

An investigation into food waste management.



Waste in Action

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An investigation into food waste management.

Executive Summary

In UK households, approximately 8.3 million tonnes of food and drink waste are thrown away each year (WRAP, 2009b). In France, 9.713 million tonnes of organic waste were found in the household waste stream (ADEME, 2007). A substantial amount of food waste, 5.3 million tonnes is avoidable through better management.

Projects such as Love Food Hate Waste which involve a national scheme of events have been successful in raising awareness of food waste with a reported 137,000 tonnes prevented or diverted from landfill since 2007. Other education campaigns include Food Champions, Green cook in Europe and action at the retailer level via the Courtauld Agreement. Management in the home concentrates on the role of food digesters. The Green Cone system has been trialled in several Local Authorities and has demonstrated a reduction in waste of trial participants.

Over 1.5 million tonnes of food waste is, however, unavoidable and will remain in the household waste stream. For many local authorities, implementing a food waste collection provides a realistic solution for meeting legislative targets for diverting biodegradable waste from landfill and increasing recycling and composting rates. There are several operational options for food waste collections; preference is likely to depend on current operational set-up, required yields, financial budgets, proximity of treatment facilities, political acceptability and public support. Separate food waste collections are increasingly more cost effective than mixed biowaste collections, especially when levied against a chargeable green waste collection or alternate weekly collections of refuse.

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1. Purpose

1.1. Aim

To investigate the prevention and management of food waste.

1.2. Objectives

- To consider the drivers for food waste prevention and collections
- To identify and evaluate methods of food waste prevention
- To identify and evaluate food waste management in the home
- To consider food waste collection options and identify good practise
- To consider approaches in the UK, France and across Europe

1.3. Definitions

For the purpose of this report, the following definitions will be used:

Food waste: *'Waste generated during the preparation of meals and any food that is not consumed. It includes food that has been thrown away, not used or partly used.'*

Green waste or Garden waste: *'Grass cuttings, woody garden waste, soil, plants, flowers, leaves, weeds'*

Biowaste: *'Biodegradable materials from kitchens and gardens that are thrown away by the householder as waste'* (WRAP, 2009a)

Organic or biodegradable waste: *'Waste materials of animal or plant origin'*

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This report will focus on household waste, however it is accepted that large quantities of food waste are generated at all levels of production and supply chain by manufacturers, retailers, catering outlets, hotels and many other sectors.

2. Background

In the UK household, an estimated 8.3 million tonnes of food and drink waste are thrown away each year (WRAP, 2009b). In France, 9.713 million tonnes of biowaste were found in the household waste stream (ADEME, 2007). In both countries, food waste has increased in recent years. Understanding the reasons for this growth enables local authorities to target preventative and collection approaches.

A substantial amount of this food waste is unnecessary and could be prevented; approximately 5.3 million tonnes of food waste could have been avoided, while 1.5 million tonnes could have been possibly avoided in the UK as classified in Figure 1 (WRAP, 2009b).

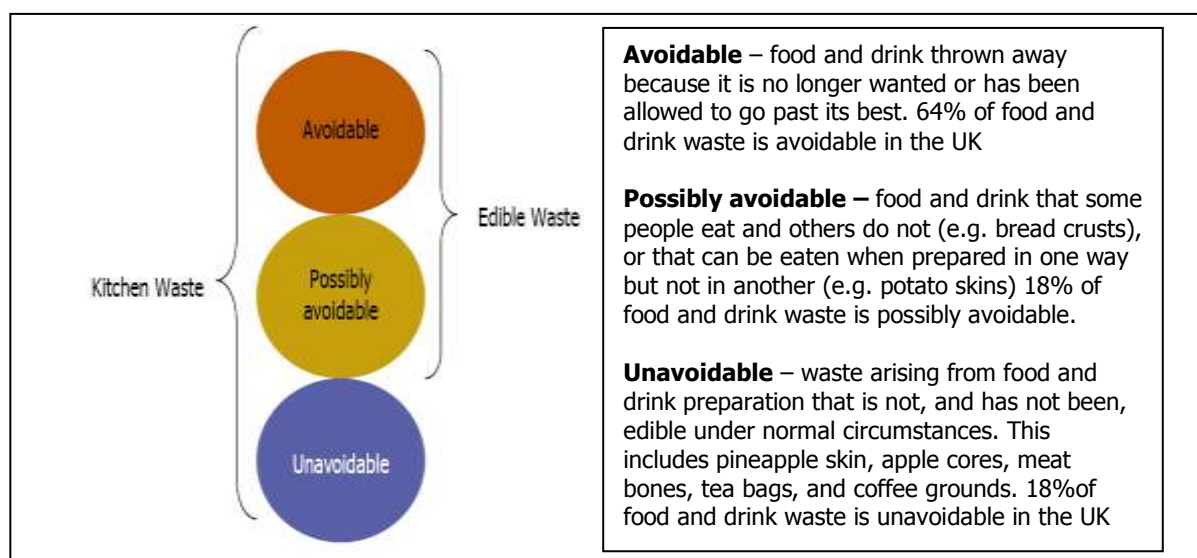


Figure 1: Food waste classification (WRAP, 2009b)

In line with the Waste Hierarchy (Waste Strategy for England, 2007), waste prevention campaigns, such as Love Food, Hate Waste and home composting may help to significantly reduce food waste and should be favoured over collection and treatment. However, over 1.5

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million tonnes (18%) of unavoidable food waste will remain in the household waste stream, which will either be managed at home or managed by a local authority.

Figure 2 shows factors influencing food waste generation and potential disposal routes. This report will focus on boxes shaded orange and yellow.

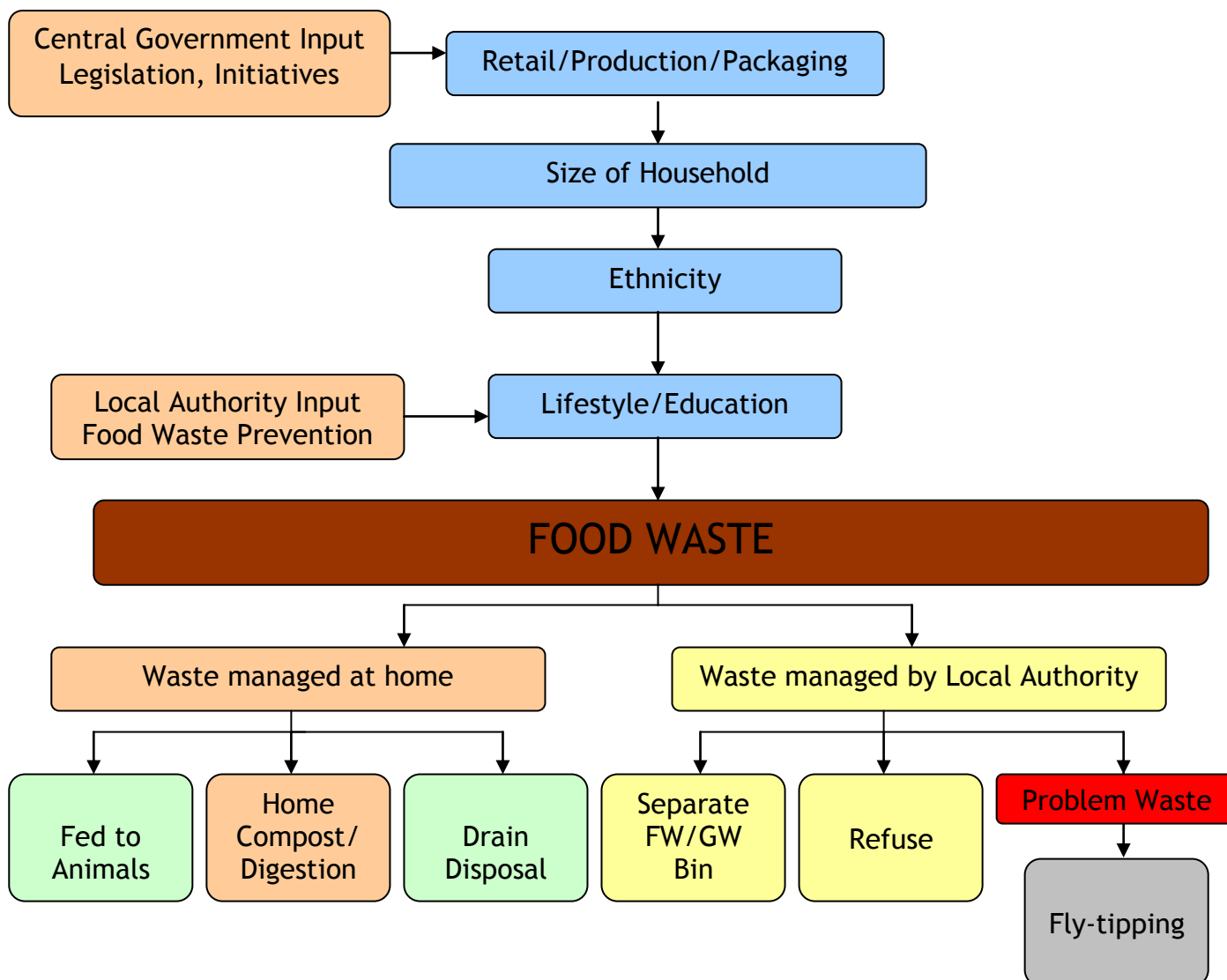


Figure 2: Food waste production factors and potential disposal routes

From the 8.3 million tonnes of food waste generated in UK households, 5.8 million tonnes are collected by local authorities (mostly in the residual stream). Approximately 22% is disposed of down the sewer, while 8% is fed to animals or home treated (WRAP, 2009).

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2.1. Household Food Waste Composition

In Europe, food waste and garden waste usually constitute between 30-40% of the mass of municipal waste (ACR+, 2009). This proportion can reach up to 80% in Mediterranean countries.

In 2002, food waste made up 17% of the household waste stream in England (Figure 3). In 2009, 31% of kerbside residual waste is estimated to be food waste (WRAP, 2009a)

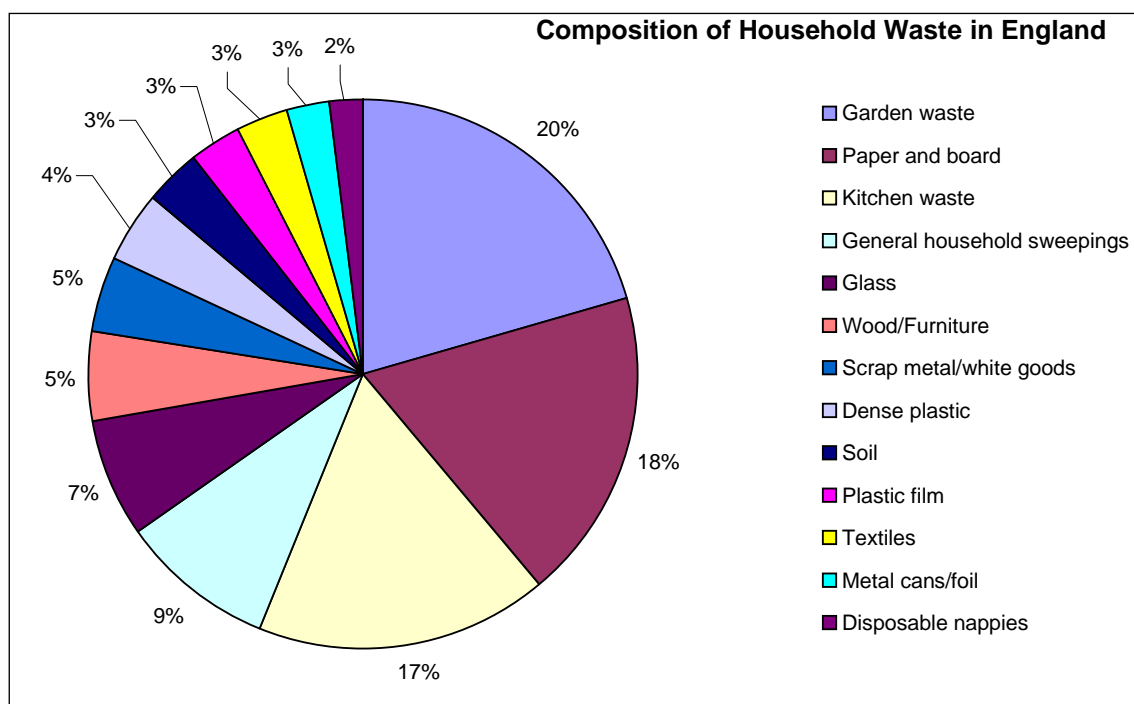


Figure 3: Composition of household waste in England (WRAP, 2002)

In the UK, each household generates approximately 330kg per year or 6kg per week of food and drink waste (WRAP, 2009b). While other factors play a part, household size is a key factor that governs how much food waste is generated; larger households produce more food waste as more people live, cook and eat there (WRAP, 2008).

In France, 9.713 million tonnes of biowaste were found in the household waste stream (ADEME, 2007). In 2009, this accounted for 28.6% of the household waste stream. This has increased from 25% in 2007 (Figure 4). While national composition data can provide guidance, local composition data is essential to fully understand waste generation in a local authority.

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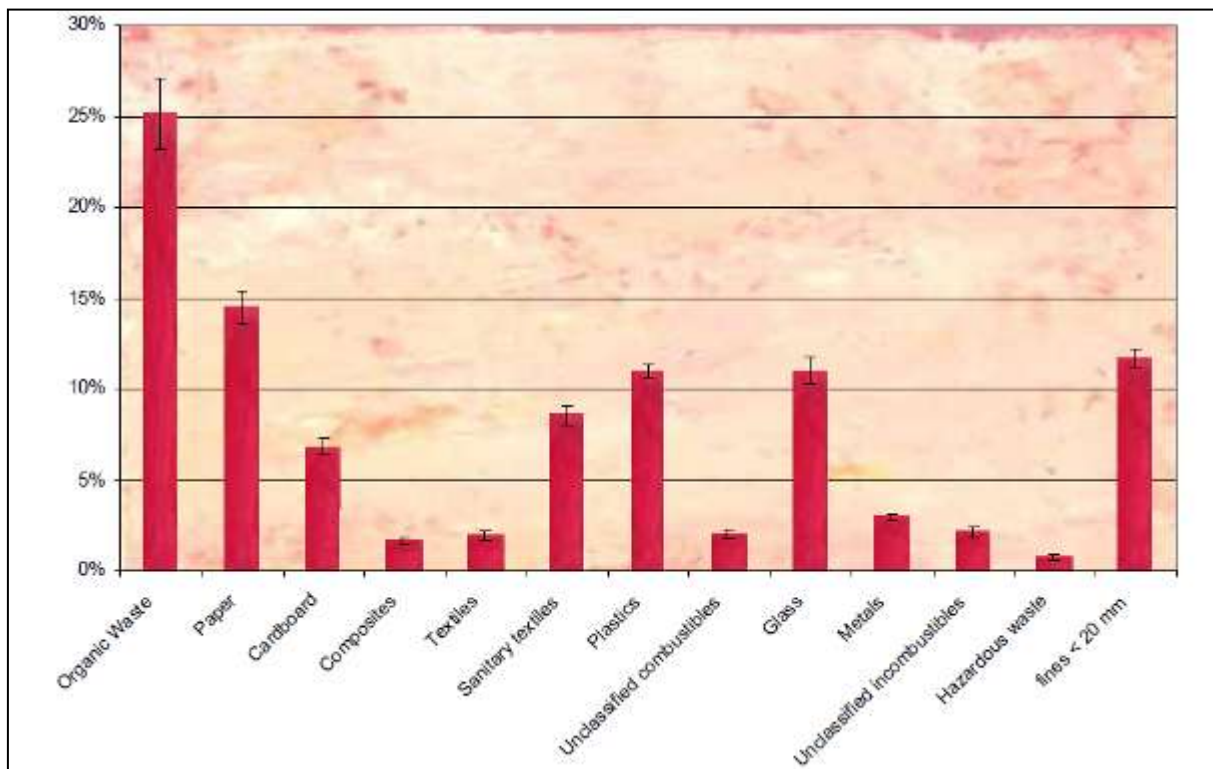


Figure 4: Average Composition of Household Waste in France (ADEME, 2007)

Analysing food waste type allows more effective targeting of prevention campaigns (Figure 5).

Also certain technologies will only treat specific types of food waste i.e. home composting to treat uncooked food. Figure 5 indicates at least 33% (23% fresh veg & salad, 13% fresh fruit) of food waste could be treated via home composting.

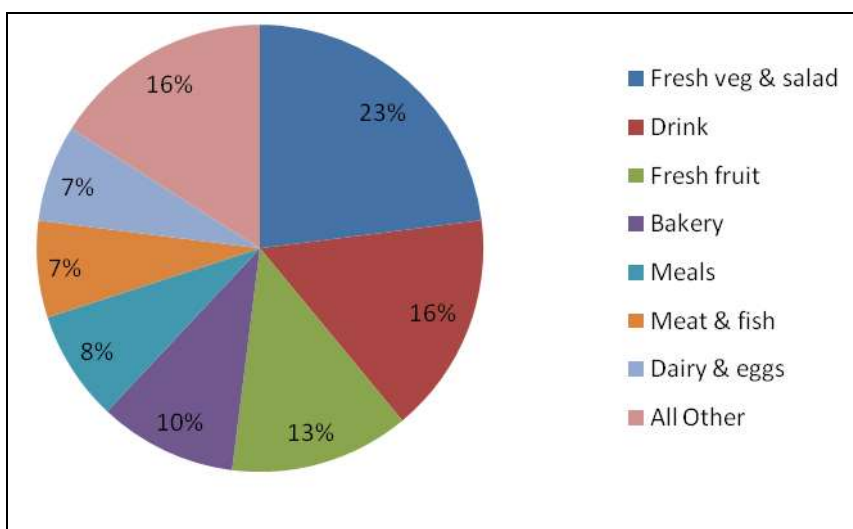


Figure 5: Proportion of weight of all food and drink waste in UK, split by food group (WRAP, 2009b)

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2.2. Legislation

Table 1 shows legislation at a European and national level, which may drive food waste prevention and implementation of collections. Local authorities have been set targets for reducing quantities of biodegradable waste sent to landfill and increasing recycling rates.

Table 1: Legislation driving food waste prevention and collections

European
<p>Thematic Strategy on the prevention and recycling of waste 2005</p> <ul style="list-style-type: none">• First waste strategy to address both waste prevention and recycling in member states.• Sets out in the Environmental Action Plan, the framework for environmental policy-making in the EU for 2002-2012.• Lead to a revised Waste Framework Directive in December 2008, which specifically requires all member states to establish waste prevention programmes by 2013.
<p>EU Landfill Directive (1999/31/EC)</p> <ul style="list-style-type: none">• Aims to significantly reduce the negative environmental impacts of land filling by introducing strict technical requirements for waste and landfill, and by setting targets to reduce biodegradable municipal waste (BMW) going to landfill.• It imposes national strategies for recycling, composting, biogas production and the recovery of biodegradable municipal waste (BMW)• The UK is obliged to reduce the amount of waste to landfill based on the amount of BMW in 1995 to 75% by 2010, 50% by 2013 and to 35% by 2020.
<p>The Waste Framework Directive (WFD 2008/98/EC)</p> <ul style="list-style-type: none">• Sets out the hierarchy of waste management options, with waste prevention as the preferred option. It outlines 'a new obligation for member states to design and introduce comprehensive waste prevention programmes'.
<p>The Animal By-Products Regulations 2003 (ABPR)</p> <ul style="list-style-type: none">• Impose a number of restrictions on the handling and treatment of waste that contains or could potentially contain animal by-products. This includes kitchen waste, but not garden waste• In order for compost made from food waste to be spread on the land, it must be treated in enclosed or under cover facilities.• Controls are placed on the processes including operating temperature, retention times and maximum particle size requirements, designed to ensure that pathogens are killed.

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National - England

National Waste Strategy for England – 2007

- Highlights the need to decouple waste generation from economic growth and environmental impacts.
- Focuses higher up the waste hierarchy, with the government setting new national targets to reduce the amount of household waste NOT re-used, recycled or composted: to reduce household waste from over 22.2 million tonnes in 2000 to 15.8 million tonnes in 2010 and to aspire to reduce this further to 12.2 million tonnes in 2020. This is equivalent decrease of 50% per person from 450 kg in 2000 to 225 kg in 2020.
- Identifies waste prevention measures as contributing to a net reduction in global green house gas emissions of at least 9.3million tonnes of CO₂ equivalent per year compared to 2006
- Contains objectives for minimising food waste along with the Landfill Directive which aims to move towards a ban on land filling bio waste.
- States '*there are strong arguments for encouraging more separate collection of food waste*' and favours treatment via anaerobic digestion providing energy
- Supports food waste trials in England
- Local authorities must reach a recycling and composting rate of **40% by 2010, 45% by 2015 and 50% by 2020**

Waste and Emissions Trading Act – 2003

- Introduced LATS (Landfill Allowance Trading Scheme) to enable England to meet landfill BMW reduction targets set out in EU Landfill Directive.
- Local authorities are set allowances for the total amount of biodegradable waste sent to landfill per year. Substantial fines will be incurred, if these allowances are exceeded.

Landfill Directive

- In April 2009, Landfill Tax rose to £40 per tonne and it is set to continue rising at £8 per tonne per year until at least 2013/14.
- The Emergency Budget 2010 placed a floor under the standard rate at £80 per tonne, so that the rate will not fall below £80 per tonne from April 2014 until at least 2020

Controlled Waste Regulations - 1992

States that local authorities can charge for the collection of garden waste

There are also a number of voluntary agreements such as the Courtauld Agreement where many large corporations have committed to address packaging and food waste in retail and manufacturing. Agreements such as this, may impact on the quantity of food waste in the

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household waste stream. Also while the government has currently opted against landfill bans for specific materials such as food waste, these will be considered further in the future (Defra, 2010).

2.3. Stakeholders

While the role of the local authority is recognised, food waste prevention and collections may be influenced by other major stakeholders and partners (Table 2). These stakeholders may offer additional resources i.e. funds, partnership working, access to communities etc.

Table 2: Stakeholders

Stakeholders	Role
Local public sector - nearby local authorities, other local authority departments i.e. community wardens, climate change working group, schools.	<ul style="list-style-type: none"> • Orchestrate joint working within and across local authorities for consistent approaches, share best practise and maximise value for money • Provide holistic environmental approach (energy, climate change, biodiversity) not just waste benefits • Influence local communities, central government and business sector
Residents and communities - community groups, resident's forum, charity groups, WI, schools, university	<ul style="list-style-type: none"> • Act as communication channels and engage with other residents to change their behaviour • Already running or mutual benefits from food waste activities i.e. cookery classes, gardening clubs, community composting
Manufacturers and retailers	<ul style="list-style-type: none"> • Address food waste issues in manufacturing and retail • Prioritise corporate social and environmental responsibility • Assess and follow environmental best practise
Disposal/Treatment contractors – IVC, AD, MBT facilities, LF	<ul style="list-style-type: none"> • Provide local, cost effective and environmental sound treatment facilities • Provide accurate data and regular performance updates
Regional bodies - South West Waste Reduction Forum (SWWRF), South West Waste Reduction Group (SWWRG)	<ul style="list-style-type: none"> • Orchestrate joint working across regional areas, with public and private sectors for consistent approaches, share best practise and maximise value for money • Influence central government and business sector on policy and legislation implementation
Government and National bodies – WRAP, EA, Defra	<ul style="list-style-type: none"> • Apply pressure to manufacturers, retailers and national bodies influencing consumers • Provide research and effective campaign models • Integrate EU legislation into UK law and waste targets

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3. Food Waste Prevention

In the UK we throw away 8.3 million tonnes of food and drink each year. Most of this is avoidable and could have been eaten if we had planned, stored and managed it better. Most food is thrown away due to cooking too much or because it was not used in time. This works out at households throwing away over £600 a year on food (WRAP, 2010). Food waste is one of the largest fractions in the waste stream, but how much can be dealt with through waste prevention?

According to research in 'The Food We Waste' (WRAP, 2007), the main reasons for food wastes in the home include:

- Buying too much – special offers such as 'buy one get one free'
- Buying more perishable food
- Poor storage and management – not eating food in date order, preparing too much.
- Sensitivity to food hygiene – not taking a chance with food close to its 'best before' date.

3.1. Prevention at the consumer stage

When questioned by WRAP, 40% of people thought that food thrown away is not an issue because it is 'natural and biodegradable' and thought that packaging was more of a problem (WRAP, 2007(a)). Attitudes and behaviour towards food waste are driven by a number of factors including:

- Retail practices that encourage people to buy more than they need.
- Lack of economic incentives to avoid food waste
- Lack of advance planning, skills and knowledge regarding food storage and preparation.

Ideas to help people waste less food introduced in supermarkets to manage food at the consumer stage, include moving away from Buy One Get One Free promotions (these promotions are not common in other European countries) to 'Buy one get one later'. The customer still benefits from

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the free items of food, but they can be collected at a later date when they are more likely to be consumed as the customer will have a smaller quantity at one time. Plans by the former government entitled “war on waste” suggested scrapping best before dates, limiting sell by labels and creating new food packaging sizes in an attempt to save £300m. With ‘best before’ dates and other labelling – The Food standards agency (FSA) found that only one-third of people correctly interpreted these terms and more than one quarter thought that food past its ‘best before date could be unsafe and should be thrown away (FSA, 2006).

Other supermarket initiatives include ‘Love your leftovers’ and ‘Great taste less waste’ involving recipes cards, vouchers and website information. Many of these ideas are being introduced through the Courtauld Commitment to reduce packaging and food waste. This is a promise signed up to by more than 40 retailers and brand owners to reduce waste and provide choices to consumers regarding the products they buy. This relates to the fact that a considerable quantity of food waste is literally waste food which has not been touched by the purchaser (Hogg *et al.*, 2007). The second phase of the commitment was launched in March 2010 with a more focused aim to achieve a greater sustainable use of resources over their entire lifecycle. The main targets of phase 2 are to reduce supply chain product and packaging waste by 5% and to reduce UK household food and drink waste by 4% by 2010. A report by the British Retail Consortium revealed that retailers in the UK have managed to halve waste sent to landfill from 48% to 23% since 2005. This has been achieved through re-use, using energy recovery technology and reducing consumer food waste (Barton, 2005).

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3.1.2. The Waste Strategy for England

The Waste Strategy 2007 contained objectives for minimising food waste with the following actions being taken by WRAP:

- Supporting the Courtauld Commitment of food brands and
- Holding discussions on how food waste reductions are to be delivered (DEFRA, 2007).

The new coalition government launched a review of the current Waste Strategy in July 2010 with an aim 'to ensure we are taking the right steps towards creating a 'zero waste' economy where nothing of value gets thrown away'. The review is in the consultation stage and their vision is to have an economy where there is 'a new public consciousness in our attitude to waste'.

3.1.3. Consumer initiatives in France

In France, the aims of the national waste policy are to 'increase organic waste recycling and material recovery, to achieve a recycling rate of 35% by 2010' (ADEME, 2010). Initiatives include publicity using comparisons between a shopping trolley of 'eco buying' and a 'non eco responsible' buyer. This highlights the cost savings as well as the reduction in packaging and food waste.

3.2. Home Education

Food waste management often focuses on collection and options for dealing with waste at a Local Authority level, however the role of education to change householder behaviour to prevent waste occurring has an important role to play. The reduction and recycling of food waste produced by people in their own homes is becoming a major strategic priority for Governments as suggested by the review of the waste strategy and new emphasis on zero waste.

The Waste Resources Action Program (WRAP) was established as a not-for-profit company in 2000 to help individuals, businesses and Local Authorities to reduce waste and recycle more.

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WRAP has a target to reduce UK consumer food waste by 25,000 tonnes by April 2011, reducing carbon dioxide equivalent emissions by over 1 million tonnes (WRAP, 2009).

3.2.1. UK campaign - Love Food Hate Waste

Launched in November 2007, the consumer-facing 'Love Food Hate Waste' (LFHW) campaign provides help with compiling shopping lists, planning meals, food portion sizing and storage and smart labels to give date warnings. LFHW claims it has already prevented 137,000 tonnes waste and helped over 2 million households with savings of £300m (WRAP, 2009).

LFHW is a national campaign and provides communications materials such as a dedicated website, range of adverts, and branding for organisations to use, including Local Authorities and businesses. Some funding has also been available to Local Authorities to run their own localised campaigns.



Figure 6: An example of a recipe card (www.lovefoodhatewaste.com)

Case Study 1: The Norfolk Waste Partnership Love Food Hate Waste Campaign

The Norfolk Waste Partnership received funding from WRAP to enable it to run its own Love Food Hate Waste campaign in 2009 and 2010. This included a launch event with celebrity chef Galton

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Blackiston and localised recipe cards (photographs 1 and 2). The £86,000 budget was also spent on advertising and promotional items such as bag clips to encourage correct storage of food. The campaign was very successful with outcomes including an estimated reduction of 8,000 tonnes of waste sent to landfill and an increase in awareness with two thirds of respondents to the citizen's panel having seen a campaign or promotion relating to the reduction of food waste. This was achieved by extensive local media coverage, 67 events and face-to face contact with 11,000 residents (NWP, 2010).



Figure 7: Photo of Keith Whitmore promoting the LFHW campaign in Norfolk

3.2.2. European campaigns

Relatively few campaigns of this nature have been run around the world, but they are becoming increasingly popular as a food waste management tool. In Europe there is the GreenCook programme –Trans-national strategy for global sustainable food management (France and Belgium).

Greencook, similar to LFHW, is aimed at reducing food wastage by in-depth work on the consumer/food relationship. This involves optimising food presentation and storage by changing behaviour of consumers and retailers. The basis of their work focuses on Communities of Practices (CoP's) that allow the sharing of knowledge between partners to create innovative

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initiatives and learn through the experience of other nation-wide campaigns such as those by WRAP. Activities by GreenCook include cook books, food audit tools and a permanent network of ambassadors to encourage food waste avoidance (INTERREG, 2010). These activities have also been promoted through the European Week for Waste Reduction which aims to encourage waste reduction initiatives in Europe and helps organisers coordinate actions from different groups including schools, Local Authorities and community groups (ARCPLUS, 2010).

3.2.3. Other campaigns

Some of the key messages are also appearing in other campaigns in the UK such as the 'Cook 4 Life' programme where 'cook and eat' sessions and demonstrations encourage healthier eating and food management.

Case Study 2: Love Food Champion's Project

This is a joint project developed by The Women's Institute and WRAP to deliver food waste information to communities via trusted intermediaries (personal engagement). Participants discussed barriers to reducing food waste and highlighted ways they could take action. The project found that through discussing and sharing ideas on reducing food waste, participants managed to cut down their food waste from an average of 4.7 kg/hh/wk to 2.2 kg/hh/wk (WRAP & the WI 2008). Education is now higher up agenda with prime time television shows dedicated to the subject – The BBC1 programme the 'Great British Waste Menu' showed a waste banquet made entirely from food that is unwanted (rejected, discarded or deemed unsuitable for sale) by supermarkets, homes and farmers (BBC, 2010). There are also a growing number of community food networks. FareShare is a UK charity that provides disadvantaged people in the community with surplus 'fit for purpose' products from the food industry and encourages people to share 'buy one get one free' offers.

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4. Food Waste Management in the Home

4.1. Home composting

There will always be an element of food waste which is unavoidable, so there is a need to manage this waste at source. Options for householders include drain disposal or feeding to animals. The most common option that is promoted by the government is home composting. In 2004, WRAP launched a targeted national home composting campaign working with 122 English and Scottish Local Authorities to provide subsidised home composters and support. Since 2004, 2 million compost bins have been sold with an estimated annual diversion rate of organic waste from landfill of 320,000 tonnes (IEP and NCC 2010).

4.2. Food waste digesters

Food waste digesters, particularly the Green Cone and Green Johanna are becoming more popular as unlike home composters, cooked food waste and unavoidable waste such as bones and peelings can also be disposed of in the digester. One of the primary roles of food digesters is to reduce materials entering the household waste stream. The most frequent material put into digesters is cooked food, followed by fruit and vegetables. This method of food waste management was chosen for a trial in West Sussex to determine the potential for food waste diversion.

Case Study 3: 'Minimisation of food waste through home digestion' – results of trials in West Sussex (Bench *et al.*, 2003).

The research showed that as well as diverting food waste from the refuse waste stream, 90% of respondents to the survey had seen a reduction in the amount of waste they normally put out for collection. Analysis showed waste reduction to be at 1 bag per week on average for the whole sample.

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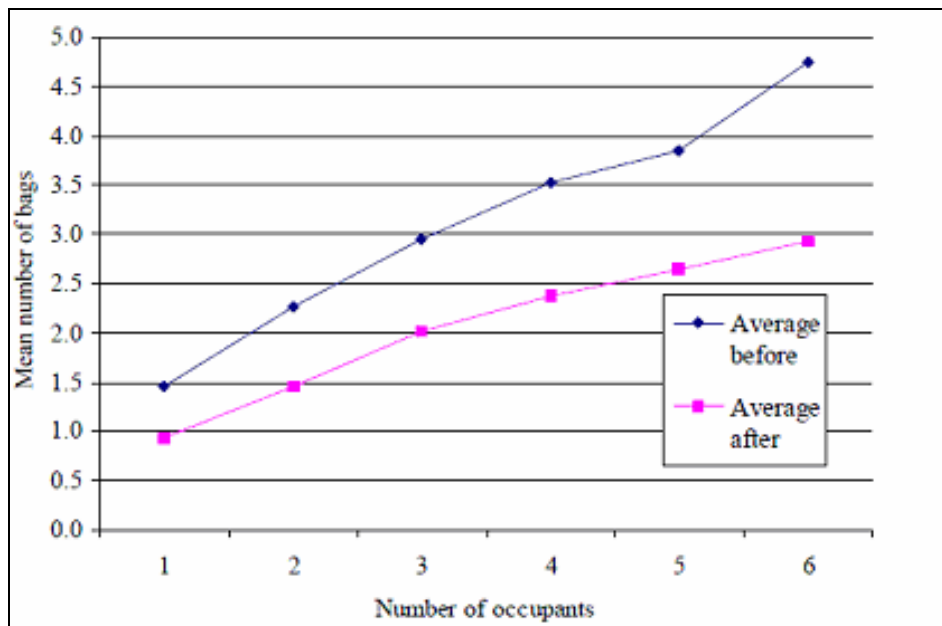


Figure 8: Average number of bin bags according to number of occupants placed out for collection before and after installation of the Green Cone (Bench *et al.*, 2003).

This shows that having to separate food waste from other waste materials encouraged the reduction in food waste as people could visualise the total amount of waste over a given period. The research concludes that there is significant scope for diverting waste from domestic collection using food digesters; such as the green cone system, with an average of 15.4kg waste diverted each month per household.

However a follow up report by the Waste & Energy Research Group (WERG) in 2006 found that only 50% of the West Sussex householders who received the Green Cones were still using them and 25% surveyed had never installed them (WERG, 2006). Caution should be taken when assuming the Green Cone would solve the problem of food waste entering the landfill waste stream as the system is not suitable for all soil types or locations. The trial in West Sussex demonstrated that the system requires the household to be committed and educated about using food waste digesters to get the most out of the system.

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A similar trial was run by Charnwood Borough Council in 2007 with 250 volunteers taking part in 6 month trial. Of the 82 trial respondents, 23% had some difficulty installing the Green Cone due to clay soil, shaded gardens or water-logging and found that 'It is evident that commitment and motivation are required of residents using Green Cones, due to the installation and low-level maintenance that is required'. The trial was deemed largely a success with a waste diversion rate of 18.1% (Bouyer and Kay, 2008).

Resource Futures claim there is still "untapped potential" for households to have home composting bins – 'there is no reason why a local authority should not be pushing towards a participation rate of 45 – 50 %' (Parfitt, 2010). In the report 'The management of Household Food Waste' (Knipe, 2006), food waste digesters are favoured as they can 'facilitate public acceptance of less frequent collections, encourage recycling of other domestic waste streams' and most importantly 'limit the growth of food waste'.

4.3. Awareness campaigns

The Environmental Protection Agency recommends that 'national and regional awareness campaigns are implemented to promote better management of organic waste at home'. Norfolk County Councils waste partnership alone last year (2009-2010) sold over 900 home composters just by adverts on their website and in a magazine (IEP and NCC 2010). A similar trial scheme was run by the environment agency l'ADEME in France, where composting takes place in rural areas but is not promoted in urban areas due to lack of space and a national dependence on incineration as the preferred waste disposal option for co-mingled waste. In Flanders residents have to pay to dispose of their waste and therefore home composting schemes are encouraged to reduce costs to the householders. 25% of the Flanders region home compost, with neighbourhood composting in urban areas and a scheme of master composters who encourage participation.

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These schemes have helped Flanders reach a recycling rate of 70% which is the highest in Europe (OVAM 2009)

However work by WRAP suggested that even under assumptions such as 87% households having gardens and 53% householders deal with 42kg of their waste in home composters, which may be difficult to realise, home composting would still only be dealing with only just over 10% of the food waste currently in the residual waste stream (Hogg et al., 2007). It is difficult to quantify how much waste is being composted as household participation varies depending on the seasons, how successful their composting is and the amount of food they waste. As with the Green Cone trial in West Sussex, changes in householder behaviour depend on the initial success of the composter and education to use the scheme correctly.

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5. Food Waste Collections

In the UK, 5.8m tonnes of food waste are collected by local authorities either through the refuse stream or food waste collections (WRAP, 2009b). While the refuse stream is disposed of in landfill, local authorities across Europe are required to limit biodegradable waste in this stream. Currently however there are great variations, in Austria and Germany over 75% of organic waste is separated from the refuse stream and collected for composted, where as in the UK, Ireland and Greece less than 10% is (ACR+, 2009).

For many local authorities, introducing a food waste collection provides a realistic solution for meeting legislative targets for diverting biodegradable waste from landfill and increasing recycling and composting rates. Separate organic collections have been found to collect more than 100kg per inhabitant each year, although green waste is prominent (ACR+, 2009).

In 2009, 137 local authorities in the UK provided a food waste collection, with 47% offering food only collections (Brook Lyndhurst, 2009). In France, green waste collections are used widely by local authorities to capture biodegradable waste; however food waste collections are not.

As kerbside recycling collections now capture a broad range of dry recyclables, a large proportion of the remaining refuse stream consists of biodegradable material. In Bournemouth, food waste makes up 38% of the refuse stream, while green waste made up 11% (ResourceFutures, 2009). Implementing a separate food waste collection would have a significant impact on the quantity and quality of material remaining in the refuse stream and ultimately its cost of disposal.

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5.1. Drivers for collections of food waste

There are a number of significant benefits to collecting food waste separately from the refuse stream. Several are directly linked to the diversion of biodegradable waste from landfill by:

- Contributing towards targets for diverting biodegradable municipal waste (BMW) from landfill.
- Improving recycling rates
- Reducing waste disposal costs as landfill cost increases
- Reducing the environmental impacts associated with landfill (toxicity in leachate, landfill gas emissions etc)
- Reducing greenhouse gas emissions by removing putrescent content from landfill sites (WRAP, 2009c)

Food waste collections can also benefit local authorities who currently use alternatives to landfill for the treatment of the refuse stream, such as Mechanical Biological Treatment (MBT) Energy from Waste (EfW) by:

- Improving recycling rates
- Producing of a high quality compost and liquid fertilisers for use as a soil improver
- Generating of heat and power through anaerobic digestion (AD) linked to combined heat and power plant or through use as a direct fuel
- Creating a greater public acceptance for alternate weekly collections (AWC) of refuse by collecting the odours fraction weekly (Friends of the Earth, 2007)
- Reducing nuisance from rats, vermin and flies attracted to food in refuse stream

The benefits will vary in different areas, depending on the local authority's current performance and collection systems already in place

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5.2. Food waste collection options

There are a number of operational options for food waste collections (Table 3).

Table 3: Food Waste Collection Options

Collection Options		Considerations
Material types collected	Single stream – food waste	<ul style="list-style-type: none"> To comply with the Animal By-Products Regulations, food waste must be treated in an enclosed unit via anaerobic digestion (AD) or in-vessel composting (IVC); where as garden waste can be composted externally in windrows. As a result green waste requires simpler, less costly treatment infrastructure than food waste (ACR+, 2009) Separate food waste collection and treatment are increasingly more cost effective than mixed collection and treatment (Eunomia, 2008) Material type will effect value and available markets of end product May be dictated by treatment facilities available locally
	Mixed with green waste	<ul style="list-style-type: none"> Residents using a single stream food waste collection are more likely to separate out their food waste compared to households offered a mixed food and garden waste collection (Friends of the Earth, 2007) Participation for biowaste collections is higher than separate food waste collections; however the quantity of food waste is greater in separate collections (Brook Lyndhurst, 2009) Recycling of cardboard is environmentally preferable to composting or digestion (WRAP, 2009d) If a free green waste scheme is already running, local authorities may consider including food waste with current operations as containers, rounds, communications etc are established thus saving costs. However ABPR compliant (i.e. leak proof) vehicles are required for food waste transportation.
	Mixed with green waste and cardboard	<ul style="list-style-type: none"> Food waste cannot be included in a chargeable green waste collection. The Controlled Waste Regulations 1992 Schedule 2 allows local authorities to charge for garden waste collection; but not for food waste collection Alternatively the cost of a separate food waste collection could be successfully offset by levying a charge on the green waste collection (Eunomia, 2008)

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Collection Options		Considerations
Collection System	Door-to-door	<ul style="list-style-type: none"> Drop-off systems allow collections from areas with high population density, where space is limited or in collective housing Higher participation and yields are found using door-to-door collection (WRAP, 2009a)
	Drop-off/Bring	
Container options	60-180l wheeled bin	<ul style="list-style-type: none"> Size is dependent on material types collected (larger container required if including green waste/cardboard), frequency of collection and expected yields The cost of biodegradable liners are 25p per unit and each participating household requires 2.5 per week (WRAP, 2009d) Cost increased by providing caddy liners but makes more publicly acceptable, cleaner for collection crews and slightly higher yields may result (WRAP, 2009c)
	5-23l/vented/un-vented caddy	
	Compostable caddy liners	
Coverage options	Opt- in	<ul style="list-style-type: none"> Opt-in may lead to disjointed rounds, but assume all participants want collection Number included is likely to be dependent on required yields and available budgets Phasing allows more time and resources to be targeted at problem areas, but may incur further cost in communications, delivery expenses etc Flat properties are more likely to experience contamination issues and may produce lower yields (WRAP, 2009c) Including schools may provide useful education tool and communications route back to parents for household collections Local businesses may also be targeted to generate revenue from the collection.
	All properties	
	Phased approach i.e. 10,000 per year	
	Flats	
	Schools	
	Businesses	

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Collection Options		Considerations
Frequency options	Bi-weekly	<ul style="list-style-type: none"> Weekly produces higher yields of food waste and offers a higher level of householder satisfaction especially when introducing alternate week collections (WRAP, 2009c)
	Weekly	<ul style="list-style-type: none"> More frequent collections maybe required in warmer climates or over the summer period to avoid odours and hygiene problems (ACR+, 2009)
	Fortnightly	<ul style="list-style-type: none"> Weekly collections may allow frequency of refuse collections to be reduced to alternate week collections
Vehicle options	New specialised vehicles	<ul style="list-style-type: none"> Dependent on demographics, property types, current collection fleet, health and safety factors, cost
	Double-shifting refuse vehicles	<ul style="list-style-type: none"> Vehicles used must be ABPR compliant, therefore refuse or green waste vehicles would need adapting to ensure leak proof and the apertures close when not loading Significant cost associated with vehicle purchasing/leasing and larger vehicles tend to have very low fuel efficiency
	Combine with current set-up i.e. green waste rounds	<ul style="list-style-type: none"> Small collection vehicles (gvW of 7.5 tonnes with a 2.5-3 tonnes payload) have proven highly effective in a UK setting for collecting food waste (WRAP, 2009a) Double-shifting vehicles may significantly reduce the cost, however smaller vehicles could not be used and may result in more disruptions to service if vehicle maintenance is required.

Local authorities are likely to prefer different options depending on the current operational set-up, required yields, financial cost, proximity of treatment facilities, quality of output material and political acceptability.

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5.3. Comparison of food waste collection systems used in South West England.

In South West England, there are 40 local authorities, using a variety of approaches to deal with food waste. Of these 40, 26 Councils are Waste Collection Authorities (WCA), four are Waste Disposal Authorities (WDA) and 10 are Unitary Authorities (UA). To establish popular and good practise, food waste and green waste collection systems used by waste collection authorities (WCA) and unitary authorities (UA) were reviewed (Appendix 1). Current treatment of the refuse stream was also noted. Recycling and composting rates were used to gauge the effectiveness of the system.

Out of 36 WCA or UA in the South West, 24 offered a collection to divert food waste from the refuse stream, either through a separate food waste collection or combined with green waste or cardboard (Figure 9). 80% offered a weekly food waste collection.

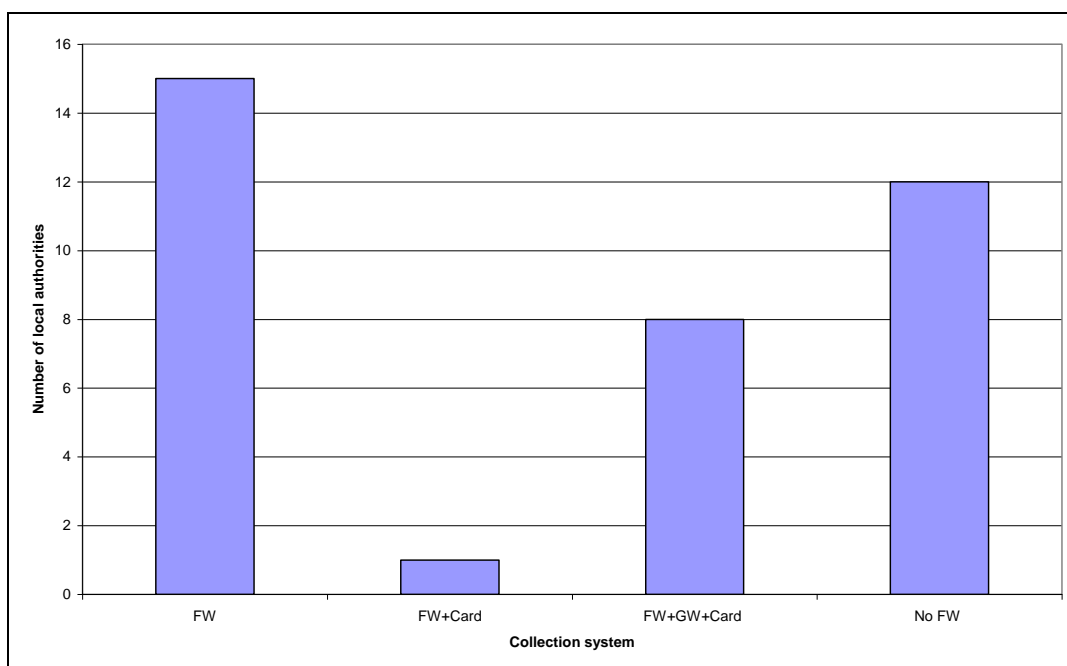


Figure 9: Graph showing the number of local authorities using a food waste collection.

There is a wide variety of containers available for the collection of food and green waste. Figure 10 shows the external collection containers used in the South West region. The chosen container is likely to be influenced by the materials collected i.e. larger containers (140-240L) will be used if

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green waste or cardboard are included in the collection, where as 23-25L containers are favoured for food waste only collections. Four authorities offered a choice of container depending on the residents needs i.e. Weymouth and Portland Borough Council offered a 120L bin or 25L caddy.

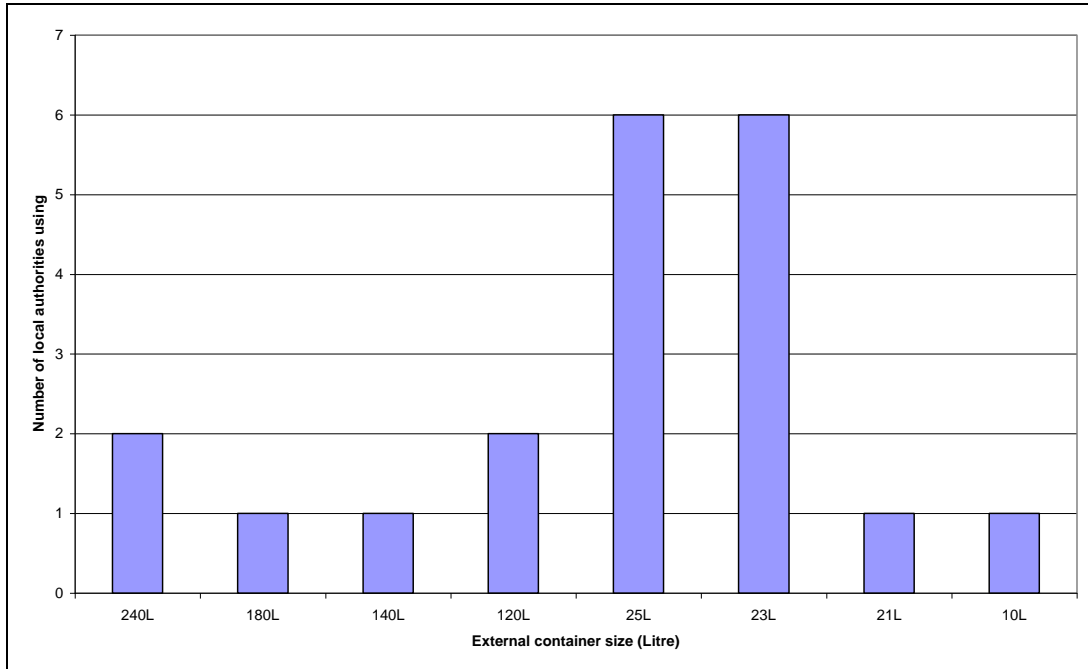


Figure 10: Graph showing external collection containers used in South West England

To encourage participation and increase capture rates, 21 authorities provide an internal container or kitchen caddy. The 7 litre kitchen caddies were found to be the most popular (Figure 11).

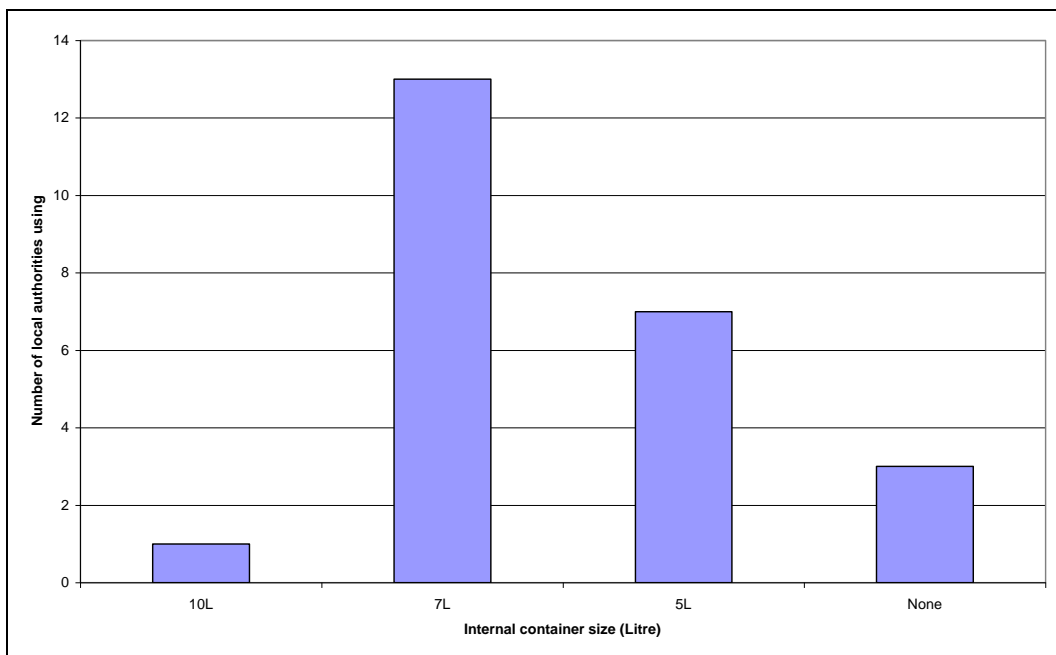


Figure 11: Graph showing internal containers used in South West England

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Kitchen caddies are available in solid or ventilated forms. The vented style provides good aeration and reduces odours; however a liner must be used. Solid caddies do not necessarily need liners and can be lined with paper (WRAP, 2009a). In the South West, 17 authorities do not provide free caddy liners. Six provided residents with an initial supply of free liners, but further supplies are charged for. One local authority provides a free supply of caddy liners each year.

Of the 12 authorities that don't provide a food waste collection, 10 offer a green waste collection. The two authorities that offer neither a food nor green waste collection use alternate weekly collections for refuse. This is likely to encourage use of the dry recycling collections. Food waste collections were used along side alternate weekly collections of refuse in 17 local authorities.

Treatment of the residual stream is likely to influence food waste collections. Of the 12 authorities that don't provide a food waste collection, five use Energy from Waste technology to treat the refuse stream. Removing food waste from the refuse stream would alter the tonnage available and waste composition for energy recovery.

When considering authorities with the top ten composting rate in the South West, five local authorities use a mixed food waste, garden waste and cardboard collection, where as four use a separate food waste collection and separate green waste collection. One authority does not offer a food waste collection, but green waste is collected from all properties using a 240l bin. When considering authorities with the top ten overall recycling and composting rate, two local authorities do not offer food waste collections, however green waste is collected at both and mechanical biological treatment (MBT) is used to treat the refuse stream of one.

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While a relatively small sample has been surveyed, the South West region demonstrates the variety of approaches taken by local authorities to deal with food waste and provides insight into the interacting factors that influence the diversion of biodegradable material from landfill and recycling rates.

5.4. Collection systems in practise

To gain a more in-depth understanding of the good food waste collection practises, a number of collection systems currently used by local authorities were considered in more detail.

Case Study 4: West Dorset District Council, Dorset - Newly introduced food waste collections

- West Dorset District Council rolled out separate food waste collections to 9,378 properties in April 2010 with WRAP funding.
- WRAP funding is conditional on a number of factors which are rationalised in Table 4

Table 4: Rationale for food waste collection configuration piloted in WRAP supported trials

Food waste collection configuration piloted in WRAP supported trials	Summary of rationale
Collection of food waste separate from garden waste	Avoids paying high treatment costs for garden waste and allows optimum mix to be achieved for processing organics through the treatment system. Since catering waste must be treated/composted under Animal By-Products Regulations requirements (i.e. in-vessel composting), processing large quantities of garden waste at higher cost treatment facilities will raise disposal costs. Separate collection of food waste means that garden waste can be collected and composted separately at a lower cost per tonne (i.e. in open windrows). Combined collections typically deliver very high proportions of garden waste which may not be the optimum feedstock for certain treatment facilities.
Weekly collections of food waste	Higher yields of food waste anticipated in comparison to fortnightly mixed food and garden waste collections, where residents tend to dispose of food waste in residual waste in weeks when garden waste is not collected. Greater participation and higher levels of householder satisfaction particularly where weekly food waste collections are provided alongside fortnightly refuse collections.
Dedicated food waste collection vehicle	This vehicle type has been successfully used for many food waste collection schemes in other parts of Europe. A key aim of the trials has been to test whether these vehicles are appropriate to UK circumstances and to understand the pros & cons of using such vehicles to collect food waste in various local authority settings.
Kerbside containers and kitchen caddies with liners	Maximise participation and householder satisfaction through making service as user friendly as possible and easy for residents to take part.
Collections from multi-occupancy properties	Pilot approaches to collecting food waste separately. Three of the WRAP trials collected food waste from multi-occupancy properties, two from the doorstep and one via a "bring" system.

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- As a result, residents were provided with 23 litre bin, plus a 7 litre kitchen caddy and one roll of liners. Additional liners can be purchased
- Schools in the collection area were also included in the scheme
- Over ten weeks, 123.75 tonnes of food waste has been collected, 1.32kg per household per week or 1.89kg per participating household per week
- They have achieved a 70% participation rate and 80% capture rate as a result of a high profile communications campaign including intro leaflets, instruction leaflets, Agrippa panels, a large number of road shows and a website DVD



Figure 12: Leaflet used as part of the communications campaign in West Dorset.

- While it is still early days, residents who have been spoken to at events are very satisfied with the new service and the local authority would like to roll the scheme out to other areas, if funding becomes available.

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Case Study 5: London Borough of Richmond upon Thames - Established collections of food waste

- As part of West London Waste Authority Project, weekly collections of uncooked food waste were first trialled in 2002/03 with 600 households.
- Residents were provided with a 240 litre bin and a 7 litre kitchen caddy (Figure 13). Caddy liners are not provided, but can be purchased locally at libraries.



Figure 13: Bin system provided by London Borough of Richmond upon Thames

- Initially non-compaction stillage vehicles were used for collection, participation rate reached 19% and 0.5kg of uncooked food waste was collected per household per week.
- In 2003, the scheme was extended to 5,000 households and added cooked food waste. The participation rate and yield increased to 33% and 0.7-0.8 kg per household per week respectively.
- The scheme was, however, limited by the collection vehicle type; therefore in 2004 modified second-hand top loader vehicles were trialled successfully.
- As a result, the scheme was extended to 65,000 households with participation reaching 45% and 1.0kg of food waste being captured per household per week.
- Since this time, participation has been maintained through ongoing communications
- The collected material is currently treated locally via anaerobic digestion

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Table 5: Recycling and composting rates from 2006-2010 for London Borough of Richmond upon Thames

	2006/07	2007/08	2008/09	2009/10
Dry Recycling Rate	23.08%	24.64%	27.95%	30.27%
Composting Rate	9.03%	11.54%	12.71%	12.15%
Total	32.11%	36.18%	40.66%	42.42%

- In 2009/10, 2,700 tonnes of food waste was collected, which contributed 3% towards the 42.42% recycling rate.

Case Study 6: East Dorset District Council - Collection of mixed food waste, green waste and cardboard

- East Dorset District Council introduced a food waste collection to 5,000 households in March 2004.
- Residents were provided with a 120 litre brown wheeled bin, plus a 7 litre kitchen caddy.
- Three rolls of biodegradable liners for the caddy, equivalent to three liners per week were also given to each household. Additional liners may be purchased through the Council.
- The collection is predominantly provided for cooked and uncooked kitchen waste and cardboard. However, residents may also include a small amount of soft garden waste in the bin.
- It was felt that the size of the bin did not actively encourage residents to use the scheme for garden waste and residents are told only to include garden waste, if they have put all of their food waste and cardboard in (so garden waste is seen as an incentive to take part in the scheme) (Figure 14).

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Figure 14: List of materials to be included in the East Dorset food waste collection

- For residents who live in flats, or who home compost there was the option of a smaller 25 litre brown bin, instead of the wheeled bin. These residents also received a kitchen caddy and liners.
- The rollout of the scheme has been supported by a comprehensive publicity programme, including an information leaflet describing the materials accepted and a 'Question and Answer' section.
- In October 2004, a further 7,000 households received the collection, with additional households being included in April 2005.
- By August 2009, 47% of households were serviced, with over 18,700 households currently receiving a collection.
- By November 2004, 1,100 tonnes of organic waste had been collected and by June 2005 2,100 tonnes.
- In 2005, waste analysis showed a 12% difference in the quantity of cardboard, food and green waste found in the residual waste between those on the brown bin scheme and

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those not. This is approximately equivalent to 1.2Kg per household per week (Endec, 2005).

- In 2006, residents receiving the food waste collection were offered a chargeable cornstarch sack collection for garden waste. Sacks cost £1.00 each (2010/11 price), which they could leave beside their brown wheeled bin. Materials collected in cornstarch sacks are composted.
- Residents may still use the old scheme of purchasing orange sacks for garden waste at a cost of £1.00 (2010/11 price). This material is collected with black refuse sacks and landfilled. Black sacks containing garden waste are not collected.

Table 6: Recycling and composting rates from 2006-2010 for East Dorset District Council

	2006/07	2007/08	2008/09	2009/10
Dry Recycling Rate	21.52%	23.44%	23.32%	22.40%
Composting Rate	10.06%	13.37%	16.01%	19.40%
Total	31.58%	36.781%	39.33%	41.80%

- Table 6 shows the improvements in composting rates resulting from the food waste and green waste collections.
- Home composting has also been continually promoted and between 2000-2009, 13,163 home compost bins were purchased by East Dorset residents through the Council's subsidized offer.

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Case Study 7: Pals Town Council, Spain - Collections including flat properties

- In June 2006, Pals Town Council introduced a separate food waste collections using 240 litre bin to all households
- Flats were also included using a communal 240 litre bin drop off system (Figure 15)



Figure 15: Photos showing 240l communal brown bin used for food waste collections and an example of the flat property collected from.

- The frequency of collections varies on the concentration of population and time of year. In summer, there are collections four to five times a week, where as in winter there are three collection a week in most areas
- All households were provided with a 5 litre kitchen caddy free of charge, however caddy liners are not given
- Letters, including instruction leaflets were sent out to all households before the bins were introduced to emphasise the importance of recycling food waste.
- The team also held a number of events at local markets where kitchen caddies for anyone were also distributed to anybody who needed one. The village/town markets are a weekly

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feature in Spain and play a significant role in community life as this is where most people get their weekly shop.

- During 2006-2009, 516.32 tonnes of food waste has been diverted from landfill.
- Each year has seen an increased tonnage of food waste collected (Table 7), although this may be slightly misleading as data from 2007 is not complete.

Table 7: Annual food waste collection tonnages from Pals Town Council, Spain

Tonnes collected	2006	2007	2008	2009
Food waste	60.68	105.32	168.49	181.83
Residual waste	2793.6	2030.5	2468.48	2428.36

- The peaks seen in June-August are also seen in the collected refuse tonnages, which may result from the many tourists that visit the area during the summer period.
- The tonnage of food waste collected is relatively low in comparison to the residual waste collected, this may be a result of the drop-off system used for flats.

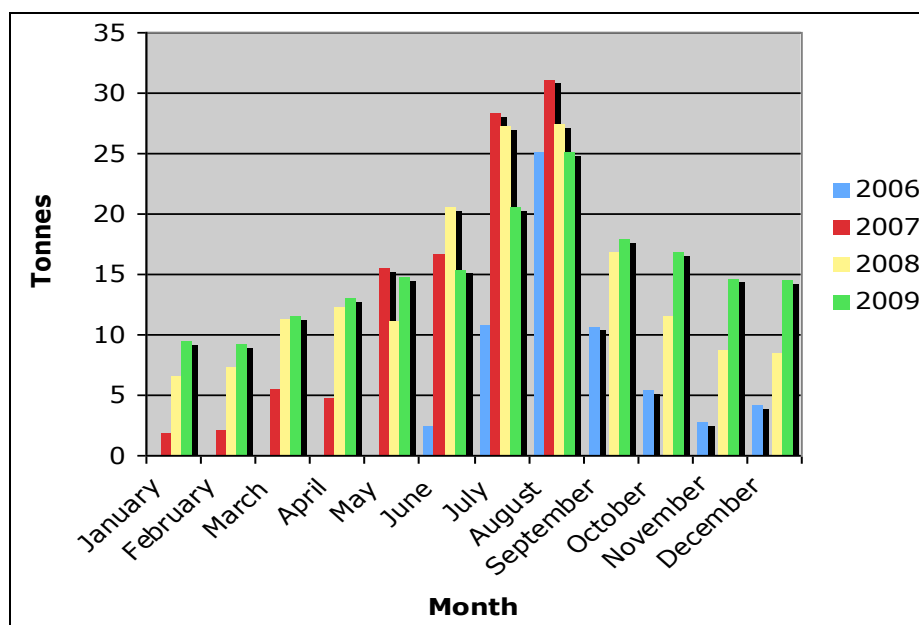


Figure 16: Graph showing food waste collected by Pals Town Council, Spain from June 2006 to December 2009

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5.5. Collection Feasibility

Section 5.1 considers a number of key drivers for the implementation of food waste collections, however there are many factors that influence how feasible and ultimately successfully a food waste collection would be in a specific local authority (Figure 17). A feasibility study or options appraisal, which are likely to form part of local authorities' waste strategy, give consideration to all collection systems used by a local authority and should provide clear indication of the best available route for dealing with food waste.

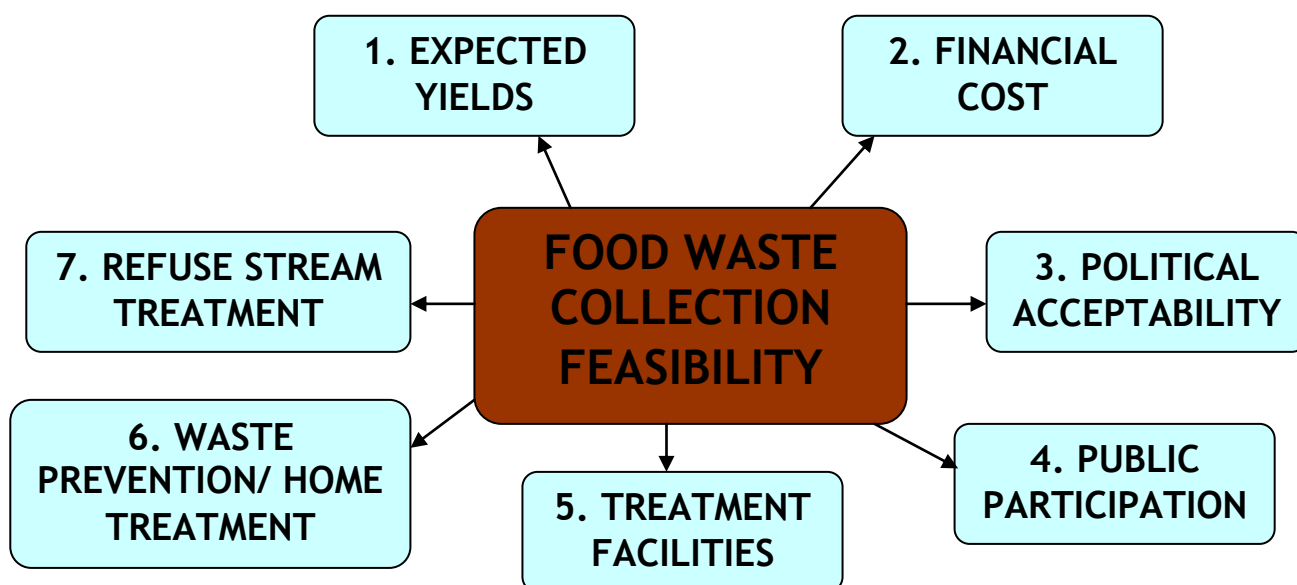


Figure 17: Factors that may influence the feasibility of a food waste collection

5.5.1. Expected yields

Will the proposed scheme capture enough biodegradable waste to reach legislative targets for diversion or improve recycling rate sufficiently?

On average, each household in the UK produced 330kg of food and drink waste per year or 6kg per week (WRAP, 2009b). In France, each household produces around 153.2kg of biowaste per year or 2.9kg per week (ADEME, 2007) Local composition data is, however essential to fully understand the potential diversion and cost benefits associated with food waste collections (WRAP, 2009c).

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Food waste yields will be influenced by:

- Operational set-up of food waste scheme i.e. frequency, container size, providing free liners (Table 3)
- Frequency and size of container for refuse collection
- Socio-demographics
- Housing stock served
- Public attitude/behaviours i.e. recycling commitment, cooking habits, home composting
- Communications campaign

In general, yields tend to be higher in more affluent areas, where refuse collections are fortnightly and when food waste collection are supported by effective communication campaigns (WRAP, 2009c).

Food waste generation varies across sectors of the community. On the basis that each household generates 5.3kg of food waste per week, households that produce less food waste than average include:

- Older people aged over 65 (3.5kg)
- Single person households (3.2kg)
- Households in social classes AB (professional) (5.0kg).

While households that produce more than average include:

- Large households (7.6kg with 5 residents, 9.6kg with 6 residents),
- Households with children (7.3kg)
- Younger households (7.4kg for 16-24s, 6.9kg for 25-34s)
- Households in social class DE (6.1-6.3kg)
- Asian households (9.1kg - 4kg attributed to non-avoidable portion)

(Brook Lyndhurst, 2009)

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While other factors are influential, household size is the key factor that governs food waste generation, as more people live, cook and eat there (WRAP, 2008). ACORN, MOSAIC or local demographic modelling can be used to identify areas which are likely to produce the most food waste.

It is expected that only a proportion of the available food waste will be captured by the collection. The capture rates (food waste presented for separate collection as a percentage of the total food waste put out at the kerbside) and participation rate (percentage of households that set out food waste for collection at least once during a three weeks cycle) will also vary depending on the communities served.

Across six food waste trials, an average capture rate of 59% was found (WRAP, 2009c). Average participation rates across 17 trial areas ranged from between 28% (for a flats collection trial) to 74%. In nine areas, participation was 70% or greater.

Table 8: Average food waste collected per household served per week in the WRAP supported trials (WRAP, 2009a)

Local authority	Average yield, kg/hh/wk	Local authority	Average yield, kg/hh/wk
Belfast	1.09	Mid Bedfordshire	1.89
Broadland	1.84	Mole Valley	1.75
Calderdale	1.28	Newcastle upon Tyne	1.14
Croydon	1.64	Newtownabbey (flats)	0.53
East Devon	1.79	Oldham	1.22
Elmbridge	1.46	Preston	1.04
Guildford	1.70	South Shropshire	2.10
Kingston-u-Thames (flats)	0.45	Sutton	1.38
Luton	1.12	Waveney	1.17
Merton	1.19	West Devon	1.48

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From Table 8, yield ranged from 0.45- 2.10kg/hh/wk for WRAP supported trials (including the 'bring' flat trials) with an average yield of 1.36kg/hh/wk. Capture and participation rates from other collection schemes in the local authority i.e. kerbside recycling, are likely to provide a more accurate basis of food waste yield calculations than national averages.

The potential yield of food waste available for collection per household will influence the operational design of a scheme, such as the number of households included, collection vehicle size and type, round size and the number of collection staff required.

5.5.2. Financial Costs

Will the proposed scheme provide cost benefits within five years?

The initial set-up of a food waste collection is financially costly. Specific cost per tonne or cost per household for food waste collections will vary greatly between different authorities depending on the chosen scheme to be implemented and current operations of the local authority. The cost of a scheme will be affected by:

- Containers provided
- Type and size of liners provided
- Number of additional staff required and local wage level
- Vehicle fleet required i.e. use current fleet with modifications, lease or purchase new vehicles
- Vehicle running costs and fuel
- Efficiencies of rounds i.e. size, set-out rates, pass rates, crew productivity
- Capture rate
- Communications campaign
- Monitoring requirements (WRAP, 2009a)

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Figure 18 demonstrates the costs that need to be factored into the first five years of the scheme, assuming a two person crew, collecting food only on a weekly basis and liners are provided free of charge.

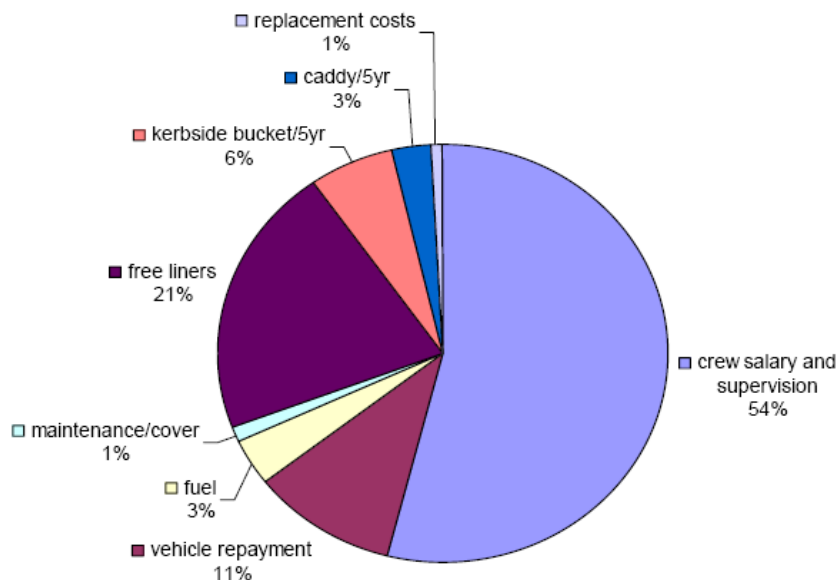


Figure 18: Breakdown of costs for a food waste collection scheme (WRAP, 2009a)

While there are costs to introducing a food waste collection, there are also significant savings that can be made as a result. Local authorities must also meet landfill diversion and recycling targets or incur substantial fines (Table 1). Food waste collections can help reach these targets and prevent fines.

As a result of a food waste collection, cost savings will also be made from other waste disposal routes operated by the authority such as the residual stream and civic amenity sites.

The cost of landfill disposal has increased drastically over the last few years. Landfill tax is currently £48 per tonne, which increases by £8 per tonne each year until at least 2014. The coalition government's Emergency Budget 2010 placed a floor under the standard rate at £80 per tonne, so that the rate will not fall below £80 per tonne from April 2014 until at least 2020 (HM Treasury, 2010). In Italy and Spain various experiments have shown that excess costs associated with the introduction of a food waste collection are more than offset by savings made by reducing the frequency of the refuse collection (ACR+, 2009). Eunomia (2008) estimates that additional

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costs of separate collections range between 0-15 Euro per tonne, but this could be offset to zero by increasing periods between refuse collections.

The ongoing operational costs of a food waste collection may be offset against landfill costs.

As a result, food waste collections may not be so favourable for local authorities where waste is not currently landfilled and therefore not affected by rising landfill costs or targets.

5.5.3. Political Acceptability

Will Councillors allow and support the scheme?

In current economic situation, a separate food waste collection is unlikely to be justified without an alternate week collection (AWC) for refuse. In the UK, AWC are becoming increasingly popular as residents are encourage to participate in the alternative collection to refuse and fewer vehicles and staff are required (ACR+, 2009) However, AWCs are often controversial as less frequent refuse collections are associated with odours, flies and sanitary problems.

If politically AWCs are not acceptable, then a separate food waste collection is also unlikely to be implemented. In these scenarios, adding food waste to current green waste collections is likely to be more feasible and financially viable than a weekly refuse and weekly food waste collection, although not if a chargeable green waste scheme operates.

5.5.4. Treatment Facilities

What are the favoured treatment technologies? Are suitable treatment facilities available locally?

The type of waste treatment technology favoured will need significant consideration; however decisions are likely to be based on cost and available facilities in the local area.

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5.5.5. Public Participation

Will the public use the scheme?

To encourage public support and active participation, a food waste collection scheme should:

- Be easy to use
- Provide suitable containers
- Be flexible to meet the needs of all residents
- Provide residents with clear instructions of how to use the scheme
- Provide consistent and reliable collections

Effective communication to residents on the benefits of food waste recovery is essential to maximise participation, maximise material capture and minimise contamination (WRAP, 2009a). Public consultation before the scheme is introduced and ongoing monitoring once implemented will encourage public ownership of the scheme and identify potential problems before participation decreases.

5.5.6. Refuse Stream Treatment

Are landfill diversions already being met by alternative treatment of the refuse stream i.e. EfW, MBT, AD?

In the UK, food waste in the household waste stream is likely to be disposed of via the refuse bin. The refuse bin has historically been landfilled, however other disposal methods such as Mechanical Biological Treatment (MBT), Energy from Waste (EfW) or Anaerobic Digestion (AD) are now utilised by some local authorities.

Globally, over 130 million tonnes of waste are incinerated every year (ISWA, 2009). France incinerate 33% of municipal waste (Veolia, 2009), as a result legislative targets to divert the

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biodegradable waste from landfill can be met without incurring the costs of a food waste collection. However, the efficiency of incineration is lowered by the moist biowaste; therefore the calorific value of the residual stream is enhanced by its removal (Commission of the European Communities, 2008).

Mechanical Biological Treatment (MBT) also diverts biodegradable waste from landfill and can reduce the overall waste stream by up to 80% (New Earth Solutions, 2010). Legislative targets may be met as the biodegradable fraction is composted; however the quality of the end product is significantly lower and has limited uses due to contamination, in comparison to compost made from separate food waste collections.

5.5.7. Impact on Waste Prevention and Home Treatment

Will a food waste collection discourage waste prevention and home treatment?

Waste prevention and home treatment should be considered the favoured option by local authorities as they prevent biowaste entering the waste stream in the first place. 690,000 tonnes of food and drink waste are disposed of via home composting each year (WRAP, 2009b).

Residents may choose to use a collection service over their current home composting systems, adding extra weight to the household waste stream and additional cost for waste collection and treatment.

However, 63% of residents using a food waste collected stated that the collection had made no difference to their home composting activity, 24% reported they home composted less, while 5% composted more at home than they had prior to the collection (WRAP, 2009a). It was found that residents still recycled uncooked vegetables and fruit peelings, tea and coffee grounds via home composting and used the collection for other type of food waste.

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6. Conclusions

Many local authorities in England are moving towards food waste collections, but it is still important to have a balance. A change in consumer behaviour and emphasis on the householder's responsibility regarding their waste is important in changing attitudes to food waste, which in turn should have knock on effects on other types of waste and encourage waste prevention. According to 'The food we waste' report (WRAP, 2008): food waste prevention also appears to be an area of waste prevention where there is little public resistance, at least in principle, with 9 in 10 people not opposed to the idea of reducing their food waste.

Waste prevention is a key tool for the management of food waste, particularly in conjunction with other methods such as a collection service which is favoured by all the top performing councils in England. However it should be noted that education and home composting can only reduce a fraction of the food waste produced and products such as the food digesters are unlikely to be suitable for everyone as the trials of Green Cone in Sussex and Charnwood demonstrated. There are not many examples of innovative ideas in the UK or France to reduce waste with most councils following the LFHW examples and promoting compost bins.

For many local authorities, implementing a food waste collection provides a realistic solution for meeting legislative targets for diverting biodegradable waste from landfill and increasing recycling and composting rates. The preferred food waste collection system will vary between local authorities depending on the current operational set-up, required biowaste yields, financial budgets, proximity of treatment facilities, political acceptability and public support.

In general, separate food waste collections are favoured over collections including mixed biowaste or cardboard. Higher yields of food waste are expected as residents using a single stream food waste collection are more likely to separate out their food waste compared to households offered

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a mixed food and garden waste collection (Friends of the Earth, 2007). Separate food waste collection and treatment are becoming increasingly more cost effective than mixed collection and treatment (Eunomia, 2008). The cost of a separate food waste collection can be successfully offset by levying a charge on the green waste collection or by implementing an alternate week collection for refuse. Furthermore separate food waste collections provide a higher quality end product that can draw higher value and be utilised in a greater variety of end markets.

Higher participation and yields are found using door-to-door collection (WRAP, 2009a), however bring system do allow the inclusion of flats and other properties with high population density, which would otherwise be excluded from the scheme.

There is a wide variety of containers available for the collection of food and green waste. The chosen container is likely to be influenced by the materials collected i.e. larger containers (140-240L) will be used if green waste or cardboard are included in the collection, where as 23-25L containers are favoured for food waste only collections. Providing caddy liners may increase costs, but they make the scheme more publicly acceptable, cleaner for collection crews and slightly higher yields may result (WRAP, 2009c)

Food waste collections are unlikely to be favoured in local authorities where the refuse stream is subjected to an alternative treatment to landfill, except alongside the introduction of an alternate week collection for refuse.

As with the introduction of any new recycling collection, comprehensive instruction on how to use the scheme and clear communications of the reasons why it is important, are essential to maximise participation.

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7. References

ACR+. '*Municipal Waste in Europe - Towards a European Recycling Society*'. Victoires Editions. 2009. ISBN:978-2-35113-049-0. Print

ADEME. '*Composition of Household Waste in France*' 2007. accessed online <http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=17571#tit1>

Ask Jennie. *Waste Consultancy Database* 2010 <http://www.askjennie.com/> website

Association of cities and regions for recycling and sustainable resource management, 13/9/10, accessed online www.acrplus.org

Barton. S, '*Retailers halve waste to landfill since 2005*' 17/9/10, Waste Management News, www.Letsrecycle.com website

Bench, M., Woodard, R. and N. stantzos, WERG, '*Minimisation of food waste through home digestion*' – results of trials in West Sussex, 2003, accessed 14/7/10

Bouyer. M and Kay. K, '*Green Cone Food Digester Trial Evaluation Report*' January 2008
Charnwood Borough Council

BrookLyndhurst '*Enhancing Participation in Kitchen Waste Collections*'. Defra Waste & Resources Evidence Programme (WR0209) Final Project Report. 2009. accessed online http://randd.defra.gov.uk/Document.aspx?Document=WR0209_8618_FRP.pdf

Carey. C, W. Phelan, C Boland, EPA 2008 '*Examining the use of food waste disposers*', 2008, EPA RPS STRIVE programme 2007-13

Commission of the European Communities. '*Green Paper On the management of bio-waste in the European Union*'. 2008 Accessed online <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0811:FIN:EN:PDF>

Davey. A, Clist. S, Godley. A, '*Home composting diversion: household level analysis*', 2009, WRAP

An investigation into food waste management.

Defra, '*Landfill Bans and Restrictions*', 2010 accessed online

<http://www.defra.gov.uk/environment/waste/strategy/factsheets/landfillban.htm>

Entec UK Limited. '*Dorset County Council Organic Options Final Report*' August 2005

Eunomia '*Food Waste Collection: Update to WRAP Biowaste Cost Benefit Study*' 2008 accessed online http://www.wrap.org.uk/downloads/Update_to_Biowaste_CBA_Report.2276618c.6164.pdf

Fareshare UK, web, accessed 21/7/10, <<http://www.fareshare.org.uk/about-us.php>>

Friends of the Earth '*Briefing Food waste collections*'. 2007. accessed online

http://www.foe.co.uk/resource/briefings/food_waste.pdf

FSA, '*Consumer attitudes to food safety 2005*', 2006, Food Standards Agency

Great British Waste Menu, BBC 1, <<http://www.bbc.co.uk/programmes/b00tkr88>>, on air 25/8/10, Television

Hogg. D, Barth. J, Schleiss. K, and E Favoino, '*Dealing with food waste in the UK*', 2007, WRAP pp.14-17, online accessed 12/7/10

HM Treasury '*Budget 2010*' 2010. accessed online <http://www.official-documents.gov.uk/document/hc1011/hc00/0061/0061.pdf>

IEP and NCC, '*Composting figures*', 2010, Norfolk Waste Partnership data spreadsheet

INTERREG IVB NEW Programme – *Investing in opportunities*, 162 E GreenCook Transnation Strategy for Global Sustainable Food Management (started 2008), <www.nweurope.eu>, accessed 14/7/10

ISWA '*Waste and Climate Change ISWA White Paper Summary*' 2009. accessed online.

www.iswa.org

Knipe, A.D, '*The management of household food waste – summary 'should composting begin at home?'*', Local Authority Waste and Recycling, March 2006

An investigation into food waste management.

LCS final campaign report Norfolk Waste partnership, 2010, NWP, final version 19/3/10

Lore Marien '*Prevention and management of household waste in Flanders*', 2009, OVAM, accessed 7/10/10, online, <www.foe.co.uk/resource>

New Earth Solutions, '*Mass Flow Modelling of MBT for Bournemouth*' 2010.

Parfitt, J. Dr, '*Subsidising composting bins could save £600,000*', Resource Futures 2010 letsrecycle article, online accessed 21/7/10

Parfitt, J. Barthel, M. & Macnaughton, S. '*Food waste within food supply chains: quantification and potential for change to 2050*'. 2009. Phil. Trans. R. Soc. B2010 365, 3065-3081 (doi:10.1098/rstb.2010.0126)

Resource Futures, '*Bournemouth Borough Council Waste Composition Analysis Phase 2 and Comparative*'. 2009 RF Project no.510

The Waste Strategy, 2007, DEFRA, accessed 21/7/10, online

Veolia, '*World Waste Survey: From waste to resource*' 2009 accessed online

<http://www.resourcesnotwaste.org/module/rrfreports/display/rrfreportdisplay.aspx?report=29>

Waste Dataflow. '*Reports on BVPI 82a Percentage of Household Waste Arisings Sent For Recycling and BVPI 82b Percentage of Household Waste Arisings Sent For Composting or Anerobic Digestion*' 2010 <http://www.wastedataflow.org/>

Waste and Energy Research Group, '*Follow up report of trial in West Sussex*', 2006

WRAP, '*Waste not, Want not*' 2002, accessed online

<http://www.defra.gov.uk/evidence/statistics/environment/waste/kf/wrkf18.htm>

WRAP, '*Understanding Food Waste*', March 2007(b), pp.14

WRAP, '*Understanding Food Waste*', March 2007(a), pp.9

Waste in Action 2010

An investigation into food waste management.

WRAP, '*The food we waste*'. 2008, accessed online <http://wrap.s3.amazonaws.com/the-food-we-waste.pdf>

WRAP, '*Evaluation of the WRAP Separate Food Waste Collection Trials*' 2009(a). accessed online http://www.wrap.org.uk/downloads/food_waste_collection_guidance_-_amended_Mar_2010.efd517f1.7749.pdf

WRAP, '*Household Food and Drink Waste in the UK - Final Report*', 2009(b) accessed online [http://www.wrap.org.uk/downloads/Household food and drink waste in the UK -_report.3dfca77c.8048.pdf](http://www.wrap.org.uk/downloads/Household_food_and_drink_waste_in_the_UK_-_report.3dfca77c.8048.pdf)

WRAP, '*Food Waste Collection Guidance*' 2009(c), accessed online http://www.wrap.org.uk/downloads/food_waste_collection_guidance_-_amended_Mar_2010.451b7293.7749.pdf

WRAP, '*Introducing Food Waste Collections for Lewes District Council: Updated Options Appraisal*.' 2009(d) LGS288-1. June 2009

WRAP, '*Waste and Resources Action Programme introduction*', 2010 accessed online 12/7/10, available at www.wrap.org

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Appendix 1: Collection systems used by local authorities in South West England (ranked by composting rate 2009/10) (Ask Jennie, 2010, Waste Dataflow, 2010)

Councils	Authority Type	Number of Households	Recycling Rate 09/10	Composting Rate 209/10	Is FW collected separately?	No of households served	Frequency	Size of external container	Size of internal container	Free caddy liners provided	Treatment method	Is GW collected separately?	No of households served	Frequency	Size of Container	Chargeable	Refuse Treatment	Refuse Frequency
Teignbridge District Council	WCA	57,392	56.23	35.46	Yes + GW/Card	57,392	Fort-nightly	240L	10L	No	IVC						EfW plant	AWC
Cotswold District Council	WCA	39,212	60.4	34.61	Yes	39,212	Weekly	10L		No	IVC	Yes	18,500	Weekly	240L	Yes	Landfill	AWC
Mid Devon District Council	WCA	33,697	46.97	30.11	Yes + GW/Card	26,958	Fort-nightly	140L/240L	5L	No	IVC						EfW plant	AWC
South Hams District Council	WCA	42,402	57.22	29.96	Yes + GW/Card	34,770	Fort-nightly	180L	7L	No	IVC						EfW plant	AWC
Forest of Dean District Council	WCA	35,893	39.76	24.79	No							Yes	35,893	Fort-nightly	240L	Yes	Landfill	AWC
Torridge District Council	WCA	30,033	41.32	22.56	Yes + GW/Card	18,020	Fort-nightly	240L	7L	No	IVC						EfW plant	Weekly
Taunton Deane District Council	WCA	48,298	45.46	21.93	Yes	48,298	Weekly	25L	5L	No	IVC	Yes	48,298	Fort-nightly	180L	Yes	Landfill	AWC
North Devon District Council	WCA	43,476	41.8	21.56	Yes + GW/Card	33,000	Fort-nightly	240L or 23L	7L	No	AD						EfW plant	AWC
West Devon Borough Council	WCA	24,186	43.92	20.3	Yes	8,000	Weekly	21L	7L	Initial supply, then pay	IVC	Yes	13,000	Fort-nightly	Reusable sacks	No	EfW plant	AWC
South Gloucestershire Council	WCA	108,951	40.63	19.75	Yes	108,951	Weekly	25L	5L	No	IVC	Yes	97,200	Fort-nightly	240L	No	Landfill	AWC
East Dorset District Council	WCA	38,749	41.85	19.4	Yes + GW/Card	18,212	Weekly	140L	7L	Yes, 3 liners pw	IVC						Landfill	Weekly

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Councils	Authority Type	Number of Households	Recycling Rate 09/10	Composting Rate 209/10	Is FW collected separately?	No of households served	Frequency	Size of external container	Size of internal container	Free caddy liners provided	Treatment method	Is GW collected separately?	No of households served	Frequency	Size of Container	Chargeable	Refuse Treatment	Refuse Frequency
Bournemouth Borough Council	UA	84,704	50	18.18	No							Yes	25,000	Fort-nightly	140L	No	MBT/IVC	Weekly
Wiltshire Council	UA	201,249	41.42	17.17	No							Yes	72,274	Varied as newly formed UA			EfW plant/ MBT	AWC
South Somerset District Council	WCA	71,697	41.86	16.9	Yes	71,697	Weekly	25L	7L	No	IVC	Yes	8,790	Fort-nightly	180L	Yes	Landfill	Weekly
North Somerset District Council	UA	90,860	37.25	16.76	Yes	39,635	Weekly	23L	5L	No	AD	Yes	69,000	Fort-nightly	120L sack	No	Landfill	AWC
Gloucester City Council	WCA	53,081	32.08	16.49	Yes	10,000	Weekly	23L	7L	No	IVC	Yes	44,000	Fort-nightly	240L	No	Landfill	AWC
Mendip District Council	WCA	47,786	40.11	16.47	Yes	47,786	Weekly	25L	7L	No	IVC	Yes	47,738	Fort-nightly	240L	Yes	AWC	AWC
Borough of Poole Council	UA	66,028	40.87	16.36	No							Yes	22,000	Fort-nightly	240L	No	EfW plant	Weekly
Bath and North East Somerset Council	UA	76,015	42.47	15.73	Yes	76,015	Weekly	23L	5L	Initial supply, then pay	IVC	Yes	14,000	Fort-nightly	240L	Yes	Landfill	Weekly
Weymouth & Portland Borough Council	WCA	30,425	43.02	15.17	Yes + GW/Card	29,480	Weekly	120L bin or 25L caddy		No	IVC	Yes	29,480	Weekly	Paper sacks	Yes	Landfill	AWC
Swindon Borough Council	UA	89,631	47.54	14.81	No							Yes	89,631	Fort-nightly	Sacks	Yes	Landfill/ EfW plant planned	AWC
Bristol City Council	UA	187,010	37.03	14.78	Yes	162,000	Weekly	25L	5L	No	IVC	Yes	11,300	Weekly	240L	Yes	Landfill	AWC

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Councils	Authority Type	Number of Households	Recycling Rate 09/10	Composting Rate 209/10	Is FW collected separately?	No of households served	Frequency	Size of external container	Size of internal container	Free caddy liners provided	Treatment method	Is GW collected separately?	No of households served	Frequency	Size of Container	Chargeable	Refuse Treatment	Refuse Frequency
Tewkesbury Borough Council	WCA	36,429	31.51	13.6	Yes	36,065	Weekly	23L	7L	Initial supply, then pay	IVC	Yes	11,700	Fort-nightly	240L	Yes	Landfill	AWC
Cheltenham Borough Council	WCA	52,945	32.85	13.18	No							Yes	42,000	Fort-nightly	Reusable sacks	No	Landfill	AWC
Christchurch Borough Council	WCA	22,928	34.34	12.32	Yes + GW/Card	630	Weekly	120L	7L	No	IVC	Yes	22,928	Fort-nightly	Sacks	Yes	Landfill	Weekly
Cornwall Council	UA	251,597	36.83	11.74	No							Yes	160,337	Varied as newly formed UA			Landfill	Weekly
Sedgemoor District Council	WCA	49,825	26.83	9.6	Yes	49,825	Weekly	23L	5L	No	IVC	Yes	10,300	Fort-nightly	180L	Yes	Landfill	AWC
Torbay Council	UA	64,371	35.7	9.54	Yes	64,371	Weekly	120L	7L	Initial supply, then pay	AD	Yes	3,220	Per request	Sacks	Yes	EfW plant	AWC
Plymouth City Council	UA	114,116	31.25	9.35	No							Yes	87,000	Fort-nightly	Reusable sacks	No	EfW plant	Weekly
East Devon District Council	WCA	63,300	34.17	9.18	Yes	30,000	Weekly	25L	7L	Initial supply, then pay	AD	No					EfW plant	AWC
North Dorset District Council	WCA	30,107	32.6	8.6	Yes + Card	6,150	Weekly	140L bin or 25L caddy		No	IVC	No					Landfill	Weekly
Exeter City Council	WCA	50,929	36.18	7.45	No							Yes	47,447	Fortnightly	240L or sacks	Yes	EfW plant	AWC
West Somerset District Council	WCA	17,285	27.2	5.34	No							Yes	17,285	Fortnightly	240L	Yes	Landfill	Weekly

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Councils	Authority Type	Number of Households	Recycling Rate 09/10	Composting Rate 209/10	Is FW collected separately?	No of households served	Frequency	Size of external container	Size of internal container	Free caddy liners provided	Treatment method	Is GW collected separately?	No of households served	Frequency	Size of Container	Chargeable	Refuse Treatment	Refuse Frequency
Purbeck District Council	WCA	21,817	32.91	3.24	No							No					Landfill	AWC
West Dorset District Council	WCA	48,134	32.72	2.99	Yes	9,378	Weekly	23L	7L	Initial supply, then pay	IVC	No					Landfill	Weekly
Stroud District Council	WCA	49,597	25.77	0.09	No							No					Landfill	AWC