

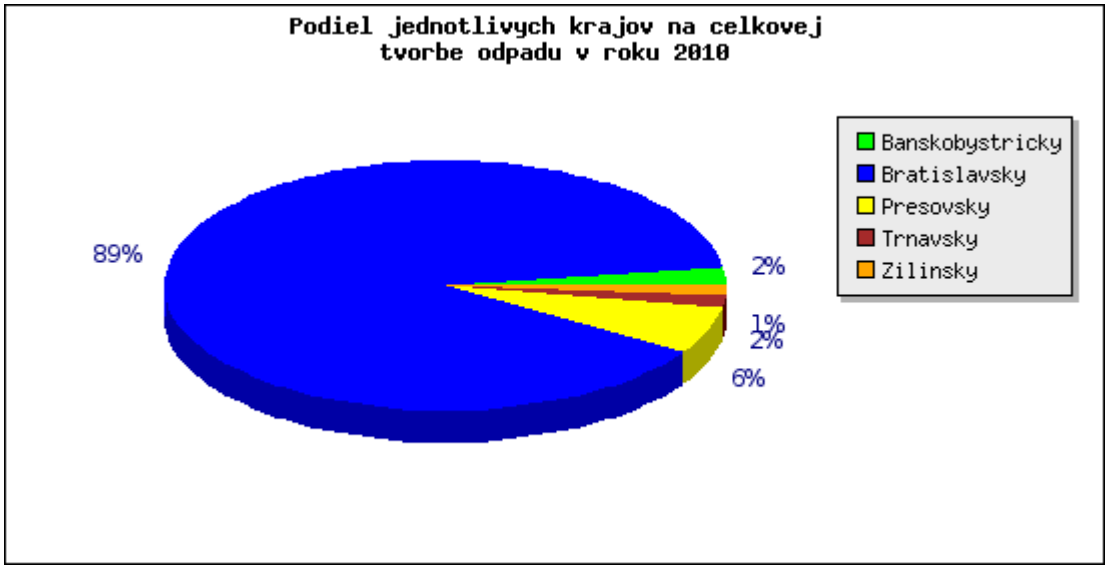


Figure 23.9. Fraction of kitchen and canteen waste in 2010 per region.

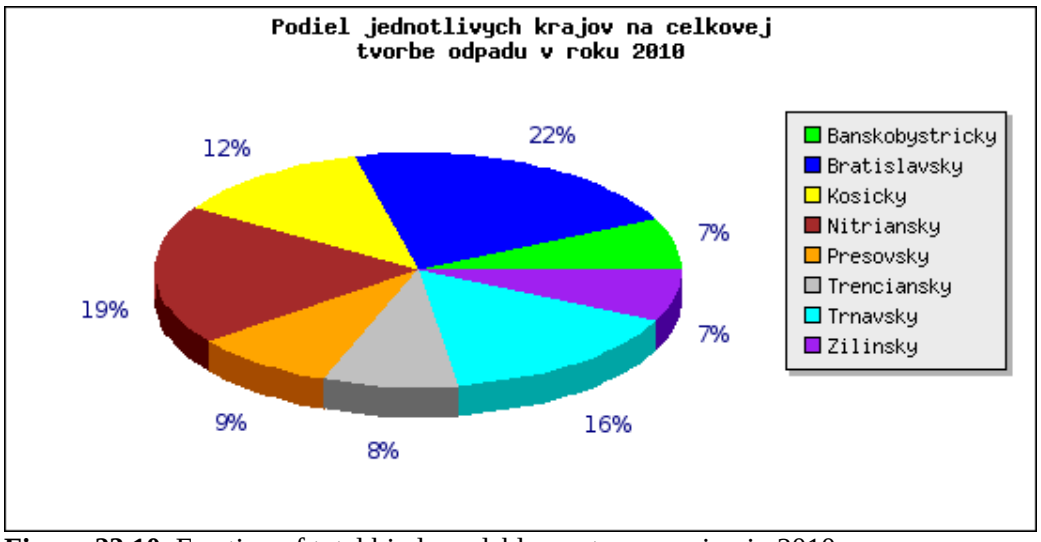


Figure 23.10. Fraction of total biodegradable waste per region in 2010.

Summary of key findings

- Separate collection of food waste from households in Slovakia is not common
- Some cities and towns have source-separate food waste collections in place but these are together with green waste
- The area in and around Bratislava is the only region where food waste collections are in place to a certain extent
- Definitions of biodegradable waste are close to those for food waste, especially in urban areas without gardens
- The population of 5.4 million and a total biodegradable waste yield of 94000 tonnes mean that only 17 kg of organic waste is collected per person per year in 2010.

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Annex

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http://cms.enviroportal.sk/waste/public-information.php

Appendix 24: Results of web-based survey on collection of source segregated domestic food waste in Slovenia

Organisation of waste collection in Slovenia

In accordance with the national legislation of Slovenia and with the Regulation on the Management of Biodegradable Kitchen and Green Garden Waste (RMBKGW, 2010), segregated collection of biological wastes, including kitchen and garden wastes, is required in Slovenia. Segregated collection of biological wastes is the responsibility of utility companies - usually public waste management companies).

Mixing of biodegradable wastes with other household wastes is forbidden. The generators of such waste must ensure home composting of this material (preferred option) or if it is not possible to compost it at home, it must be collected separately in brown/green collection containers and left for the waste management companies. The public service waste management company does not charge for biowaste collection and recovery to those households that compost biodegradable waste themselves.

Decisions on how to organise household waste collections are adopted at the national level; there are some small differences between 210 municipalities in Slovenia, however, mainly in the colour of biowaste containers, frequency of waste removal etc. The waste management company responsible for waste collections in the area of a certain municipality chooses whether there is a door-to-door collection, and how frequently each waste is collected. This usually depends on the territory covered by the municipality (rural or urban), population density, and available funds for waste management. Furthermore, the municipality can choose to carry out the waste collection using its own workforce (public company) or can ask a private company to do it. In most cases, however, wastes are cases collected by public utility companies. The biggest private company for waste collection in Slovenia is Saubermacher Slovenia (http://www.saubermacher.si).

If a member of the public wants to obtain information about waste collection, this can be found on the municipality's website, various leaflets or even printed on the back of the invoice. This usually includes information on the categories into which wastes must be sorted, which bins to use, how to ask for a bin and when the different collections occur.

Methodology

The main national agencies providing information on waste management are the National Statistics Office of Slovenia (Statistični urad republike Slovenije - SURS, www.stat.si) and the Environment Agency of the Republic of Slovenia (Agencija republike Slovenije za okolje - ARSO, www.arso.gov.si) which publishes annual Environmental Indicators (Kazalci okolja - KOS). The websites of these organisations were searched for information on separate food waste collections, especially on the amount of biological waste collected, amount of biological wastes exported and types of waste recovery used in Slovenia.

First a general web search was carried out. The keywords used were: separate (ločeno) + waste (odpadkov) + collecting (zbiranje) + Slovenia (Slovenija). Terms used for different waste types were "odpadki hrane" (food wastes), "kuhinjski odpadki" (kitchen wastes), and "biološki odpadki" (biowastes) and were also used in the web search. Keywords were used all together and in different combinations.

A number of websites of public and private waste management companies (Snaga Maribor www.snaga-mb.si; Snaga Ljubljana www.jhl.si/snaga; Saubermacher Slovenia www.saubermacher.si; Komunala Zagorje www.komunala-zagorje.si; Komunalno podjetje Ormož www.kp-ormoz.si; Simbio www.simbio.si) were also studied to see if there are any differences between separate waste collections or between different municipalities and to collect more detailed information about the type and frequency of biological wastes collection schemes. The websites of some regions, municipalities and larger cities were also reviewed (Maribor www.maribor.si; Ljubljana www.ljuljana.si; Celje wwwcelje.si; Koper wwwkoper.si; Kranj www.kranj.si).

The current state of Slovenian biogas plants was also examined. The number, type and installed power of biogas plants were investigated by reviewing existing studies about biogas production and potential in Slovenia.

National legislation about separate waste collection was reviewed and cross compared.

The survey was conducted between March 20, 2012 and April 6, 2012.

Results

The results indicated that there is no source separated collection of domestic food waste in Slovenia, other than in combination with green waste. Kitchen and garden wastes are collected together within the general category of biological wastes.

None of the official websites included in the survey provided any information on source segregated food waste collection as a specific category. Food/kitchen wastes are included in biological wastes. National or company statistics do not provide any data on separate collections of food waste. The websites of Maribor, Ljubljana, Celje, Koper, and Kranj gave only very general data and no information about separate food waste collection was found.

At least one pilot project has been carried out, when separate waste collection schemes were introduced (in 1997 and 1998) in Maribor (a city with 104,000 inhabitants). All registered households were equipped with small 10-litre containers (or 35-litre containers for apartment blocks). The main findings were that households used this container for other purposes, and they used other ways of collecting biowastes e.g. paper bags, paper plates etc. Because households were not interested in the separate kitchen waste collection and because the pilot project showed that the quantity of collected kitchen wastes was smaller than expected, it was concluded that the collection method tested was not effective; and as there were no regulatory requirements for separate kitchen waste collection Snaga Maribor, the public utility company of Maribor, therefore decided not to proceed with this kind of collection. It is possible however that the situation would be different now, as environmental awareness is higher than in 1997, separate waste collection schemes are widely adopted and kitchen wastes are collected separately in most households in Slovenia but are put in biowaste containers.

Annual reports about the types and quantities of collected waste are mandatory for all separate waste collection contractors; however these reports are not published and are therefore unknown to the public.

When reviewing the websites of individual waste collection contractors and municipalities, no separate food waste collections were found. This service is not offered, because the share of food wastes in biological wastes is high enough for efficient use in biogas plants. Because households that produce a lot of biological wastes (e.g. private houses, farms, those with their own garden etc) should primarily compost their biological wastes where possible, and because some households compost their garden wastes and at the same time receive a separate biowaste collection service, biowastes mainly consist of kitchen wastes. This is especially true in urban areas, where households do not have gardens but live in apartment blocks. Therefore biological wastes are typically wet enough and appropriate for composting and for use in biogas plants (Biofutura, 2009).

Separate collection of kitchen and garden wastes instead of joint collection of biological wastes has been identified as too expensive by the two biggest public utility companies in Slovenia - Snaga Ljublajna and Snaga Maribor (Snaga Maribor, 2012 andpersonal communication with Head of Biowastes in Snaga Maribor, Mr. Miran Čurin). The estimated benefits resulting from the increased efficiency of biogas plants (or the improved quality of the compost) are expected to be lower than the estimated increase in costs for separate collection of kitchen and garden wastes.

Kitchen wastes are collected separately in restaurants, school and other canteens (e.g. primary and secondary schools, universities, hospitals, old people's homes, councils) and from catering services and public kitchens (RMBKGW, 2010) (Figure 24.1).

Figure 24.1. Requirement for separate collection of canteen wastes, from Snaga Maribor (http://www.snaga-mb.si/dejavnosti-podjetja/loceno-zbiranje-odpadkov/organski-kuhinjski-odpadki-pomije/)

The web based survey of Slovenian municipalities and utility companies carried out in March and April 2012 showed that more than 50% of households in urban areas use biological waste collection and disposal. In rural areas this share is much smaller and is approximately 10% (Snaga Maribor, 2012 and pers. comm). Utility companies offer (or at least should offer) separate biowaste collection services or at least the possibility of composting in all

municipalities - rural and urban. This is not yet fully implemented in rural areas, however, where people usually compost their biological wastes themselves.

The amount of biological wastes deposited in mixed/other household wastes and then landfilled is also still higher than the objective set for 2012 (OPOO, 1999). Results of analysis carried out by Snaga Maribor (sieve analysis) has shown that approximately 15-20% of kitchen wastes and from 3 to 17 % (strong seasonal dependence) of garden wastes can still be found in containers for mixed/other household wastes (Snaga Maribor, 2012 and pers. comm).

Biological wastes in Slovenia are collected in 120 and 240-litre containers coloured brown or green. Because the density of biological wastes is quite high larger containers are not suitable for biological waste collection, because they can be easily damaged when disposing of the wastes. Biological wastes are collected door to door. Large garden wastes like wood, large branches and logs must not be put in biological wastes containers but should be disposed of at collection/recycling centres (Snaga Maribor, 2012; Snaga Ljubljana, 2012; Simbio, 2012, Komunala Zagorje, 2012; Komunalno podjetje Ormož, 2012, Saubermacher Slovenija, 2012). Figure 2 shows an example for information available to the public on materials accepted in the collections. Because the containers are used relatively small, it is impossible to put large wastes that do not belong in biological waste (like bicycles etc) into them. Based on the data of Snaga Maribor (2012), most householders use the biological waste collections properly.

Figure 24.2. Information on the organic waste collections from the website of Snaga Maribor (http://www.snaga-mb.si/dejavnosti-podjetja/loceno-zbiranje-odpadkov/biorazgradljivi-odpadki-in-zeleni-vrtni-odpad-iz-gospodinjstev/)

Biological wastes are collected once a week during the summer period and once every fortnight in the winter period, when quantities of biological wastes are smaller and temperatures lower. Some differences can be noted between waste management companies collecting biowastes in rural and urban areas and in the duration of summer/winter period.

The collected biowastes are mainly composted. There are 6 operating composting facilities in Slovenia. The biggest one is the composting plant at Vrhnika founded in 1997 (when separate biological waste collections started), which that composts more than 10,000 tonnes of biological household wastes (Kompostarna Vrhnika, 2012).

The examination of the current state of biogas exploitation in Slovenia showed that the biogas potential in Slovenia is relatively unexploited, but the growth of exploitation from 2008 to 2009 was a considerable 117%. The production of electricity from biogas at the end of 2009 was approximately 40 GWh. At the end of 2010, there were 17 biogas plants with approximately 17 MW of installed capacity (JARSE, 2011). Studies and strategic documents (e.g. National Renewable Energy Action Plan - NREAP, 2010) have concluded, however, that the biogas potential in Slovenia is very high. The technical potential estimated in studies, considered in the preparation of National Energy Programme, differs significantly: from 222 to 2755 GWh/year (MZG, 2010). The maximum technical biogas potential of Slovenia is likely to be overestimated and the minimal underestimated. Despite this, NREAP foresees production of approximately 367 GWh/year of energy in biogas plants with a total installed capacity of 61 MW by 2020 (58 MW by 2015) (NREAP, 2010). In similar studies such as Biogas for Eastern Europe project (BiG East, 2009), which were not included in the preparation of NREAP and NEP, the estimated technical and total potential is much smaller. The NREAP goal may not be too ambitious, however, because the study made by the Agricultural and Forestry chamber (KGZ, 2011), which was also not included in the preparation of NREAP and NEP, estimates a biogas potential by 2020 of 927 GWh/year, which is almost three times more than the NREAP goal for 2020. Because biogas plants also use a certain percentage of biological wastes as a substrate for biogas production, it is important to have information about potential capacities for biowaste processing.

The examination of potential raw materials/waste for biogas production also showed that biogas potential is largely unexploited. In 2007, biogas plants in Slovenia used approximately 2,800 tonnes of biological wastes. The collected annual amount of municipal biowaste in Slovenia is approximately 30,000 tons which represent 3.6% of all municipal waste (SURS, 2011 and ARSO, 2010); 64% of which is used in Slovenian biogas plants for biogas production (ARSO, 2010). The price for collecting biological waste from households is approximately €70 per ton (Biofutura, 2009).

Biological wastes are also exported from Slovenia. However, Slovenia mainly exports sewage sludge and only a small percentage of collected biowastes is exported.

The goal of Slovenia is to reduce landfilled biodegradable waste from 47% (base year 1995) to 16% by 2015 (OPOO, 1999).

Summary of key findings

- Separate collection of domestic food wastes in household is almost unknown and is not implemented in Slovenia. There has however been at least one pilot project related to separate kitchen waste collection.
- Food wastes are collected together with garden wastes in 120 and 240-litre containers within the door to door biological wastes collection scheme.

- More than 50% of households in urban areas and approximately 10% of households in rural areas use biological wastes collection schemes. Others compost their biological wastes themselves.
- There is a priority to increase the share of collected biowastes and to decrease the share of biowastes in other/mixed household wastes. However, separate food waste collection from households is not planned in the near future.
- Quantities of collected and composted biowastes are increasing. Biogas production and the number of operating biogas plants have also increased constantly in the last decade.

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Appendix 25: Results of web-based survey on collection of source segregated domestic food waste in Spain

Organisation of waste collection in Spain

Competencies regarding the environment in Spain are deferred to the autonomous communities (comunidad autónoma, CA). Collection, treatment and disposal of waste is the responsibility of the municipalities following the regulatory framework set up by the EU, Spain and regional governments. The Waste Management Plan 2008-2015 ("Plan Nacional Integrado de Residuos, PNIR, 2008-2015") establishes national targets for waste management, but the execution, methodology and strategies to achieve them are entirely the responsibility of the local authorities following CA guidance. Spain is comprised of 19 CAs that cover a total area of 505658 km^2. Depending on the area of the CA, it can consist of just one province (e.g. Madrid) or several provinces (e.g. Andalucía with 8 Provinces). In some CAs waste management (e.g. collection, transfer and treatment) is organised at the provincial level but in others different geographical arrangements are in place. Local authorities have the responsibility to contract private companies to provide the different services for waste management (e.g. collection, selection, treatment, etc) and to ensure and enforce the quality of the different services. Generally, one-year contracts are signed between the local authority and the private company through a public bid process. Therefore local authorities could be considered as unitary authorities responsible for both collection and disposal. The cost of household waste collection is generally part of the monthly public services bill levied on each household. Rates for the service vary throughout the country. An additional charge may be levied for garden waste or bulky items, at the discretion of the local authority. The local authority is also responsible for the supply of any container required to hold the waste that it has the statutory duty to collect, but is not required to provide additional lining materials. It is also not responsible for supplying equipment such as home composters or garden refuse sacks, although it may do so free of charge or at a subsidised rate depending on CA policy. It has been found that some local authorities apply discounts for households that use home composting due to their lower household waste production.

The Plan Nacional Integrado de Residuos (PNIR, 2008-2015) requires that each municipality with a population over 5000 inhabitants collects source separated waste. The PNIR specifies that at least four streams of waste should be collected in domestic and civic amenities and places special emphasis on the separate collection of recyclable materials. Consequently, most CA have implemented urban (i.e. domestic and civic amenities) collection of waste using four containers as (1) Paper/Card, (2) Glass, (3) Packaging and (4) Organic Fraction (OF). Generally, the OF is a mixture of food waste (FW), green waste (GW) and a list of materials that varies within communities. A further requirement in the PNIR is that special materials (e.g. furniture, electronics, paints and solvents, etc) must be taken to special waste collection points located at public places, referred to as clean points (Puntos Limpios). In Spain, FW is rarely collected as a separate stream; the only identified example is the Basque Country. However, FW/GW collection schemes are widespread in Catalunya and Castilla-Leon, partially implemented in Islas Baleares and under pilot programmes in Castilla La Mancha and La Rioja. Biowaste collection schemes are planned and under execution in Aragon where livestock waste is the main component in the OF.

Statistics are available for urban waste rather than for domestic waste in most regions. Detailed data on urban waste collection is available from the INE (Instituto Nacional de Estadisticas) on their webpage (http://www.ine.es/) and in the report "Cantidad de residuos

urbanos recogidos clasificados por tipo de residuo y CC.AA". Biowaste is reported as the fraction of urban waste that is not collected as a separated source (i.e. container 4). Information on waste collection services is widely publicised on CA, provinces and municipalities webpages, but no central body is in charge of reporting compiled data for the whole country.

Methodology

A systematic search was carried out of webpages for the 19 CA waste collection authorities in Spain, with the aim of identifying those offering collection of source segregated food waste (FW) either as a single material or co-mingled with gardem wastes (GW) as well as those offering biowaste collection (BW).

The search was carried out by going to the main website of the autonomous regions, finding the section dealing with waste management and looking for information on food waste collection. For those CAs identified as having schemes further information was gathered from each website according to the headings shown in Table 1. Often the websites of the local authorities (municipalities) hold more details including allowed and not allowed wastes, frequency of collections and reasons for collecting separately.

Reports of programmes of waste management schemes in the different CA identified through the web pages were examined to identify general and key features of the waste collection schemes and to determine the current status in the implementation of such schemes. Webpages of municipalities or provinces with FW, FW/GW or Biowaste collection schemes were examined in detail to identify the specific characteristics of each scheme.

Local authority area and population data was obtained from INE (2009) and indices of human development from Fundacion Bancaja (2010). Tonnages of urban waste collected and tonnages sent for recycling, composting or re-use in 2009 were taken from the INE (2009) for 17 of the 19 CA which cover 99.8% of the population (i.e. data for the autonomous cities of Ceuta and Melilla were not available). This data was used for comparison purposes between the different CA. For some CA statistical information for household waste was also found and reported in the Annexes dedicated to individual autonomous communities.

The following terms were found useful in web searches:

Food waste: Spanish - Food waste: "restos de comida, residuos organicos, materia organica, fraccion organica, compost"; Catalan - “restes del menjar, residus organics, materia organica, fraccio organica, compost” (food waste, organic waste, organic matter, organic fraction, compost)
Waste management: Spanish - “recogida selectiva, gestion de residuos, residuos domesticos, recogida de basuras, residuos urbanos, recogida puerta a puerta, punto limpio, ecoparque, planta de tratamiento, basurero, vertedero”; Catalan - “recollida selectiva, gestio de residus, residus domestics, recogida d’escombreries, brossa, residus urbans, recollida porta a porta, deixalleries, ecoparcs, planta de tractament, abocador” (collection, waste management, domestic waste, refuse collection, municipal waste, collected door-to-door)
Containers: Spanish - “containers de superficie, containers subterraneos, sistema de recogida neumatica, container plasticos, container envases, container materia organica, container vidrio, container papel, cubo de la basura, cubo materia organica”; Catalan - “container de superficie, container subterrani, sistema de recollida subterrania, sistema de recollida

pneumatica, container plastic, container envasos, container materia organica, container vidre, paper, cub de la materia organica" (surface containers,underground containers, pneumatic collection system, containers for specified materials including organic waste)

Table 25.1. Data collected in survey

No	Main Category	Subcategory	Unit	Observation
	Year Assessed			
1	Local Authority	Name		Name
2		Type 1		
3		Type 2		
4		Region		
5	LA Characteristics	Area	km2	Area
6		Population	no.	Population
7		Population density	person/km2	Population density
8	General waste	Household - total waste	tonnes/person-year	Waste
9		Household waste sent for recycling/composting/reuse	tonnes/person-year	Recycling
10			% total	Recycling %
11	Socio-economic	Indices of Human Development	Average Score	IHD
12			Rank of Average Score	IHD
13	Separate FW collection?	Type		
14		Status		
15		Comment		
16	Collection frequency	Separate FW Collections		
17		Residual waste collection		
18		Separate Recyclable Collection		
19		Separate Green waste		
20		Comment		
21	Materials	Bones		
22		Eggshells		
23		Paper/ card		
24		Shredded paper		
25		Liquid		
26		Oil / fat		
27		Faecal		
28		Plant		
29		Biodeg bags		
30		List accepted		
31		Accept		
32		List rejected		
33		Reject		
34		Comment		
35	Containers	Caddies (e.g. 5-10 litres)	yes/no	
36			size (l)	
37		Buckets (e.g. 10-25 litres)	yes/no	
38			size (l)	
39		Wheeled bins	yes/no	
40			size (l)	
41		Other bins	yes/no	
42			type	
43			size (l)	
44		Biodegradable bags	yes/no	
45			user pays?	
46			Comment	
47		Wrap in newspaper		
48		Comment		
49	Destination plant	Plant		
50				
51		Treatment type		
52		Treatment comment		
53	Information provided	Promote home composting?		
54		Give reasons for collection?		
55		Comments		

Results

CA were identified according to Table 2 below. The last column indicates whether there is collection of source segregated food waste (FW) either as a single material, co-mingled with green wastes (GW), or part of a biowaste collection (BW).

Table 25.2. Autonomous Communities (CA) in Spain

CA	Population (inhabitants)	Area (km^2)	Population density (inhabitants/ km^2)	%Area	%Population	Food Waste Collection
Andalucia	8424102	87268	97	17.3%	17.9%	No
Catalunya	7539618	32114	235	6.4%	16.0%	Yes
Madrid	6489680	8028.00	808	1.6%	13.8%	No
Valencia	5117190	23255	220	4.6%	10.9%	No
Galicia	2795422	29574	95	5.8%	5.9%	No
Castilla y Leon	2558463	94223	27	18.6%	5.4%	Yes
Pais Vasco	2184606	7234	302	1.4%	4.6%	Yes
Islas Canarias	2126769	7447.00	286	1.5%	4.5%	No
Castilla La Mancha	2115334	79463	27	15.7%	4.5%	Yes
Murcia	1470069	11313	130	2.2%	3.1%	No
Aragon	1346293	47719	28	9.4%	2.9%	Yes
Islas Baleares	1113114	4992	223	1.0%	2.4%	Yes
Extremadura	1109367	41634.00	27	8.2%	2.4%	No
Asturias	1081487	10604	102	2.1%	2.3%	No
Navarra	642051	10391	62	2.1%	1.4%	No
Cantabria	593121	5321	111	1.1%	1.3%	No
La Rioja	322955	5045	64	1.0%	0.7%	Yes
Ceuta	82376 (combined total)	18				
Melilla		12	2496	0.0%	0.2%	No data
TOTAL	47112017	505658				7 FW

Table 25.325.3 and 25.4 summarise the population and average parameters of CAs by type of FW collection service.

Table 25.325.3 shows the population provided with each type of FW collection service. Almost 17 million, or 36.5 % of the population of Spain (53.6% of the area according to Table), live in areas which now offer some form of separate collection of FW: it should be noted, however, that this is not equal to the number with current access to FW collections,

since in many cases these schemes are recently introduced and have not yet been rolled out to the full CA area.

Table 25.3. Population of CAs by type of service provision

		Population	
No separate FW collection	No separate FW collection	29,740,251	63.5%
	Total	29,740,251	
Separate FW collection	FW-only collection	2,178,339	36.5%
	FW/GW collection	13,598,733	
	Biowaste collection	1,347,095	
	Total	17,124,167	
Total		46,864,418	

Table 25.4 shows some average parameters for the CAs according to their FW collection group. Of the 17 waste collection authority websites examined, 7 (41.2%) had some form of food waste collection. 1 of these were for food waste only, 5 were mixed collections with garden waste and 1 mixed with other organic waste (e.g. livestock waste).

Table 25.4. Average parameter values for CAs with different collection systems

	Food waste collection scheme				
	FW only	FW/GW	Biowaste	No FW	All FW
Number of UA	1	5	1	10	7
Area (km^2) [b]	7,234	43,167	47,719	23,484	32,707
%Area [a]	1.4%	42.7%	9.4%	46.4%	53.6%
% Population [a]	4.6%	28.9%	2.9%	63.2%	36.4%
Population density (number of persons/km^2) [b]	301.1	114.6	28.2	193.0	148.0
Urban waste (tonnes/person-year) [b]	0.618	0.588	0.555	0.558	0.587
Urban Waste sent for recycling, composting or reuse (tonnes/person-year) [b]	0.133	0.133	0.098	0.090	0.122
%Recycling + composting+reuse [b]	21.6%	22.8%	17.7%	15.9%	20.7%
Average of IHD [b]	0.99	0.95	0.96	0.95	0.97
Average of Ranking score IHD [b]	1	9	5	11	5
a: Sum of % area and population for the UA in the group					
b: Average of area, population density, urban waste and IHD for the UA in each group					

Some differences were noted between the groups of CAs with no separate FW collections and those with FW-only or co-mingled collections.

On average, CAs with FW-only collections were more densely populated, sent more urban waste for recycling, composting and reuse and had better indices of human development than those without a separate collection service. Similarly, CAs with a type of FW collection (i.e. FW/GW and Biowaste) on average had higher recycling percentages (i.e. waste sent for

recycling, composting and reuse) and better indices of human development than those without FW collection services.

A slightly more complex picture can be seen from the distributions in Figure 1: for example, 5 of the 7 CA offering a type of FW collection had better IHD ranking (i.e. ranked in the first 10 positions in the country), while CAs ranked in the last 7 positions are less likely to offer a separate collection service. Whilst the influence of population and population density on the presence of FW collection scheme is less clear with collections in all the groups examined.

CAs with higher proportion of urban waste sent for recycling, composting and reuse (i.e.>20%) were more likely to offer a FW collection scheme (e.g. 4 of the 7 schemes). The remaining 3 CA offering a FW collection scheme had recycling rates in the range 10-20 %. As the number of FW collection schemes is increasing (e.g pilot and planning stages) these results are only a snapshot of the current position, but may indicate the characteristics and motives of early adopters.

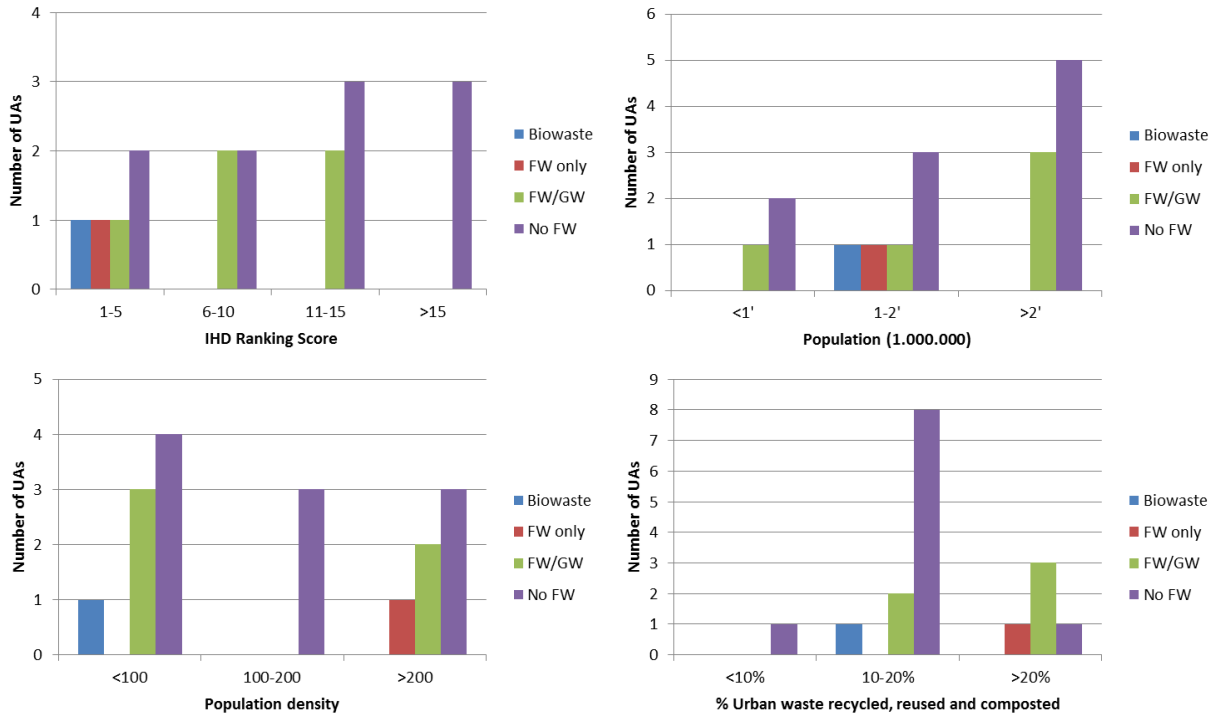

Figure 25.1. Distribution of selected CA characteristics according to type of FW collection scheme

Source segregated FW collections

Some key characteristics of the CAs that provide some type of FW collection are shown in Table 5; full details of the survey results are available in spreadsheet format. A concentration of schemes in the north of the country is evidenced.

Table 25.5. Autonomous communities providing FW type collections

Autonomous Community	FW scheme		Region	Area	Population	Population density	Urban waste	Recycling, composting or reuse		Human development indexes	
Name	Scheme	Coverage		km^2	No	persons/km^2	tonnes/person-year	tonnes/person-year	%	IHD	Ranking score IHD
Aragón	Biowaste	Partial	North east	47,719	1,347,095	28	0.555	0.098	17.7%	0.96	5
Balears Isles	FW/GW	Partial	Isles	4,992	1,106,049	222	0.639	0.092	14.5%	0.94	13
Castilla y León	FW/GW	High	North west	94,223	2,559,515	27	0.602	0.205	34.1%	0.96	4
Castilla - La Mancha	FW/GW	Partial	Midlands	79,463	2,098,373	26	0.593	0.133	22.4%	0.93	14
Cataluña	FW/GW	High	North east	32,114	7,512,381	234	0.536	0.130	24.4%	0.96	6
Basque Country	FW only	High	North	7,234	2,178,339	301	0.618	0.133	21.6%	0.99	1
La Rioja	FW/GW	Partial	North	5,045	322,415	64	0.571	0.106	18.5%	0.96	7

Charges. The web sites investigated do not specifically state the schemes charges; as noted earlier, the municipalities have the responsibility to provide waste collection services to their residents.

Optional or compulsory schemes. The web pages investigated do not specifically establish whether the schemes are opt in or compulsory. However, the coverage of the schemes could give an idea of this status. Of the 7 CA providing a FW type of collection service 3 are offering schemes that are well established, extended and therefore possibly compulsory (i.e. Basque Country, Catalunya and Castilla-Leon). The remaining 4 CA are still running pilot schemes in a part of the territory and most likely with an opt-in status (i.e. Aragon, Balears Isles, Castilla-La Mancha and La Rioja).

Frequency of collection. There is a high level of heterogeneity in frequency of collections in each CA due to the high number of municipalities grouped within a CA, with their individual collection arrangements. Collections range from fortnightly to several times per week – this can be seasonal as well, with an increased frequency of organics collection in the summer months. Individual case studies of the CAs Catalunya, Basque Country and Balears Isles are provided later in this report with detailed information on each.

Materials collected. Nearly all of the websites stated very clearly which materials were acceptable and many also reinforced this by providing a list of materials that were not acceptable. Materials listed as acceptable in the Basque Country, Catalunya and Castilla-Leon are presented in the case studies.

Bags and liners, containers and collection vehicles. This information was often not clearly stated in the web pages investigated, however the case studies do provide some general information for those CAs.

Treatment process. The CA web pages gave information on the type of treatment process used. The split between composting and energy recovery types of treatment (e.g. biomethanization and anaerobic digestion) is shown in Table 6. Only 1 CA (i.e. Catalunya) is using AD and the primary treatment process and 3 more CA are using energy recovery as a secondary treatment process (i.e. Aragon, Castilla-Leon y La Rioja). 5 CA use composting as the primary process which reflects the early or low level of market penetration of AD in Spain.

Table 25.6 Waste treatment process type

Autonomous Community	Primary process	Secondary process
Aragón	Composting	Biomethanization
Balears Isles	NS	NS
Castilla y León	Composting	Energy recovery
Castilla - La Mancha	Composting	NA
Cataluña	AD	Composting
Basque Country	Composting	NA
La Rioja	Composting	Energy recovery

Summary of key findings for Spain

- 41% of the autonomous regions in Spain, covering 36.5% of the population, are providing some type of FW collection.
- FW schemes are highly concentrated in the north of Spain and in communities with the highest indices of human development.
- From the current schemes 1 autonomous region is collecting FW only, 5 are collecting FW/GW and 1 is collecting biowaste.
- Only 3 of the CA have well established schemes, whilst the remaining 4 CA have schemes on pilot level status
- Only 1 CA is using AD as the primary treatment process
- As yet there is no single common list of materials accepted in FW-only schemes

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Appendix 25a: Case studies of individual autonomous regions

Case study 1: Catalunya

Authority Characteristics
Waste management in Catalunya is the responsibility of each municipality following the guidance of the Autonomous region authority (Agencia de Residus de Catalunya) and the regulatory framework established by the Spanish Government through the Plan Nacional Integrado de Residuos (PNIR) 2007-2015. Waste management in Catalunya focuses on waste minimisation and obtaining the maximum value from the remaining unavoidable waste. Selective collections are compulsory for all municipalities and further information can be obtained in most local authorities' websites.

Catalunya has 829 municipalities and statistical data is easily accessible through links from the Catalan government website "Generalitat de Catalunya" (www.gencat.cat) which directs to the "Institut d'Estadistica de Catalunya" (www.idescat.cat). Detailed information about waste management is found in the "Agencia de Residus de Catalunya" website (www.arc-cat.net), where information about types of wastes, prevention, selective collections models and management systems, value and recycling, final treatment and public awareness are published. Queries and paperwork can be also processed through the same website. This analysis and all contents and graphics presented here are based on the survey of the previously mentioned websites and direct links from these websites.

For consistency with other Spanish regions, the year assessed was 2009. With an area of 32,108 km^2, the population of Catalunya was 7,475,420 inhabitants (233 person/km^2). Looking at the Human Development Index of 0.96, Catalunya would rank 8th in Spain (Fundación Bancaja, 2010).

General Waste / Separated Waste
Urban waste production is among the highest in the country (0.56 tonnes/person-year). The planned closure of Barcelona's landfill in El Garraf in 2006 encouraged the local government (Generalitat de Catalunya) to find alternatives. This resulted in a proactive attitude towards waste management, making Catalunya a referent of good practice in Spain. Having achieved 37.5% of household recycling/composting/reuse rate (0.21 tonnes/person/year), improvements have been made consistently year on year (Figure 25.2).

Catalunya started the separated collection of organic waste in 1999. This includes food waste mixed with garden waste but from here forward it will be referred to as organic waste. In 2009, the organic fraction of municipal waste collected was 8.1% of the total waste produced, a quantity that rose to 9.8% in 2010 (Figure 25.3). The Catalan government has set an objective of 700,000 tonnes by 2012, meaning that collections of household organic waste should increase by 71% from 2010 quantities.

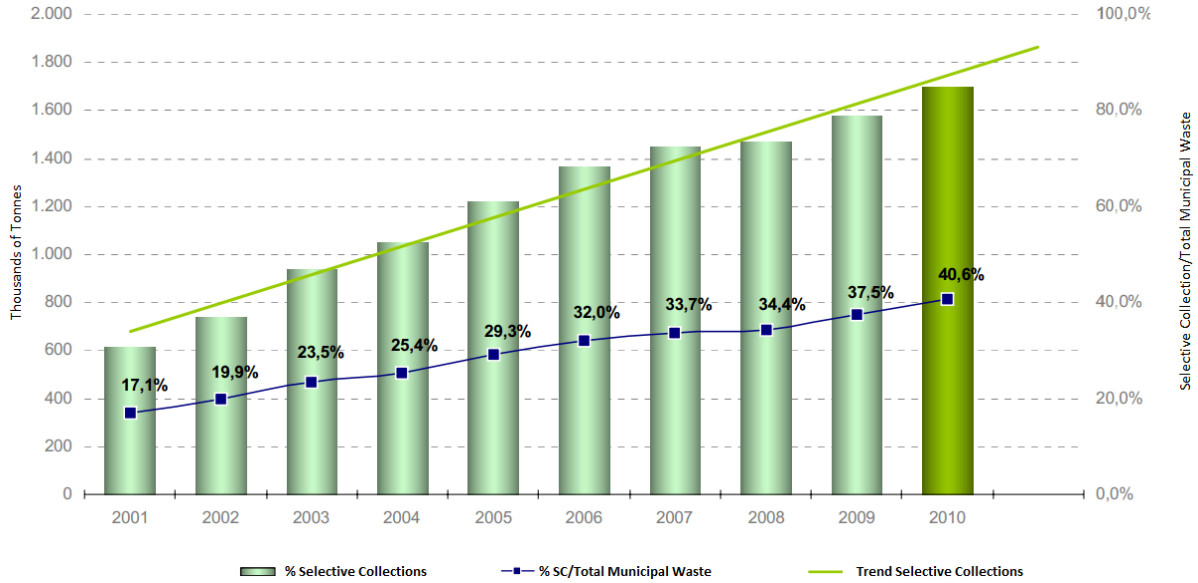

Figure 25.2. Evolution of separated collections of Municipal Waste in Catalunya. Adapted from: Agencia de Residus de Catalunya (2011)

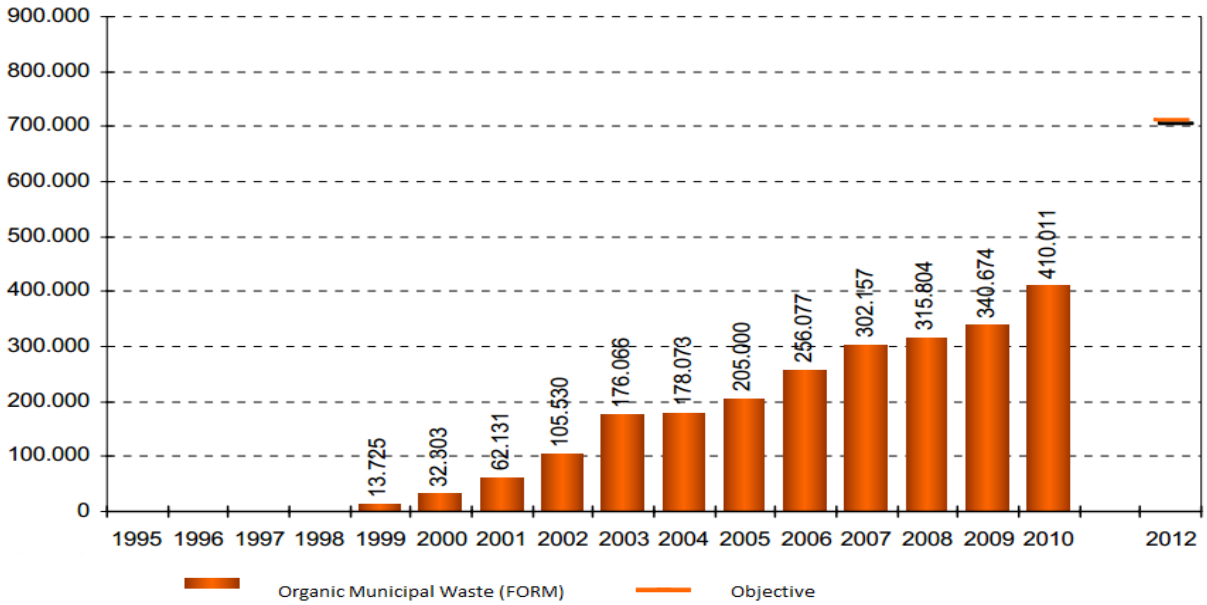

Figure 25.3 Evolution of the Organic household waste in collected in Catalunya Adapted from: Agencia de Residus de Catalunya (2011)

Management

There are four models of waste collection: over ground (Figure 25.4) and underground containers (Figure 25.5), pneumatic collection systems (Figure 25.6) and kerbside (Figure 25.7). Over ground containers are the most common in urban areas, where containers of different colours are dedicated to different waste streams: green containers for glass, blue for paper/cardboard, yellow for packaging/metallic tins, grey for general waste and brown for organic waste. Underground containers and pneumatic systems are typical of certain neighbourhoods in Barcelona capital city. Kerbside bins are most common in door to door collections, typically in lower density populations, including 80 local authorities in 2009, serving more than 250,000 habitants (less than 4% of the population). According to Giro i Fontanals (2008) the quantity and quality of collections is notably better in those towns.

a) Overground

b) Underground

c)Pneumatic collection

d) Kerbside

Figure 25.4 Bin types

According to the level of segregation, there are 3 models: one in which waste is divided into five fractions - organic, glass, paper/cardboard, packaging and general waste; one where packaging and general waste are combined, resulting in four fractions; and another where paper/cardboard is combined with packaging, also resulting in 4 fractions (Figure 25.5).

Frequency

The frequency of collections depends on each local authority; however, collections in urban areas happen almost on a daily basis for organic waste, and general waste, and weekly or fortnightly for the other fractions. Door to door collections of organic and general waste have a frequency of a couple of times a week or more, with between one and two collections for each of the other waste streams.

Organic Waste

Separation of household organic waste is promoted by information campaigns in local authorities' magazines, radio and TV. Organic waste is first collected and stored in household kitchens in small buckets that are usually provided free of charge to citizens. The use of compostable bags is recommended, but this is not enforced with penalties.

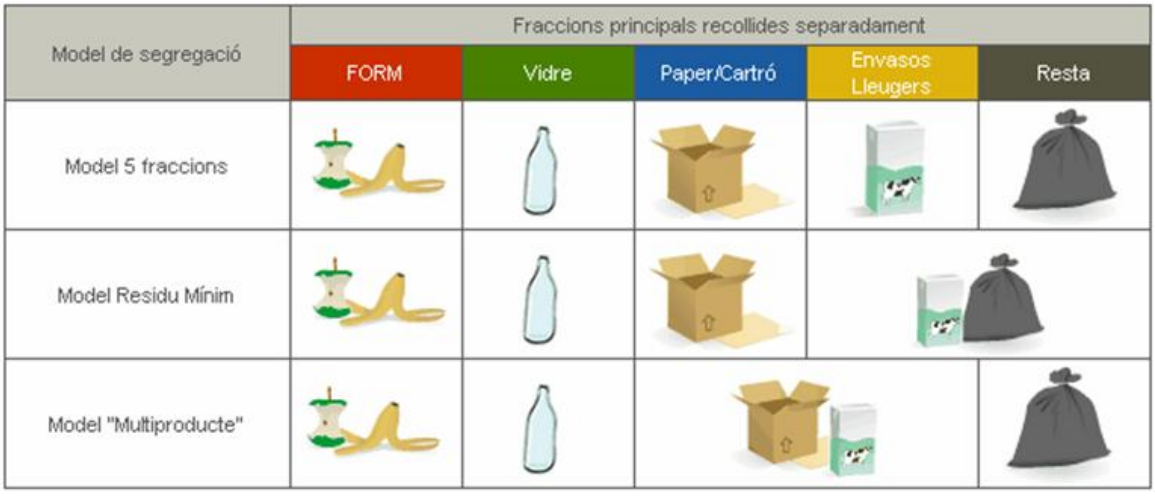

Figure 25.5. Selective Collections Model of Segregation.
Source: Generalitat de Catalunya (2012)

Materials accepted

The website of the "Agencia de Residus de Catalunya" indicates an extensive list of allowed organic wastes (Figure 25.6): fruit and vegetable waste, bones and meat, fish and fish bones, seafood shells and mollusc, egg shells, nut shells, expired food, food leftovers, bread, coffee and infusions waste, also green waste such as flower bouquets, flowers and leaves, weed, grass, tree leaves and small pruning branches. Cork, sawdust, natural wood chips, chopsticks and ice cream sticks are also allowed. Domestic pet waste without absorbent soils and kitchen paper, napkins and tissues are also allowed. Similarly there is a list of not allowed wastes (Figure 25.7): glass, paper, cardboard, light packaging, large waste, special waste, pruning waste, medical waste, personal care waste (diapers, tampons, dental floss), housekeeping waste (vacuum bags), tobacco butts, ash, pictures, credit cards and labels.

Figure 25.6. Allowed materials in the separated organic waste collections.
Source: Agencia de Residus de Catalunya (2011)

Figure 25.7. Non-allowed materials in the separated organic waste collections.
Source: Agencia de Residus de Catalunya (2011)

Destination Plants

Taking into consideration the destination of the waste and the type of infrastructure required for the treatment, Catalunya is divided in seven larger areas and 29 smaller zones (Figure 25.8). These areas have assigned destination plants where waste is sorted, recycled, reused, composted or if unavoidable sent to controlled landfills (Figure 25.9).

Information
Through the website of "La Generalitat de Catalunya", it is possible to access all the relevant data and statistics related to waste in their territory. Information is clear and specific, oriented towards the general population, commerce and local authorities

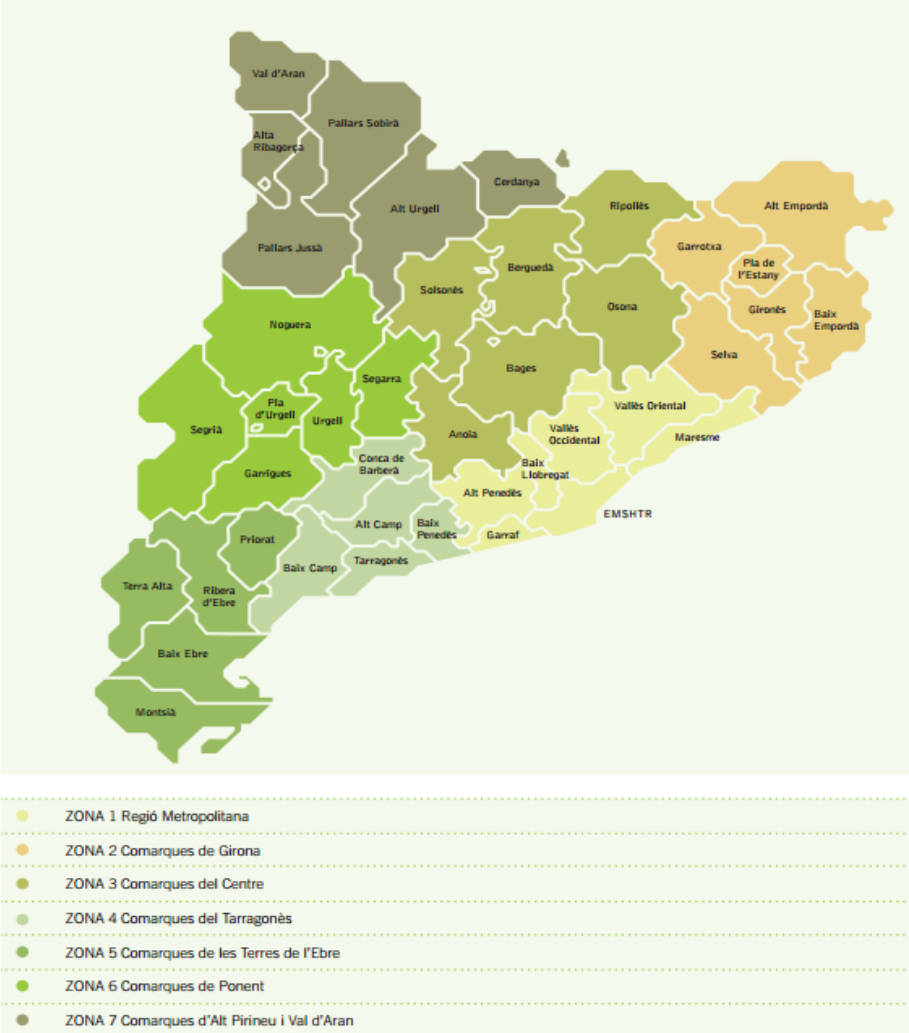

Figure 25.8. Waste Collection zones in Catalunya Source: Agencia de Residus de Catalunya (2009)

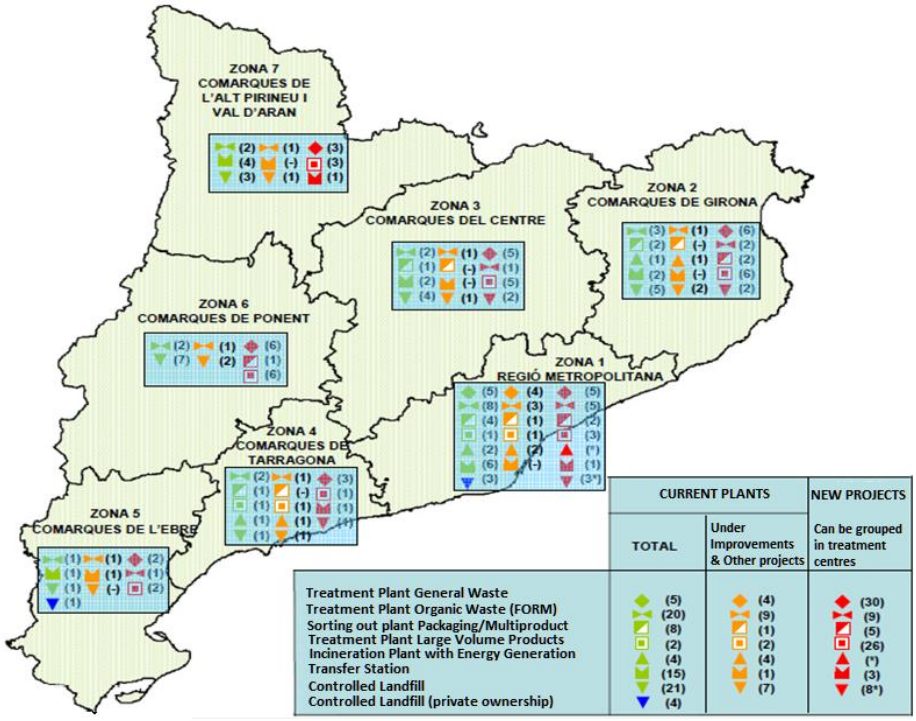

Figure 25.9. Infrastructure map. Adapted from: Agencia de Residus de Catalunya (2009)

Case study 2: Euskadi

Authority Characteristics
Waste management in Euskadi (Basque Country) is the responsibility of each municipality and "Mancomunidades" (commonwealths) following the guidance of the Autonomous region authority assisted by Ihobe, a Public Society that works in the field of environmental protection and management (www.ihobe.net). Waste management in Euskadi focuses on waste prevention and recycling using economic measures, such as the internalisation of the environmental costs associated with waste management. Selective collections are compulsory for all municipalities and information can be obtained in most local authorities' websites.

Euskadi has 251 municipalities, and demographical and environmental statistical data is easily accessible through Euskal Estatistika Erakunda (www.eustat.es). Information about waste management is available from the Environmental Department of the Basque Government "Departamento de Medio Ambiente, Planificacion Territorial, Agricultura y Pesca" (www.ingurumena.ejgv.eukadi.net). Information about waste is not easily found and it is necessary to navigate around or using the advance searching tool to reach the right page. The website explains what urban waste is , how waste can be separated, what and where "clean points" are and other general information about collections, storage, transport, value and elimination (Administración General de la Comunidad Autónoma de Euskadi, 2012). The pages have brief information and lack graphical content. Copies of forms for waste producers and logistics companies can also be processed through the same website. This analysis and all contents and graphics presented here are based on the survey of the previously mentioned websites plus the one of Usurbil local authority (www.usurbil.net), due to its much better qualitative content.

In the Regional Government website, there appears a very clear definition of urban waste:
"*Urban or municipal waste is the waste of households, shops, offices and service companies, and all these waste streams that are not considered dangerous and because its nature or composition can be assimilated to the ones produced in the previous places or activities*". In this category wastes generated from the cleaning of public spaces, dead animals, furniture, abandoned vehicles and small building household works can also be considered. This report refers to household waste; the urban waste generated only in households.

For consistency with other Spanish regions, the year assessed was 2009. With an area of 7,234 km^2, the population of the Basque Country was 2,169,038 habitants (300 person/km^2). Looking at the Human Development Index (HDI) of 0.99, the Basque Country would rank 1st in Spain (Fundación Bancaja, 2010).

General Waste / Separated Waste
Household waste production is 0.34 tonnes/person/year. There is a network of 8 landfills authorised to collect urban waste but their constrained capacity has encouraged local authorities to minimise waste. Having achieved 32.93% of household recycling/composting/reuse rate (almost 0.10 tonnes/person/year), efforts have remained flat since 2008 as appears in Figure 25.10.

Separated collections of organic waste are something relatively new in the Basque Country and it represents only 0.27% of the total household waste and 1.11% of the household waste collected separately. Local authorities encourage people to compost their own waste by providing free composters and some municipalities working with door to door collections

such as Usurbil, who apply a 40% reduction in the waste collection tax (Usurbil, 2011). Since the beginning of their door to door collections, this town has increased separated collections from 28% in 2008 to 80% in 2010 and it has managed to send almost 45% of household organic waste to composting plants in addition to the compost produced by almost 20% of the population in their own households (Ministerio de Agricultura Alimentacion y Medio Ambiente, 2012).

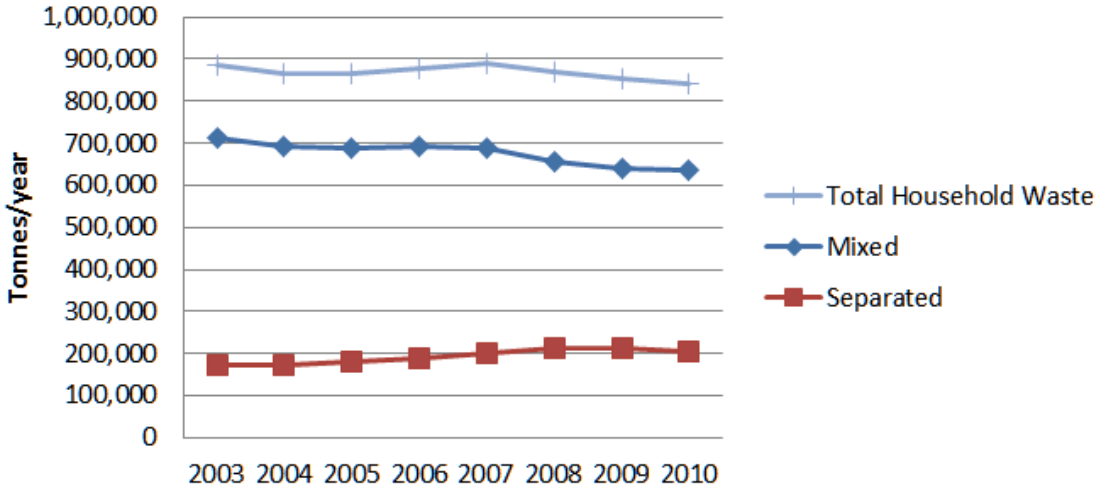

Figure 25.20. Evolution of separate collections of Municipal Waste in the Basque Country

Management

The waste collection models are the same as in Catalunya. Pneumatic collection is found in several municipalities (e.g. Vitoria, Baracaldo). The colour system of over ground containers is also the same: green containers for glass, blue for paper/cardboard, yellow for packaging/metallic tins, grey for general waste and brown for organic waste. The segregation of waste is always divided into five fractions: organic waste, glass, paper/cardboard, packaging and general waste. Door to door collections, on the other hand, follow different rules. There is also a separate container for organic waste but the other fractions are thrown in plastic bags, except cardboard and paper that can be tied with a cord and glass that is generally put in green containers on the road. Due to the end of life of several landfills, there is an interest from some political parties to establish door to door collections in more areas to improve the quality and quantity of selective collections. Door to door collections are a recent phenomenon in the Basque Country but initial data (e.g. Usurbil) shows that it has been a success. However, these schemes encounter political opposition because they are considered to be too expensive.

Frequency

The frequency of collections depends on each local authority; however, collections in urban areas happen almost on a daily basis for organic and general waste, and a few times per month for the other fractions.

The local authorities that run door to door collections do separate collections on a daily basis. A representative example can be seen in Figure 25.11, where residents of the urban area of Usurbil have to deposit waste from 6.30 to 8.30 in the morning. Residents of rural areas have to carry their waste to deposition areas that only they can open.

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Organic Waste	Packaging	Paper / Cardboard	Organic Waste	Packaging	Organic Waste	General Waste
Pampers and sanitary towels						

Figure 25.31. Calendar of waste collections. Adapted from Usurbil (2011)

Organic Waste

Organic waste is first collected and stored in household kitchens in small buckets that are usually provided free of charge to the citizens. Composting is promoted actively by local authorities and some of them (e.g. Usurbil) encourage composting through courses and manuals, visits to households, phone support, supply of free composters and even supply of pruning waste (Ministerio de Agricultura Alimentacion y Medio Ambiente, 2012). Since the beginning of organic waste collections there has been a continuous increase in quantities (Figure 25.12).

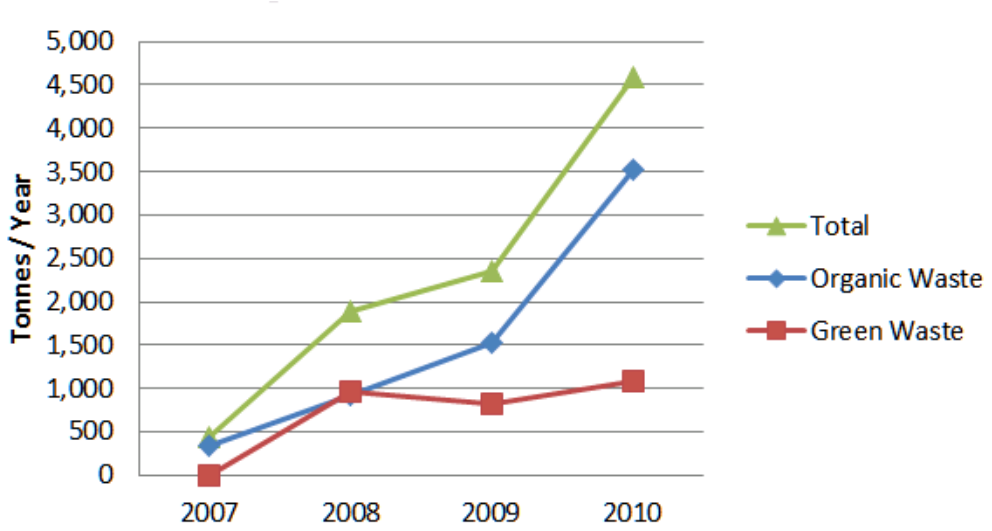

Figure 25.42. Evolution of organic household waste collected in the Basque Country

Materials Allowed

The website of the "Departamento de Medio Ambiente, Planificacion Territorial, Agricultura y Pesca" of the Basque government provides a very general description of what is allowed: "food waste" and "household organic waste". It is necessary to browse the websites of local authorities to obtain an exhaustive list of the food and household organic wastes that can be deposited as organic waste.

Based on the information provided by the Usurbil local authority (Usurbil, 2011) these are the wastes allowed: Fish, meat, vegetables, fruit, seafood shells, egg shells, nuts shells, infusion tea waste, coffee beans and waste, kitchen paper, napkins and tissues, flowers and plants, grass (small quantity), wooden sticks (small quantity), sawdust (small quantity), small amounts of wooden ash. Similarly, there is a list of wastes that are not allowed and includes: Faecal (from the general waste), synthetic and plastic bottle taps (from the packaging fraction), non-compostable nappies, tobacco butts, sweeping dust and wooden ash (from the general waste fraction).

Destination Plants

Taking into consideration the destination of the waste and the type of infrastructure required for treatment, the Basque Country is divided in three regions (its three provinces). These areas have assigned destination plants where waste is sorted, recycled, reused, composted or if unavoidable sent to controlled landfills (Figure 25.13). However, there is a lack of capacity for the treatment of waste in the Basque country since the establishment of door to door collections. Currently, part of the organic waste is sent to other Spanish regions (e.g. Castilla La Mancha) and France (Itxassou).

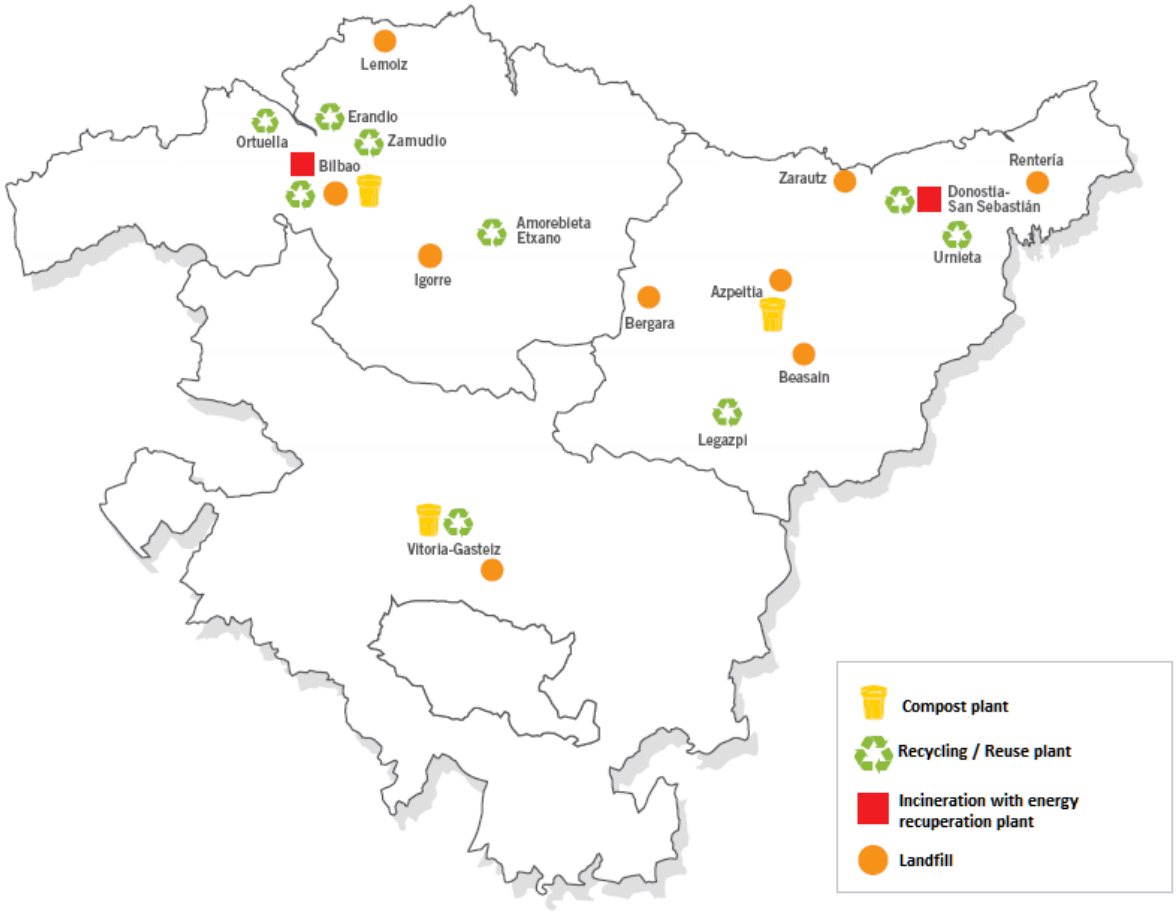

Figure 25.53. Map of the main current and planned urban waste infrastructure in the Basque Country. Adapted from IHOBE (2008)

Information

On the Basque Government website, it is not possible to access all the relevant data and statistics related to waste in their territory. Information is general and brief, unless specific documents are found. Visits to the local authorities' websites are necessary to get a full picture of how waste is managed.

Case Study 3: Illes Balears

Authority Characteristics
Waste management in Les Illes Balears is the responsibility of each municipality following the guidance of the Autonomous region authority through the three local governments of each island (Consell de Mallorca, Consell de Insular Menorca and Consell Insular d'Eivissa i Formentera) and the regulatory framework established by the Spanish Government through the Plan Nacional Integrado de Residuos (PNIR) 2007-2015. Waste management in Les Illes Balears focuses on waste minimisation, obtaining the maximum value from waste and the elimination of the remaining waste. Selective collections are not compulsory and each local authority decides what fractions to collect separately.

The autonomous community of Les Illes Balears has 67 municipalities and detailed statistical data is accessible at the website of the "Institut d'Estadística de les Illes Balears" (www.ibestat.es). Waste information oriented to industrial producers and logistics companies is available in the "Conselleria d'Agricultura, Medi Ambient I Territori" of the "Govern de le Illes Balears" (www.caib.es), the regional government. However, this information is not applicable to households and it is necessary to visit the websites of the "Consells" of each island to have an idea of how waste is managed.

For consistency with other Spanish regions, the year assessed was 2009. With an area of 4,985 km^2, the population of Les Illes Balears was 1,072,844 habitants (220 person/km^2). Looking at the Human Development Index of 0.94, Les Illes Balears would rank 13th in Spain (Fundación Bancaja, 2010).

General Waste / Separated Waste
Urban waste production is among the highest of Spain with 0.57 tonnes/person/year. Separated collections of household waste are limited (14.56%). The container colour code is the same as in the rest of Spain; however, most waste collections are mixed (grey containers). Household and urban waste generation in "Les Illes Balears" present seasonal changes due to the impact of tourism in the region. In Menorca and Eivissa there are no separate collections of household food waste (Consell d'Eivissa, 2012) but in Mallorca there is. The following relates only to that island.

Materials Allowed
The only information found appears in a poster from the "Mallorca Recicla" campaign (Mallorca Recicla, 2009) and it indicates the materials that are allowed in the organic fraction of food waste: solid food waste, dried bread, pasta and rice, cakes and sweets, fruit and vegetables, kitchen paper, napkins, egg shells, nuts, seafood and molluscs, coffee waste, tea infusions waste, small garden waste, small amounts of meat and fish. The list of materials that are not allowed include: liquid food waste (stock, milk and sauces), cotton and hair, nappies and sanitary towels, vegetable waste of large volume or treated with pesticides, leaves and sawdust, medicines, paper and cardboard, glass, ceramic, stones, packaging, plastic bags, synthetic and metallic bottle taps and lids, dead pets, leather, tobacco buts, sweeping dust, vacuum cleaner bags, ink, toners, paint, bleach, detergents, dissolvent, batteries and oils.

Destination Plants
This information was not found.

Information
Access to detailed information about food waste collections is not available at the regional government website and not easy to reach from the local authorities.

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Appendix 26: Results from web-based survey on collection of source segregated domestic food waste in Sweden

Organisation of household waste collection in Sweden

The responsibility for organization of household waste collection in Sweden is divided between the municipalities and organizations responsible for packaging waste which are listed under the Producer Responsibility Ordinance of packaging waste (newspaper, plastic-, cardboard-, metal- and glass-packaging). Thus, households are responsible for collection and management of household food waste, hazardous waste, e-waste, bulky waste and residual waste.

The packaging industry has organized the collection of recyclable packaging through the organisation FTI (Förpacknings- och Tidningsinsamlingen/*The packaging and newspaper collection*). The members pay a fee, based on the weight of the packaging they put on the market each year. The fee covers the collection and transportation system of packaging/newspapers from households to recycling. Data on the amount of recyclables collected from each municipality is collected by the organisation and displayed through their webpage (FTI, 2012).

Since 2005, separate collection of food waste is a part of the Swedish National Environmental Quality Objectives, aimed to guide the regional and local authorities in their activities. The objectives state that 35% of the food waste generated by households, restaurants and larger kitchens should be collected separately for further biological treatment by 2010 (Swedish Government, 2004). An update of this objective has been proposed by the Swedish Environmental Protection Agency, suggesting that 40% of the same waste should be separately collected by 2015 for biological treatment in which the energy and nutrient content in the waste is recovered (Miljömålsberedningen, 2011). According to previous studies, Swedish households generate between 90-100kg food waste per person and year (Swedish Waste Management, 2011). In 2010, more than 140 Swedish municipalities were offering separate collection of household food waste (Swedish Waste Management Association, 2011).

Biological treatment has increased in Sweden during the last five years; from 469 880 tonnes in 2006 to 587 170 in 2010. These numbers include both garden waste and food waste. Biological treatment now accounts for 13.5 % of the total quantity of treated household waste in Sweden. Biological treatment of food waste, excluding home compost, increased by 20% to 214,300 tons in 2010. According to the Swedish Waste Management association, 24% of the Swedish household food waste was biologically treated in 2010. Thus, the environmental objective of 35% by 2010 was not met. Anaerobic digestion increased by 21% compared with 2009 while composting of food waste is declining. This trend is probably related to an increased focus on energy recovery over nutrient recycling (Swedish Waste Management, 2011).

Digestate from anaerobic digestion of food waste has for a long time suffered from confusion with wastewater treatment sludge, where the risk for concentrations of some metals, principally cadmium, can be high. Thus, another factor that could encourage the uptake of anaerobic digestion rather than composting, has been the introduction of a certification system for digestate in 2010 (SP, 2010). Five of the larger anaerobic digestion plants in the country currently hold this certification (SP, 2012). Two organizations for organic production

and high quality production of agricultural products (KRAV and Svenskt Sigill Kvalitetsråd) have also approved digestate based on source-separated food waste as bio-fertilizer. This system helps the anaerobic digestion plants to market their product as a bio-fertilizer.

Household waste, according to the Swedish legislation, also includes waste similar to household waste generated by businesses. As an example, waste generated in staff kitchens in office buildings are considered as household waste. As in many other European countries, Swedish municipalities can choose to carry out the waste collection with their own workforce or can contract a private company to do it. However, the municipality is always responsible for the collection and treatment of household waste in relation to the generator.

Swedish municipalities offer different collection schemes for residual waste – and in cases where special schemes for food waste is provided also for this fraction – for each individual generator[4], all according to the needs of the generator in question. Thus, frequency of collection varies between properties. According to the Swedish Waste Management Association (Avfall Sverige), the most common form of collection in Sweden is collection of mixed household waste disposed of in 190 litre bins from single houses every other week and weekly collection of waste disposed of in 660 litre bins from multi-family dwellings. However, examples of more frequent collection (twice a week) exist. Food waste separately collected in plastic bags for optical sorting is disposed of and collected together with mixed household waste, while separately collected food waste often is collected separately from special bins (often brown instead of green, which is used for mixed household waste) or with multi-compartment vehicles, where mixed waste and food waste can be collected in the same route. The fraction of multi-compartment vehicles is increasing (Swedish Waste Management Association, 2011).

Methodology

The Swedish Waste Management Association made a summary of Swedish municipalities with separate collection of food waste in 2010. Since then, many new municipalities have joined and it was therefore necessary to enter the website of all 290 municipalities individually for data collection. All web-sites were accessed during the month of March, 2012. In many cases, the municipal web-page directed the reader to the web-page of the municipal waste management enterprise (i.e. a public company, fully or majority owned by the municipality or a number of municipalities in the same region).

The information gathered from each website is shown in Table 26.1.

The terms "avfall" (waste), "renhallning" (refuse collection) "matavfall" (food waste) or "bioavfall" (biowaste) were used in order to find the right part of the webpage.

[4] Generator in this case is each subscriber of the municipal waste management service, i.e. a single household or a larger multi-family dwelling area which divide the same waste management substription.

Table 26.1. Data collected in survey

No.	Main Category	Subcategory	Unit	Possible responses
1	Local Authority	Name		
2		Type		Collection/Unitary/Disposal
3		Area	km2	
4		Population	no.	
5		Population density	person/km2	
6		Household waste collected	tonnes/person-year	
7		Household waste sent for recycling/composting/re-use	tonnes/person-year	
8	Separate FW collection?			Yes/No/NS
9		Status		Compulsory/Opt-in/NS
10	Frequency	FW Collections		Weekly/Fortnightly/Other/NS
11		Residual Collection		Weekly/Fortnightly/Other/NS
12		Recyclable Collection		Weekly/Fortnightly/Other/NS
13		Comments		
14	Type	Type		FW only/with GW
15		Comments		
16		Contracted out or operated by council		Yes/No/NS
17		Comments		
18	Materials	Bones		Yes/No/NS
19		Eggshells		Yes/No/NS
20		Paper/ card		Yes/No/NS
21		Shredded paper		Yes/No/NS
22		Liquid		Yes/No/NS
23		Oil / fat		Yes/No/NS
24		Faecal		Yes/No/NS
25		Plant		Yes/No/NS
26		Biodeg bags		Yes/No/NS
27		List accepted		Yes/No/NS
28		Accept		
29		List rejected		Yes/No/NS
30		Reject		
31		Comments		
32	Containers	Caddies	yes/no	Yes/No/NS
33			size (l)	
34		Buckets	yes/no	Yes/No/NS
35			size (l)	
36		Wheeled bins	yes/no	Yes/No/NS
37			size (l)	
38		Other bins	yes/no	Yes/No/NS
39			type	
40			size (l)	
41		Biodegradable bags	yes/no	Yes/No/NS
42			user pays?	Yes/No/NS
43			Comments	
44		Newspaper		Yes/No/NS
45		Comments		
46	Cost			Yes/No/NS
47		Comments		
48	Coverage			Yes/No/NS
49		Began		Date
50		Comments		
51	Vehicle			Yes/No/NS
52		Type		
53	Target Plant	Food Waste		Yes/No/NS
54			Plant	
55		Residual Waste		Yes/No/NS
56			Plant	
57	Information provided	Treatment type		Yes/No/NS
58		Treatment Comments		
59		Home composting		Yes/No/NS
60		Reduced price composters		Yes/No/NS
61		Reasons for collection		Yes/No/NS
62		Other info		
63		Comments		

Results

Source-separation of household food waste

The web-based investigation found that 152 of the 290 Swedish municipalities provide possibilities for separate collection of household food waste. Another three report plans to introduce such systems in the near future (during 2013). Tables 26.2a, b, and c show some facts on the municipalities with separate collection of food waste.

Table 26.2a. Local Authorities providing Food Waste collections in Sweden

Name	Region	Area	Population	Population density	Household - total waste	Household waste sent for recycling/ composting/ reuse	
		km2	no.	person/km2	tonnes/ person-year	tonnes/ person-year	% total
Ale	Västra Götaland	316.5	27,577	87.1	0.312	0.072	23.1%
Alingsås	Västra Götaland	472.0	38,053	80.6	0.312	0.089	28.5%
Bjuv	Skåne	115.3	14,851	128.8	0.298	0.040	13.4%
Boden	Norrbotten	4007.9	27,643	6.9	0.365	0.083	22.7%
Bollebygd	Västra Götaland	263.2	8,356	31.7	0.312	0.074	23.7%
Borlänge	Dalarna	583.9	49,323	84.5	0.338	0.062	18.3%
Borås	Västra Götaland	909.9	104,106	114.4	0.312	0.077	24.7%
Bromölla	Skåne	162.5	12,366	76.1	0.298	0.057	19.1%
Burlöv	Skåne	18.9	16,843	891.2	0.298	0.046	15.4%
Båstad	Skåne	209.8	14,230	67.8	0.298	0.101	33.9%
Danderyd	Stockholm	26.4	31,799	1204.5	0.225	0.080	35.6%
Enköping	Uppsala	1178.5	40,015	34	0.547	0.070	12.8%
Eskilstuna	Södermanland	1099.9	97,596	88.7	n.d.	0.081	n.d.
Eslöv	Skåne	419.1	31,728	75.7	0.298	0.076	25.5%
Fagersta	Västmanland	269.0	12,553	46.7	0.238	0.099	41.6%
Falköping	Västra Götaland	1045.0	31,689	30.3	0.312	0.065	20.8%
Falun	Dalarna	2040.1	56,124	27.5	0.338	0.075	22.2%
Färgelanda	Västra Götaland	589.0	6,606	11.2	0.312	0.065	20.8%
Gnesta	Södermanland	461.2	10,345	22.4	n.d.	0.079	n.d.
Gotland	Gotland	3134.1	57,308	18.3	0.220	0.049	22.3%
Gävle	Gävleborg	1613.4	95,428	59.1	0.097	0.075	77.3%
Göteborg	Västra Götaland	447.8	520,374	1162.2	0.312	0.098	31.4%
Hagfors	Värmland	1824.2	12,282	6.7	0.175	0.084	48.0%
Hallstahammar	Västmanland	170.7	15,224	89.2	0.238	0.078	32.8%
Haninge	Stockholm	458.1	78,326	171	0.225	0.058	25.8%
Haparanda	Norrbotten	922.8	10,041	10.9	0.365	0.086	23.6%
Hedemora	Dalarna	835.1	15,119	18.1	0.338	0.075	22.2%
Helsingborg	Skåne	344.0	130,626	379.7	0.298	0.082	27.5%
Hjo	Västra Götaland	297.0	8,790	29.6	0.312	0.073	23.4%
Hofors	Gävleborg	409.9	9,578	23.4	0.097	0.075	77.3%
Huddinge	Stockholm	131.0	99,049	756	0.225	0.049	21.8%
Hällefors	Örebro	985.0	7,140	7.2	0.320	0.069	21.6%
Härryda	Västra Götaland	266.8	34,854	130.6	0.312	0.081	26.0%
Hässleholm	Skåne	1268.5	50,164	39.5	0.298	0.080	26.8%
Höganäs	Skåne	150.8	24,698	163.7	0.298	0.091	30.5%
Hörby	Skåne	419.4	14,901	35.5	0.298	0.073	24.5%
Höör	Skåne	290.9	15,492	53.3	0.298	0.071	23.8%
Jokkmokk	Norrbotten	17614.3	5,119	0.3	0.365	0.059	16.2%
Järfälla	Stockholm	53.8	67,320	1251.1	0.225	0.090	40.0%
Jönköping	Jönköping	1480.4	128,305	86.7	0.261	0.083	31.8%
Kalix	Norrbotten	1807.7	16,591	9.2	0.365	0.079	21.6%
Karlskoga	Örebro	468.2	29,616	63.3	0.320	0.075	23.4%
Karlskrona	Blekinge	1042.2	64,215	61.6	0.127	0.083	65.4%
Karlstad	Värmland	1150.5	86,409	75.1	0.175	0.072	41.1%
Kil	Värmland	359.7	11,682	32.5	0.175	0.059	33.7%
Klippan	Skåne	374.3	16,601	44.3	0.298	0.075	25.2%
Kristianstad	Skåne	1246.3	79,930	64.1	0.298	0.081	27.2%
Kumla	Örebro	204.2	20,510	100.5	0.320	0.060	18.8%
Kungsbacka	Halland	606.7	75,954	125.2	0.401	0.101	25.2%
Kungsör	Västmanland	202.7	8,086	39.9	0.238	0.087	36.6%
Kävlinge	Skåne	152.6	29,261	191.8	0.298	0.083	27.9%
Köping	Västmanland	604.6	24,807	41	0.238	0.087	36.6%
Landskrona	Skåne	140.3	42,189	300.7	0.298	0.074	24.8%
Lerum	Västra Götaland	258.6	38,788	150	0.312	0.068	21.8%
Lidingö	Stockholm	30.8	44,081	1431.2	0.225	0.049	21.8%
Lindesberg	Örebro	1377.6	23,108	16.8	0.320	0.071	22.2%
Linköping	Östergötland	1427.4	147,334	103.2	0.688	0.083	12.1%
Ljusnarsberg	Örebro	575.5	4,870	8.5	0.320	0.082	25.6%
Lomma	Skåne	55.5	22,017	396.6	0.298	0.064	21.5%
Luleå	Norrbotten	2094.2	74,426	35.5	0.365	0.084	23.0%

Table 26.2b. Local Authorities providing Food Waste collections in Sweden, cont'd

Name	Region	Area	Population	Population density	Household - total waste	Household waste sent for recycling/ composting/ reuse	
		km2	no.	person/km2	tonnes/ person-year	tonnes/ person-year	% total
Lund	Skåne	427.2	111,666	261.4	0.298	0.052	17.4%
Lysekil	Västra Götaland	208.5	14,398	69.1	0.312	0.058	18.6%
Malmö	Skåne	156.9	302,835	1930.5	0.298	0.068	22.8%
Malung-Sälen	Dalarna	4085.1	10,262	2.5	0.338	0.049	14.5%
Mark	Västra Götaland	929.3	33,791	36.4	0.312	0.069	22.1%
Mellerud	Västra Götaland	516.8	9,068	17.5	0.312	0.082	26.3%
Mora	Dalarna	2812.6	20,107	7.1	0.338	0.065	19.2%
Motala	Östergötland	983.5	41,828	42.5	n.d.	0.860	n.d.
Mölndal	Västra Götaland	145.8	61,337	420.6	0.312	0.059	18.9%
Nacka	Stockholm	95.1	91,616	963.2	0.225	0.094	41.8%
Nora	Örebro	618.5	10,429	16.9	0.320	0.083	25.9%
Norberg	Västmanland	417.8	5,725	13.7	0.238	0.086	36.1%
Norrköping	Östergötland	1495.1	130,623	87.4	0.688	0.083	12.1%
Nykvarn	Stockholm	152.8	9,331	61.1	0.225	0.068	30.2%
Nyköping	Södermanland	1420.8	51,896	36.5	0.260	0.059	22.7%
Nässjö	Jönköping	930.3	29,367	31.6	0.261	0.075	28.7%
Ockelbo	Gävleborg	1065.0	5,907	5.5	0.097	0.059	60.8%
Olofström	Blekinge	389.8	12,876	33	0.127	0.068	53.5%
Orsa	Dalarna	1730.9	6,867	4	0.338	0.061	18.0%
Orust	Västra Götaland	386.5	15,129	39.1	0.312	0.084	26.9%
Osby	Skåne	576.2	12,699	22	0.298	0.082	27.5%
Oskarshamn	Kalmar	1049.5	26,166	24.9	n.d.	0.043	n.d.
Oxelösund	Södermanland	35.4	11,250	317.9	0.260	0.082	31.5%
Perstorp	Skåne	158.8	7,159	45.1	0.298	0.092	30.9%
Piteå	Norrbotten	3087.0	40,942	13.3	0.365	0.082	22.5%
Ronneby	Blekinge	825.3	27,910	33.8	0.127	0.073	57.5%
Rättvik	Dalarna	1920.7	10,859	5.7	0.338	0.082	24.3%
Sala	Västmanland	1166.9	21,568	18.5	0.238	0.063	26.5%
Sandviken	Gävleborg	1166.4	36,995	31.7	0.097	0.042	43.3%
Sigtuna	Stockholm	327.4	41,329	126.2	0.225	0.079	35.1%
Simrishamn	Skåne	391.4	19,147	48.9	0.298	0.078	26.2%
Sjöbo	Skåne	492.2	18,143	36.9	0.298	0.081	27.2%
Skellefteå	Västerbotten	6802.9	71,580	10.5	0.264	0.062	23.5%
Skinnskatteberg	Västmanland	659.4	4,412	6.7	0.238	0.083	34.9%
Skurup	Skåne	193.6	14,946	77.2	0.298	0.069	23.2%
Skövde	Västra Götaland	673.7	51,761	76.8	0.312	0.082	26.3%
Smedjebacken	Dalarna	947.9	10,662	11.2	0.338	0.071	21.0%
Sollentuna	Stockholm	52.6	65,891	1251.7	0.225	0.070	31.1%
Solna	Stockholm	19.3	69,946	3624.1	0.225	0.090	40.0%
Sorsele	Västerbotten	7368.4	2,729	0.4	0.264	0.092	34.8%
Staffanstorp	Skåne	106.8	22,296	208.7	0.298	0.071	23.8%
Stenungsund	Västra Götaland	251.9	24,601	97.7	0.312	0.102	32.7%
Stockholm	Stockholm	187.2	864,324	4617.9	0.225	0.082	36.4%
Strängnäs	Södermanland	739.7	32,687	44.2	0.260	0.081	31.2%
Sundbyberg	Stockholm	8.7	39,539	4560.4	0.225	0.071	31.6%
Sundsvall	Västernorrland	3189.6	96,113	30.1	0.383	0.081	21.1%
Surahammar	Västmanland	343.8	9,871	28.7	0.238	0.092	38.7%
Svalöv	Skåne	387.3	13,250	34.2	0.298	0.083	27.9%
Svedala	Skåne	218.1	19,805	90.8	0.298	0.081	27.2%
Sävsjö	Jönköping	679.1	10,871	16	0.261	0.081	31.0%
Söderhamn	Gävleborg	1060.8	25,334	23.9	0.097	0.048	49.5%
Södertälje	Stockholm	525.2	87,685	167	0.225	0.083	36.9%
Sölvesborg	Blekinge	185.3	16,793	90.6	0.127	0.072	56.7%
Tanum	Västra Götaland	917.2	12,320	13.4	0.312	0.075	24.0%
Tibro	Västra Götaland	220.7	10,625	48.2	0.312	0.082	26.3%
Tjörn	Västra Götaland	167.4	14,959	89.4	0.312	0.082	26.3%
Tomelilla	Skåne	395.9	12,930	32.7	0.298	0.049	16.4%
Trelleborg	Skåne	339.9	42,542	125.2	0.298	0.081	27.2%
Trollhättan	Västra Götaland	409.9	55,499	135.4	0.312	0.084	26.9%
Trosa	Södermanland	209.7	11,493	54.8	0.260	0.081	31.2%

Table 26.2c. Local Authorities providing Food Waste collections in Sweden, cont'd

Name	Region	Area	Population	Population density	Household - total waste	Household waste sent for recycling/ composting/ reuse	
		km2	no.	person/km2	tonnes/ person-year	tonnes/ person-year	% total
Tyresö	Stockholm	69.3	43,328	625.7	0.225	0.081	36.0%
Täby	Stockholm	60.7	64,558	1063.2	0.225	0.088	39.1%
Uddevalla	Västra Götaland	637.7	52,156	81.8	0.312	0.098	31.4%
Umeå	Västerbotten	2316.6	116,465	50.3	0.264	0.082	31.1%
Upplands Väsby	Stockholm	75.1	40,194	535.3	0.225	0.098	43.6%
Uppsala	Uppsala	2182.8	200,001	91.6	0.547	0.083	15.2%
Uppvidinge	Kronoberg	1171.9	9,216	7.9	0.314	0.082	26.1%
Vadstena	Östergötland	181.9	7,317	40.2	0.688	0.081	11.8%
Vansbro	Dalarna	1539.6	6,818	4.4	0.338	0.082	24.3%
Varberg	Halland	868.7	58,576	67.4	0.401	0.079	19.7%
Vaxholm	Stockholm	57.9	11,141	192.5	0.225	0.081	36.0%
Vellinge	Skåne	142.6	33,510	235	0.298	0.086	28.9%
Vetlanda	Jönköping	1500.5	26,302	17.5	0.261	0.081	31.0%
Vänersborg	Västra Götaland	642.7	36,962	57.5	0.312	0.086	27.6%
Värmdö	Stockholm	448.0	38,894	86.8	0.225	0.073	32.4%
Västervik	Kalmar	1871.6	36,015	19.2	n.d.	0.036	n.d.
Västerås	Västmanland	957.9	138,709	144.8	0.238	0.081	34.0%
Växjö	Kronoberg	1665.5	83,710	50.3	0.314	0.086	27.4%
Ystad	Skåne	350.1	28,427	81.2	0.298	0.086	28.9%
Åstorp	Skåne	92.2	14,789	160.4	0.298	0.066	22.1%
Älmhult	Kronoberg	890.8	15,629	17.5	0.314	0.082	26.1%
Älvdalen	Dalarna	6871.5	7,184	1	0.338	0.080	23.7%
Älvkarleby	Uppsala	215.0	9,089	42.3	0.547	0.066	12.1%
Älvsbyn	Norrbotten	1698.0	8,253	4.9	0.365	0.082	22.5%
Ängelholm	Skåne	420.1	39,626	94.3	0.298	0.065	21.8%
Örebro	Örebro	1373.2	137,121	99.9	0.320	0.077	24.1%
Örkelljunga	Skåne	319.6	9,663	30.2	0.298	0.079	26.5%
Östersund	Jämtland	2208.3	59,373	26.9	**0.077**	0.031	40.3%
Österåker	Stockholm	312.4	39,792	127.4	0.225	0.030	13.3%
Östra Göinge	Skåne	432.0	13,603	31.5	0.298	0.079	26.5%
Överkalix	Norrbotten	2764.5	3,549	1.3	0.365	0.067	18.4%
Övertorneå	Norrbotten	2362.1	4,810	2	0.365	0.082	22.5%

Separation of organic streams

Food waste is collected as its own stream in 146 of the 152 municipalities; only in six municipalities is food waste sorted together with garden waste. Thus, in the majority of municipalities, food waste is sorted separately, without being mixed with other fractions. In one case, food waste is sorted separately, but later treated together with garden waste for production of compost. Table 26.3 shows the breakdown of population in municipalities with each food waste collection scenario. It should be noted, however, that this may not be equal to the number with current access to FW collections, since in many cases these schemes may not have been rolled out to the full municipality area.

Table 26.3. Population Served by Separate Food Waste Collection in Sweden

	Population	%
separate FW-only collection	7,067,532	76%
FW with GW	105,006	1%
no FW collection	2,159,593	23%
Total	9,332,131	100%

Availability of information

Information regarding waste management is in general located either amongst issues related to "building and living" or "environment and nature" in the municipal web-site. The availability is in general good. However, in some cases the information was quite hidden and the general search-function had to be used on the web-site.

Provided information
Municipalities with separate collection of food waste commonly have extensive information on the design and purpose of this scheme on their webpage. However, in many cases, the information regarding sorting instructions and the further treatment of collected food waste could be improved. The information regarding food waste sorting was in general related to:

- Practical arrangements regarding food waste collection (how bags for collection should be used, how bins for collection should be placed, how problems with flies can be avoided, how problems with freezing of collection bags in bins for food waste during the winter can be avoided and how new bags for separate collection can be ordered or collected).
- Sorting of food waste
- How food waste is processed after collection

Design of food waste collection systems
The most common collection system for source-separated food waste from single-family homes uses two separate wheeled bins, one for food waste and one for residual waste. In most cases, different colors are used for these two bins. A multi-compartment system is also available in which different fractions are separated into separate containers. Another collection system sometimes used, is optic sorting of different colored bags that are put into the same bin. Bags are then taken by the waste collection vehicle to an optical sorting facility where the bags are separated automatically for the right treatment.

In 78% of the municipalities with separation collection of food waste, information on the type of bag used for the separate collection of food waste was provided through the municipal webpage. Out of the cases where information was provided, paper bags are used in 82% of the cases, plastic bags for optical sorting in 15% and biodegradable bags in 3% of the cases.

Bags for separate food waste collection (paper bags, coloured plastic bags or bio-plastic bags) are commonly provided by facility owners or facility managers in multi-family dwelling areas. In single household houses, it is common that a number (normally around 150 bags) are provided per household and year. If the households are in need of more bags, they can be ordered from the municipality via internet or phone and delivered in the mailbox at the next collection occasion. Other municipalities ask inhabitants in single household houses to, at the day of the food waste collection, put an empty paper bag between the lid and the bin or in some other way mark their bin if they are in need of more bags, and bags will be delivered on the same day. Yet another solution is for the municipality to have a stock of bags in some of the larger supermarkets in the municipality, from which they can be picked up by households.

Sorting instructions
76% of the municipalities with separation collection of food waste provide sorting instructions in the form of an "accepted" list. However, these sorting instructions are often not very detailed. Categories commonly present in the sorting information are: left-overs, peels, tea bags/ coffee grounds, flowers, pot-plants and bread. Interestingly enough, there is a large variation amongst the municipalities in relation to their instructions for sorting of some of these fractions. In many cases, coffee filters and tea bags can be sorted as food waste, while in other cases, they are not accepted in the food waste collection. The same is seen in

relation to pot-plants. In some cases they are accepted as food waste and in others not. Several municipalities also use a "non-accepted" list. Fractions commonly seen on such lists are: cat litter, textiles, pot-plants, soil, ash, snuff, cigarettes, chewing gum and vacuum-cleaning bags. Table 26.4 shows the materials specified on "accepted" and "non-accepted" lists, where this information was provided.

Table 26.4. Selected materials specified as accepted or rejected in FW collections

	Yes	No	Not specified	Total
Bones	76	6	70	152
Eggshells	95	0	57	152
Paper/ card	1	37	114	152
Shredded paper	1	37	114	152
Liquid	1	23	128	152
Oil / fat	7	20	125	152
Faecal	0	30	122	152
Plant	60	15	77	152
Biodegradable bags	7	42	103	152

Treatment of separately collected food waste

Firstly, it is important to note that very few examples of biological treatment of organic fraction from mixed municipal solid waste are currently in use in Sweden. Only one municipality reports the use of such a system, in which the organic fraction is composted after mechanical sorting.

Thus, biological treatment of food waste is in almost all cases dependent on separate collection and source-separation from the household. The food waste collected is most commonly treated by anaerobic digestion (104 municipalities or 68% of the municipalities with food waste collection). The digestion is either performed together with other solid organic waste fractions or together with wastewater treatment sludge. Composting of separately collected food waste is performed in 31 municipalities, equal to 20% of the municipalities where such information was provided. 2 municipalities used a combination of AD and composting, while 15 municipalities did not provide web information on the treatment process used.

Table 26.5. Waste treatment process type

	No. of municipalities	%
AD	104	68%
Composting	31	20%
AD/Composting	2	1%
Not specified	15	10%
Total	152	100%

Supporting information

In addition to information on sorting, some websites also provided information on the treatment processes and final uses of biogas such as vehicle fuel, although information quality was highly variable.

Figure 26.1. Example leaflets with info on foodwaste recycling (top, Malmo municipality) and biogas for fuel use (bottom, Eskilstuna municipality).

Summary of key findings

- Separate collection of source-separated household food waste is expanding rapidly in Sweden.

- 152 municipalities, equal to 52% of the Swedish municipalities report to have separate collection of food waste through their web-pages. Another 3 municipalities are currently introducing the scheme which will be in place by 2013.
- The most common design of collection system is separate collection in paper bags for disposal in wheeled bins – commonly in a separate bin for food waste, but the use of multi-compartment bins is increasing.
- The most common treatment technology for source-separated food waste is anaerobic digestion. This is chosen by 76% of the municipalities where information of treatment is provided through the web-page.
- The source-separation of food waste can assume to increase in Sweden, as this is a part of the National Environmental Quality Objectives since 2005. Newly suggested changes to these objectives, together with increased use of biogas as vehicle fuel and certification systems for produced digestate, are likely to increase interest in anaerobic digestion of separately collected food waste in Sweden, at the expense of composting.

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Appendix 27: Results of web-based survey on collection of source segregated domestic food waste in the United Kingdom

27A: Results of web-based survey on collection of source segregated domestic food waste in England

Organisation of waste collection in England

Waste collection in England and Wales is the responsibility of local authorities, which are designated according to various categories depending on the size and population density of the community they serve (e.g. district, borough, metropolitan district or borough and city). These councils are grouped together in counties, and the County Council normally has responsibility for disposal of waste collected by the local authority (LA). In some cases where a district or city is large enough it has the status of a unitary authority and is responsible for both collection and disposal. Local authorities may carry out collections by direct labour using their own employees, or may subcontract the collection service to an external organisation. The cost of household waste collection is covered as part of a general local tax (Council Tax) levied on each household, but an additional charge may be levied for garden waste or bulky items, at the discretion of the LA. The LA is also responsible for the supply of any container (e.g. bin or bag) required to hold the waste that it has statutory duty to collect, but is not required to provide additional lining materials. It is also not responsible for supplying equipment such as home composters or garden refuse sacks, although it may do so free of charge or at a subsidised rate depending on local policy. The Household Waste Recycling Act 2003 (HWRA 2003) requires that each local authority makes provision to collect at least two recyclable materials as identifiable streams. The HWRA 2003 does not specify what these should be, nor that they should be separate components: they can be collected as a single co-mingled fraction. For the purposes of the HWRA 2003 garden and food waste are considered as recyclable materials. LAs are required to comply with the HWRA 2003 by 31 December 2010. Other major drivers for the introduction of source separated collection include the Landfill Allowance Trading Scheme (LATS) which was introduced to help meet landfill diversion targets in the EU Landfill Directive (99/31/EC). Under the LATS scheme, LAs receive an allowance for waste sent to landfill, which are tradable and decrease each year.

The central government body responsible for waste management is the Department for Environment, Food and Rural Affairs (Defra, www.defra.gov.uk), although many day-to-day aspects of monitoring the system for pollution prevention are carried out by the Environment Agency (www.environment-agency.gov.uk). Detailed data on municipal waste collection and disposal is available from Defra and on the WasteDataFlow website (www.wastedataflow.org), but this covers all biodegradable municipal waste and does not report specifically on food waste. The Waste Resources Action Programme (WRAP, www.wrap.org.uk) also provides advice and commentary to government on best practice regarding waste resource utilisation and has commissioned or carried out an extensive range of studies on domestic food waste (Hogg et al., 2007; Exodus, 2007; WRAP, 2007; Mills and Andrews, 2009; Quested and Johnson, 2009; Ventour, 2009), including studies on the operation of source separated collection trials (Bridgwater and Parfitt, 2009).

Information on waste collection services is widely publicised on local authority webpages.

Methodology

A systematic search was carried out of webpages for the 325 waste collection authorities in England, with the aim of identifying those offering collection of source segregated food waste (FW) either as a single material or co-mingled with green wastes (GW). The waste collection authorities were identified from local authority collected waste statistics (Defra, 2010) and website addresses were obtained from DirectGov (2011). The search was carried out by going to the main website of the LA, finding the section dealing with waste management and looking for information on food waste collection. For those LAs identified as having schemes further information was gathered from each website according to the headings shown in Table 27A.1.

The webpages of 33 waste disposal authorities were also examined as these often gave information on which of the LAs within their area operated FW collection schemes, and thus provided an additional check, although the information was less detailed than on the individual LA websites.

In addition a general web search was carried out using google.co.uk with the search term 'Food waste' and the restriction 'pages from UK'. This produced references to a number of useful recent reports giving information on food waste collection (Arcadis, 2009; Brook Lyndhurst, 2009; Eunomia, 2011), but neither the search nor the reports identified any additional LA collection schemes. The term 'kitchen waste' is also sometimes used to describe food waste, but was not found separately. The term 'biodegradable municipal waste' or BMW is also used, but applies to a broader category of organic materials including paper and green waste; elsewhere in Europe this is more commonly referred to as the organic fraction of municipal solid waste (OFMSW).

Local authority area and population data was obtained from ONS (2010, 2011) and indices of deprivation from DCLG (2011). Tonnages of household waste collected and tonnages sent for recycling, composting or re-use in 2010 were taken from Defra (2010).

Table 27A.1. Data collected in survey

No.	Main Category	Subcategory	Unit	Possible responses
1	Local Authority	Name		
2		Type		BC/CC/DC/LBC/MBC/UA
3				Collection/Unitary/Disposal
4				E Midlands, Eastern, London, North East, North West, South East, South West, W Midlands, Yorkshire and Humber
5		Area	km2	
6		Population	no.	
7		Population density	person/km2	
8		Household waste collected	tonnes/person-year	
9		Household waste sent for recycling/composting/re-use	tonnes/person-year	
10			% of total	
11		Indices of Multiple Deprivation	Average Score	
12			Rank	
13	Separate FW collection?			Yes/No/NS
14		Status		Compulsory/Opt-in/NS
15	Frequency	FW Collections		Weekly/Fortnightly/Other/NS
16		Residual Collection		Weekly/Fortnightly/Other/NS
17		Recyclable Collection		Weekly/Fortnightly/Other/NS
18		Comments		
19	Type	Type		FW only/with GW
20		Comments		
21		Contracted out or operated by council		Yes/No/NS
22		Comments		
23	Materials	Bones		Yes/No/NS
24		Eggshells		Yes/No/NS
25		Paper/ card		Yes/No/NS
26		Shredded paper		Yes/No/NS
27		Liquid		Yes/No/NS
28		Oil / fat		Yes/No/NS
29		Faecal		Yes/No/NS
30		Plant		Yes/No/NS
31		Biodeg bags		Yes/No/NS
32		List accepted		Yes/No/NS
33		Accept		
34		List rejected		Yes/No/NS
35		Reject		
36		Comments		
37	Containers	Caddies	yes/no	Yes/No/NS
38			size (l)	
39		Buckets	yes/no	Yes/No/NS
40			size (l)	
41		Wheeled bins	yes/no	Yes/No/NS
42			size (l)	
43		Other bins	yes/no	Yes/No/NS
44			type	
45			size (l)	
46		Biodegradable bags	yes/no	Yes/No/NS
47			user pays?	Yes/No/NS
48			Comments	
49		Newspaper		Yes/No/NS
50		Comments		
51	Cost			Yes/No/NS
52		Comments		
53	Coverage			Yes/No/NS
54		Began		Date
55		Comments		
56	Vehicle			Yes/No/NS
57		Type		
58	Target Plant	Food Waste		Yes/No/NS
59			Plant	
60		Residual Waste		Yes/No/NS
61			Plant	
62	Information provided	Treatment type		Yes/No/NS
63		Treatment Comments		
64		Home composting		Yes/No/NS
65		Reduced price composters		Yes/No/NS
66		Reasons for collection		Yes/No/NS
67		Love Food Hate Waste		Yes/No/NS
68		Other info		
69		Comments		

Results

Of the 325 waste collection authority websites examined, 121 (37%) had some form of food waste collection. 57 of these were for food waste only while 64 were mixed collections with garden waste. This is in agreement with the findings of Brook Lyndhurst (2009), who noted that the split between food waste only and mixed collections was almost even, with food waste only collections being introduced at a faster rate.

Table 27A.2 shows the number of people provided with each type of FW collection service. Almost 30 million, or 60% of the population of England, live in areas which now offer some form of separate collection of FW: it should be noted, however, that this is not equal to the number with current access to FW collections, since in many cases these schemes are recently introduced and have not yet been rolled out to the full LA area.

Table 27A.2. Population of LAs by type of service provision

	Population	
No separate FW collection	19,664,800	40%
with GW	11,432,100	23%
separate FW-only collection	18,396,600	37%
Total	49,493,500	100%

Some differences were noted between the groups of LAs with no separate FW collections and those with FW-only or co-mingled collections. Table 27A.3 shows parameters in which a t-test indicated a difference in sample mean that was significant at the 5% level. On average, LAs with FW-only collections were smaller in area, more densely populated, collected less household waste per person and had lower indices of multiple deprivation than those without a separate collection service. A slightly more complex picture can be seen from the distributions in Figure 1: for example, FW-only collections are more common in LAs with either high or low deprivation indices, while LAs with high or low populations are less likely to offer a separate collection service. Of the 10 LAs with populations over 375,000, only one (Bristol CC) collects FW-only, while one (Manchester CC) collects FW with GW. There are also strong regional trends, with a preponderance of schemes in the south and east of the country and in London (Table 27A.4). As the number of FW collection schemes is increasing these results are only a snapshot of the current position, but may indicate the characteristics and motives of early adopters.

Table 27A.3. Average parameter values for LAs with different collection systems*

		No FW	FW-only	with GW	all FW
No		204	57	64	121
Area	km^2	423	261	329	297
Population density	number/km^2	1313	2557	1520	2008
Waste	tonnes/person-year	0.463	0.380	0.406	0.394
Recycled	tonnes/person-year	0.175	0.146	0.173	0.160
% recycled	%	37%	38%	42%	40%
IMD		20.0	17.7	17.7	17.7
Rank IMD		152	187	178	182

* Differences significant at 5% level in t-test assuming unequal sample variances

Table 27A.4. Number of LA collection schemes by English region

	All	FW-only	% of all
E Midlands	40	2	5%
Eastern	46	9	20%
London	33	14	42%
North East	12	0	0%
North West	39	3	8%
South East	67	17	25%
South West	37	10	27%
W Midlands	30	1	3%
Yorkshire and Humber	21	1	5%
Total	325	57	18%

The slightly higher proportion of waste sent for recycling from LAs with comingled FW and GW schemes is probably due to the separate collection of GW, which typically comprises 15% of household waste. It is unlikely that the smaller quantity of waste per person in LAs with FW-only collections can be attributed to the influence of these schemes, as in many cases the 2010 waste data pre-dates their introduction; the difference therefore probably reflects different socio-economic conditions and reliance on other forms of collection.

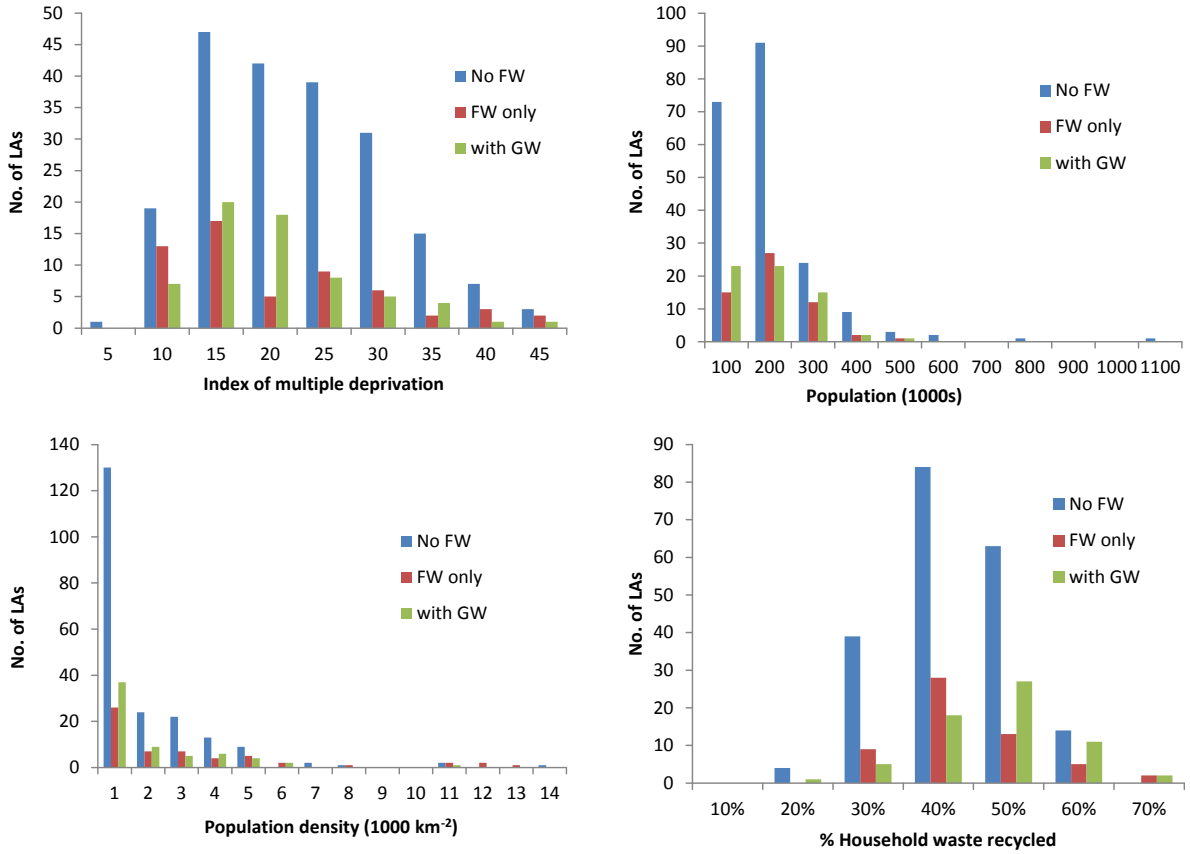

Figure 27A.1. Distribution of selected LA characteristics according to type of FW collection scheme

Co-mingled collections. The approach to co-mingled collection was consistent, with most LAs providing a 240-litre wheeled bin in which GW is placed and permitted components of

FW are added: these generally exclude bones, liquids and fats. The major difference between schemes of this type is whether the bin is provided free of charge or at a cost.

Source segregated FW collections

Some key characteristics of the LAs that provide FW-only collections are shown in Table 27a.5; full details of the survey results are available in spreadsheet format.

Table27A. 5. Local Authorities providing FW only collections

Name	Type 1	Type 2	Region	Area	Population	Population density	Waste	Recycling	Recycling %	IMD	RIMD
				km^2	no.	person/km^2	tonnes/person-year	tonnes/person-year	% total	Average Score	Rank of Average Score
Bath and North East Somerset Council	DC	Unitary	South West	350	167,300	478	0.465	0.197	42.5%	12.10	247
Braintree District Council	DC	Collection	Eastern	611	142,700	233	0.390	0.193	49.5%	14.00	212
Bristol City Council	CC	Unitary	South West	109	433,100	3,981	0.377	0.141	37.4%	25.17	79
Broadland District Council	DC	Collection	Eastern	552	123,000	223	0.380	0.181	47.7%	10.41	279
Bromley LB	LBC	Unitary	London	153	310,200	2,030	0.426	0.171	40.2%	14.95	203
Calderdale MBC	MBC	Unitary	Yorks & Humber	363	201,600	556	0.391	0.165	42.0%	23.18	105
Camden LB	LBC	Collection	London	21	231,200	11,158	0.303	0.090	29.8%	25.43	74
Castle Point Borough Council	BC	Collection	Eastern	44	89,200	2,026	0.376	0.139	36.9%	14.88	204
Central Bedfordshire	UA	Unitary	Eastern	716	252,900	353	0.451	0.227	50.3%	10.73	269
Chelmsford Borough Council	BC	Collection	Eastern	342	167,800	491	0.424	0.157	37.1%	9.57	295
Cheltenham Borough Council	BC	Collection	South West	47	113,900	2,443	0.423	0.139	32.9%	15.46	195
City of London	CC	Unitary	London	3	11,500	4,440	0.425	0.150	35.2%	11.15	262
Cotswold District Council	DC	Collection	South West	1163	83,500	72	0.425	0.257	60.4%	10.93	266
Dover District Council	DC	Collection	South East	316	106,100	336	0.372	0.115	30.8%	20.69	127
Ealing LB	LBC	Collection	London	54	316,600	5,821	0.340	0.128	37.6%	25.01	80
East Devon District Council	DC	Collection	South West	813	132,700	163	0.306	0.104	34.2%	13.87	215
East Northamptonshire Council	DC	Collection	E Midlands	510	85,000	167	0.343	0.105	30.6%	13.32	225
Eastleigh Borough Council	BC	Collection	South East	80	120,800	1,505	0.323	0.141	43.8%	10.49	275
Elmbridge Borough Council	BC	Collection	South East	96	130,600	1,363	0.383	0.169	44.0%	7.24	320
Epsom and Ewell Borough Council	BC	Collection	South East	34	72,700	2,159	0.368	0.169	46.0%	8.46	307
Gloucester City Council	CC	Collection	South West	41	117,300	2,831	0.404	0.130	32.1%	20.87	125
Hackney LB	LBC	Collection	London	21	216,000	10,425	0.343	0.083	24.3%	42.89	2
Harborough District Council	DC	Collection	E Midlands	593	83,400	141	0.431	0.230	53.3%	7.57	319
Haringey LB	LBC	Collection	London	31	225,500	7,256	0.398	0.100	25.1%	36.10	13
Harlow District Council	DC	Collection	Eastern	31	80,600	2,593	0.319	0.113	35.3%	23.73	95
Hounslow LB	LBC	Collection	London	57	234,200	4,110	0.409	0.136	33.2%	21.84	118
Isle of Wight Council	UA	Unitary	South East	381	140,200	368	0.537	0.171	31.9%	20.73	126
Islington LB	LBC	Collection	London	16	191,800	12,342	0.339	0.099	29.1%	35.87	14
Knowsley MBC	MBC	Collection	North West	96	149,400	1,559	0.418	0.116	27.9%	41.01	5
Lambeth LB	LBC	Collection	London	26	283,300	10,938	0.312	0.085	27.1%	31.24	29
Luton Borough Council	BC	Unitary	Eastern	44	194,300	4,413	0.451	0.162	35.8%	25.78	69
Maidstone Borough Council	BC	Collection	South East	394	148,200	376	0.378	0.116	30.6%	13.85	217
Merton LB	LBC	Unitary	London	39	206,400	5,313	0.347	0.117	33.6%	14.56	208
Mole Valley District Council	DC	Collection	South East	259	83,800	324	0.376	0.190	50.4%	8.02	310
Newcastle-under-Lyme Borough Council	BC	Collection	W Midlands	210	124,200	592	0.408	0.117	28.7%	18.93	150
North Somerset Council	DC	Unitary	South West	373	209,100	561	0.486	0.181	37.2%	15.18	201
Norwich City Council	CC	Collection	Eastern	39	140,100	3,606	0.310	0.107	34.6%	25.65	70
Oxford City Council	CC	Collection	South East	47	149,300	3,203	0.288	0.110	38.2%	21.17	122
Pendle Borough Council	BC	Collection	North West	168	89,300	530	0.364	0.129	35.6%	30.72	33
Richmond upon Thames LB	LBC	Collection	London	54	189,000	3,475	0.410	0.174	42.4%	10.12	285
Royal Borough of Kingston upon Thames	BC	Unitary	London	39	166,700	4,291	0.355	0.164	46.2%	11.66	255
Runnymede Borough Council	BC	Collection	South East	78	83,900	1,080	0.329	0.082	25.0%	9.64	293
Sefton MBC	MBC	Collection	North West	153	273,300	1,789	0.386	0.152	39.4%	24.25	92
Shepway District Council	DC	Collection	South East	357	100,300	281	0.388	0.141	36.5%	23.53	97
South Gloucestershire Council	UA	Unitary	South West	497	262,200	527	0.473	0.193	40.9%	10.62	272
South Oxfordshire District Council	DC	Collection	South East	679	130,600	192	0.357	0.220	61.4%	8.38	308
Spelthorne Borough Council	BC	Collection	South East	57	92,600	1,625	0.346	0.116	33.5%	11.20	260
Surrey Heath Borough Council	BC	Collection	South East	96	83,900	876	0.319	0.160	50.0%	6.89	324
Sutton LB	LBC	Unitary	London	44	192,200	4,365	0.401	0.151	37.6%	15.43	196
Torbay Council	UA	Unitary	South West	62	134,000	2,156	0.449	0.160	35.7%	26.82	61
Tower Hamlets LB	LBC	Unitary	London	21	234,800	11,332	0.279	0.073	26.3%	39.59	7
Uttlesford District Council	DC	Collection	Eastern	640	75,600	118	0.378	0.203	53.8%	7.94	312
Vale of White Horse District Council	DC	Collection	South East	578	118,700	206	0.346	0.125	36.1%	8.53	306
Waverley Borough Council	BC	Collection	South East	344	119,300	346	0.313	0.117	37.4%	7.14	321
West Devon Borough Council	BC	Collection	South West	1160	52,700	45	0.362	0.159	43.9%	16.79	172
West Oxfordshire District Council	DC	Collection	South East	712	102,500	144	0.424	0.143	33.7%	7.76	316
Woking Borough Council	BC	Collection	South East	65	91,800	1,418	0.353	0.158	44.9%	9.93	289

Table 27A.6 shows FW-only collections categorised by LA type. The proportion in each category is similar apart from for London Borough Councils, where 40% offer FW-only collections. This high level of provision is reflected in a variety of city-wide initiatives giving information on recycling options (www.capitalwastefacts.com, www.recycleforlondon.com)

Table 27A.6. FW-only collections by LA category

	Total no. in category	With FW-only collection	% with FW collection
District Council	106	16	15%
Borough Council	108	17	16%
London Borough Council	30	12	40%
Metropolitan Borough Council	30	3	10%
City Council	32	5	16%
Unitary Authority	19	4	21%
Total	325	57	18%

Charges. Although only 27 websites specifically stated the collection service was free it can be assumed that the schemes operated without charge, as there is a statutory requirement for LAs to collect this material as a component of household waste. A small number of authorities impose a charge if a replacement container is needed: for example Woking Borough Council stated, *"for replacement of both 23-litre green collection bin and 7-litre silver kitchen caddy £18.00, 23-litre green collection bin £16.50, 7-litre silver kitchen caddy £14.00."* Many of the authorities also provide a starter pack of compostable liners free of charge, but once these have been used new ones must be purchased. Most websites provide information on where the public can obtain compostable liners, usually in the form of a list of local stockists.

Optional or compulsory schemes. Of the 57 authorities providing a FW-only collection service, 16 scheme were opt-in, 24 compulsory and the remaining 17 did not state the type of scheme. One website clearly stated the penalty for failing to participate in a compulsory collection: "*We will not be checking your food waste bins but we will be monitoring participation. If you do not recycle your food waste, but are able to, you will receive a letter or a visit from a Waste Support Officer. If you persistently do not recycle your food waste, you could face a fine of up to £1,000"* (Lambeth LBC).

Frequency of collection. 50 (88%) of the LA websites stated that FW was collected weekly, while the other 7 did not specify the collection frequency. Those collecting FW also collected residual waste and recyclables, and the frequency of these collections is shown in Table 27A.7. 20 (35%) continued to collect residual waste on a weekly basis. This is surprising both because removal of the food waste component is a means of reducing odour and nuisance value, making less frequent collection more acceptable (Gladding, 2009); and as it suggests the introduction of separate FW collection may have led to an increase in energy and other costs, unless routing of the other waste collections has been adjusted.

Table 27A.7. Collection Frequency

	FW		Residual Waste		Recyclables	
Weekly	50	88%	20	35%	31	54%
Fortnightly	0	0%	19	33%	14	25%
Not specified	7	12%	18	32%	12	21%
Total	57	100%	57	100%	57	100%

Materials collected. Nearly all of the websites stated very clearly which materials were acceptable, with only one (<1%) not providing a list of accepted materials. Most (43 or 75%) also reinforced this by providing a list of materials that were not acceptable.

Materials listed as acceptable in almost every case included raw and cooked meat and fish; dairy products such as cheese; bread, pasta and rice; fruit/vegetable waste; tea and coffee grounds; and generic materials such as plate scrapings. There was considerable commonality in the lists, but also minor differences. In most cases these were in the form of extra information given for clarity: specific examples included "*Fruit (including fallen fruit from your garden)*" (Epsom and Ewell BC); "*Leftovers from your meals*" (Norwich CC); "*any out of date food (including dairy products)*" (Shepway DC); "*Cores, pips, seeds*" (Surrey Heath BC); *"tinned and dry pet food"* (Norwich CC); *"leftover takeaway food"* (several).

Table 27A.8 summarises materials explicitly listed as acceptable or unacceptable in different schemes. In contrast to comingled collection schemes, where bones were almost always excluded, over 80% of FW-only schemes specifically stated that these were accepted. Over half of the websites also stated that eggshells were accepted, indicating that it was felt advice would be needed on this material. Of the LAs accepting shredded paper, all five sent the waste to be composted. The 2 LAs accepting paper and card gave specific details: *"Food stained paper and card – e.g. pizza boxes, fish & chip paper"* (Uttlesford DC); *"small cardboard items such as toilet rolls or egg boxes"* (Bristol CC). Only a limited number of LAs specifically accepted other biodegradable materials such as paper or fats and oils. None stated that they accepted faecal material and 30% specifically excluded this; terms used ranged from the rather formal *"animal faeces"* to specific items such as *"disposable nappies and incontinence pads"*, and to the more colloquial *"pet poo"*. In several cases materials which are specifically identified as acceptable in one scheme were rejected by another: this may be due to slight differences in the way the schemes operate or the destination of the waste material, or may simply reflect the fact that separate FW collection is a relatively new phenomenon and a common established list has not yet been developed. A selection of typical LA listings is shown in Table 9, and a complete listing of materials accepted or rejected by each LA is included in Appendix A.

Table 27A.8. Selected materials specified as accepted or rejected in FW collections

	Yes	No	Not specified	Total
Bones	47	5	5	57
Eggshells	29	0	28	57
Paper/ card	2	32	23	57
Shredded paper	5	4	48	57
Liquid	4	27	26	57
Oil / fat	7	30	20	57
Faecal	0	17	40	57
Plant	3	21	33	57
Biodegradable bags	12	16	29	57

Table 27A.9. Examples of LA listings for accepted and unacceptable materials

Accepted
• All food waste, including dairy products, meat, carcasses and bones, bread, fish and all mixture of cooked food scrapings are suitable.
• Cooked and raw food, meat and fish (including bones) vegetable and fruit peelings, egg shells (if you cannot compost at home), dairy products (for example cheese and yoghurt), tea bags and coffee grounds, newspaper to wrap your food waste, biodegradable/compostable liners.
• Food waste – cooked and uncooked, e.g. fruit and vegetable peelings, left-over plate scrapings etc., Meat and fish - including bones, Bread, cakes and pastries, Rice, pasta and beans, Tea bags and coffee grinds, Cut flowers, Pet food.
• Fruit and vegetable peelings, pips and cores, Meat and bones, Fish and bones, Dairy products and egg shells (not liquid), Teabags, tea leaves and coffee grounds, Bread and cakes, Cereals, Plate scrapings and left over cooked food, Food past its use-by-date (please remove all packaging).
• Fruit and vegetables, meat and fish, tea bags and coffee grounds, bread and pastries, dairy products, rice, pasta and beans, eggs and eggshells, cooked and leftover food.
Not accepted
• Food packaging and plastic bags, Drinks, such as tea or juice, Oil or liquid fat, Coffee filter paper.
• Bones, Liquids, Oil or liquid fat, Packaging of any sort, Plastic bags.
• No plastics bags, (even if they are biodegradable), Glass, Cans and tins, Cat, dog or other pet food, Liquids, Garden waste.
• Plastic bags, cooking oil, food packaging, carcasses (whole chickens or turkeys), animal waste, nappies, garden waste, any other non-food waste.
• Raw meat and fish; Plastic bags; Bones; Tins and cans; Glass; Paper.
• Shredded paper, Garden waste, Cooking oil, Plastic bags, Pet litter, Food packaging.

To assist the public in understanding the FW-only concept, some LAs also offered brief general descriptions: for example Maidstone BC website states "*We accept all cooked and uncooked food waste including meat, fish and bones*", while Richmond upon Thames BC uses the rather snappier slogan "*If it grows and you can eat it, we can recycle it"*. Additional information was also provided in Frequently-Asked Questions sections, often with detailed suggestions: for example *"Small scrapings of oil from a pan are fine but please don't empty the whole contents of a deep fat fryer – but you could pour this used oil into a plastic bottle and take to your local Recycling Centre for recycling on your next visit"*, and *"Please don't include large amounts of any liquid e.g. a bottle of out-of-date milk but if you have jars with liquid such as pickled onions, just pour away the liquid and add the onions to your food waste"* (Bath and North East Somerset Council).

Bags and liners. The web survey revealed considerable potential for confusion over the use of bags and liners. Very few of the collection authorities supply bags or liners as part of the service. In most cases the option of lining the bin is left up to the householder: 40 (70%) of the LA websites specifically mention that lining with newspaper or paper is allowed, and 18 provide a video of how to do this, while Oxford City Council provide a diagram (Figure 2). Information on the types of bag that can be used in the scheme is less clear, and this is compounded by the use of the terms biodegradable and compostable. Some websites succeeded in explaining the requirements clearly: for example Haringey Council's instructions said "*Please do not put any plastic bags in this bin. Plastic bags, even those labelled 'biodegradable', will not compost as quickly as the food waste itself*". South Gloucestershire Borough Council's website states "*You cannot use plastic or biodegradable bags that are not compostable to put your food waste in. They must have the compostable logo printed on them"*. 16 (28%) of the local authorities specifically state that they do not accept biodegradable bags and 44% do not state whether they accept them or not. An example of the potential for confusion on this point is shown on the website of Bromley

Borough Council where the list of acceptable items included *"Cut flowers (placed in a compostable bag or newspaper)"* but the unacceptable items list includes *"Plastic-film and food wrappings (including plastic or biodegradable bags)"*.

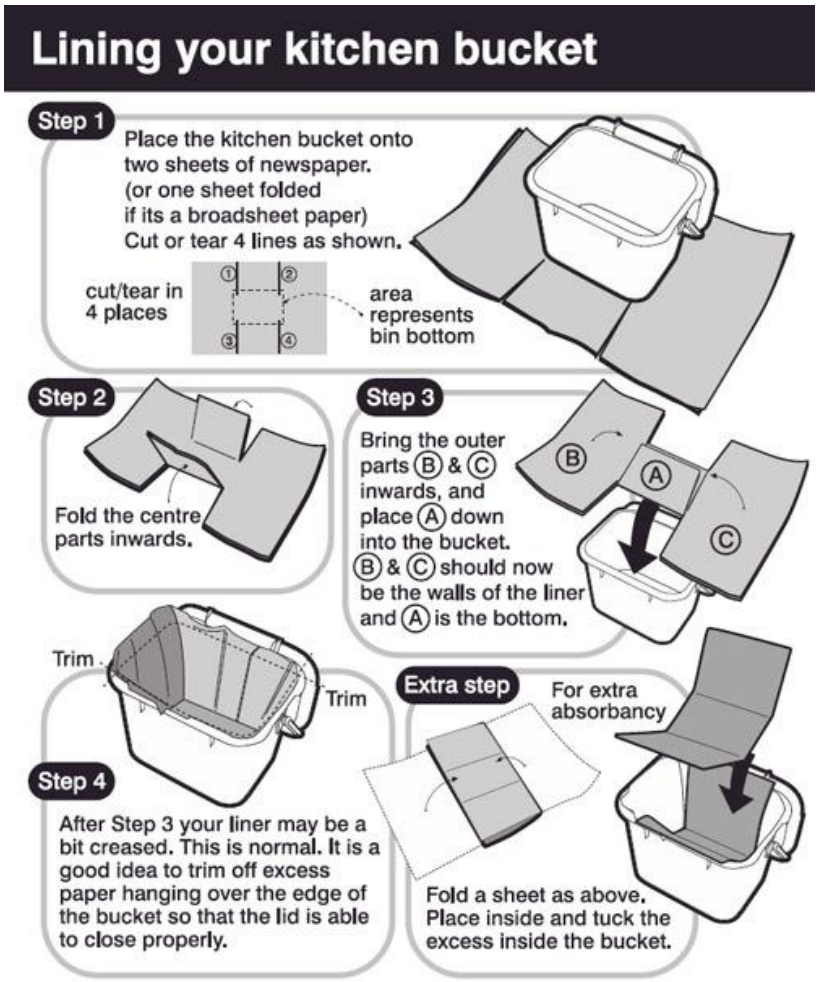

Figure 27A.2. Diagram of how to line a caddy (Oxford CC, www.oxford.gov.uk)

Containers. All of the LA websites that provide information on the type of containers and bins used specify the caddy and bin system, where the household receives a small kitchen caddy and a larger external bin. Only 2 (3%) of the websites do not state the containers used in the collection service. 41 LAs did not specify the exact size of the caddy or bucket utilised. Those that did gave caddy volumes of 5, 7 or 10 litres and bins of 20, 21, 22, 23 or 35 litres.

Collection vehicles. Most LA websites did not give specific information on the type of vehicle used: only 4 mentioned using specialist or twin-compartment vehicles. This information was evidently not felt to be important in obtaining public cooperation.

Treatment process. 45 (79%) of the LAs gave information on the type of treatment process used. The split between anaerobic digestion and composting shown in Table 27A.10, with 2 local authorities using both methods. The dominance of composting reflects the fact that FW-only collection and treatment is still in its infancy. Although the majority of LAs specified the treatment type, there was less information on the target plant for the waste, with only 13 (23%) of the websites mentioning this. Where the waste is treated in a local plant, this provides an opportunity to increase the sense of local relevance and ownership of the scheme;

however as many of the FW collections schemes are relatively new and the number of AD plants treating FW in the UK is increasing, this information may be omitted as it is likely to go out of date.

Table 27A.10. Waste treatment process type

	No. of LAs	%
AD	10	18%
Composting	33	58%
AD and composting	2	4%
Not specified	12	21%
Total	57	100%

Supporting information. 40 (70%) of the LA websites provided supporting information on why food waste recycling is important. 35 (61%) also gave information on home composting, although some LAs initially discouraged this. Just under 50% of websites mentioned the Love Food Hate Waste campaign (www.lovefoodhatewaste.com) which promotes minimisation of food waste. Most of the LAs also provided downloadable information on the collection scheme, ranging from simple instructions to more detailed explanations covering all aspects of the scheme (Figure 27A.3).

a) Chelmsford BC

b) Broadlands DC

Figure 27A.3. Examples of supporting information leaflets

Summary of key findings

- 37% of LAs in England provide some form of separate food waste collection, with 18% offering food-waste only collections.
- As yet there is no single common list of materials accepted in FW-only schemes, but a degree of consistency is emerging with only small differences between schemes.
- Instructions on the acceptability of biodegradable plastic bags are unclear and are likely to cause confusion amongst the public.

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Attachment 27A.A

Table A1. LA listings of acceptable materials for FW-only collection schemes

- All cooked or uncooked food waste and plate scrapings, Meat, fish and bones , Fruit (including fallen fruit from your garden) and vegetables, Dairy products such as cheese, Eggs (including shells), Bread, cakes and pastries, Rice and pasta, Pet food , Tea bags and coffee grounds.
- All food leftovers (including meat and fish), fruit and vegetables, raw and cooked, any out of date food (including dairy products), bread, rice, pasta and beans, meat and fish, raw and cooked including bones.
- All food waste, including dairy products, meat, carcasses and bones, bread, fish and all mixture of cooked food scrapings are suitable.
- All items of cooked and uncooked food waste can be recycled using this service.
- Bread, Cakes and biscuits, Cheese, Coffee grounds, Eggs including the shell, Fish (no bones), Fruit, Meat (no bones), Noodles, Pasta, Rice, Tea bags, Vegetables, Approved compostable liners **only.**
- Bread, cakes and pastries, Meat and fish - raw and cooked including bones, All dairy products such as eggs and cheese, Fruit and vegetables - raw and cooked, Tea and coffee grounds, Rice, pasta and beans, Uneaten food from your plates and dishes.
- Cooked and raw food, meat and fish (including bones) vegetable and fruit peelings, egg shells (if you cannot compost at home), dairy products (for example cheese and yoghurt), tea bags and coffee grounds, newspaper to wrap your food waste, biodegradable/compostable liners.
- Cooked and raw food, meat and fish, bones, dairy products, vegetables and fruits, cheese, yoghurt, rice and pasta, vegetable and fruit peelings, egg shells, pet food, paper towels and tissues, tea bags and coffee grounds.
- Cooked food (plate scrapings), Meat and fish scraps including bones, Fruit and vegetable peelings, Eggs and egg shells, Diary products, Cut flowers, Tea bags and coffee grinds.
- Dairy products (including butter, cheese, eggs, eggshells), Fish, meat and bones, Rice and pasta, Fat and lard, Fruit and vegetables, Tea bags and coffee grounds, Bread and cake, Pet food.
- Dairy Products such as Cheese, Bread and other Baked Products, Meat and Meat Bones, Eggs and Egg Shells, Fish and Fish Bones, Fruit and Vegetable Peeling, Out of date Food Please remove packaging, Plate Scrapings, Coffee Grounds and Tea bags.
- Food waste – cooked and uncooked, e.g. fruit and vegetable peelings, left-over plate scrapings etc., Meat and fish - including bones, Bread, cakes and pastries, Rice, pasta and beans, Tea bags and coffee grinds, Cut flowers, Pet food.
- Fruit & vegetables, Dairy, Meat and bones, Fish, Tea & coffee grounds, Bread & pastries.
- Fruit and vegetable peelings, Cooked and uncooked food, Meat and bones, Plate scrapings and leftovers, Eggshells, Teabags and coffee grounds, Dead house plants / flowers, Food stained paper and card – e.g. pizza boxes, fish & chip paper.
- Fruit and vegetable peelings, Cooked food, Raw meat & fish, Bones, Leftover food/plate scrapings etc.
- Fruit and vegetable peelings, pips and cores, Meat and bones, Fish and bones, Dairy products and egg shells (not liquid), Teabags, tea leaves and coffee grounds, Bread and cakes, Cereals, Plate scrapings and left over cooked food, Food past its use-by-date (please remove all packaging).
- Fruit and vegetable peelings, Teabags and coffee grounds, Egg shells, Meat and bones, Left over cooked food, Left over uncooked food.
- Fruit and vegetables, meat and fish, cooked and uncooked food, leftover food, bread, pasta, cereal and rice, tea bags and coffee grounds, dairy products and egg shells, bones, small cardboard items such as toilet rolls or egg boxes, small amounts of shredded paper.
- Fruit and vegetables, meat and fish, tea bags and coffee grounds, bread and pastries, dairy products, rice, pasta and beans, eggs and eggshells, cooked and leftover food.
- Fruit and vegetables; Meat, fish and bones; Cooked and uncooked food; Leftover food; Bread, pasta, cereal and rice; Tea bags and coffee grounds; Dairy products and eggshells; Shredded paper; Cut flowers.
- Fruit, vegetables and peelings; Meat, fish and bones; Cooked and uncooked food; Plate scrapings; Leftover food; Bread, pasta, cereal and rice; Tea bags and coffee grounds; Dairy products and eggshells; Cut flowers (placed in a compostable bag or newspaper).
- Fruit, vegetables, meat and fish, Dairy products and eggshells, Bread, pasta, cereal, rice,

Table A1. LA listings of acceptable materials for FW-only collection schemes

Cooked and uncooked food, leftover food, Bones and pet food, Tea bags and coffee grounds.
- Fruit; Raw vegetables; Cooked vegetables; Cooked meat and fish; Bread and pasta; Tea bags; Egg shells.
- Fruits and vegetables - raw and cooked, Dairy product such as cheese and egg shells, Raw and cooked meat as well as fish, Leftover food from your dishes and plates, Bread, cakes and pastries, Rice, pasta and cereal, Tea bags and coffee grounds.
- Leftovers from your meals, meat - raw and cooked, including fat, bones, fish - raw and cooked, including bones and shells, eggs including the shells, all dairy products eg cheese, vegetables and fruit - raw and cooked, bread, cakes and other baked goods, rice, pasta and beans, tea bags and coffee grounds, cooking oil, lard and other fats, tinned and dry pet food.
- Meal leftovers, fruit & vegetable peelings, meat & fish, bones, fat & gristle, rice, pasta, beans & cereals, cheese, yogurt & eggs shells, tea bags & coffee grounds, bread, cakes & pastries, mouldy & out-of-date food.
- Meat & Bones, Fish, Bread & pastries, Plate Scrappings, Tea & Coffee grounds, Dairy, Fruit and Vegetables.
- Meat and bones, fruit and vegetables, dairy, food waste, fish.
- Meat and fish – raw and cooked (including bones), Fruit and vegetables – raw and cooked (including fruit stones), All dairy products such as eggs and cheese, Bread, cakes and pastries, Rice, pasta and beans, Uneaten food from your plates and dishes, Tea bags and coffee grounds.
- Meat and fish - raw and cooked including bones, all dairy products such as cheese and eggs, raw and cooked vegetables and fruit, bread, cakes and pastries, rice, pasta and beans, uneaten food from your plates and dishes, tea bags and coffee grounds, cooking oil, lard and fats (do not put cooking oil in plastic containers), old flowers. [2 occurrences].
- Meat and fish – raw and cooked including bones, All dairy products such as eggs and cheese, Raw and cooked vegetables and fruit, Bread, cakes and pastries, Rice, pasta and beans, Uneaten food from your plates and dishes, Tea and coffee grounds. [2 occurrences].
- Meat and fish - raw and cooked including bones, Fruit and vegetables - raw and cooked including peelings, Dairy products such as eggs and cheese, Bread, cakes and pastries, Rice, pasta and beans, Uneaten food from your plates and dishes, Tea bags and coffee ground.
- Meat and fish - raw and cooked including bones, Fruit and vegetables - raw and cooked, All dairy products such as eggs and cheese, Bread, cakes and pastries, Rice, pasta and beans, Uneaten food from your plates and dishes, Tea bags and coffee grounds. [2 occurrences].
- Meat and fish – raw and cooked including bones, Fruit and vegetables – raw and cooked, All dairy products such as eggs and cheese, Bread, pasta and beans, Uneaten food from your plates and dishes, Tea bags and coffee grounds.
- Meat and fish – raw and cooked, Cooked bones, Dairy products including eggs, egg shells, butter and cheese, Raw and cooked vegetables and fruit, Bread, cakes and pastries, Rice, pasta and beans, Uneaten food from your plates and dishes, Tea and coffee grounds, Cat and dog food.
- Meat and fish - raw and cooked, including bones, Uneaten food from plates and dishes, All dairy products, such as eggs and cheese, Raw and cooked vegetables and fruit, Breads, cakes and pastries, Rice, pasta and beans, Tea bags and coffee grounds.
- Meat and fish - raw and cooked, Raw and cooked vegetables and fruit including peelings, All dairy products such as cheese and eggs (including shells), Breads, pastries and cakes, Pasta, rice and beans, Teabags and coffee grounds, Uneaten leftovers from dishes and plates (including fish and poultry bones), Out-of-date food.
- Meat and fish – raw and cooked, including bones, fruit and vegetables – raw and cooked, all dairy products such as eggs and cheese, bread, cakes and pastries, uneaten food from your plates & dishes, tea bags and coffee grounds.
- Meat and fish (raw and cooked including bones), fruit and vegetables (raw and cooked), dairy products (including cheese, eggs and egg shells), bread, cakes and pastries, rice and pasta, tea bags, tea and coffee grounds, used kitchen paper towels, uneaten food from plates and dishes.
- Meat and fish including bones, fruit and vegetable peelings and cores, dairy, products and bread, rice and pasta.
- Meat and Fish, Fruit and vegetables, All dairy products, Bread, cakes & pastries, Rice, pasta & beans, Uneaten food, Tea bags & coffee grounds.
- Meat and fish, raw and cooked including bones, fruit and vegetables, raw and cooked. All

Table A1. LA listings of acceptable materials for FW-only collection schemes

dairy products such as eggs and cheese, breads, cakes, pastries, rice pasta and beans. Uneaten food from your plates and dishes, tea bags and coffee grounds.
- Meat, fish and bones; Bread, pasta and rice; Vegetable and fruit waste; Eggs and cheese; Tea bags; All cooked and raw foods; Coffee grounds with paper filters.
- Plate scrapings, Meat (including bones), Rice, pasta and noodles, Tea bags and tea leaves, Eggs (including shells), Bread, cakes and biscuits, Cheese, Coffee grounds, Fish (including bones), Pet food, Takeaway leftovers, Fruit and vegetables.
- Raw / cooked meat/fish (including bones), leftover food, fruit / vegetable peelings, teabags and coffee grounds, eggshells, cooking oil and fats (soak oils into newspapers).
- Raw and cooked food including bones, Dairy products such as cheese and eggs (including shells), Bread, toast, pizza, cakes, biscuits, croissants, pastries etc, Rice, noodles, pasta, beans, cous cous, Uneaten breakfast cereal, Uneaten food from your plates including gravy, sauce, custard etc and leftover takeaway food, Leftover food and small amounts of fat from your cooking pots.and pans, Tea bags and coffee grounds, Pet food
- Raw and cooked fruit and veg, meat and fish including bones and skin, cheese and other dairy products, eggs and shells, small amount of liquids, oil and fats, bread cakes and pastries.
- Raw and cooked fruit and veg, meat and fish including bones and skin, cheese and other dairy products, eggs and shells, small amount of liquids, oil and fats, bread cakes and pastries.
- Raw and cooked meat including bones, Raw and cooked fish including bones, Raw and cooked fruit and vegetables, Dairy products such as cheese and eggs (including shells), Bread, toast, pizza, cakes, biscuits, croissants, pastries etc, Rice, noodles, pasta, beans, cous cous, Uneaten breakfast cereal, Uneaten food from your plates including gravy, sauce, custard etc and leftover takeaway food, Leftover food and small amounts of fat from your cooking pots and pans, Tea bags and coffee grounds, Pet food.
- Shredded paper (loose); Fruit and vegetables - raw and cooked; Fruit and vegetable peelings; Tea bags and coffee ground; Egg shells; Cooked and raw meat; Cooked and raw fish; Meat and fish bones; Dairy products ; Bread, cakes and pastries; Rice, pasta and beans; Uneaten food from your plate.
- Tea bags and coffee grounds; all leftover food; rice, beans and pasta; bread cakes and pastries; eggs, including shells; meat and fish – raw and cooked, including bones; fruit and vegetables – raw and cooked and peelings, nut shells; all dairy products such as cream and cheese; uneaten food.
- Uneaten food from your plates and dishes, Pasta / rice, Fruit and vegetable peels (raw and cooked), Cores, pips, seeds, Tea / coffee grounds, Bread, cakes, pastries, Meat (including bones), Solid fat, Fish (including bones),Dairy products – i.e. cheese, eggs.
- We accept all cooked and uncooked food waste including meat, fish and bones.

Multiple occurrences shown [thus].

Table A2. LA listings of unacceptable materials

- Animal bedding, Bones, Cardboard, Cooking oil, Foil, Hair, Milk, Packaging, Paper, Pet food, Pet litter, Plastic bags, Plastic trays, Tins, Any liners or bags that do not clearly show the European Bioplastics logo.
- Any packaging, plastic bags, non food products, garden waste.
- Any plastic, including plastic bags, Pet litter, Disposable nappies, Wood shavings or ash, Cardboard (these can be placed in your blue recycling bin or sack), Packaging, Straw/hay, Cooking oil, Green garden waste, Animal bedding, Cat, dog or other animal faeces, Hair, Dead flowers, Tins (these can be placed in your blue recycling bin or sack), Cutlery or kitchenware, Milk.
- Bones, Liquids, Oil or liquid fat, Packaging of any sort, Plastic bags.
- Cat or dog food, Liquids (e.g. milk, oil, soup), Animal bedding, Animal Waste, Packaging - cans, foil, glass and plastic etc., Plastic bags, General refuse.
- Cooking oil, Packaging, Plastic Bags, Garden waste.
- Drinks, such as tea or juice, Oil or liquid fat, Food packaging, Plastic bags, Coffee filter paper.
- Dry recycling, Non-recycling, Plastic / degradable bags, Garden waste, Glass, Tin cans, Foil.
- Food cans and jars; Garden waste; Plastic bags - please don't use them as liners; Pet faeces; Human faeces; Nappies; Plastic/synthetic coffee filters.
- Food packaging and plastic bags, Drinks, such as tea or juice, Oil or liquid fat, Coffee filter paper.
- Garden waste, packaging, pet poo, plastic bags.
- Glass, Packaging of any sort, Plastic bags, Liquids, Oil or liquid fat, Pet food, bedding or faeces.
- No animal bedding or droppings please. Small scrapings of oil from a pan are fine but please don’t empty the whole contents of a deep fat fryer – but you could pour this used oil into a plastic bottle and take to your local Recycling Centre for recycling on your next visit. Please don’t include large amounts of any liquid e.g. a bottle of out-of-date milk but if you have jars with liquid such as pickled onions, just pour away the liquid and add the onions to your food waste.
- No plastics bags, (even if they are biodegradable), Glass, Cans and tins, Cat, dog or other pet food, Liquids, Garden waste.
- Non-food products, Packaging of any sort, Plastic bags (don't use them as liners), Oils or liquids, Glass of any kind.
- Non-food products, packaging of any sort, plastic bags. (don't use them as liners), oils, liquids or any glass of any kind & animal faeces.
- Oil, fats or liquids, Any type of plastic carrier bag, Any packaging - even that marked 'compostable' or biodegradable' as this takes too long to break down, Nappies, Other rubbish.
- Packaging of any sort eg cardboard, plastic film, plastic bags, other recycling, glass, garden waste, straw or other animal bedding.
- Packaging of any sort, liquids, oil or liquid fat. [2 occurrences]
- Packaging of any sort, liquids, oils or liquid fats and plastic bags.
- Packaging of any sort, plastic bags, glass, metal and paper, oils and liquids, nappies, soil, rubble and stones, any other waste.
- Packaging of any sort, Plastic bags, Liquids, Animal faeces, Oil or liquid fat, Newspaper or kitchen roll.
- Packaging of any sort, plastic bags, liquids, oil or fat.
- Packaging of any sort, plastic bags, liquids, oil or fat, pet litter, wood shavings or ash, green garden waste, dead flowers, milk.
- Packaging of any sort, plastic bags, liquids, oil or liquid fat, bread bags.
- Packaging of any sort, Plastic bags, Liquids, Oil or liquid fat, Tins, Cans, Glass.
- Packaging of any sort, Plastic bags, Liquids, Oil or liquid fat.
- Pet litter or faeces, any kind of packaging, plastic bags, other general waste.
- Plastic (including bags made from biodegradable plastic), corn starch liners without the compostable logo, metal and glass, any other household waste.
- Plastic bag liners, Packaging, Liquids/Oils, Garden Waste, Cardboard.
- Plastic bags and liquids of any sort.
- Plastic bags, cling film or other wrapping/packaging materials.
- Plastic bags, cooking oil, food packaging, carcasses (whole chickens or turkeys), animal waste, nappies, garden waste, any other non-food waste.

Table A2. LA listings of unacceptable materials

- Plastic bags, pet litter or faeces, any kind of packaging, nappies, garden waste, other recyclable materials such as glass, paper or metals, other general waste, soil.
- Plastic bags, Tin foil, Cling film, Packaging of any sort, Large amounts of liquids like soup, oil or drinks, Pet waste or bedding.
- Plastic, packaging of any kind, metal and glass, any other household waste, animal faeces, animal bedding, pet litter, cardboard, nappies. [2 occurrences]
- Plastic-film and food wrappings (including plastic or biodegradable bags); Disposable nappies and incontinence pads (please double-bag and place in refuse); Pet waste (please double-bag and place in refuse); Any other household waste.
- Raw meat and fish; Plastic bags; Bones; Tins and cans; Glass; Paper.
- Shredded paper, Garden waste, Cooking oil, Plastic bags, Pet litter, Food packaging.
- Supermarket carrier bags (even if they are made from bio-degradable plastic); Any food packaging (wrappings, trays or cartons); Oil or liquid fat; Food and drinks cans; Other liquid food waste; Glass; Animal waste.
- Uncooked bones, Plastic bags and packaging of any sort, Polystyrene, Liquids, Any oil and fat (including solid fats such as lard), Animal faeces, Cardboard, Nappies, Pet litter, Animal bedding, Tetra Pak container.

Appendix 27B: Results of web based survey on collection of source segregated domestic food waste in Northern Ireland

Organisation of waste collection in Northern Ireland

As a part of the United Kingdom, municipal solid waste management in Northern Ireland is similar to England and Wales. There are 26 district councils in Northern Ireland that are divided into three groups. These are Arc 21, the Southern Waste Management Partnership (SWaMP), and the North West Region Waste Management Group (NWRWMG). The three groups are responsible for preparing and implementing Waste Management Plans in order to meet the targets for recycling and composting of household waste set out in the Northern Ireland Waste Management Strategy 2006-2020. The targets for recycling and composting rate are set at 35% of household waste by 2012, 40% by 2012 and 45% by 2020 (Department of Environment, 2006). These targets are in line with the Northern Ireland Landfill Allowances Scheme (NILAS) and help to meet the diversion targets for biodegradable waste in EU Landfill Directive (99/31/EC).

In Northern Ireland, district councils are responsible for the collection and disposal of municipal waste in their areas. It is recommended that at least two materials are collected separately for recycling or recovery (Department of Environment, 2006). Councils can make their own decisions on what kind of collection method is adopted, including details such as collection frequency for different materials and type of containers used.

District councils are also responsible for reporting the data on municipal solid waste collection via kerbside, bring sites and civic amenity sites to the Department of Environment (DoE). While the DoE is responsible for publishing the statistical report on a quarterly and annual basis, performance in the collection of municipal wastes is reported under nine parameters, including as quantities and recycling rates: full details can be found on the DoE website (http://www.doeni.gov.uk/index/information/asb/ statistics.htm).

All district councils provide the information on household waste collection in detail on their webpages.

Methodology

The aim of this study was to identify what kind of food waste collection service is offered by the district councils: either source-separated food waste collection or co-mingled collection with garden waste or other biodegradable materials. At the start of the study, a list of websites for the 26 district councils was obtained from NIDirect (2012) and searched systemically via each council webpage. The relevant information can usually be found under the section on waste collection, recycling or bins. If a source-separated food waste collection scheme had already been implemented in the district council, detailed information on this was recorded in a spreadsheet. Pilot schemes were also taken into account in this search.

In addition a general web search was carried out using google.co.uk with the search term ‘food waste’ + ‘name of the district council’, to ensure there was no other information on food waste collections in that council if insufficient information related to food waste collection was found on the council website. A number of reports were obtained from the UK's Waste & Resources Action Program (WRAP) website www.wrap.org.uk. Reports in the

local news were also examined to check whether any source-separated food waste collection schemes had been implemented in the past but had changed their practice or been withdrawn.

The survey was conducted between 5 and 10 April 2012.

Results

The search of 26 district council websites shown that 96% of the councils did not have source separated food waste collections implemented. Currently, only Belfast City Council has introduced a trial source-separated food waste collection in part of the area (Belfast City Council, 2012a). On the other hand, Newtownabbey Borough Council took part in the trial collection scheme in October 2007 that was organised by Waste & Resources Action Program (WRAP, 2009). Findings are reported in detail as below:

Source separated food waste collection scheme

Currently, only one council operates a source-separated food waste collection in Northern Ireland. There are 17 district councils that collect food waste with garden waste, equal to 65% in total (Table 27B.1). Among those councils operating co-mingled food waste collections, 65% of them provide the household with a small kitchen caddy and liners (Table 27B.2). Food waste is separated and kept in the caddy before being transferred to large wheeled bins and co-mingled with garden waste. The collection containers are usually provided by councils free of charge, and the provision of a liner is not compulsory, but depends on the practice in different councils. If a liner is provided, a tag is also provided to fasten on the bin when running out of liners. New liners will be provided by collection crew during the collection. For those households not provided with a caddy and liner, newspaper or compostable plastic bags can be used to wrap up the food waste and placed in the wheeled bin for collection.

Table 27B.1. Number of district council collecting co-mingled food waste and green waste in Northern Ireland

Waste Management Group	All	Co-mingled collection	% of all
Arc21	11	10	91%
Southern Waste Management Partnership	8	6	75%
North West Region Waste Management Group	7	1	14%
Total	26	17	65%

Table 27B.2. Number of district council providing food waste caddy and liners

Waste Management Group	Co-mingled collection	Provided	% of all
Arc21	10	9	90%
Southern Waste Management Partnership	6	2	33%
North West Region Waste Management Group	1	0	0%
Total	17	11	65%

Source separated food waste collection pilot scheme in Belfast

Belfast City Council (BCC) is one of the councils in the waste management group Arc 21. According to the Department of Environment (2011), the dry recycling and composting rate in BCC is about 27% which is the worst performance in Northern Ireland. In order to improve the recycling rate, BCC introduced a trial weekly source separated food waste

collection scheme in part of the area including the Lower Ormeau, Markets, Ballynafeigh, Sydenham, Donegall Road and Falls in June 2008. In total, 6938 households were served and the average participation rate was about 45% (WRAP, 2009).

As the recycling rate increased after implementation, the pilot scheme was extended originally to 2009 and has continued to run until now (Belfast City Council, 2008). Households in Ardoyne, Little Americas and Cavehill Road areas are now covered in the pilot scheme, meaning that a further 2100 households are served (Belfast City Council, 2012a). The participating households are provided with two bins and free biodegradable liners. A small brown kitchen caddy of 7-10 litres is used to contain the leftovers. When the caddy is full, food waste is transferred to the larger green external food waste container of 20-25 litres for collection (Figure 27B.1). All food waste including dairy products, raw and cooked meat, vegetables, bread, cake, peelings and pasta can be put in the food waste caddy; only fat, liquid, plastic bags, packaging and cigarette butts are prohibited (Figure 27B.2).

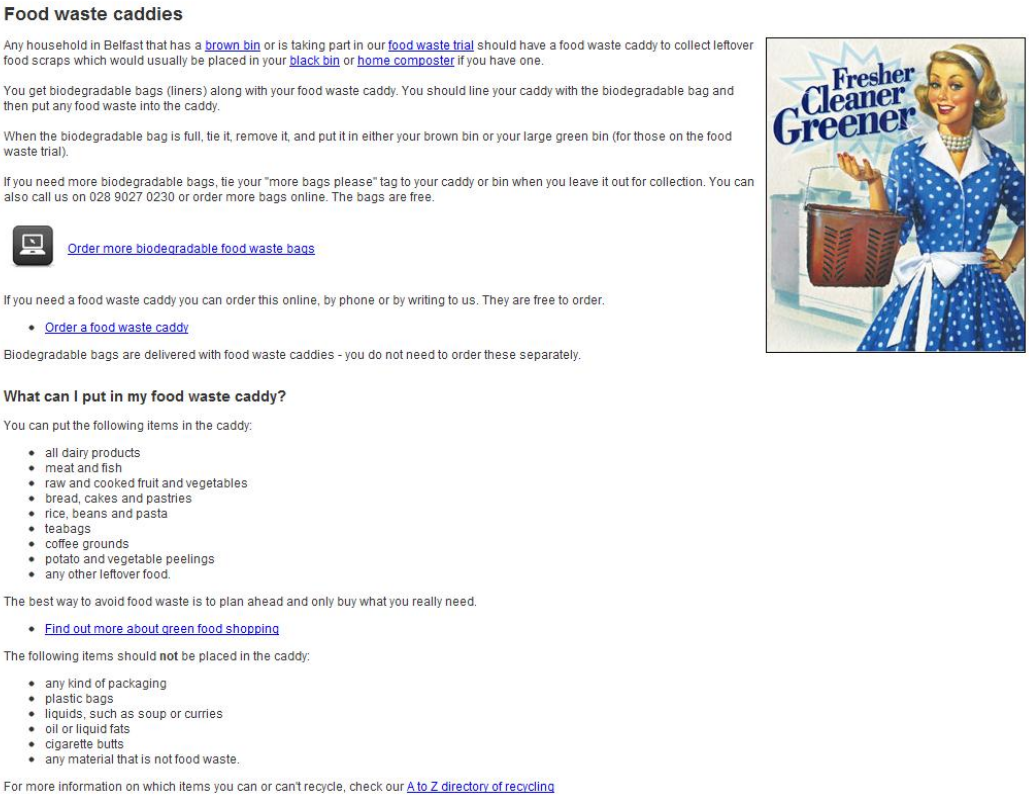
For those residents not living in the above areas a co-mingled food and garden waste collection is offered instead. A small brown caddy and liners are still provided, but the source-separated food waste is tied in the bag and placed in the 240-litre brown wheeled bin along with garden waste. The general refuse bin and the brown bin are collected weekly on the same day by the two different refuse collection vehicles (Belfast City Council, 2012b).

Figure 27B.1. Kitchen caddy and external food waste bin using in Belfast (Source: BCC website)

Previous trial food waste collection scheme in Newtownabbey

Newtownabbey Borough Council (NBC) introduced a source separated food waste collection in October 2007, which was the first local council run food waste collection scheme in Northern Ireland. The scheme served 1552 households in multi-occupancy housings. Householders were provided with a 7-litre kitchen caddy, 25-litre external food waste container and a free roll of liners. As the participating households were living in high rise buildings, the collection method was different from the one running in Belfast. The householders in Newtownabbey were asked to source separate food waste using the kitchen caddy and to place the external container at the doorstep. The collection crew used slave bins to empty the containers every week. The collection started from the top of each building and each floor was double swept to tip the container into the slave bin at each door step. At the

end of the collection, the slave bin was unloaded into a 7.5-tonne single compartment collection vehicle and sent to the processing plant. The participation rate was monitored and it was observed that the overall participation rate decreased from 30.5% to 26.1% (WRAP, 2008). No study report or press release from the council website was found mentioning that this trial scheme has terminated. On the other hand, no information related to this scheme could be found on the NBC webpage. Instead, NBC has introduced a new food waste collection service to all households in the area, which is for co-mingled food and garden waste using the small caddy and wheeled bins (Newtownabbey Borough Council, 2012). An email was sent to the council to ask whether the trial scheme was still operating. NBC replied that they provide food waste collection but did not specify which scheme or schemes. As a result, it is not certain whether the scheme in multi-occupancy housing is continuing, but a new food waste collection service is widely operating in NBC.



Food waste caddies

Any household in Belfast that has a brown bin or is taking part in our food waste trial should have a food waste caddy to collect leftover food scraps which would usually be placed in your black bin or home composter if you have one.

You get biodegradable bags (liners) along with your food waste caddy. You should line your caddy with the biodegradable bag and then put any food waste into the caddy.

When the biodegradable bag is full, tie it, remove it, and put it in either your brown bin or your large green bin (for those on the food waste trial).

If you need more biodegradable bags, tie your "more bags please" tag to your caddy or bin when you leave it out for collection. You can also call us on 028 9027 0230 or order more bags online. The bags are free.

Order more biodegradable food waste bags

If you need a food waste caddy you can order this online, by phone or by writing to us. They are free to order.

- Order a food waste caddy

Biodegradable bags are delivered with food waste caddies - you do not need to order these separately.

What can I put in my food waste caddy?

You can put the following items in the caddy:

- all dairy products
- meat and fish
- raw and cooked fruit and vegetables
- bread, cakes and pastries
- rice, beans and pasta
- teabags
- coffee grounds
- potato and vegetable peelings
- any other leftover food.

The best way to avoid food waste is to plan ahead and only buy what you really need.

- Find out more about green food shopping

The following items should **not** be placed in the caddy:

- any kind of packaging
- plastic bags
- liquids, such as soup or curries
- oil or liquid fats
- cigarette butts
- any material that is not food waste.

For more information on which items you can or can't recycle, check our A to Z directory of recycling

Figure 27B.2. Acceptable and unacceptable items in food waste listed in BCC (Source: BCC website)

Key findings

- Only Belfast City Council provides a source-separated food waste collection scheme in Northern Ireland, which is a pilot scheme started in June 2008 and extended until now. Approximately 9000 households are involved in this pilot scheme.
- Newtownabbey Borough Council introduced a source separated food waste collection in October 2007, which was the first food waste collection scheme run by a local council in Northern Ireland and the first in multi-occupancy housings.
- 17 district councils collect food waste with garden waste, equal to 65% in total. Among those councils, 65% of them provide a small kitchen caddy and liners to households.

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WRAP. 2009. *Evaluation of the WRAP Separate Food Waste Collection Trials* [Online]. Available: http://www.wrap.org.uk/downloads/Evaluation_of_the_WRAP_FW_Collection_Trials_Update_June_2009.432da82d.7271.pdf [Accessed 9 April 2012].

Attachment 27B-A Information on source-separated food waste collection schemes in 26 district councils in Northern Ireland

Waste Management Group	District	Source separated FW?	Co-mingled with Garden waste?	Caddy provided?
Arc21	Antrim Borough Council	No	Yes	Yes
	Ards Borough Council	No	Yes	Yes
	Ballymena Borough Council	No	Yes	Yes
	Belfast City Council	Trial taken place	Yes	Yes
	Carrickfergus Borough Council	No	Yes	No
	Castlereagh Borough Council	No	Yes	Yes
	Down District Council	No	No	n/a
	Larne Borough Council	No	Yes	Yes
	Lisburn City Council	No	Yes	Yes
	Newtownabbey Borough Council	No	Yes	Yes
	North Down Borough Council	No	Yes	Yes
Southern Waste Management Partnership (SWaMP)	Armagh City and District Council	No	Yes	NS
	Banbridge District Council	No	Yes	Yes
	Cookstown District Council	No	Yes	No
	Craigavon Borough Council	No	Yes	No
	Dungannon and South Tyrone Borough Council	No	No	n/a
	Fermanagh District Council	No	No	n/a
	Newry and Mourne District Council	No	Yes	No
	Omagh District Council	No	Yes	Yes
North West Region Waste Management Group (NWRWMG)	Ballymoney Borough Council	No	No	n/a
	Coleraine Borough Council	No	No	n/a
	Derry City Council	No	No	n/a
	Limavady Borough Council	No	No	n/a
	Magherafelt District Council	No	Yes	No
	Moyle District Council	No	No	n/a
	Strabane District Council	No	No	n/a

Key:

NS – Not sure
n/a – Not applicable
Web-based survey of food waste collection schemes in Northern Ireland

District	Population	Style	Source separated FW?	Co-mingled with GW?	Details	Ref
Antrim	54,100	Borough	No	Yes	Brown for compostable household materials, You can put into your brown bin materials including garden waste, vegetable peelings, fruit, napkins and kitchen roll, cold ashes, egg shells and tea bags.	1
Ards	78,200	Borough	No	Yes	Brown bins are available to residents free of charge and to make food recycling more convenient, the Council is to provide small 'kitchen caddies' to all homes with a brown bin, which can then be used to collect food waste. When the caddy is full, the contents can simply be emptied into the brown bin.	2
Armagh	59,400	City and District	No	Yes	Not mention whether small caddy provided or not, brown wheelie bin is provided to collect food waste, garden waste and cold ashes.	3
Ballymena	63,500	Borough	No	Yes	Autumn 2011 all houses within the borough should have received a brown bin, kitchen caddy, biodegradable bags, bag replacement tag. Brown bins will be collected on alternating weeks with your grey/black bin. Food waste caddy used.	4
Ballymoney	30,600	Borough	No	No	Food waste is not acceptable in your blue/brown bin;	5
Banbridge	48,000	District	No	Yes	if they do have food leftovers, they should recycle it through the brown bin collection scheme with a view to reducing the amount of waste sent to landfill. All food waste including fish, meat and bones should be placed in the brown bin and never in the black bin.	6
Belfast	268,700	City	Trial taken place	Yes	You get biodegradable bags (liners) along with your food waste caddy. You should line your caddy with the biodegradable bag and then put any food waste into the caddy; When the biodegradable bag is full, tie it, remove it, and put it in either your brown bin or your large green bin (for those on the food waste trial); The food waste collection trial currently covers	7, 8

District	Population	Style	Source separated FW?	Co-mingled with GW?	Details	Ref
					homes in the Lower Ormeau, Markets, Ballynafeigh, Sydenham, Donegall Road and Falls areas. We've recently extended it, together with Bryson Recycling, to a further 2,100 households in Belfast. The Ardoyne, Little Americas and Cavehill Road areas are now included in the trial.	
Carrickfergus	40,200	Borough	No	Yes (No caddy)	After 16th October 2009 you will be allowed to put all food waste into your brown bin with the garden waste. Food waste can we wrapped in newspaper before being placed in the brown bin. alternate week collection system for brown, believe no food waste caddy provided	9, 10
Castlereagh	67,000	Borough	No	Yes	Food Waste Recycling- The brown bin collection service now includes the collection of food waste, both cooked and uncooked. Please see the food waste leaflet below for more information. With food waste caddy	11
Coleraine	56,800	Borough	No	No	No green waste collection and food waste as well	12
Cookstown	36,700	District	No	Yes (No caddy)	new food waste collection for those households with brown bins. Starting from April 2011, households with brown bins have been able to use them to dispose of food waste in addition to garden waste. The material is collected with grass cuttings and other garden waste to be treated and composted into a rich peat-free soil improver that can be used in gardens and for pot-plants. Food scraps can be wrapped in a sheet of old newspaper. Because the contents of the bins are to be composted	13
Craigavon	93,600	Borough	No	Yes (No caddy)	All households in the Borough have two bins – a blue bin and a green bin. Some households however also have a brown bin. Brown bins are used for plate scrapings, including meat and bones, fruit and vegetable peelings, garden waste, bread, teabags, cold ashes and egg shells.	14, 15
Derry	109,800	City	No	No	No green waste collection and food waste as well,	16

District	Population	Style	Source separated FW?	Co-mingled with GW?	Details	Ref
					just only have blue bins	
Down	70,800	District	No	No	No food waste collection, all goes to the general refuse bin. Blue for recyclables, black for residual and brown for the green waste.	17, 18
Dungannon and South Tyrone	57,700	Borough	No	No	No food waste collection, all goes to the general refuse bin. Blue for recyclables, black for residual.	19
Fermanagh	63,100	District	No	No	The Council operates a 2-bin kerbside wheeled bin collection system - a blue bin for dry recyclable waste including plastics, cans, papers, magazines and cardboard and a green bin for all other residual waste. Blue bins are emptied on alternate weeks to green bins	20
Larne	31,700	Borough	No	Yes	Each household will soon receive a kitchen caddy, a supply of bio-degradable liners and a leaflet explaining how the scheme works. We expect every household to have received a caddy, etc. by the end of December 2009. Please do not put food waste into your brown bin until you have received a caddy and liners.	21, 22
Limavady	33,600	Borough	No	No	No food waste collection, all goes to the general refuse bin. Blue for recyclables, grey for residual and brown for the green waste.	23
Lisburn	117,800	City	No	Yes	Food waste in brown wheelie bin with green waste, caddy and liner provide for collection	24, 25
Magherafelt	44,700	District	No	Yes (no caddy)	After running a brown bin trial with 2,500 properties the Council expanded the scheme to approximately 7,500 properties; Magherafelt District Council area have been issued with brown bins for the collection of kitchen and garden organic waste for composting.	26
Moyle	17,000	District	No	No	Provided Blue for recycable, Brown for garden waste. No food waste could be placed in the brown bin	27
Newry and Mourne	99,900	District	No	Yes (no caddy)	Provided Blue for recycable, Brown for garden waste and food waste.	28

District	Population	Style	Source separated FW?	Co-mingled with GW?	Details	Ref
Newtownabbey	83,600	Borough	No	Yes	Up until now food waste has gone directly into your black bin, but residents are now able to recycle food waste by putting it into your brown bin. Each household will have received a kitchen caddy, a supply of bio-degradable liners. Just put your waste food into the caddies and when full tie up the liner and put it into your brown bin along with your garden waste. Garden and food waste will be recycled into compost.	29, 30
North Down	79,900	Borough	No	Yes	Caddy provide to separate food waste, and then transfer tp green wheelies bin; grey for refuse, green for GW and FW, blue for recycable	31,32
Omagh	52,900	District	No	Yes	Omagh District Council introduced brown bins in Omagh town to recycle organic waste including garden and food waste to households as part of the Council's strategy to work with residents to reduce waste and recycle more; From 28th March 2011 Omagh District Council are extending the Brown Bin Service to towns and villages throughout the district.	33
Strabane	40,100	District	No	No	Only Blue bin for recyclable, not brown bins for garden and food waste	34

1 http://www.antrim.gov.uk/index.cfm/website_Key/27/Category_key/128/Page_Key/550/show/more
2 http://www.ards-council.gov.uk/services/brown-bins.php
3 http://www.armagh.gov.uk/recycling/brown-bin
4 http://www.ballymoney.gov.uk/Three_Bins.aspx
5 http://www.ballymena.gov.uk/brownbin.asp
6 http://www.banbridge.com/news_detail.asp?id=1021&area=1&pid=
7 http://www.belfastcity.gov.uk/bins/foodwaste.asp
8 http://www.belfastcity.gov.uk/bins/foodwaste.asp#trial
9 http://www.carrickfergus.org/environment/waste-collection/your-new-food-waste-collection-service/
10 http://www.carrickfergus.org/fs/doc/Sustainable%20Development%20Audit%20and%20Action%20Plan.pdf
11 http://www.castlereagh.gov.uk/FWaste.asp

12 http://www.doeni.gov.uk/niea/waste/municipal_data_reporting.htm
13 http://www.cookstown.gov.uk/operationalservices/wastemanagement/recyclingdisposal/whatyoucanrecycle/
14 http://www.craigavon.gov.uk/environment/waste-services/166-household-bin-collections.html
15 http://www.letsgetsorted.net/downloads/CBC_Brown_BinLeaf.pdf
16 http://www.derrycity.gov.uk/Recycle/Recycling/Blue-Bin
17 http://www.downdc.gov.uk/Environment---Planning/Waste---Recycling-Services/Brown-Bin.aspx
18 http://www.downdc.gov.uk/Environment---Planning/Waste---Recycling-Services/Blue-Bin.aspx
19 http://www.dungannon.gov.uk/pubuploads/2012%20Refuse%20Collection%20Calendar-1.pdf
20 http://www.fermanagh.gov.uk/index.cfm?website_Key=47&Category_key=133&Page_Key=313
21 http://www.larne.gov.uk/uploads/docs/826_Food%20Information%20Leaflet.pdf
22 http://www.larne.gov.uk/template1.asp?parent=553&pid=1500&parent2=1500&area=1&text=1
23 http://www.limavady.gov.uk/living/waste-and-recycling/wheeled-bin-instruction/
24 http://www.lisburncity.gov.uk/your-city-council/council-departments/environmental-services/new-wheeled-bin-collection-service/
25 http://www.lisburncity.gov.uk/filestore/documents/technical_services_/Food_Waste_Leaflet_for_web.pdf
26 http://www.magherafelt.gov.uk/technical-services/recycling-waste/brown-bins/index.php
27 http://www.moyle-council.org/content/?id=182&l1id=24&l2id=100
28 http://www.newryandmourne.gov.uk/environment/Services/Recycling_Campaign/Bin_Contents.aspx
29 http://www.newtownabbey.gov.uk/recycle/brownbins.asp
30 http://www.newtownabbey.gov.uk/recycle/foodwaste.asp
31 http://www.northdown.gov.uk/template1.asp?parent=413&parent2=592&pid=626&area=4
32 http://www.northdown.gov.uk/template1.asp?parent=413&pid=943&parent2=943&area=4
33 http://www.omagh.gov.uk/environment/waste_management/brown_bins/
34 http://www.strabanedc.com/council/services/blue-bins/

http://www.newtownabbey.gov.uk/news/displayarticle.asp?article=519

Appendix 27C: Results of web-based survey on source segregated food waste collection in Scotland

Organisation of waste collection in Scotland

Waste management practice in Scotland is similar to that in England, but there are some differences in the legal and regulatory framework due to Scotland's independent legal system. As in the rest of the UK local authorities are responsible for waste collection and may provide this using their own employees (direct labour), or by subcontracting the service to another organisation. In some cases Local Authorities are also responsible for waste disposal (Defra, 1990). The LA is responsible for the supply of any containers (e.g. bins or bags) that are used for household waste but is not required to provide additional equipment such as lining materials, home composters/digesters although this is sometimes done depending on local policy and secured funding.

LAs in Scotland are not required to comply with the Household Waste Recycling Act 200 (HWRA 2003) but will have to comply with the Zero Waste Scotland Regulations 2012, as part of the legislation transposing the Waste Framework Directive 2008/98//EC to Scotland,. These draft regulations include the requirement to provide source segregated dry recyclable collection from households and to start introducing food waste collection schemes before 31 December 2013. It is stated that a source segregated food waste collection must be provided to households that can present their bin at the kerbside. Best practice will also include collection of food waste from high rise dwellings aim. A clear target is set on 31 December 2015 by which time the rolling out of food waste collections has to be completed (LARAC, undated). Other relevant information includes:

- Co-mingled garden/food collections will be permitted where it can be demonstrated that they deliver equivalent or better environmental outcomes to separate food waste collection.
- Where separate food waste collection is not offered, there is a requirement on LAs to promote food waste prevention and/or home composting.

Other major drivers for the introduction of source separated collection in Scotland include the Landfill Allowance Trading Scheme (LATS) which was introduced to help meet landfill diversion targets in the EU Landfill Directive (99/31/EC). Under the LATS scheme, LAs are allowed to send a certain amount of biodegradable municipal waste to landfill, which decreases each year. The trading of LATS is now suspended in Scotland (LARAC, undated).

The central body responsible for waste management is Scottish Environmental Protection Agency (SEPA, http://www.sepa.org.uk/), which has a statutory duty to protect the environment and human health from the effects of waste management and disposal. SEPA has both regulatory and enforcement functions. Detailed data on municipal waste collection and disposal is available from SEPA and on the UK's main WasteDataFlow website (www.wastedataflow.org): this covers all biodegradable municipal waste and does not report specifically on food waste. The Waste Resources Action Programme (WRAP, www.wrap.org.uk) also provides advice to local government on best practice regarding food waste management. Zero Waste Scotland (http://www.zerowastescotland.org.uk/) offers support to Local Authorities in Scotland as do the Scottish Waste Awareness Group (SWAG, www.wasteawarescotland.org.uk) and the Community Resources Network Scotland (CRNS, http://www.crns.org.uk/). Information on waste collection services is publicised to a varying extent on Local Authority web pages.

Funding of food waste collection in Scotland. The Scottish Government introduced the Zero Waste Scotland Fund, which provides funding to Local Authorities to meet recycling and landfill diversion targets. The Zero Waste Scotland Food Waste Programme has £4 million funding (2011-12) to support source segregated food waste collection (LARAC, undated).

Methodology

A systematic search was carried out of webpages for the 32 waste collection authorities in Scotland, with the aim of identifying those offering collection of source segregated food waste (FW) either as a single material or co-mingled with green wastes (GW). The waste collection authorities were identified from statistics published by SEPA (2011a). The search was carried out by going to the main website of each LA, finding the section dealing with waste management and looking for information on food waste collection. For those LAs that were identified having schemes, detailed information was gathered as in Table 27A.1.

In addition, a general web search was carried out using google.co.uk with the search term 'food waste' and the restriction of area 'Scotland'. This produced references to several useful reports (Zero Waste Scotland, 2008), but neither the search nor the reports identified any additional LAs providing source segregated food waste collections.

Local Authority area and population data and indices of deprivation were obtained from The Scottish Government (2011a, b). Tonnages of household waste collected and tonnages sent for recycling, composting or re-use in 2010 were taken from SEPA (2012).

Results

The analysis of 32 websites of Scottish Local Authorities providing household waste collection showed that 15 (46.9%) of LAs have some form of source segregated food waste collection. Almost the same number of LAs provide only food waste collection - 8 (25%) compared to food with green waste collection 7 (21.9%).

According to the report by Zero Waste Scotland (2011b), there were 6 food waste collection trials in 2008. Three of these, however, in Glasgow, Inverclyde, and North Lanarkshire, did not proceed to FW collections. Only Inverclyde states in the website clear plans to introduce a source segregated FW collection scheme during 2012. These trials represent a significant fraction of the total number of schemes running and the reasons for non-implementation are thus of interest, but were not detailed on the website.

Table 27C.1 shows the number of people provided with each type of FW collection service. Around 2.5 million, or 51% of the population of Scotland, live in areas that now offer some form of separate collection of FW: it should be noted, however, that this is not equal to the number with current access to FW collections, since in many cases these schemes are recently introduced and have not yet been rolled out to the full LA area.

Table 27C.1. Population of LAs by type of service provision

	Population	
No separate FW collection	2,557,520	49%
with GW	1,023,940	19.6%
separate FW-only collection	1,640,640	31,4%
Total	5,222,100	100%

Some differences were noted between the groups of LAs with no separate FW collections and those with FW-only or co-mingled collections. On average, LAs with FW-only collections were smaller in area, more densely populated, and collected less household waste per person. The Index of Multiple Deprivation was lower in areas with co-mingled food waste collection.

Table 27C.2. Average parameter values for LAs with different collection systems*

		No FW	FW-only	with GW	all FW
Are	km^2	2731	2383	1777	2080
Population		150442	205080	146277	175679
Population density	number/km^2	430	641	372	506
Waste	tonnes/person-year	0.56	0.53	0.58	0.56
Recycled	tonnes/person-year	0.22	0.21	0.23	0.22
% recycled	%	40%	39%	40%	40%
IMD		21	21	17	19
Rank IMD		3226	3233	3663	3448

A slightly more complex picture can be seen from the distributions in Figure 27C.1: for example, LAs with a low population are less likely to offer a separate collection service, while FW-only collections are more common in LAs with lower deprivation indices. The data from the web-based survey also showed that LAs, which do not have source segregated FW collection still achieve high rates of recycling. The sample size is small however and as in England the the number of FW collection schemes is increasing so these results primarily provide a snapshot of the current situation.

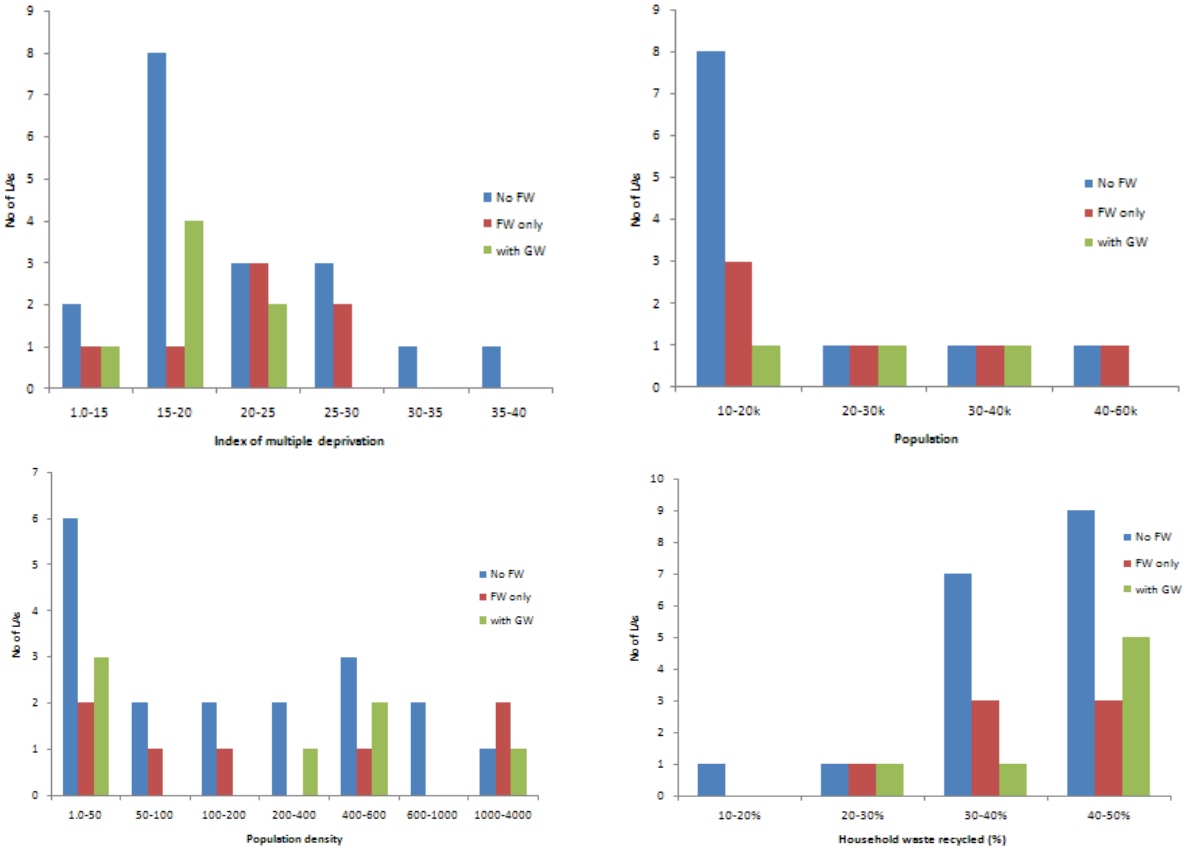

Figure 27C.1. Distribution of selected LA characteristics according to type of FW collection scheme

Source segregated FW collections

Some key characteristics of the LAs that provide FW-only collections are shown in Table 27C.3; full details of the survey results are available in spreadsheet format.

Charges. None of the 32 websites reviewed specifically stated that the food waste collection service was free. It can be assumed that the schemes operate without charge, as there is a statutory requirement for LAs to collect this material as a component of household waste.

Optional or compulsory schemes. Of the 14 LAs providing FW collection service, 4 schemes are opt-in while the remaining 10 LAs do not state the type of the scheme. Falkirk Council provides a direct online service for opting out from food waste collection (http://www.falkirk.gov.uk/services/corporate_neighbourhood/estates_management/waste_management/household_recycling/food_waste_recycling/opt_out_page.aspx).

Table 27C.3. Local Authorities providing FW only collections

Local Authority Name	Type			Area	Population (2010)	Population density	Household - total waste 2010/11	Household waste sent for recycling/composting/reuse (2010/11)		Indices of Multiple Deprivation	
				km2	no.	person/km2	tonnes/person-year	tonnes/person-year	% total	Average	Rank of
FW only collection											
Argyll and Bute	UA	UA	Scotland	6909	89200	12.91069619	0.562547247	0.247926009	0.440720331	19.54437	3220.8934
Aberdeenshire	UA	UA	Scotland	6313	245780	38.93236179	0.625373248	0.203161518	32.49%	11.64721	4500.1595
Dundee	UA	UA	Scotland	60	144290	2404.833333	0.494023217	0.149463061	30.25%	29.07387	2520.5363
East Ayrshire	UA	UA	Scotland	1262	120240	95.27733756	0.548929774	0.252417157	45.98%	26.77824	2567.0519
Edinburgh	CC	UA	Scotland	264	486120	1841.363636	0.416090739	0.122848371	29.52%	16.1777	4170.5355
Falkirk	UA	UA	Scotland	297	153280	516.0942761	0.528410491	0.247254567	46.79%	21.97853	2511.1389
South Lanarkshire	UA	UA	Scotland	1772	311880	176.0045147	0.537415256	0.186449885	34.69%	21.12647	3233.8435
Stirling	UA	UA	Scotland	2187	89850	41.08367627	0.540262771	0.262783287	48.64%	21.63196	3137.2487
FW collection with GREEN waste											
Aberdeen	CC	UA	Scotland	186	217120	1167.311828	0.53451513	0.164931904	30.86%	16.87477	3944.0562
East Renfrewshire	UA	UA	Scotland	174	89540	514.5977011	0.505047398	0.238113927	47.15%	10.55955	4929.6583
Eilean Siar	UA	UA	Scotland	3071	26190	8.528166721	0.709667053	0.155587183	21.92%	21.81875	2536.0714
Fife	UA	UA	Scotland	1325	365020	275.4867925	0.632974933	0.312962105	49.44%	20.41111	3227.1929
Moray	UA	UA	Scotland	2238	87720	39.19571046	0.654446181	0.270358436	41.31%	17.91845	3465.3393
Perth and Kinross	UA	UA	Scotland	5286	147780	27.9568672	0.549035729	0.26342178	47.98%	15.06892	3718.1852
West Dunbartonshire	UA	UA	Scotland	159	90570	569.6226415	0.467745169	0.193910566	41.46%	17.06552	3821.3818

Frequency of collection. 6 (75%) out of 8 LAs providing a source segregated FW-only collection stated that the service is provided on a weekly basis, while other two LAs collected food waste fortnightly. LAs providing co-mingled FW collection, on the other hand, mainly collected FW on a two-week basis 5 (62.5%) compared to weekly collection in 2 (28.5%) LAs.

LAs collecting FW (separately or co-mingled) also collected residual waste and recyclables, and the frequency of these collections is shown in Table 27C.4.

Table 27C.4. Collection Frequency

	FW only		FW + GW		Residual Waste		Recyclables		GW Separate	
Weekly	6	75%	2	25%	2	13.33%	2	13.33%	0	0.00%
Fortnightly	1	12.5%	5	62.5%	13	86.67%	11	73.33%	4	50.00%
Every 4 weeks	0	0%	0	0%	0	0.00%	2	13.33%	1	12.50%
NS	1	12.5%	0	0%	0	0.00%	0	0.00%	3	37.50%
Total	8	100%	7	100%	15	100.00%	15	100%	8	100%

Only 2 (13.33%) LAs continued to collect residual waste on a weekly basis when offering source segregated FW collection. 4 (50%) LAs which had FW-only collections also provided GW collection on every two weeks basis.

Materials collected. All of the websites of LAs stated clearly which materials were acceptable by providing a list. Only one LA provided an image based list (Figure 27C.2).

13 (75%) of the LAs also provided a list of materials that were not acceptable. Only two LAs (13.3%) did not provide the list of materials that should not go into food waste containers.

Materials listed as acceptable in almost every case included raw and cooked meat and fish; dairy products such as cheese; bread, pasta and rice; fruit/vegetable waste; tea and coffee grounds; and generic materials such as plate scrapings. There was considerable commonality in the lists, but there were also minor differences. In most cases these were in the form of extra information given for clarity: specific examples included "*fast food such as chips, burgers and pizzas*" (Edinburgh Council); "*hard and other fats please allow to cool before transferring, tinned and dried pet foods*" (East Ayrshire Council); "*semi-liquid foods e.g. yoghurts, smoothies*" (Falkirk Council); "*leftovers and plate scrapings*" (South Lanarkshire Council); "*cat and dog food* " (Stirling Council); "*Avoid putting hot food in. Let it cool first"* (Aberdeenshire Council). The 7 LAs that collected GW with FW added additional biodegradable materials that were allowed to be collected.

Figure 27C.2. Dundee Council FW collection leaflet.

Figure 27C.2 continued. Dundee Council FW collection leaflet.

Tables 27C.5 and 27C.6 summarise the materials explicitly listed as acceptable or unacceptable in different schemes. LAs providing FW-only and co-mingled FW collection service usually included bones in the lists of acceptable materials. Egg-shells were accepted in co-mingled FW collection schemes more often than in FW only collections (7 LAs compared to 2 LAs, respectively). Only two LAs out of 15 providing FW collections stated that material from celluloses (card/paper/shredded paper) was collected. Only one LA accepted biodegradable materials such as liquid, fat or oil. None stated that they accepted faecal material and 13% specifically excluded this. In several cases materials that are specifically identified as acceptable in one scheme were rejected by another: this may be due to different treatment methods or may reflect the fact that separate FW collection is relatively new and an agreed list has not yet been established. A complete listing of materials accepted or rejected by each LA is shown in Table 27C.7. An example of a list provided by one LA is shown in Figure 27C.3.

Table 27C.5. Selected materials specified as accepted or rejected in FW only collections

	Yes	No	NS	Total
Bones	7	0	1	8
Eggshells	2	0	6	8
Paper/ card	0	4	4	8
Shredded paper	1	4	3	8
Liquid	1	4	3	8
Oil / fat	1	3	4	8
Faecal	0	2	6	8
Plant	0	4	4	8
Biodegradable bags	6	0	2	8

Table 27C.6. Selected materials specified as accepted or rejected in FW + GW collections

	Yes	No	NS	Total
Bones	6	0	1	7
Eggshells	5	0	2	7
Paper/ card	1	4	2	7
Shredded paper	1	3	3	7
Liquid	0	5	2	7
Oil / fat	0	5	2	7
Faecal	0	5	2	7
Plant	7	0	0	7
Biodegradable bags	1	2	4	7

Table 27C.7. Examples of LA listings for accepted and unacceptable materials

Accepted

- Beans, pasta and rice, Bread, cakes and pastries, Dairy products such as eggs and cheese, Fruit and vegetables, Meat and fish, including bones, Tea bags and coffee grounds.
- Leftovers from meals, meat - cooked and raw, including fat, skin and bones, fish - cooked and raw, including bones, skin and shells , eggs - including shells , fruit and vegetables - cooked and raw, including cores and peelings , breads, cakes, pastries, biscuits , rice, pasta and beans , tea bags, coffee grounds , cooking oil, hard and other fats please allow to cool before transferring , tinned and dried pet foods.
- Beans, pasta and rice, Cakes and pastries, Dairy products such as eggs and cheese, Fruit and vegetables, Meat and fish including bones, Tea bags and coffee grounds, Flowers / plants, Grass cuttings / weeds , Hedge clippings , Sawdust / wood shavings , Small branches
- Beans, pasta and rice, Bread cakes and other bakery items, Dairy items, such as cheese, Eggs and egg shells, Fruit and vegetables, including peelings, Meat and fish, including bones, Tea bags and coffee grounds, Fast food such as chips, burgers and pizzas.
- Wood (no nails), All food scraps, teabags, card, cardboard, wood shavings, grass cuttings, telephone directories., meat & meat products, grease proof paper, contents of vacuum bag, nuts and nut shells, hair clippings, junk mail, books, coffee grounds , magazines, soil, paper hand towels, food boxes, envelopes, catalogues, food preparation scraps, fruit and vegetables, leaves, flowers, sawdust, paper hankies, paper towel, eggshells, weeds, food preparation peelings.
- Meat and fish - raw and cooked, including bones, Fruit and vegetables - raw and cooked (uncooked peelings can be composted at home) , All dairy products such as eggs, cheese and yoghurt , Bread, cakes and pastries, Rice, pasta and beans , Uneaten food from your plates and dishes, Food purchased but not used (all packaging removed) , Tea bags and coffee grounds , Semi-liquid foods eg. yoghurts, smoothies.
- Bread, cakes and pastries, Cheese, Eggs (including the shells), Fruit and vegetables (including peelings), Meat and fish (including bones and carcasses), Pasta, rice and noodles, Plate scrapings, Tea bags and coffee grounds, Flowers and plants, Grass cuttings, Hedge trimmings, Leaves, Twigs and small branches.
- Bark, Branches (up to 3 inch diameter), Food waste, Grass cuttings, Hedge trimmings, Leaves, Plants, Weeds.
- Flowers, Plants, Hedge trimmings, Sawdust and bark , Small twigs , Weeds (with the exception of Japanese Knotweed), Grass cuttings, Leaves, Meat and fish,
- including bones , Fruit and vegetables , Dairy products and eggs, Bread, cakes and pastries , Beans, pasta and rice , Tea bags and coffee grounds.
- Raw and cooked fruit and vegetables and their peelings, Tea bags and ground coffee, Raw and cooked meat and fish, Solid dairy products such as butter and Rice, pasta and beans, cheese, Breads, cakes and pastries, Leftovers and plate scrapings
- Cooked and uncooked foods, fruits and veg, bread, rice, pasta and cereals, meat and fish, bones and skins, leftovers, tea bags and coffee grounds, newspaper and biodegradable liners, used kitchen roll and paper tissue, cat and dog food.
- Meat & fish, Egg shells, Bones, Fruit & vegetables, Dairy products including eggs & cheese, Bread, cakes, pastry, Beans, pasta, rice, Tea bags & coffee grounds.

Table 27C.7. Examples of LA listings for accepted and unacceptable materials

Not accepted
- Large branches, plastic bags, rubble, soil or turf, general refuse, animal bedding, bottles, cans or jars, foil and cling film, food and drink containers, liquids including oil and fat, packaging, paper and cardboard, pet faeces (including cat litter), plastic bags. - Bottles, cans or jars, Foil or cling film, Food or drink containers, Liquids, including oils and fats, Packaging. - Food packaging - cardboard, plastic wrappings, tins, liquids such as juices , glass, garden waste, straw or other animal bedding products. - Liquids including oils and fats, plastic bags / liners, foil and cling-film, Soil / turf, Rubble / bricks, Plastic bags. - Liquids (including milk and cooking oil), Food packaging, plastic bags or bin liners (carrier bags), Garden waste, Animal waste or bedding. - Plastic bags or liners, Liquids e.g. oil, soup, yoghurt, Foil or cling film, Rubble and stones, Soil, turf or compost, Japanese Knotweed, Animal waste, General waste. - Plastic bags, Root balls, Rubble, Soil, Stones, Turf, Blocks of wood. - Food and drinks containers, food wrapping , Plant pots, Soil, rubble, stones and bricks, Large branches, logs , Plastic bags or liners. - Packaging or wrappings into the food waste caddy.

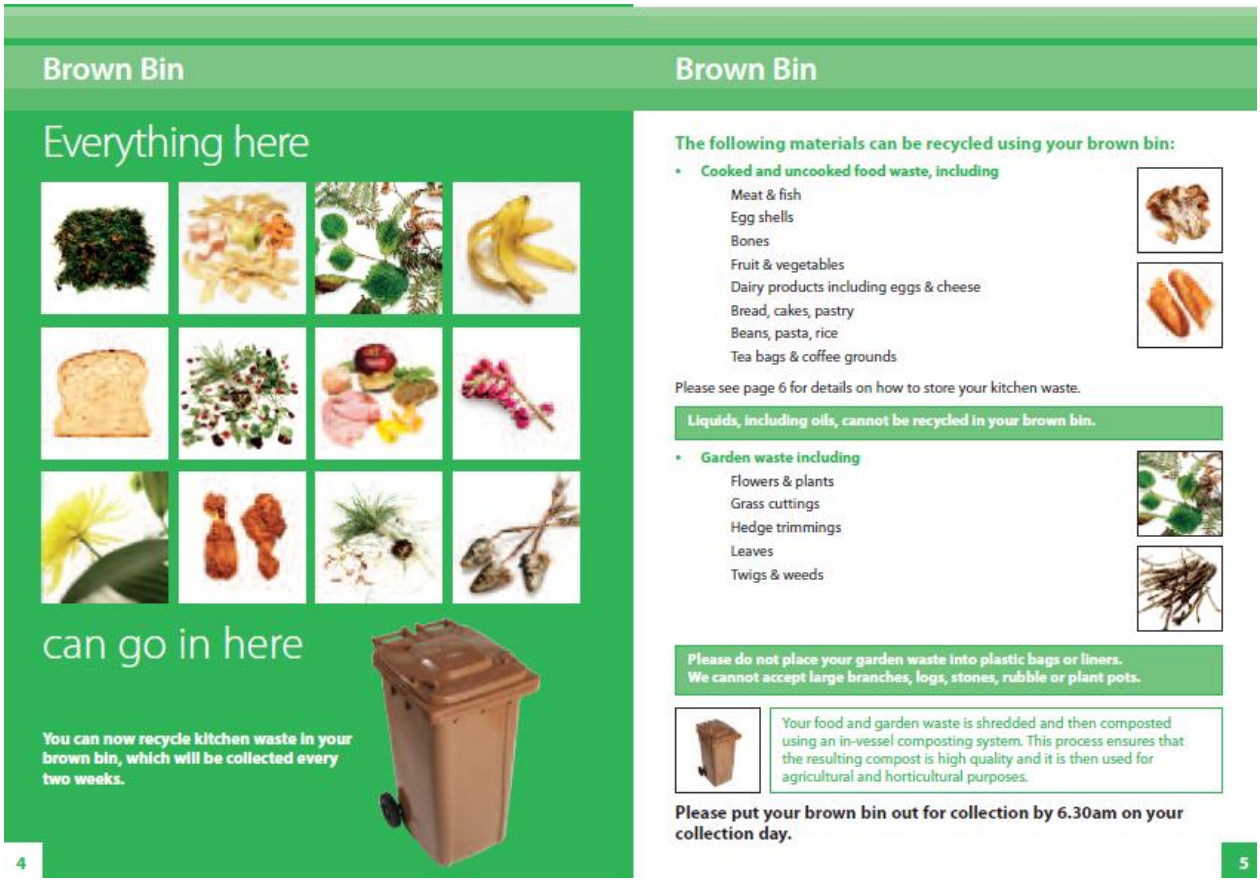

Figure 27C.3. West Dunbartonshire Council Food Waste Collection Leaflet.

Bags and liners. The web based survey revealed considerable difference between the way LAs supply the liners as seen in Table 27C.8. Only 2 (13%) LAs provided lining materials during all FW collection service.

Table 27C. 8. Provision of lining material in different LAs.

	No of LAs	%
Provided for whole length of FW collection service	2	13%
Provided for a limited period of time (3 months; trial duration or initial delivery of liners)	5	33%
No source	3	20%
Not provided	5	33%

LAs that do not provide liners or provided them only for a short period of time, gave directions where liners could be purchased: "*Compostable liners for your kitchen caddy are available to buy in some local shops, most large supermarkets and through online retailers*" (Edinburgh City Council). A number of LAs that send FW to be composted were the only ones that clearly stated that biodegradable bags are not suitable for FW collection. 3 (20%) LAs mention that it is possible to wrap food waste into newspaper. 2 LAs specify that they do not accept biodegradable bags. An example of advice on how to cover kitchen caddy with the liner and use the service is in Figure 27C.4.

Figure 27C.4. How to use FW recycling service – Aberdeenshire Council

Containers. All of the websites for LAs that provide FW collection had information about FW containers – the kitchen caddy and kerbside bin. Only 1 (7%) of the websites did not state what type of containers were used in the collection service. 2 (13%) LAs did not give the exact size of the caddy or bin utilised. Those that did specify this gave caddy volumes of

5, 6, 7 or 10 litres and bins of 23 litres. When there was a co-mingled collection the householder was not provided with a separate FW kerbside bin, but was encouraged to put FW in the GW bin.

Collection vehicles. Most LA websites did not give specific information on the type of vehicle used: only 2 mentioned using specialist or twin-compartment vehicles (30/70 by volume) as seen in Figure 27C.5.

a) Food waste collection vehicle used by Argyll and Bute Council

b) Food waste collection vehicle used by Eilean Siar Council

Figure 27C.5. Information on collection vehicles

Treatment process. 13 (87%) of the LAs gave information on the type of treatment process used. The split between anaerobic digestion and composting (open air or in-vessel) is shown in Table 27C.9: anaerobic digestion is the option used by 33% of LAs.

Table 27C.9. Waste treatment process type

	No. of LAs	%
AD	5	33%
Composting (open)	2	13%
In-Vessel Composting	6	40%
Not specified	2	13%
Total	15	100%

Supporting information. 8 (53%) of the FW collecting LA websites provided supporting information on why food waste recycling is important. 20 (62.5%) of all LA websites surveyed gave information on home composting. 15 (just under 50%) of all websites mentioned the Love Food Hate Waste campaign (www.lovefoodhatewaste.com) which promotes minimisation of food waste. Most of the LAs also provided downloadable information on the collection scheme, ranging from simple instructions to detailed explanations covering all aspects of the scheme (Figure s 27C.3 and 27C.4). Edinburgh City Council provided a video about FW collection (http://www.youtube.com/watch?v=TpKEkRBcTEk&feature=youtu.be).

Summary of key findings

- 47% of LAs in Scotland provide some form of source separated food waste collection, with 25% offering food-waste only collections. There is still some way to go, however, in order to achieve the targets set in Zero Waste Scotland Regulations 2011.
- As yet there is no single way of managing food waste common to all the Local Authorities.
- There is a need to ensure that if a food waste trial is rolled out, that it would become a successful long term scheme.

References

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The Scottish Government (2011a) *Scottish Local Government Financial Statistics 2009-10* [WWW] Available from: http://www.scotland.gov.uk/Publications/2011/02/21143624/1 [Accessed 30/03/2012].

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Attachment 27C-A

Links to Local Authority websites that provide FW collection services.

FW only collections	
Argyll and Bute: Helensburgh and Lomond	http://www.argyll-bute.gov.uk/sites/default/files/Helensburgh%20Recycling%20Guide.pdf
Aberdeenshire	http://www.aberdeenshire.gov.uk/waste/Collection_services/FoodWasteRecycling.asp
Dundee	http://www.dundeecity.gov.uk/dundeecity/uploaded_publications/publication_2675.pdf
East Ayrshire	http://www.east-ayrshire.gov.uk/PlanningAndTheEnvironment/RubbishAndRecycling/Rubbish-HouseholdWaste/HouseholdWaste-DomesticBins/FoodWasteBins.aspx
Edinburgh	http://www.edinburgh.gov.uk/info/1055/recycling/435/recycling_points/3
Falkirk	http://www.falkirk.gov.uk/services/corporate_neighbourhood/estates_management/waste_management/household_recycling/food_waste_recycling/food_waste_recycling.aspx
South Lanarkshire	http://www.southlanarkshire.gov.uk/info/1054/rubbish_and_recycling/822/food_waste_collection/2
Stirling	www.stirling.gov.uk/__documents/waste-management/flyer1a5.pdf
FW collection with GREEN waste	
Aberdeen	http://www.aberdeencity.gov.uk/planning_environment/environment/waste_aware/household_waste/rub_food_waste_collections.asp
East Renfrewshire	http://www.eastrenfrewshire.gov.uk/index.aspx?articleid=1669
Eilean Siar	http://www.cne-siar.gov.uk/recycling/index.asp?servicename=Rubbish%20-%20household%20waste&snlid=906
Fife	http://www.fifedirect.org.uk/topics/index.cfm?fuseaction=page.display&p2sid=E7A7C7DE-65BF-00F7-DC5814559ADE3698&themeid=81E299FB-1BCF-4994-8C8A-233463B738F6
Moray	http://www.moray.gov.uk/downloads/file62304.pdf
Perth and Kinross	http://www.pkc.gov.uk/Planning+and+the+environment/Waste+and+recycling/Household+recycling/What+can+be+recycled/Food+Waste.htm
West Dunbartonshire	http://www.west-dunbarton.gov.uk/environment/waste-services/recycling-at-home/

Appendix 27D: Results of web-based survey on collection of source segregated domestic food waste in Wales

Organisation of waste collection in Wales

Waste collection in Wales, as in England, is the responsibility of local authorities (LAs). Wales is divided into 22 councils, all of which are unitary authorities (UAs), responsible for both collection and disposal of waste. The councils may carry out collections by direct labour using their own employees, or may subcontract the collection service to an external organisation; in most cases in Wales the service is contracted out to private companies or, in one case, a non-profit group (Cwm Harry – for Powys County Council).

In general Wales is subject to the same laws with respect to household waste collection as England, but there are some regional variations in policy. As in England, the cost of household waste collection is covered as part of a general local taxation (Council Tax) levied on each household, but an additional charge may be levied for garden waste or bulky items, at the discretion of the UA. The UA is also responsible for the supply of any container (e.g. bin or bag) required to hold the waste that it has statutory duty to collect, but is not required to provide additional lining materials. It is also not responsible for supplying equipment such as home composters or garden refuse sacks, although it may do so free of charge or at a subsidised rate depending on local policy. The Household Waste Recycling Act 2003 (HWRA 2003) requires that each local authority makes provision to collect at least two recyclable materials as identifiable streams. The HWRA 2003 does not specify what these should be, nor that they should be separate components: they can be collected as a single co-mingled fraction. For the purposes of the HWRA 2003 garden and food waste are considered as recyclable materials. UAs were required to comply with the HWRA 2003 by 31 December 2010. Other major drivers for the introduction of source separated collection include the Landfill Allowance Trading Scheme (LATS) which was introduced to help meet landfill diversion targets in the EU Landfill Directive (99/31/EC). Under the LATS scheme, UAs receive an allowance for waste sent to landfill, which are tradable and decrease each year.

As in the rest of the UK, the central government body responsible for waste management is the Department for Environment, Food and Rural Affairs (Defra, www.defra.gov.uk), although many day-to-day aspects of monitoring the system for pollution prevention are carried out by the Environment Agency (www.environment-agency.gov.uk). Detailed data on municipal waste collection and disposal is available from Defra and on the WasteDataFlow website (www.wastedataflow.org), but this covers all biodegradable municipal waste and does not yet report specifically on food waste. The Waste Resources Action Programme (WRAP, www.wrap.org.uk) also provides advice and commentary to government and the public on best practice regarding waste resource utilisation and has commissioned or carried out an extensive range of studies on domestic food waste (Hogg et al., 2007; Exodus, 2007; WRAP, 2007; Mills and Andrews, 2009; Quested and Johnson, 2009; Ventour, 2009), including studies on the operation of source separated collection trials (Bridgwater and Parfitt, 2009).

Wales met by 2008 its earlier target of landfilling less than 0.710 million tonnes of biodegradable municipal waste by 2010 (Welsh Assembly Government, 2010). The Welsh government has now required all of the 22 Welsh councils to provide separate collection for food waste as set out in its June 2010 waste strategy, 'Toward Zero Waste'. The strategy includes ambitious targets of at least 70% recycling by 2025 across all sectors, including

businesses, households and the public sector, and statutory recycling targets for municipal waste collected by local authorities. The construction sector will be expected to reuse and recycle 90% of its wastes by 2025. The waste strategy also states that food waste should be collected separately and processed in anaerobic digestion facilities.

The Welsh government is also making extensive efforts to eliminate food waste before it arises, through financial support of programs such as FareShare, which supports charitable distribution of unsellable but high-quality food to disadvantaged groups, from supermarkets and local food companies. This unsellable food would otherwise be waste (Welsh Assembly Government, 2012).

Information on waste collection services is publicised on the councils' webpages.

Methodology

A systematic search was carried out of webpages for the 22 unitary authorities in Wales, identifying those offering collection of source segregated food waste either as a single stream or co-mingled with green wastes. The unitary authorities were identified from the Welsh Assembly Government's 'Local Government' webpage at http://wales.gov.uk/topics/localgovernment/?lang=en which has links to the unitary authorities' individual webpages. The search was carried out by going to the main website of each UA, finding the section dealing with waste management and looking for information on food waste collection. Further information was gathered from each website according to the headings shown in Table 27A.1.

As all unitary authorities in Wales now provide food waste collection to at least some of their residents, the search of the 22 UA webpages was sufficient for information gathering without requiring additional Google key word searches.

Tonnages of household waste collected and sent for recycling, composting or re-use were taken from Defra (2010).

Results

All 22 Welsh councils provide separate collection of either food waste or food and garden waste to at least some of their residents. As of February 2011, four out of five Welsh households have separate collection of food waste (Welsh Assembly Government, 2011).

Of the 22 unitary authorities, 20 (91%) collect food waste alone as a separate stream, while the remaining 2 (9%) collect it as a mixed stream with garden waste.

Table 27D.1 shows some characteristics of the UAs that provide FW collections; full details of the survey results are given in spreadsheet format in Appendix A. The two councils collecting garden and food waste together are the last two in the table. Both collect on a fortnightly basis, alternating with fortnightly refuse collection. A green wheeled bin (240 litres) is provided into which residents can put food waste and garden waste.

Table 27D.1. Local Authorities providing Food Waste collections in Wales

Name	Type	Authority	Region	Area	Population	Population density	Waste	Recycling	Recycling %
				km^2	no.	person/km^2	tonnes/person-year	tonnes/person-year	% total
Blaenau Gwent County Borough Council	CBC	Unitary	south Wales	109	68,400	628	0.449	0.164	36.5%
Bridgend County Borough Council	CBC	Unitary	south Wales	246	134,600	547	0.439	0.201	45.7%
Caerphilly County Borough Council	CBC	Unitary	south Wales	278	173,100	623	0.470	0.271	57.6%
Cardiff Council		Unitary		143	341,054	2,385	0.462	0.191	41.2%
Carmarthenshire County Council	CC	Unitary	southwest Wales	2395	180,700	75	0.405	0.206	50.7%
Ceredigion County Council	CC	Unitary	(west coastal)	1795	76,900	43	0.490	0.235	48.0%
Conwy County Borough Council	CBC	Unitary	north Wales	1130	110,900	98	0.447	0.197	44.1%
Denbighshire County Council	CC	Unitary	north-east Wales	844	96,700	115	0.429	0.243	56.5%
Flintshire County Council	CC	Unitary	north-east Wales	438	149,700	342	0.506	0.222	43.8%
Gwynedd Council		Unitary	north-west Wales	2548	119,000	47	0.475	0.216	45.5%
Isle of Anglesey County Council	CC	Unitary	north-west coast \	714	68,600	96	0.572	0.299	52.3%
Merthyr Tydfil County Borough Council	CBC	Unitary	south Wales	111	55,700	502	0.517	0.179	34.6%
Monmouthshire County Council	CC	Unitary	south-east Wales	850	88,100	104	0.493	0.261	53.0%
Neath Port Talbot County Borough Council	CBC	Unitary	south Wales	442	137,400	311	0.514	0.193	37.6%
Newport City Council		Unitary	south Wales	190	141,300	744	0.422	0.190	45.0%
Pembrokeshire County Council	CC	Unitary	south-west Wales	1590	117,100	74	0.486	0.227	46.7%
Powys County Council	CC	Unitary	mid Wales	5179	131,300	25	0.512	0.199	39.0%
Rhondda Cynon Taf County Borough Counc	CBC	Unitary	south Wales	424	234,300	553	0.469	0.175	37.4%
City and County of Swansea		Unitary	south-west Wales	378	232,500	615	0.437	0.183	41.8%
Vale of Glamorgan Council		Unitary	south Wales	335	125,000	373	0.445	0.181	40.7%
Torfaen County Borough Council	CBC	Unitary	south Wales	126	90,500	718	0.477	0.199	41.6%
Wrexham County Borough Council	CBC	Unitary	north-east Wales	498	133,600	268	0.506	0.253	50.1%

Charges. There is a statutory requirement for UAs to collect this material as a component of household waste. Bins and kitchen caddies are provided free of charge in most cases; some authorities charge for replacement containers. Most authorities also provide a starter pack of compostable liners free of charge; once these have been used new ones can be obtained for free or purchased, depending on the authority.

Optional or compulsory schemes. Although the websites did not explicitly state that participation in the food waste collection scheme was compulsory, it is compulsory for the councils to provide the service, and the information on the websites made clear that this was the preferred option for householders to dispose of their food waste. In most cases, refuse collection is only provided fortnightly, which provides a further incentive to use the weekly FW collection rather than keeping putrescible materials for up to two weeks in the refuse bin.

Frequency of collection. 20 (91%) of the UAs collect FW on a weekly basis, while 2 (9%) had fortnightly FW collection (with garden waste). The frequency of collections of FW, recyclables and residual waste is shown in Table 3. Only 3 UAs (14%) continued to collect residual waste on a weekly basis. Most councils have reduced the frequency of refuse collection to fortnightly, enabled by the reduction in odour and nuisance value resulting from the removal of the food waste component (Gladding, 2009), and allowing a cost saving on refuse collection which helps to compensate for the cost of adding the FW collection.

Table 27D.2. Collection Frequency

	FW		Residual Waste		Recyclables	
Weekly	20	91%	3	14%	19	86%
Fortnightly	2	9%	19	86%	3	14%
Total	22	100%	22	100%	22	100%

Materials collected. Most websites stated very clearly which materials were acceptable, except for five (23%) that did not provide a list of accepted materials, using only the term 'food waste' as the guidance for materials to go into the bin.

Materials listed as acceptable in almost every case included raw and cooked meat and fish; dairy products such as cheese; bread, pasta and rice; fruit/vegetable waste; tea and coffee grounds; and generic materials such as plate scrapings. There was considerable commonality in the lists, but also minor differences. In most cases these were in the form of extra descriptions given for illustration. For example Swansea Council website includes in its list of accepted materials "*Small bones up to and including chicken carcass, lamb bone or anything left over from a typical family Sunday roast*".

Table 27D.3 shows materials explicitly listed as acceptable or unacceptable in different schemes. Bones and eggshells were explicitly mentioned in most cases, indicating that it was felt advice would be needed on this material. Only a limited number of UAs specifically accepted other biodegradable materials such as paper or fats and oils. None stated that they accepted faecal material and 19 (86%) specifically excluded this.

Table 27D.3. Selected materials specified as accepted or rejected in FW collections

	Yes	No	Not specified	Total
Bones	20	0	2	22
Eggshells	20	0	2	22
Paper/ card	17	2	3	22
Shredded paper	11	3	8	22
Liquid	1	15	6	22
Oil / fat	2	12	8	22
Faecal	0	19	3	22
Plant	2	17	3	22
Biodegradable bags	4	16	2	22

Bags and liners. Compostable liners were provided by most unitary authorities as part of the service. New liners were supplied by the council free of charge in 14 (67%) of the cases, with a further 4 (27%) of UAs providing a list of stockists for householders to purchase replacement liners. 16 (73%) of the UA websites specifically mention that lining with newspaper or paper is allowed. In most cases this would only be necessary if the householder had run out of compostable liners. Most websites provide information on where the public can obtain compostable liners. In most cases householders can attach a sticker, empty liner or note to their waste container on collection day to indicate that a new set of liners is needed, which are then provided by the driver of the waste vehicle. Where extra liners are not delivered by waste vehicles, they can be ordered from the council or purchased at local stockists, a list of which is provided on the council's website. Many of the websites specifically stated that purchased liners must carry the European bioplastics logo as shown in Figure 27D.1.

Figure 27D.1. European bioplastics compostable logo (reproduced from http://www.wrexham.gov.uk/assets/pdfs/recycling_waste/kitchen_caddy.pdf)

Containers. Almost all of the UAs (21 or 95%) provided a two-container system for food waste, including a small kitchen caddy and a larger outdoor caddy or wheeled bin, commonly referred to as a 'wheelie bin'. The one UA not providing a kitchen caddy is one of the two that co-collect FW with garden waste in wheeled bins on a fortnightly basis. All of the websites stated the type of containers used in the collection service, although only 7 (34%) gave the exact size of the containers. Those that did generally gave caddy volumes of 5 and 7 litres and bins of 22, 23, 25 litres. One LA provides a bin of 47 litres, with a specific comment on the FAQ section of the website that this should be large enough for all users, although a smaller bin size may be preferred to reduce the incidence of contamination by introduction of unwanted materials. *"The 47 litre bin will be more than adequate for the majority of households participating in the scheme. In the rare event that you find the bin is not big enough please contact us using the contact details below"* (Rhondda Cynon Taf). This LA was also the only one that specifically accepted liquids (Table 27D.4).

Collection vehicles. Most UA websites did not give specific information on the type of vehicle used: only 2 mentioned using twin-compartment vehicles.

Treatment process. 17 (86%) of the UAs gave information on the type of treatment process used. The split between anaerobic digestion, composting and vermicomposting is shown in Table 27D.4. The dominance of composting reflects the fact that, although AD is preferred in the Wales Waste Strategy (2010), actual AD processing infrastructure is still in the early development stage. Although the majority of UAs specified the treatment type, there was less information on the target plant for the waste, with only 13 (23%) of the websites mentioning this. Where the waste is treated in a local plant, this provides an opportunity to increase the sense of local relevance and ownership of the scheme. As many of the FW collections schemes are relatively new and the number of AD plants treating FW in the UK is increasing, this information is not included in this report as it is likely to go out of date quickly.

Table 27D.4. Waste treatment process type

	No. of UAs	%
AD	3	14%
Composting	14	64%
Vermicomposting	2	9%
Not specified	3	14%
Total	22	100%

Supporting information. 21 (95%) of the UA websites provided supporting information on why food waste recycling is important. The same number also gave information on home composting, with reduced price composters offered by 21 (95%) of the UAs. 12 (55%) of websites mentioned the Love Food Hate Waste campaign (www.lovefoodhatewaste.com) which promotes minimisation of food waste. Most of the UAs also provided downloadable information on the collection scheme, ranging from simple instructions to detailed booklets covering all aspects of the scheme, as shown in Figure 27D.2. Many of the websites also included games and information on recycling (of both dry materials and food waste) for children, or cartoon recycling champions as shown in Figure 27D.3.

Figure 27D.2. Example pages of WWII-styled 'Recycle for Victory' information booklet (Bridgend County Borough Council).

Figure 27D.3. Examples of characters used for recycling promotion – from top: 'Enviroman' (Merthyr Tydfil) 'Sammy Seagull' (Swansea), 'Dan Can the Super Recycler' (Torfaen), 'Rhys Cycle & Dr. Clean (Rhonda Cynon Taf).
http://www.rctcbc.gov.uk/en/environmentplanningandwaste/rubbish,wasteandrecycling/recycling-foodrecycling/recycling-foodrecycling.aspx

Summary of key findings

- 100% of UAs in Wales provide some form of separate food waste collection, with 91% offering food-waste only collections.
- As yet there is no single common list of materials accepted in FW-only schemes, but a degree of consistency is emerging with only small differences between schemes.
- Weekly collection of food waste and fortnightly collection of residual waste is practiced in the majority of Welsh unitary authorities.

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