



Vision 2020: UK roadmap
to zero food waste to landfill

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It is a great privilege to share with you our 'Vision 2020: UK roadmap to zero food waste to landfill'. In February 2011, we launched our manifesto entitled 'Vision 2020: The future of the food waste recycling sector', which set out our ambition to eradicate food waste from landfill by the end of the decade. Inspired by the debate generated by that first report, we brought together key industry stakeholders as the Vision 2020 Visionary Panel, chaired by former Secretary of State for the Environment Lord Deben, to help shape a viable roadmap to turn this exciting vision into reality. This report is the culmination of that work.

We would like to thank the following organisations for the insight and information they provided to the panel:

- **The Chartered Institute of Waste Management (CIWM)**
- **Food Chain and Biomass Renewables Association (Fabra)**
- **The Institute of Hospitality (IoH)**
- **The Local Authority Recycling Advisory Committee (LARAC)**
- **London Thames Gateway Development Partnership**
- **Unilever**
- **The Waste and Resources Action Programme (WRAP)**

We are also extremely grateful to the many other reports and organisations that we have drawn on for supporting material, many of whom are referenced in this report. We also want to show our appreciation to BioRegional, an entrepreneurial charity that promotes sustainable businesses through its One Planet Living philosophy, for its help in finalising the report and shaping the practical and achievable recommendations to ensure we treat food waste as a valuable resource in the future.

TO DATE, OVER 100 ORGANISATIONS, FROM UNIVERSITIES TO MICHELIN-STARRED RESTAURANTS, HAVE SIGNED UP TO THE VISION 2020 AMBITION. TO FIND OUT HOW TO JOIN THEM, VISIT WWW.VISION2020.INFO



Foreword

Philip Simpson

ReFood

Welcome to our Vision 2020 report which sets out a UK roadmap for achieving zero food waste to landfill by 2020. Consulting far and wide on the issue of food waste, we have been impressed by how much the diverse organisations, and indeed many businesses, share our passion for dealing more effectively with this critical issue.

Our message is clear; food waste is a valuable resource that should never end up in landfill sites. Everyone from the food producer, through to the retailer, the restaurant and the householder can play their part in ensuring that we take full advantage of its considerable potential, by ensuring we re-use, recycle and recover every nutrient and kilowatt of energy it has to offer.

By separating and dealing with food waste effectively, we can unlock all of its value while also removing it as a contaminant to other waste streams. This will ensure high-quality, commercially-viable, recyclable materials across the board, helping to return billions of pounds to the UK economy.

We believe this document sets out a clear and realistic framework for positive change to happen by 2020. We look forward to playing our part and hope that you too will be inspired to join the Vision 2020 campaign.

Thank you.



Foreword

Sue Riddlestone OBE

BioRegional

BioRegional is delighted to lend its support to Vision 2020, and warmly welcomes the proposals set out in this report.

Nearly 20 years ago, I established BioRegional together with Pooran Desai, to develop solutions that would allow us to meet more of our needs from local, renewable resources. We want people to live a high quality of life within a fair share of the earth's resources. We call this One Planet Living. Not only do we now have many more of the tools that we need to reduce our impacts and achieve One Planet Living, we also have an even better understanding of the issues.

Achieving zero food waste to landfill within the next seven years is a big challenge and we will need the support and actions of individuals, businesses small and large and by Government if this vision is to be realised.

However, the case for change is compelling. We will save billions of pounds. We will prevent millions of tonnes of greenhouse gases from entering our atmosphere. Crucially, we will ensure that food is treated as a precious resource.

This report provides a platform for change, by identifying where food waste arises, sharing success stories and making firm recommendations about how further improvements can be made. It paints a picture of a world in which food is never 'waste'.

I very much look forward to working with you to eradicate food waste from landfill.



Executive summary

In the UK, we throw away some 14.8m tonnes of food every year throughout the supply chain. This report acknowledges food waste as both an issue and a valuable resource. It aims to act as a roadmap to encourage behavioural change at all levels, within both business and society, and to set the framework for a food waste-free future.

The recommendations presented in our report are underpinned by a strong environmental and economic case for reducing food waste, with the potential to deliver the following annual benefits:

- **Save over £17bn by reducing food wasted by households, businesses and the public sector.**
- **Prevent 27m tonnes of greenhouse gas (GHG) from entering the atmosphere.**
- **Return over 1.3m tonnes of valuable nutrients to the soil.**
- **Generate over 1Twh electricity, enough to power over 600,000 homes.¹**

The challenges of dealing with food waste are complex but this should not hold back change. With clear direction, we can create opportunities that will drive the positive environmental, economic and social outcomes, for the greater good.

The report highlights:

- **Where and why food waste is happening at each stage of the UK supply chain.**
- **What actions are being taken to tackle food waste in each sector.**
- **What more can be done in the future.**

We would like to see Government and industry take a more consistent and holistic approach to waste in the UK – one that maximises its potential as a resource. As the biggest contaminant in the waste stream, food waste consigns millions of tonnes and billions of pounds of valuable resources to landfill or incineration each year. Consequently, this document underlines the central role that removing food from our waste will play in delivering cost efficiencies and better environmental outcomes. In order to achieve zero food waste to landfill, the report's principal recommendations are:

- **A clear timetable for the phased introduction of a ban on food waste to landfill to come into full force by 2020, allowing industry the time to finance and develop the optimum collection and processing infrastructure.**
- **Mandatory separate collections of food waste from homes and businesses, with an outcome that optimises its value to provide energy, nutrients for agriculture and preferably heat.**
- **Greater collaboration at every stage of the supply chain and between key stakeholders to accelerate the adoption of best practice, improve waste prevention, create efficiencies and maximise the value of food waste as a resource.**
- **The integration of food waste education into school, college and professional training programmes and increased support for WRAP's 'Love Food Hate Waste' initiative.**

Failure to take a cohesive approach to food waste is likely to lead to fragmented action. This, in turn, could result in solutions that will consign valuable resources to incineration, potentially cause environmental damage and represent a lost opportunity to develop a more integrated infrastructure in the UK to reprocess and recycle all waste.

FOOD WASTE IS A VALUABLE RESOURCE THAT SHOULD NEVER END UP IN LANDFILL SITES

¹ See appendix – food waste facts

Section 1

The issue of food waste





Food waste – Setting the UK and global scene



50%

OF ALL FOOD PRODUCED ON
THE PLANET NEVER REACHES ITS
INTENDED HUMAN STOMACH

Food waste is a global concern. The United Nations, the EU and, closer to home, WRAP are among many organisations across the public, charitable and private sectors that have prioritised its reduction over the coming years.

At a global level, it is widely acknowledged that we are entering a period of resource scarcity – where the cost of available resources is increasing and demand from an expanding global middle class, combined with population growth and climatic changes, are putting massive pressure on food, water, mineral and energy resources.²

Despite these rising global pressures on food production, it is estimated that 50% of all food produced on the planet never reaches its intended human stomach.³ As a result some 550bn cubic metres of water are wasted globally in growing crops that never reach the consumer.⁴ These statistics highlight that when we waste food, we also waste all of the land, nutrient, water and energy resources that went into producing it.

An increase in demand, combined with pressure on food production, led to price spikes in 2008 and 2011.⁵ Rising food bills have forced more and more people into food poverty, not just overseas but also in the UK. Indeed, the food bank charity The Trussell Trust reports that the number of people turning to it for emergency food in the UK increased by 170% to almost 350,000 people in 2012/2013.⁶ On a social level, it is increasingly difficult to reconcile food waste with increasing food poverty.

Recently, the UK's International Development Committee pointed out that we are never more than a few days from a significant food shortage, yet it is a resource we all too often take for granted.⁷ In the UK, we produce approximately 14.8m tonnes of food waste every year, which accounts for over 20m tonnes of GHG emissions

and 6.2bn litres of water.⁸ Around 40% of this food waste ends up in landfill⁹ where it produces harmful methane that has a global warming potential (GWP) 21 times greater than carbon dioxide.

The UK is now at a crossroads and it is more important than ever before that we address the issue of food waste correctly. As the population continues to increase and more pressure is placed on global food production, we have not just a moral obligation but also an absolute need to address the issue. This applies both to reducing food waste and to better utilising it where it is unavoidably produced.

AS THE POPULATION CONTINUES TO INCREASE AND MORE PRESSURE IS PLACED ON GLOBAL FOOD PRODUCTION, WE HAVE NOT JUST A MORAL OBLIGATION BUT AN ABSOLUTE NEED TO ADDRESS THE ISSUE OF FOOD WASTE

The UK now...

When Vision 2020 was first launched in early 2011, there was an absence of available statistics on food waste in the UK. WRAP's 2008 report entitled 'The Food We Waste' estimated that 6.7m tonnes of food waste were generated by households every year, but elsewhere it was largely guesswork.



14.8m
TONNES OF FOOD
WASTE PRODUCED
PER YEAR IN THE UK



40%
OF FOOD
WASTE ENDS UP
IN LANDFILL



30%
OF UK VEGETABLE
CROPS ARE
NOT HARVESTED



LANDFILL PRODUCES
HARMFUL METHANE WITH
GLOBAL WARMING POTENTIAL
**21 TIMES
GREATER
THAN CO₂**

...and in 2020

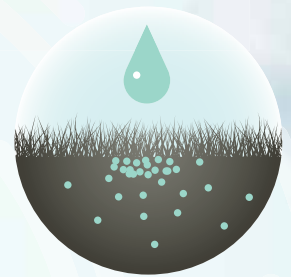
Thanks to a body of research principally funded by WRAP since then, the picture is clearer and the size of the benefits more easily determined. This is what the UK could look like in 2020 if we achieve zero food waste to landfill.



OVER
1.1TWh
OF ENERGY
PRODUCED



GREENHOUSE GAS
EMISSIONS
REDUCED BY
27m
TONNES



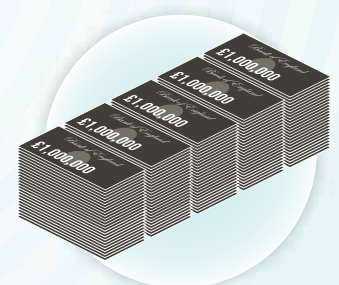
OVER
1.3m
TONNES OF
VALUABLE NUTRIENTS
RETURNED TO THE SOIL
PER ANNUM



£3.7bn
POTENTIAL
SAVINGS IN THE
PUBLIC
SECTOR



£12bn
SAVED
BY HOUSEHOLDERS



£2bn
SAVED
BY UK PLC
(RETAILERS,
MANUFACTURERS
and CATERERS)



A significant change in the waste industry over the past few years has been the shift in mindset from waste to resource. Central to this shift is the waste hierarchy and landfill tax, which push waste materials higher up the value chain by increasing the cost of landfill and placing a greater importance on the principles of reduce, re-use, recycle and recover.

The recycling of paper, plastics, glass and metals is now, for many, second nature. However, this enthusiasm for recycling has not extended to food waste and it is estimated that almost 6m tonnes of food end up in landfill each year.¹⁰ This is a considerable waste of resources, when one considers the number of opportunities available to capture food waste and put it to better use.

Another concept that supports treating food waste as a resource is the circular economy. The circular economy is an approach advocated by the Ellen MacArthur Foundation and supported by major companies such as Nike, Kingfisher Group, Unilever and Marks & Spencer.

Instead of our current linear economy, one where people design products, draw on resources to make them, use the products and then discard them, the circular economy takes the resources in those unwanted products and puts them into manufacturing new things. The change goes right up the supply chain so that products are designed to be dismantled easily, enabling components to be re-used or recycled.

Making the transition from **food waste to food resource**



Current food resource and waste flows



Implementing measures that would adopt a circular economic approach would cut out 'disposal' and retain the resource value of food in a classic closed loop.

The food waste hierarchy



REDUCE

Avoid generating food waste



FEED PEOPLE IN NEED

Donate extra food to food banks, soup kitchens and shelters



FEED LIVESTOCK

Surplus food unsuitable for human consumption supplied as animal feed



ANAEROBIC DIGESTION

Unavoidable food waste converted to produce bio-fertiliser and energy



COMPOST

Unavoidable food waste converted to produce compost



LANDFILL/ INCINERATION

Last resort to disposal



LAST RESORT

LAST RESORT



Food waste needs to fit within this more sustainable way of thinking. The food waste hierarchy is one such model, which is supported by a number of organisations, notably WRAP, The London Food Board and Feeding the 5000. Like the waste hierarchy it favours solutions with more desirable environmental and economic outcomes. It draws an important distinction between surplus food, which can be used to feed humans or animals, and food waste that can be further processed to return nutrients to the soil, extract energy and generate heat.

When it comes to surplus food fit for human consumption, many food producers and supermarkets are already working with food redistribution initiatives such as food banks, managed by the Trussell Trust, FareShare and other charities to ensure it reaches those in need.

Surplus food used to feed animals is already governed by strict regulations. In addition, safety and security standards in the supply chain ensure that animal by-products (ABPs) destined for pet food meet the exacting standards required for animal consumption.

Where unavoidable food waste occurs, Defra puts anaerobic digestion (AD) as the most desirable disposal option.¹¹

This is because it is an efficient way to turn potential GHG into energy and heat and also produces high-quality organic digestate that can be used to fertilise agricultural land. Composting, too, can ensure the nutrient value of food waste is captured.

There is a variety of routes for food waste, depending on whether it is surplus or unavoidable in nature and these are discussed in section 3 – Generating value from food waste (see page 50). Some of these routes have been in existence for well over 100 years. Yet it is clear from the volume of food waste that ends up in landfill or incinerators that much of the resource value in it has, for too long, been lost.

Increasing the amount of food waste that is recovered and recycled is fundamental to achieving zero waste to landfill.

IT IS CLEAR FROM THE VOLUME OF FOOD WASTE THAT ENDS UP IN LANDFILL OR INCINERATORS THAT MUCH OF THE RESOURCE VALUE IN IT HAS, FOR TOO LONG, BEEN LOST

Section 2

Food supply chain industry sectors



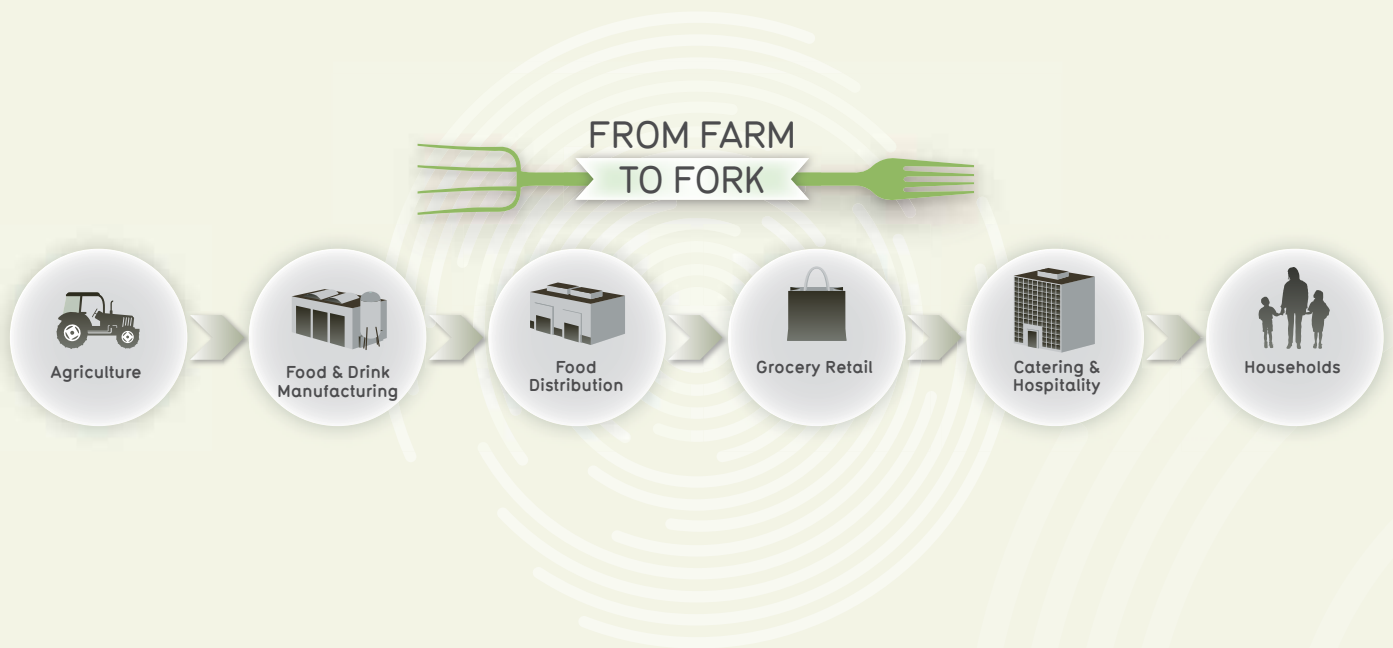


Understanding food waste in the supply chain

Fundamental to the ambition of driving food waste away from landfill is an understanding of where and why food waste is generated. The reality is that food waste occurs at every stage of the food supply chain, from farm to fork and beyond. The reasons for food waste are numerous and often sector-specific but wherever it happens it carries a cost. Tackling it doesn't just make environmental sense; it makes sound commercial sense as well.

Here, we look at each of the sectors in the food supply chain to provide an introduction to where and why food waste is generated. We highlight the positive action that is already being taken to overcome it and make recommendations on how each part of the process can be improved.

We provide case studies and practical recommendations that are designed to put organisations large and small, as well as individuals, firmly on the road to achieving zero food waste to landfill.







Agriculture

There are more than 9m hectares of agricultural land in the UK, of which 4.9m hectares are arable and the remainder livestock.¹² Employing more than 300,000 people, the agriculture industry produces 59% of the UK's food needs, with the remaining 41% imported, meaning the cost, quality and availability of our food is influenced by many factors, from both Europe and further afield.¹³

How food waste is dealt with in the agricultural sector largely depends on whether it is generated by livestock or by arable farming.

Livestock

Livestock farming waste principally falls into two categories: manures/slurries and ABPs. Both wastes are unavoidable and already have well-established outlets. Most slurries are returned to land but can contribute significantly to methane generation through their storage. A report in Sweden revealed that stored manures were responsible for 14% of overall GHG emissions from Swedish agriculture.¹⁴

Currently, ABPs are banned from landfill throughout the EU under the Animal By-Products Regulations (ABPR) and their processing is therefore handled by a long-standing and efficient market. These industries turn ABPs into a variety of useful products such as edible fats, hides for leather, pet food ingredients, biodiesel and biofuels.

Arable

It is reported that as much as 30% of UK vegetable crops are not harvested, due to them failing to meet exacting standards based on their physical appearance.¹⁵ Poor forecasting and

planning in the food supply chain also leads to surplus crops being grown. What happens to this crop waste is less clear but some falls into the surplus food category and will be used in the manufacture of foodstuffs such as pies and soups, or used for animal feed. If no outlet can be found, it is usually ploughed back into the land. Anecdotally, it is believed that very little would be disposed to landfill in the UK due to the high cost of transport and landfill tax.

Barriers in agriculture

While AD has been shown to be an effective means of treating slurries, capturing biogas and generating heat, capital cost is often a barrier. Furthermore, according to the Renewable Energy Association,¹⁶ (REA) new planning guidance for renewable energy¹⁷ could make it more difficult to develop waste treatment sites in the green belt for organics recycling and AD.

Moving crop waste further up the food waste hierarchy can also be challenging, especially for perishables such as fruit and vegetables. It is often necessary to dry produce to make it suitable for modern animal feed supply chains, which can make this more costly than ploughing the material



AS MUCH AS

30%

OF ALL UK VEGETABLE CROPS ARE NOT HARVESTED, DUE TO THEM FAILING TO MEET EXACTING STANDARDS BASED ON THEIR PHYSICAL APPEARANCE



back into the land to return nutrients to the soil. There are also logistical challenges to moving crop waste, as fruits and vegetables are traditionally grown in central, eastern and southern regions of the UK, while livestock is reared in the north and west. This means that transporting one to feed the other adds cost and time.

Food manufacturers or livestock farmers also require certainty of supply and price and so relying on agricultural food surpluses can be too 'hit and miss', while livestock farmers require certain nutrients and fats in their feed which may not be met consistently enough by farm-generated surplus food.

Is anything changing?

The Institute for Grocery Distribution (IGD), WRAP and others have identified closer collaboration up and down the supply chain as fundamental to driving up efficiencies and minimising waste. The appointment of a Grocery Code Adjudicator in June 2013 opens the way for better dialogue between suppliers and supermarkets and, if embraced, should be seen as an important step forward in facilitating improved planning and forecasting.

Dialogue is also proving to be a vital tool in the activities of organisations, such as Feeding the 5000, which is raising awareness of surplus food and, through its initiative Gleaning Network UK, empowering communities to work with local farmers and food

redistribution charities to recover unwanted crops from fields for human consumption.

Trade organisations are also running initiatives that support moving agricultural waste further up the hierarchy. On the crop side of the industry, the Potato Council, in its own 'war on waste', is addressing issues throughout the process from planning and improved growing mediums, through to crop processing and storage. Other sectors may follow its lead.

With regards to livestock, the Foodchain & Biomass Renewables Association (FABRA) has introduced online training modules to educate abattoir staff on the relevant legislation and ways to maximise the value from products by minimising the downgrading of ABPs. Such a training initiative is one that could be replicated across the wider food industry.

Finally, in terms of closing the loop, Steyr Traktoren, a German tractor manufacturer, is introducing a biogas engine in 2015 that will allow farmers to power their tractor using bio-methane generated by on-site AD-processed slurries. In spring 2014, WRAP and Defra are due to report on trials to demonstrate the benefits of using digestate from AD in agriculture.

Case study. In May 2012, severe frosts wreaked havoc on crops in southern England, causing cosmetic damage to Cox, Braeburn, Gala, Jazz and red dessert apples. The apples had blemished skin but still tasted great. Waitrose stocked bags of this so-called 'ugly fruit' in its stores during the autumn, giving customers the chance to buy apples that cost less but still tasted as good as unblemished fruit and support British orchards.

Waitrose



Recommendations. While it is believed a small proportion of the food waste generated at farm level ends up in landfill, there are still opportunities to ensure that the resource value of all foods is maximised, especially arable, fruit and vegetable crops. There are a number of recommended actions to support both a reduction in waste and the take-up of recycling and recovery options, such as AD:

- Defra to broker an industry-wide commitment between farmers, retailers and Government to avoid food waste caused by aesthetic requirements. The biggest change needs to come from consumers and the food processing and hospitality industries by encouraging them to buy misshapen or blemished fruits and vegetables to ensure they are not wasted.
- Further collaboration between the National Farmers' Union (NFU) and the AD sector to ensure that the quality of digestate from the AD process, together with its efficient delivery, guarantees nutrients and organic fraction are returned to the soil.
- Further support for and development of small-scale, on-farm AD facilities for processing animal manures/slurries and other farm residues with focus on maximising nutrient, energy and heat potential with all installations. This should include a collaborative review involving WRAP, Defra, the NFU and the Anaerobic Digestion and Biogas Association (ADBA), to develop a clear business case for farmers and investors for projects of varying scale and feedstock levels that builds on best practice guidance being developed by the Environment Agency (EA), ADBA and Defra.¹⁸
- Defra, WRAP and the NFU to undertake more detailed research into food waste in the agricultural sector and the opportunities to find viable and suitable outlets for surplus crops to avoid them going to waste, while providing improved financial security for farmers. The internet and social media platforms such as those being explored by Plan Zheroes and Gleaning Network UK may be an effective way of marrying surplus food with viable outlets quickly.

Food and drink manufacturing

The food industry is the largest manufacturing sector in the UK, with a turnover of £76.7bn (16% of all UK manufacturing) and employing 395,000 people.¹⁹ There are around 10,000 food and drink manufacturing sites in the UK²⁰ producing in the region of 3.2m tonnes of food waste.²¹

Factors identified by the Institute of Grocery Distribution (IGD) as contributing to the generation of food waste in production include under or overweight products; trimmings, such as crusts or tomato ends; technical errors; contamination of machinery; inconsistency within processes used, such as cooking times and temperature and market-imposed waste, exacerbated by take-back systems and last-minute order cancellations.²²

As a polarised sector, more is known about the small number of large manufacturers. For these companies, who are typically producing food waste in bulk, the business case for diverting food waste is clear, as landfill represents the most expensive disposal option.

Barriers in manufacturing

For the large number of small manufacturers producing significantly less individual volumes of food waste, there are issues surrounding separate collection. The perceived cost and frequency of collection, as well as misconceptions surrounding smell and vermin can all be seen as potential barriers.

Some food manufacturers also make use of industrial macerator systems, which discharge to the sewer. This can be thought of by those users as a low-cost solution but are unpopular in the water industry and many are lobbying for a ban on macerators because of their impact on sewer systems.²³

Contamination by packaging is also, for some, a barrier to moving food waste up the hierarchy. WRAP's

organics report identified that only 27% of AD facilities in the UK at the time of the survey had de-packaging systems.²⁴ Although that position is likely to have changed significantly, it is an indication that the availability of facilities capable of handling packaged food waste is not likely to be in line with the available AD plant capacity.

A reluctance to change food production systems or operations to reduce or improve the outcomes for food waste can also be a barrier to it being moved up the hierarchy. Operational change often requires investment and behavioural change. Real or perceived difficulty related to measuring the return on investment and concerns in altering staff behaviour can often dissuade organisations from taking those important first steps.

Is anything changing?

Despite the level of waste, the food manufacturing sector has made enormous strides in diverting material from landfill. Recognising the commercial benefits, large food manufacturers are increasingly considering zero food waste to landfill policies.

In 2007, the Food & Drink Federation (FDF), which represents food and drink manufacturers, announced its Five-Fold Environmental Ambition, one of which was to send zero food and packaging waste to landfill by 2015. Another was to reduce product and packaging waste in the supply chain by 5% by the end of 2012, against a 2009 baseline.

LARGE FOOD MANUFACTURERS
ARE INCREASINGLY
CONSIDERING ZERO FOOD
WASTE TO LANDFILL POLICIES



WRAP's Courtauld Commitment is a voluntary agreement aimed at reducing the carbon and wider environmental impacts of the sector.²⁵ It sets specific targets for the reduction and diversion from landfill of food waste throughout the supply chain. WRAP's last update on the Courtauld Commitment in 2012 showed that of the 2.3m tonnes of waste generated by those signed up in the supply chain, including manufacturers, 80% was recovered or recycled, 10% was sent for disposal to landfill and 10% was discharged to sewer. Now in its third phase, which runs from 2013 to 2015, there are new targets for the manufacturing and retail sectors to further reduce grocery ingredient, product and packaging waste in the supply chain by 3% before 2015, against the 2012 baseline.

In its efforts to encourage waste reduction, the Institute of Grocery Distribution (IGD) has identified five key business principles that can be applied to drive down waste: measurement, engagement, forecasting, packaging design and efficient product range. It has produced a collaborative toolkit which demonstrates how producers and retailers can work closely to identify waste hotspots, establish why they are happening and develop

solutions to resolve the issue. To help businesses to apply best practice, it has developed more than 50 case studies which show the toolkit in action. These demonstrate how companies such as Booker, Brakes, Kellogg's and Kraft have reduced food waste successfully on lines such as sandwiches, cakes, snacks and ready meals, delivering considerable cost savings.²⁶

To help put surplus food to better use a new food redistribution working group, chaired by WRAP, was launched in the UK in early January 2013. Among attendees, the FDF reports 17 of its members are now working more closely with organisations such as FareShare in order to redistribute surplus food to people in need.²⁷

Another initiative that is exploring options for surplus foods is The Pig Idea.²⁸ Launched by Tristram Stuart, founder of Feeding the 5000, the campaign has raised awareness of the potential for certain food waste streams, if properly regulated, to be used in pig feed. This supports the idea that materials such as clean bread, dough, cereals and confectionery are suitable for animal feed.



Case study. Ferndale Foods in Erith, Kent produces innovative, high-quality ready meals for supermarkets, manufacturing some 15,000 tonnes of finished products from 200 product lines. In 2010, a drive to increase its recycling operations, reduce its environmental impact and lower costs, identified food waste as a key component in achieving these objectives.

Kieron Foody, sustainability manager for parent company Oscar Mayer, said: “Food waste collection has led to better visibility and understanding of all our waste streams. We’ve now maximised zero food waste to landfill and this has enabled further recycling opportunities, which has reduced our waste costs by 16% year on year.”

In 2012, Ferndale Foods generated more than 400MWh of renewable energy by diverting its food through PDM Group’s biomass combustion process, producing nutrient-rich fertiliser from the ash and displacing more than 250 tonnes of GHG. As a group, Oscar Mayer has seen similar benefits by sending food waste to AD across its other UK sites.

The FDF website has further case studies describing manufacturers who have successfully achieved diversion of waste from landfill.²⁹



Recommendations. The positive actions outlined above demonstrate that a lot has been achieved in diverting material from landfill in the food manufacturing sector. There are plenty of best practice case studies and guidance to inspire even more innovation in the future. This is great news; however, there are still steps that can be taken to create more value from food waste:

- Food manufacturing businesses of all sizes to adopt the food waste hierarchy and develop action plans to review systems and processes in order to separate food waste.
- Businesses to include food waste and consideration of the food waste hierarchy in all waste contract specifications.
- Better coordination between manufacturers, distributors and retailers with optimal storage, handling and forecasting to avoid food waste being shifted across the supply chain, as demonstrated by the IGD waste prevention toolkit.³⁰
- Further collaboration between the various groups delivering positive change within the sector to coordinate efforts, share experiences and data. This scope should be widened to gain valuable insight from other countries in Europe and globally.
- Government to introduce a phased ban on food waste to landfill from 2017 for business, based on turnover and/or volume of waste generated (e.g. above 50kg of food waste per week), to give companies time to look for and adopt alternative disposal options. This should be supported by mandatory separate collection of food waste with an outcome that optimises its value for energy, nutrients for agriculture and preferably heat. The second phase is to ensure all food waste from households and businesses is diverted from landfill by 2020. This will allow industry to develop the appropriate infrastructure to optimise the resource value of food waste.

Food distribution

Food distribution is so closely aligned to all elements of the food supply chain that it is difficult to obtain figures that separate it from the food sector as a whole. Consequently, while overall food waste in the supply chain is estimated at around £5bn per annum, the majority of this is assigned to either manufacturers or retailers.³¹ WRAP's best estimate to date is that 4,000 tonnes of food waste per year is generated in distribution.³² However, this figure is scaled up from data provided by a single supermarket so it is difficult to determine how representative this is. Despite the lack of clarity, there is undoubtedly food waste happening in the vital distribution links.



Typical of the problems reported in logistics are issues with poor or damaged packaging, faulty or inaccurate temperature control settings and environmental factors such as damp or contamination.

When these types of incidents occur, food waste can arrive for disposal in large quantities – literally by the lorry load. The fact that it is not reported does not mean that it does not exist, nor that it does not represent a significant financial burden.

Barriers in distribution

Often incidents of damage or loss of food in the supply chain are 'one-offs' caused by unforeseen circumstances, human error or lack of planning. Such situations mean that they are frequently written off as natural shrinkage, with no real attempt to measure their impact or address them proactively.

IGD research identified that there was an element of not wanting to "open up a can of worms" with colleagues or trade partners, as well as fears over damage to reputation, which means that many in the industry are not reporting waste incidents.³³

Also, assigning responsibility and ownership for waste between the producer and the end destination can be problematic. This is because

the supply chain has multiple stakeholders within an organisation and may also include a number of external logistics partners.

Rising fuel prices have driven suppliers to consider lightweight packaging to reduce vehicle weights but this, in turn, can result in foodstuffs becoming more vulnerable to damage or contamination.³⁴

Is anything changing?

WRAP's Courtauld Commitment is prompting change up and down the supply chain, with more rigorous attempts to identify and eliminate waste not only being driven by commercial realities but also by the requirement for year-on-year waste reductions. It has established a number of tools and case studies that can be applied to all elements of the supply chain, with transparency of reporting and measurement acting as the catalyst for positive action.

Similarly, the IGD waste prevention toolkit and case studies provide a valuable insight into how and where best practice is happening and how to apply it to all elements of the supply chain. The focus is on greater collaboration between partners and suppliers to understand the risks and opportunities for change.



4,000

TONNES OF FOOD WASTE
PER YEAR IS GENERATED
IN DISTRIBUTION

Case study. Reynolds is a family-run business that supplies fresh food and chilled products to around 3,000 restaurant groups, contract caterers and high-end hoteliers and restaurateurs. The company reviews operations continuously throughout the supply chain to improve resource efficiency.

Technical director Ian Booth explains that there is a range of factors at play:

“Are we getting the best possible life out of the product? Have we worked with our suppliers to see if that life can be extended? How can we better understand temperature control within the supply chain and analyse how we can get the longest potential shelf life?”

As a food distributor, Booth explained that Reynolds had to prioritise food safety and quality, but added that food wastage was linked closely to them both. One of the biggest challenges was adapting to seasonal changes when

products from the domestic market are replaced by products from overseas.

“There can be differences in temperature, sunlight and distribution time and they all affect the quality of the produce. Obviously, quality affects the product and that can impact upon how much our customer gets and potentially how much waste that customer has.”

Booth went on to say that the company reduced food waste by working with its customers to forecast menu changes. This, he said, enabled the business to adapt the type and volume of food that it supplied to its customers. Reynolds has cut waste through product development, such as its line of prepared vegetables for customers. In this way it can ensure that misshapen vegetables are fully exploited in stews and soups.


Reynolds®
fresh ideas for foodservice

“One of the biggest and most important challenges facing the food supply chain is convincing organisations and consumers to recycle food waste rather than send it to landfill. Efficient processing of food waste can reduce emissions, capture energy and recycle essential yet finite nutrients. When food waste is sent to landfill, not only does it release methane but the nutrient value is not captured. The food waste management industry is tackling the issue of food waste across the food chain, going to great lengths to preserve its inherent value.”

FABRA – STEVE WOODGATE, CHIEF EXECUTIVE



Recommendations. The distribution element of the food supply chain is one that is often overlooked, as seen by the lack of data about this sector. However, there is a real opportunity to drive positive change:

- Closer collaboration between suppliers, customers and the logistics providers to measure and better understand where waste is happening and look for opportunities to minimise it. Utilise the best practice examples that WRAP and IGD have developed to drive down waste.
- Businesses to include food waste and consideration of the food waste hierarchy in all waste contract specifications.
- A review of the opportunities to optimise the shelf life of food produce, by sharing best practice and looking at optimal storage and transit methods and tools.
- A review of packaging and storage containers to ensure they offer the most protection for food in transit. Encourage businesses to strike the right balance between achieving vehicle weight reductions through lightweight packaging and guaranteeing that products reach their destination intact and fit for purpose.
- Government to introduce a phased ban on food waste to landfill from 2017 for business, based on turnover and/or volume of waste generated (e.g. above 50kg of food waste per week), to give companies time to look for and adopt alternative disposal options. This should be supported by mandatory separate collection of food waste with an outcome that optimises its value for energy, nutrients for agriculture and preferably heat. The second phase is to ensure all food waste from households and businesses is diverted from landfill by 2020. This will allow industry to develop the appropriate infrastructure to optimise the resource value of food waste.

Grocery retail

According to the IGD, the UK grocery market was worth £169.7bn in 2013 and employed more than 1m people in more than 100,000 stores.³⁵ The industry is dominated by a small number of large household names such as Tesco, Sainsbury's, Asda, Morrisons, Waitrose, Aldi and Lidl and is estimated to produce 300,000 tonnes of food waste per year; 200,000 tonnes of this is believed to be avoidable. The potential saving to retailers of addressing surplus and avoidable food waste is more than £360m, and the equivalent of 800,000 tonnes of GHG.³⁶

Food waste within the sector is generated in many ways. These range from cultural issues surrounding acceptability of 'imperfect' foods to over-ordering, damaged stock, fridge and freezer breakdowns and products going out of date. Furthermore, the retail sector has come under scrutiny for creating waste at either end of the supply chain – through excessive demands on suppliers and by encouraging consumers to buy, and therefore waste more, by marketing multi-buy deals.

Barriers in retail

Consumer demand, product choice, competitive price-driven marketing, short-termism in planning and forecasting food supplies; these can all contribute to driving up food waste. However, consumers also play a role and are often blamed for demanding 'perfect' fruit and vegetables.

For some, changing consumer and staff behaviours can be seen as a risk in light of the intense competition between retailers, making this a

potential barrier to the implementation of new waste strategies.

Smaller convenience format retailers, including supermarket-based chains, symbol groups and independents, face particular challenges when it comes to dealing with food waste. For example, there are limitations to back-haul solutions. The principle of back-haul is that vehicles making a delivery to stores also take waste away for recycling. However, this is not possible from smaller stores as one vehicle tends to service multiple drop points and there is risk associated with mixing fresh produce and food waste on the same vehicle. Additionally, smaller shops have less frequent deliveries and less space to store waste.

For these smaller units, separate food waste collections from store may be thought of as expensive in comparison to general waste, while the opportunity to provide surplus produce for charities is more challenging due to the smaller quantities involved.

³⁵ IGD: www.igd.com/our-expertise/Retail/retail-outlook/3371/UK-Grocery-Retailing/

³⁶ Waste arising in the supply of food and drink to households in the UK, WRAP 2010

TESCO, FOR INSTANCE, NOW SEPARATES SURPLUS BREAD FOR ANIMAL FEED AND CERTAIN MEAT PRODUCTS FOR PET FOOD INGREDIENT MANUFACTURE



Is anything changing?

Since the start of 2013, a number of initiatives have been announced by the major retailers to demonstrate their commitment to reducing food waste.

In May 2013, Tesco launched a major campaign against food waste, with a series of initiatives as part of its Tesco and Society programme aimed at promoting a new image for supermarkets and creating social change. Philip Clarke, CEO of Tesco, announced that food would come in smaller packages, food promotions would be tailored to stop encouraging people to buy large amounts of food with a short shelf life and its Clubcards would be used to report to customers the relative healthiness of their purchase and how to limit food waste.

Tesco is not alone. Asda scrapped buy one, get one free promotions of core products in 2009. In June 2013 it announced that it was to start sending surplus chilled foods to food banks in an agreement with FareShare that would see ingredients supplied for a further 3.6m meals a year.

In addition, significant progress has been made in the retail sector since the launch of the Courtauld Commitment, with 80% of waste produced by signatories now being recovered or recycled.³⁷ Phase three of the Courtauld Commitment could realise up to £1.6bn of savings, a cumulative reduction of 1.1m tonnes of waste, GHG reductions of 2.9m tonnes and a 20% decrease in household food waste.³⁸

As part of their commitment to reducing waste, Tesco, Sainsbury's and Asda have refined the use of their delivery fleet to back-haul recyclable materials to central depots. From here, food surplus and food waste can be separated and sent for re-use, recovery or recycling.

Tesco, for instance, now separates surplus bread for animal feed and certain meat products for pet food ingredient manufacture, while Sainsbury's has been donating safe and nutritious food to FareShare for 18 years. Additionally, all supermarket groups recycle their ABP material in line with legislation, so that it is either rendered or processed through technology solutions such as AD or energy from waste (EfW).

Recommendations. Larger retailers are extremely influential in establishing best practice for both preventing food waste throughout the supply chain and in securing the best possible outcomes in terms of disposal options. By setting themselves zero food waste to landfill goals, they are identifying solutions that can influence smaller retailers and the opportunities they have for tackling food waste. To take things to the next stage, there are a number of simple and straightforward actions that have the potential to make a real difference:

- Defra to broker an industry-wide commitment between farmers, retailers and government to avoid food waste caused by aesthetic requirements. The biggest change needs to come from consumers and the food processing and hospitality industries by encouraging them to buy misshapen or blemished fruits and vegetables to ensure they are not wasted.
- Businesses to include food waste and consideration of the food waste hierarchy in all waste contract specifications.
- The development of a marketing charter that ensures food waste is dealt with through preferable marketing strategies, such as discounting excess stock and food near its expiry date, rather than 'buy one, get one free' offers, which encourage consumers to buy more than they need. This could be facilitated by the FDF or similar body.
- Guidance to be offered by retailers on storage and freezing, ensuring that date marks and instructions on food packaging are clear and consistent.
- The extension and increase in food waste education programmes such as 'Love Food Hate Waste', with a significant increase in the level of investment from £2m to multiples of this amount through additional private sector support. Currently £1 spent by the campaign saves £150 worth of food from landfill.
- Government to introduce a phased ban on food waste to landfill from 2017 for business, based on turnover and/or volume of waste generated (e.g. above 50kg of food waste per week), to give companies time to look for and adopt alternative disposal options. This should be supported by mandatory separate collection of food waste with an outcome that optimises its value for energy, nutrients for agriculture and preferably heat. The second phase is to ensure all food waste from households and businesses is diverted from landfill by 2020. This will allow industry to develop the appropriate infrastructure to optimise the resource value of food waste.



Case study. In 2012, three months ahead of schedule, Waitrose achieved its aim of sending zero food waste to landfill in the UK. Through its 'Treading Lightly' environmental strategy, it conducted a thorough review of its operations and supply chain, which enabled it to identify all the factors contributing to food waste so that these could be addressed individually.

As a result, it implemented a series of solutions, including donating surplus food for redistribution through food banks, for animal charities and zoos and any remaining food waste was sent to AD. Indeed, Waitrose was one of the first organisations to identify AD as the preferred solution for its unavoidable food waste.

Waitrose Recycling & Waste Manager, Arthur Sayer, said: "We work to reduce the amount of waste we produce as it's not in our business interest to produce any waste at all. Inevitably though, some food waste does occur and AD has proven to be a sustainable way of eliminating the need to send it to landfill, reducing our impact on the environment and creating renewable energy along the way."

Waitrose



THE POTENTIAL SAVING
TO RETAILERS OF
ADDRESSING FOOD
WASTE IS MORE THAN

£360m





Catering and hospitality sector

There are almost 260,000 catering and hospitality outlets in the UK, ranging from cafes and restaurants to hotels and pubs. These are known in the industry as the 'profit sector'. A second 'cost sector' includes organisations where catering is supplied but for whom it is not their primary function, such as hospitals, prisons, schools and offices. Figures from 2011 show that the sale of food and drink in the hospitality sector totalled £42.8bn, with an estimated 8 million meals served.³⁹

According to WRAP, the profit sector of the hospitality industry produces an estimated 600,000 tonnes of food waste per year. Of this, 400,000 tonnes could have been eaten if it had been better planned, portioned, managed, stored or prepared.⁴⁰ The Sustainable Restaurant Association (SRA) conducted its own survey into the reasons for most restaurant wastage and concluded that 65% was preparation waste, including peelings, offcuts, egg shells, etc., 30% was from plate scraping and 5% resulted from spoilage, typically due to poor storage or inventory management.⁴¹

Within the cost sector the numbers are even more significant. It is estimated that 3.4m tonnes of food waste is produced, 2m tonnes of which is avoidable. It is thought that 30m hospital meals are left uneaten every year; while primary and secondary schools combined generate in excess of 80,000 tonnes of food waste per year.⁴² For both the cost and profit sector, forecasting footfall, limited options for re-using unserved food, inflexible portion sizes and a desire not to run out of food can all lead to waste.

WRAP's findings within the hospitality sector also concluded that food waste recycling within the industry was "rare" and that "the management of waste for disposal was very traditional, with most companies relying on four-wheeled bins to contain mixed waste for disposal".

Barriers

The WRAP report of 2011 highlights that the sector is dominated by a large number of small and medium-sized enterprises (SMEs). Indeed, some 73% of sites employ less than 10 people, while only 3% employ 50 or more. This implies that waste is generated in relatively small volumes in a large number of places and as such, sites are typically serviced by easy-to-use frequent collections in four-wheeled general waste bins. It is the general waste bin itself that is one of the key barriers to the uptake of food waste recycling within the UK hospitality sector.

The general waste collection model highlighted in WRAP's report operates nationally and typically with a one-price-fits-all approach, irrespective of weight. In some areas that is changing, but in others, it maintains a collection mechanism that favours landfill or incineration and therefore delivers less desirable environmental outcomes. The adjacent infographic demonstrates how food waste can be collected for significantly less than the cost of landfill tax through this regime. The landfill tax alone stands at £72 per tonne, while gate fees into AD plants are reported at a current mean of £41 per tonne.⁴³ Paying per bin rather than by weight means as long as this general waste model prevails, the landfill tax will fail to divert food waste from landfill.

General waste collection model



ONE-PRICE-FITS-ALL

Assuming £10 per 1100 litre bin collection charge



How the model currently operates:

- One bin, one price regardless of how much you put in.
- The heavier the bin, the cheaper the cost per tonne.
- The lighter the bin, the higher the cost per tonne.
- Overall the collection round makes money because there is a mix of light and heavy bins.

Why it is part of the problem:

- Landfill tax was introduced to encourage recycling by making disposal to landfill more expensive than recycling.

- If heavy mixed waste bins can be collected for less than the cost of landfill tax the economic benefit of recycling is lost.
- Food waste is heavy, so there is no driver to recycle food waste once it is in a mixed waste bin.
- In a mixed waste bin it is difficult to determine how much food waste is produced.
- If it is difficult to measure food waste, it is difficult to reduce it.
- Reducing food waste saves the most money and is better for the environment.

As a result the consumer inadvertently becomes locked into a waste service that has the least desirable economic and environmental outcomes.

Given the number of catering and hospitality locations, it is not surprising that collection mechanisms remain a key barrier to separate collection. Space can be an issue for hotels, restaurants and pubs, especially in urban areas. Collection frequency and time, as well as concerns about odour and vermin, are all issues that organisations report. Some of these are real, many are perceived, but all contribute to prevent change. However, we must not lose sight of the fact that food waste is currently already collected, albeit in a general waste bin, so while separate collection of catering food waste is undoubtedly challenging, it is not insurmountable.

Separate collection of food waste has a number of potential benefits. Firstly, it provides the hospitality business with an opportunity to measure and reduce the amount of waste it generates. In turn, this approach will deliver cost savings and environmental benefits. Finally, it removes the biggest contaminant from the waste stream and therefore increases the availability and value of the remaining recyclables.

Culture and behavioural change in a catering and hospitality environment can be extremely challenging, particularly as a result of staff turnover and language barriers.

Also, concerns about hygiene associated with food waste in the kitchen environment, weight constraints related to moving food waste and packaging contamination in the bins, all need to be addressed.

Is anything changing?

Across the sector there is a lot of positive change happening. For example, in 2012, WRAP launched the Voluntary Agreement to the Hospitality and Food Service Sector, which runs from 2012 to 2015. It aims to see a reduction of 5% in food and associated packaging waste and a 70% increase in the amount of unavoidable food waste sent to AD by the end of the scheme.

In addition to this initiative, the Hospitality Carbon Reduction Forum, a group of leading organisations

including the likes of JD Wetherspoons, Whitbread, Mitchells & Butler, Nando's and Hammerson has recently instigated a review that will explore the potential for the member companies' food waste to be collected separately by collaborating on procurement of their collection services. It is an idea that has already been implemented on a small scale by like-minded organisations in Bristol. Poco, 2013 Sustainable Restaurant of the Year, worked with similar restaurants in its local area to pool waste procurement collectively and negotiate better rates. At the heart of the scheme was a separate collection of food waste and lower rates for the group's other recyclables. As a result, 90% of its waste is now recycled or re-used and led Poco's restaurant owner Tom Hunt to say "managing food waste helps profit margins".

Unilever Food Solutions has developed a toolkit to help businesses of all sizes reduce their waste and a smartphone app called 'Wise up on Waste' to advise restaurants how to manage their food better.⁴⁴ Recommendations include regularly checking returned plates to determine if portion sizes are correct, accurate measuring of ingredients, use of a 'specials' board to manage ingredients effectively, accurate ordering and creative use of leftovers, surplus food items and offcuts.

Unilever Food Solutions has reported numerous successes. Among these, Kings Valley Hotel in Ireland has saved 7% on its purchase of food, while Frimley Hall Hotel identified that garnishes were largely uneaten and saved £100 per month by removing them from plates altogether. This money-saving message is underlined by a compelling video by Monaghan County Council called Food Waste = Money Waste.⁴⁵

Increasingly, software systems to manage restaurant inventories and guide recipe choices are becoming available. In Finland, such solutions have been widely used by schools for many years and software developer Jamix reports significant waste reductions, as well as more nutritious menus, as a result.

⁴⁴ www.unileverfoodsolutions.co.uk/our-services/your-kitchen/wise-waste-app

⁴⁵ www.youtube.com/watch?v=VGTPKKOVoz4 ⁴⁶ www.planzheroes.org

⁴⁷ Agra Europe June 2013: Dr Zoe Davies, General Manager of NPA comment

In October 2011, the Sustainable Restaurant Association (SRA) launched the 'Too Good to Waste' initiative to highlight the food waste issue and encourage the use of 'doggy boxes' which prompt customers to take home uneaten food. Leading sustainable Mexican food chain Wahaca has reported a 20% reduction in plate scraping waste as a result.

Food redistribution to people in need is supported by hospitality sector retailers such as Paul, which works with social enterprise Plan Zheroes, to make use of the internet and social media platforms to marry surplus food producers with charities in local areas.⁴⁶

Initiatives to use catering waste to feed animals are also gaining momentum. For example, the 'Pig Idea' is a recently launched campaign to highlight the potential benefits of feeding catering waste to pigs. This is a practice that was widespread in the UK and the rest of Europe until 2001, when an outbreak of foot and mouth disease, linked to feeding catering waste to pigs, led to an epidemic that devastated the livestock farming industry, impacted tourism significantly and cost the UK economy an estimated £6bn. As a consequence, its practice was banned throughout Europe and many other countries.

The National Pig Association website has much on this debate and its view is that: "Feeding pigs properly-treated and rigorously-tested foods, such as unsold bread and vegetables can deliver significant environmental benefits but there is always a risk of regulatory breakdown, as happened in the 2001 national foot-and-mouth outbreak, when infected swill was fed to pigs on a Northumberland unit. We appreciate that the Pig Idea campaigners have the best of intentions and have been at pains to explain all the legal issues but we remain concerned that promoting the image of pigs eating waste food is unhelpful."⁴⁷

**FEEDING PIGS
PROPERLY-TREATED AND
RIGOROUSLY-TESTED
FOODS, SUCH AS UNSOLD
BREAD AND VEGETABLES
CAN DELIVER SIGNIFICANT
ENVIRONMENTAL
BENEFITS**



Case study

Profit sector. The Savoy Hotel in London is an iconic location. It was also one of the first five star hotels in London to separate and recycle its food waste. When the venue reopened in 2010, it had a goal of being one of London's most sustainable hotels. As part of the initiative, it set ambitious targets for its waste and central to this ambition was food waste. By separating its unavoidable food waste it has achieved a recycling rate of over 90%, reduced its overall waste costs by £200 per week and, in 2012, this material contributed towards the generation of 216MWh of electricity – enough to light 35% of its guest rooms for 8 hours per day – and saved more than 200 tonnes of GHG.

The hotel was recently awarded a Green Tourism Gold Certificate, the 2013 SRA Award for 'Best Food Waste Strategy' and 2013 Considerate Hotelier Green Team of the Year.

Debra Patterson, Environmental Manager at The Savoy, said: "The Savoy has always been a hotel of firsts – from electric lifts, to generating its own electricity. Finding a sustainable solution for our waste was important and that extended to our food waste. We were delighted to adopt a programme that allowed us not only to reduce the amount of waste going to landfill, but to make a significant improvement to The Savoy's overall carbon footprint by displacing fossil fuels."

SAVOY

Cost sector. Facilities management and contract caterer Sodexo piloted a programme with three hospitals in Manchester, Romford and Roehampton to implement a number of initiatives, including the segregation of food waste. It was challenging, but ultimately very successful, as the hospitals improved recycling rates significantly.

David Ferriter, PFI & LIFT Contract Manager, NHS SW London, commented: "It is phenomenal to think that Queen Mary's in Roehampton went from a 40% recycling rate, which we always thought was good, to a 92% recycling rate in a very short space of time. This initiative has helped the hospital improve significantly its 'green credentials', as well as achieving its environmental targets and also demonstrates our compliance with the waste hierarchy. In addition, at a time of annually-escalating landfill tax charges, the initiative has helped the Trust in stabilising its waste costs."



Recommendations

- Develop solutions to ensure separation of food waste does not lead to issues of hygiene in the supply of food or health and safety concerns for staff.
 - National waste bodies to conduct a review of current catering and hospitality waste contracts to assess the environmental impact of paying per bin rather than by weight.
 - Ensure that learning how to address food waste according to the food waste hierarchy becomes an integral part of chef training and educational initiatives such as Food for Life in schools and the Campaign for Better Hospital Food.
 - Businesses to include food waste and consideration of the food waste hierarchy in all waste contract specifications.
 - Government to introduce a phased ban on food waste to landfill from 2017 for business, based on turnover and/or volume of waste generated (e.g. above 50kg of food waste per week), to give companies time to look for and adopt alternative disposal options. This should be supported by mandatory separate collection of food waste with an outcome that optimises its value for energy, nutrients for agriculture and preferably heat. The second phase is to ensure all food waste from households and businesses is diverted from landfill by 2020. This will allow industry to develop the appropriate infrastructure to optimise the resource value of food waste.
-



Households

There are around 26m households in the UK,⁴⁸ each producing relatively small volumes of weekly food waste yet contributing 7.2m tonnes of the 14.8m tonnes of food waste generated annually in the UK.⁴⁹ Of this, 61%, or 4.4m tonnes, is thought to be avoidable, which represents an opportunity for households to save as much as £659 each per year.

The reasons for food waste generation in the home are complex. Busy lives mean people are finding it increasingly difficult to plan meals properly. In addition, there is confusion caused by labelling on food packaging, principally sell by and use by dates and storage instructions. In addition, a lack of knowledge and understanding of how to cook, prepare and store food, all contribute to household food waste.

According to a Local Government Association (LGA) report, 37% of all UK household waste still goes to landfill, while 43% is recycled. Worryingly, after several years of continual strong growth, the rates of recycling in the UK are beginning to plateau. The same report points to the opportunity for local authorities to realise significant savings by tapping into the remaining resource value of its householders' waste, which in turn could stabilise the cost of waste disposal for the taxpayer. However, it cites contamination by food waste as a significant barrier to maximising the value in recyclables and suggests that reducing the level of contamination by half could yield over £1bn more value from recycle by 2019/20.⁵⁰

Barriers to addressing household food waste

At a time when household budgets are under increasing pressure, the benefits of planning family meals and re-using ingredients can play a significant part in helping to curb unnecessary costs. If change is to be instigated, households must first recognise the problem and this is at the heart of the issue.

There has been a strong drive in recent years to encourage better diets by recommending the consumption of five portions of fruit and vegetables a day. On the evidence of householders' waste bins, the message is influencing purchasing habits, but not their consumption. Families throw away a staggering 4.8bn grapes, 1.9bn potatoes, 1.6bn apples and 1bn tomatoes per annum.⁵¹ Clearly, there is a balance to be drawn between encouraging the positive behaviour surrounding healthy diets and discouraging the unintended consequences of avoidable food waste.

Across the UK we are rightly proud of the provision of clean, regular public services which deal with our waste. However, it has been the subject of much media attention, particularly

“Separate food waste collections are becoming the norm and have high satisfaction levels from people that use the service. Householders' attitudes to waste have come a very long way in a relatively short period of time.”

JOY BLIZZARD, LARAC





surrounding the maintenance of weekly collections and the introduction of recycling bins. The issue is that weekly general waste collections make it easy for everyone to throw materials away without giving a second thought to their potential for re-use or recycling. The easy option inadvertently locks society into carrying out less desirable behaviours and is, therefore, a significant barrier to change. Furthermore, the lack of a clear, consistent, national strategy for waste in England is stalling investment in collection and an optimal disposal infrastructure and confuses the public that use them.

Is anything changing?

WRAP's 'Love Food Hate Waste' is a well-established campaign that is used throughout the UK, both in the public and private sectors, to highlight food waste and encourage waste prevention. Recent figures suggest that, in real terms, food waste generation by UK households has fallen by 1.1m tonnes,⁵² so improvements are being seen. The campaign's efforts are underpinned by the Courtauld Commitment, which sets targets for waste reduction and recycling throughout the supply chain, including households. These themes have been embraced by some celebrity chefs who are working on initiatives to encourage better food management in the kitchen. For example, Jamie Oliver's TV series *Money Saving Meals* looks at budgeting, meal planning, saving money and the use of leftovers to reduce waste.

Northern Ireland

Northern Ireland began the process of a formal consultation in September 2013 on legislation to ban food waste to landfill.

Scotland

Food waste is an integral part of Zero Waste Scotland, a major initiative to reduce waste to landfill. Central to this strategy has been the phased banning of food waste to landfill and incineration, the ban on the use of macerators and the introduction of separate collection of food waste from households and businesses for AD.

Wales

The Welsh Assembly has taken a unique and ambitious approach to its strategy on waste, and illustrates how a public-private partnership has helped to shape a policy, strategy and most importantly, a delivery programme for waste.

A leading consultancy was commissioned to review the available options for Welsh waste and its conclusion was to set an optimal target of 70% recycling by 2025. Key to this strategy was the statutory separation and weekly collection of food waste from all households to deliver a nutrient-rich fertiliser for Welsh agriculture and renewable energy through AD. In addition, it introduced weekly collections of kerbside sorted paper, glass and card, separate collection of green waste and regular (in most cases fortnightly) collections of residual waste. Fundamental to this strategic approach to waste was taking a holistic view of the total waste output for Wales and introducing a nationally consistent solution. The principle was that the more source separation undertaken at the kerbside, the better the quality and value of recyclate and the lower the overall cost of service delivery. Equally, the more consistent the service, the less confusing it is for the householder. The initiative is still in its infancy but, by the end of 2012, Wales had exceeded its interim recycling target and achieved a 54% recycling rate.

The Welsh Assembly is demonstrating that a collaborative and consistent approach to waste can create the economies of scale that can deliver the infrastructure that will turn all wastes, including food waste, into valuable resources. Plans are in place for the construction of a series of strategically located AD plants as well as consideration for reprocessing facilities to turn recyclables into raw material for local manufacturing. This closed loop model of recycling can also work in urban areas, creating jobs and linking waste collection and treatment, energy and heat generation in a symbiotic way.

England

England is yet to offer a clear, national strategy to realise the full resource potential of its waste streams and specifically food waste. Consequently, different local authorities take different approaches to their waste. However, we are starting to see examples of collaboration at local authority level in the form of waste procurement partnerships, which are demonstrating clear cost and environmental benefits.

The South and Vale Partnership, highlighted next, clearly demonstrates what can be achieved and that the Welsh targets, while ambitious, are achievable in both England and Wales.

Recommendations.

- Government to provide a strategic framework for tackling household waste, centred on best practice, commercial benefits, cost efficiencies and positive environmental outcomes that encourage separate food waste collections.
- Support the development of further collaborative waste collection partnerships across council boundaries to pool collective resources, maximise operational efficiencies and process recycles locally. This should include consideration of further sustainable industry parks to attract manufacturers, reprocessors and jobs, as well as moving food waste further up the waste hierarchy by optimising resources for energy, nutrients for agriculture and heat.
- Where long contracts are in place for local authority waste services, ask the waste provider about ways to avoid food waste going to landfill or incineration and explore mutually beneficial solutions.
- Local authorities to be urged to speed up the adoption of separate food waste collections to maximise environmental benefits and reduce contamination of other forms of recycling.
- Extend and increase support for food waste education programmes such as 'Love Food Hate Waste', with an increase in the level of investment and a review of the effectiveness of campaign strategies in tackling avoidable food waste.
- Consider innovative ways of reinforcing the message that food waste can be recycled. For example, TV production companies could include prominent food caddies in food programmes such as The Great British Bake Off, whose audiences are large and diverse.
- Government to introduce a phased ban on food waste to landfill from 2017 for business, based on turnover and/or volume of waste generated (e.g. above 50kg of food waste per week), to give companies time to look for and adopt alternative disposal options. This should be supported by mandatory separate collection of food waste with an outcome that optimises its value for energy, nutrients for agriculture and preferably heat. The second phase to ensure all food waste from households and businesses is diverted from landfill by 2020. This will allow industry to develop the appropriate infrastructure to optimise the resource value of food waste.

Case study. The South Oxfordshire and Vale of White Horse District Councils are the top two recycling counties in England, with recycling rates of 67.9% and 68.7%, respectively. The pair have recently formed a joint venture, South and Vale, to provide shared services to the 110,000 households within the area and streamline costs.

Food waste recycling is pivotal to their success to date, with more than 9,000 tonnes of food waste per year diverted from landfill and processed through AD at an average of 1.7kg per household, per week. The service has delivered savings to the partnership of £1.2m per annum.

A recent survey of 1,100 households in the area showed that about 50% of the residents were aware that the food waste collected is being treated at AD facilities and that there was an overall service satisfaction rating of 90%.

The partnership is confident of increasing rates yet further. Ian Matten, Shared Parks & Waste Manager at South and Vale, said: "We know that about 25% of our refuse bin is still made up of food waste and we need to get this into our food waste collection and away from landfill. We aim to achieve this by focusing on more promotion, especially around communal properties and looking to extend the collection service to schools within the area. We will also complete detailed analysis of the door-stepping responses to better understand why households may not be recycling and address any reasons identified."



Section 3

Solutions and summary





Generating value from food waste

By treating food waste separately, it is possible to move it further up the waste hierarchy, reduce treatment costs and ensure that its true potential is realised. After prevention, the food waste hierarchy splits into two key areas, which both offer opportunities to optimise the full resource value of food waste, whether to feed others or animals, as in the case of surplus food or to extract the calorific and nutrient value through processing options, such as AD.



IN 2010, APPROXIMATELY

5.4m

TONNES OF MATERIAL,
LARGELY GREEN WASTE, WAS
COMPOSTED IN THE UK



ONE TONNE OF FOOD
WASTE IN LANDFILL
GENERATES

0.4

TONNES
OF CARBON DIOXIDE



Solutions for surplus food

Surplus food that is fit for human or animal consumption sits higher in the food waste hierarchy and should be prioritised by businesses ahead of other means of treatment. Outlined below are some of the more common solutions for surplus food and animal products.

Food redistribution

Food redistribution takes surplus but edible food and redistributes it to people in need. This usually takes place through an intermediary or food banks. FareShare, the Trussell Trust and Plan Zeroes are just a few examples of organisations operating in this field in the UK.

Since the recession, the number of food banks in Britain has grown rapidly to more than 250, with retailers and distributors such as Tesco, Sainsbury's, Booker and 3663 contributing surplus food. New food banks are opening at a rate of three a week to provide emergency food supplies to those most in need, and making food redistribution even more crucial.⁵³

Animal feed

The UK livestock animal feed industry is a well-established and regulated solution for handling surplus food. The sector comprises approximately 25 reprocessors which handle in the region of 550,000 tonnes of surplus food from the manufacturing, retail and distribution sectors.⁵⁴

Only certain materials are suitable for feeding to livestock and poultry, due to the risk associated with feeding animal proteins to animals of the same species. Therefore, feedstock for the animal feed reprocessors is restricted to former foodstuffs that do not contain animal protein, such as clean bread, flour, biscuits, crisps, dough, grains, fruits and vegetables. Sweets containing bovine gelatine or any of the above materials containing traces of animal protein cannot be used.

Depending upon the volume and type of foodstuff, these materials will have a commercial value and therefore, in most cases, represent a more economically viable solution than landfill or incineration.

Pet food

Likewise, the pet food industry is a strong, growing and well-regulated sector in the UK. The sector produced more than 1.26m tonnes of pet foods in 2011, with a value of £2.14bn.⁵⁵ Pet foods typically fall into four market categories: wet (e.g. tinned cat and dog food), dry (e.g. biscuits), mixers and treats. The meat industry is a significant contributor to the wet and dry pet food sector.

'Wet' ABPs that are considered fit but not intended for human consumption, such as hearts, lungs, kidneys and giblets, are separated and stored at source and then checked and processed by specialist organisations into blocks of frozen meat for supply into pet food manufacturers. These co-products represent a revenue stream for the producer.

'Dry' ABPs, not intended for human consumption, such as bone, are typically processed in rendering plants which destroy harmful bacteria and produce processed animal protein (PAP). This product is then used as an ingredient in dry dog and cat biscuits. Again, dependent upon volume, material type and location, these products have a commercial value.

Rendering

Rendering is the industry standard technology in most western countries applied to handling ABPs. The EU Animal By-Products Regulations (ABPR) outline the correct means of collection, transportation, storage and processing of ABPs. Rendering is a long-established industry within the UK, processing around 2.25m tonnes per annum.⁵⁶ It is also an essential part of the UK food supply chain and critical in safeguarding biosecurity.

The markets and uses for the rendered products depend upon the level of risk associated with the input material. The ABPR specify three categories of ABP. Surplus or avoidable food wastes, such as bone, fat trimmings, slaughtered livestock or poultry heads and feet would all generally fall into the lowest category of risk, Category 3 ABP. Consequently the animal fat (tallow) can be sold as an organic ingredient in soaps, soap powders and cosmetics. The PAP is typically sold into the pet food industry as a dry protein additive for dog and cat biscuits.

Solutions for unavoidable food waste

Unavoidable food waste is a resource. Food, by its very nature, contains nutrients and energy and therefore solutions should seek to maximise the resource potential in the material.

Outlined here are a number of common existing technology solutions for food waste.

Anaerobic digestion

AD is a proven technology solution and has been widely used in the water treatment industry for many years. It was cited by Defra in its 2011 Waste Review as the preferred option for food waste, although it has equally useful applications in agriculture for processing slurries, other agricultural waste and purpose-grown crops. In its latest report on the progress of the Government's AD strategy, Defra reports that the number of AD plants in the UK has now risen to 110 and a further 200 have received planning permission.

In simple terms, AD is a biological process. Food waste is first de-packaged, normally by machine, then pasteurised by being heated to 70°C for one hour to kill harmful bacteria, before passing into large digesters. Here good bacteria, in the absence of oxygen, work on the food and produce methane gas and a liquid/solid fraction called digestate.

The technology is particularly versatile as there are a number of possible uses for the methane gas. Once cleaned, it can be used in engines to generate energy, injected directly into the gas grid or liquefied for use as a transport fuel. In addition to that, AD would contribute towards the reduction of GHG emissions. Indeed, one tonne of food waste processed through AD saves at least 0.612 tonnes of GHG.⁵⁷

The tables in our appendix show that the potential of AD in the UK is substantial. In principle, it could be used to process 5m tonnes of unavoidable food waste, generate 1.1TWh per annum of renewable electricity through traditional combined heat and power (CHP) systems and provide employment to more than 4,000 people.

Furthermore, the digestate produced through AD can be applied to land as a low-carbon bio-fertiliser, with the potential to return up to 4m tonnes of digestate, replacing vital organic matter and over 1.4m tonnes of nutrients to the soil every year.

Whilst helping to improve the health of our soils, it also provides an alternative source of nutrients to fertilisers derived from petrochemicals, thereby further reducing GHG emissions from the agricultural industry. It is a classic closed-loop solution and a clear example of the circular economy already in action.

In-vessel composting (IVC)

Open windrow composting, where organic material is laid out in exposed rows and repeatedly turned so that it degrades naturally under an aerobic process, is typically used for materials such as leaves, grass and manure, often described as green waste. IVC is an extension of this process; in that the feedstock is first stored in a sealed unit where the material is allowed to build up heat until harmful bacteria are destroyed. Because of this, IVC is also a permissible solution for catering waste.

In 2010, approximately 5.4m tonnes of material, largely green waste, were composted in the UK, the majority of which produced coarse 0-40mm grade compost for use in agriculture with an estimated value of £9.2m. However, whilst this ensures that nutrient content and organic matter can be returned to the soil, unlike AD, it is not a source of biogas.

Rendering

Rendering plants are also capable of handling unavoidable and high risk, Category 1 and 2 ABPs. Typical examples are fallen stock or animals infected with specified diseases such as BSE or foot and mouth.

The process is the same as the low risk material but the potential markets are more limited. The resultant tallow can be used in the production of biodiesel and meat and bone meal (MBM) can be used as a biofuel to generate renewable energy.

The use of rendered products (PAP, MBM and tallow) can be estimated to reduce GHG emissions by approximately 70,000 tonnes per annum.⁵⁸ This is because they can be used as a direct replacement of soya bean in the production of pet foods, palm oil in the manufacture of bio-diesel, and fossil fuels in the generation of energy.



Energy from waste (EfW)

In 2012, 24 EfW plants in England treated almost 4m tonnes of residual municipal solid waste (MSW) and solid recovered fuel (SRF).⁵⁹

EfW encompasses a number of thermal treatment processes and the historic issues and concerns associated with air quality are now monitored rigorously and regulated by EU legislation. Typical modern EfW plants serve an important purpose in treating hard to recycle mixed wastes, generating electricity and in providing heat. However, due to the hazardous nature of some of the wastes, the ash has limited uses and any nutrient value in the input material is lost.

Some biomass-only thermal treatment processes take MBM from high-risk rendering facilities and other organic materials to generate renewable energy. The resultant ash has minimal contamination and can be used legitimately as a phosphorous-rich fertiliser for agriculture.

Waste-derived renewable electricity from thermal combustion in England is forecast to grow from the current 1.2TWh to between 3.1TWh and 3.6TWh by 2020.⁶⁰

EfW has a role to play in UK waste strategy, but it is important to safeguard against the loss of crucial resources by avoiding treating a large proportion of our waste in this way. The LGA argues that setting more challenging targets to achieve 70% recycling could unlock a further £3bn in revenues for local authorities.⁶¹ Putting too much emphasis on expanding EfW capacity has the potential to undermine the LGA's ambition to realise the full value of household waste and deliver savings for the taxpayer.

Macerators/food waste disposal (FWD) units

Macerators have been used in various sectors for many years, particularly the hospitality sector, as a low-cost means of disposal. FWD units are more commonly associated with small-scale use within the domestic environment. Both units traditionally add water to food waste, blend the material into a liquid and discharge the slurry to the sewage system.

Discharging food waste to sewers places extra demands upon our old wastewater infrastructure, leads to blockages, the unnecessary use of water and, it could be argued, feeds our growing rat population.

A report commissioned by the National Food Waste Programme concluded that, "Kerbside collection of segregated domestic kitchen food waste was shown to have lower GHG emissions and overall financial costs when compared with the use of domestic FWD units followed by discharge to sewer, where both routes used a thermal hydrolysis process followed by anaerobic digestion (THP/AD) with energy recovery and biosolids reuse."⁶² Furthermore, once the cost of blockages was factored in, the expenditure on FWD units further increased, which suggests that macerators and FWD units may not deliver the best economic or environmental outcome for food waste.

Landfill

Around 40% of food waste generated in the UK is currently disposed of via landfill.⁶³

The process of layering general waste into a large void starves biodegradable material, including food waste, of oxygen and creates methane. Methane has a GWP 21 times greater than carbon dioxide and methane from landfill represents 40% of all the UK's methane and 3% of GHG emissions.⁶⁴ One tonne of food waste in landfill generates 0.4 tonnes of GHG.⁶⁵

Once capped, increasingly landfill sites are designed to capture methane gas. The more modern solutions can achieve up to 80% efficiency in biogas retention, although prior to capping methane is lost to the atmosphere. Revenues from methane are potentially a significant contributor to turnover for the landfill operators. For example, Biffa Group reported that 13% of its annual revenue came from EfW, which included landfill gas.⁶⁶

Landfill taxes were introduced in 1996, with a yearly increase of £8 per tonne. Landfill tax in 2013 stands at £72 per tonne and will be capped next year at £80 per tonne. Clearly, this is a significant driver for many businesses to divert material from landfill.

"Despite the challenges faced, food waste has the potential to be turned into an opportunity. CIWM is generally supportive of landfill restrictions as a signal that the landfilling of waste that is bio-degradable or has intrinsic material or energy value should be reduced and – so far as is practicable – stopped. The UK has made good progress on food waste collection and prevention, particularly household food waste, but there is still much to do and CIWM welcomes the roadmap being put forward by Vision 2020 to help drive further behaviour change."

STEVE LEE, CEO OF CIWM

AROUND
40%
OF FOOD WASTE GENERATED
IN THE UK IS CURRENTLY
DISPOSED OF VIA LANDFILL



Conclusion

In summary, the time is right to make a real difference to how we approach food waste. Exciting initiatives up and down the supply chain have started to build a real momentum to deliver a more positive outcome. Industry thinking is changing and campaigns that encourage adoption of the food waste hierarchy and the circular economy have begun to shift behaviour away from waste and towards resource.

However, with 14.8m tonnes of food waste produced, 40% still disposed of to landfill and more still lost to incineration, we need to be doing more by embracing both the 'carrot' and the 'stick'.



We have shown that:

- **The majority of food waste is generated in relatively small quantities in a very large number of places and that the cumulative effect of this waste is a significant financial cost to UK businesses and households and has damaging environmental outcomes.**
- **The profile of this waste is serviced by the general waste bin which currently undermines the landfill tax as a driver and consigns millions of tonnes and billions of pounds of valuable resources to landfill or incineration.**
- **Forward-thinking organisations of all sizes and throughout the various sectors are demonstrating the business case for food waste reduction and recycling. They are in the minority and therefore represent a tiny proportion of what could be achieved across the board.**
- **Recycling figures have reached a plateau in England. Without change similar to the policies being delivered in Wales and Scotland and being considered in Northern Ireland, we are unlikely to see a significant improvement in our performance on household waste.**

We have presented a roadmap that:

- **Favours a landfill ban on food waste with a phased timeframe to allow Government policy to be clearly developed, strategy to be implemented and industry to invest in the infrastructure to deliver on it.**
- **Takes a more holistic approach to waste in general, maximising the resource value in all of its streams.**
- **Encourages collaboration in and between industry and across local authorities to take better advantage of economies of scale and best practice.**
- **Supports a food waste hierarchy that encourages businesses and local authorities to find the best economic and environmental outcomes for food waste streams.**
- **Calls for a more consistent national approach to maximise the resource value in waste and simplify systems for the user.**

By achieving the goal of zero food waste to landfill, we will not only help to deliver demanding landfill and carbon reduction targets, but we can also save millions of pounds at every stage of the food chain. It will provide inexpensive renewable energy, deliver employment opportunities, create chemical-free fertilisers for use by UK farmers and help to restore valuable nutrients back into the land. By separating food waste, we can also unlock billions of pounds of value from recyclable materials currently consigned to incineration or landfill. This synopsis recently prompted the Green Alliance to describe a ban on food waste to landfill as a 'political no brainer'.⁶⁷

Government has an important role to play. Industry needs a more long-term, ambitious, integrated and consistent national approach to waste that will give businesses the confidence to invest in the infrastructure that will deliver positive change for all.

The report recognises the excellent work of individuals and businesses who have already begun the journey of food waste reduction and recycling. It provides some practical steps and sources of information as a guide for people in their homes and businesses who want to do more. The document also highlights the real need for continued collaboration if we are to succeed in our ambitions and achieve an important long-term objective.

Fundamentally, we believe food waste recycling is the absolute linchpin of a better waste strategy in the future; the key to reducing food waste, to saving valuable water, nutrient and energy resources, to unlocking the value in recyclables and to achieving a lower carbon future for some of the UK's key industry sectors.

Individually and collectively now is the time to tackle the UK food waste issue. By taking action now, we firmly believe eradicating food waste from landfill by 2020 is not only achievable, it is essential in securing better economic, environmental and social outcomes for the UK.

⁶⁷ Dustin Benton, Green Alliance, ADBA Conference report, Food Manufacture, July 2013

Glossary

ABPs	animal by-products
ABPR	Animal By-Products Regulations
AD	anaerobic digestion
ADBA	Anaerobic Digestion & Biogas Association
CHP	combined heat and power
EA	Environment Agency
EFFPA	European Former Foodstuff Processors Association
FABRA	Foodchain & Biomass Renewables Association
FDF	Food and Drink Federation
GHG	greenhouse gas
GWP	global warming potential
IGD	The Institute of Grocery Distribution
IVC	in-vessel composting
LGA	Local Government Association
MBM	meat and bone meal
MSW	municipal solid waste
NFU	National Farmers Union
ONS	Office for National Statistics
PAP	processed animal protein
PFMA	Pet Food Manufacturers Association
SRA	Sustainable Restaurant Association
SRF	solid recovered fuel
WRAP	Waste & Resources Action Programme

Appendix

Food waste facts, calculations and assumptions

Table 1 Summary of total food waste facts

Sector		Total food waste million tonnes (pa)	Financial saving £million (pa)	Mt CO ₂ e saving (pa)
Household		7.2	12,031	18.7
UK PLC	Manufacturing	3.2	974	5.4
	Distribution	0.004	3	0.01
	Retail	0.4	366	0.8
	Hospitality	0.6	724	1.7
UK PLC subtotal		4.2	2,067	7.9
Public sector		3.4	3,687	8.6
UK total		14.8	17,784	-

Note: to avoid double counting, the GHG saving figures for the supply chain and household food waste should not be added together.

Sector	Avoidable food waste			Unavoidable food waste			References
	Million tonnes (pa)	Financial saving £million (pa)	Mt CO ₂ e saving (pa)	Million tonnes (pa)	Financial saving £million (pa)	Mt CO ₂ e saving (pa)	
Household	4.4	12,000	17	2.8	30.8	1.7	New estimates for household food and drink waste, WRAP 2011
Manufacturing	1.9	960	4.6	1.3	14.1	0.8	Waste arising in the supply of food and drink to households in the UK, WRAP 2010
Distribution	0.002	2.6	0.007	0.002	0.018	0.001	
Retail	0.2	364	0.7	0.1	1.6	0.1	
Hospitality	0.4	722	1.6	0.2	2.2	0.1	The composition of Waste Disposed of by the UK Hospitality Industry, WRAP 2011
Public sector	2.0	3,672	7.8	1.4	15	0.8	Handy facts & figures: UK Retail & Hospitality/Food Service, WRAP 2011
Total	9.0	17,721	-	5.8	63.7	-	

Renewable energy

Table 2 Potential renewable energy generation from food waste

	Available food waste sent to AD plants (million tonnes pa)	Net electrical output from food waste AD via CHP (kWh/tonne)	Renewable energy production (GWh pa)
UK total	5.8	200⁶⁸	1,157

Assumption: all biogas is used for electrical generation via CHP at 91.3% load factor (i.e. operating at 8000 hours per year); this is equivalent to an installed generating capacity of 145MWe.

Nutrients returned to soil

Table 3 Potential nutrients returned to soil

	Available food waste for AD plants (million tonnes pa)	Nutrient conversion factor	Nutrients returned to soil (million tonnes pa)
UK total	5.8	0.24⁶⁹	1.4

⁶⁸ Review of the generation costs and deployment potential of renewable electricity technologies in the UK, DECC 2011

⁶⁹ Accelerating the uptake of Anaerobic Digestion in England: An Implementation Plan, Defra 2010

Estimated potential financial savings

Table 4 Estimated potential financial savings from preventing food waste

	Avoidable food waste (million tonnes pa)	Cost of waste (£ per tonne)	Financial saving £million (pa)
Manufacturing	1.9	500	960
Distribution	0.002	1,088	2.6
Retail	0.2	1,676	364

Calculation method and assumptions:

- Avoidable food waste tonnage is calculated based on an estimated 60% rate as per the proportion of household avoidable food waste. Please note currently there is no readily available data on the avoidable food waste tonnage for each of the supply chain stages.
- The potential financial savings from food waste prevention are calculated using WRAP estimate cost of waste (£ per tonne) for each of the supply chain stages, which includes the cost of purchase of food, haulage and disposal. (Reference: table 24, page 69, Waste arising in the supply of food and drink to households in the UK, WRAP 2010)

Table 5 Estimated potential financial savings from diverting food waste from landfill to AD

	Unavoidable food waste (million tonnes pa)	Cost saving from diverting food waste from landfill to AD (£ per tonne)	Financial saving £million (pa)
Household	2.8	11	30.8
Manufacturing	1.3		14.1
Distribution	0.002		0.018
Retail	0.1		1.6
Hospitality	0.2		2.2
Public sector	1.4		15

Calculation method and assumptions:

- The potential financial savings from food waste diversion from landfill to AD are calculated using WRAP estimate cost figure (£11 per tonne). (Reference: page 40, The composition of Waste Disposed of by the UK Hospitality Industry, WRAP 2011)

Estimated potential carbon savings

Table 6 Estimated potential carbon savings from preventing food waste

	Avoidable food waste (million tonnes pa)	Carbon conversion factor (tonnes of CO ₂ eq per tonne of waste)	Carbon saving (million tonnes pa)
Manufacturing	1.9	2.4	4.6
Distribution	0.002	2.8	0.007
Retail	0.2	3.2	0.7
Public sector	2	3.8	7.8

Calculation method and assumptions:

- Potential carbon savings from food waste prevention are calculated using WRAP estimates of annual GHG conversion factors associated with the UK supply chain waste. (Reference: table 28, page 72, Waste arising in the supply of food and drink to households in the UK, WRAP 2010)

Table 7 Estimated potential carbon savings from diverting food waste from landfill to AD

	Unavoidable food waste (million tonnes pa)	Unavoidable food waste (million tonnes pa) Carbon conversion factor for AD vs landfill (tonnes of CO ₂ eq per tonne of waste)	Carbon saving (million tonnes pa)
Household	2.8	0.612	1.7
Manufacturing	1.3		0.8
Distribution	0.002		0.001
Retail	0.1		0.1
Hospitality	0.2		0.1
Public sector	1.4		0.8

Calculation method and assumptions:

- Potential carbon savings from diverting food waste from landfill to AD are calculated using Defra GHG conversion factors. (Reference: Annex 14, Defra GHG conversion factor 2012)

Food waste collection schemes

Table 8 Investment for food waste collection schemes

	Number of local authorities in the UK do not have food waste collection	Capital investment for introducing food waste collection scheme (£ million)	Investment required £million (pa)
Household	230	0.6	138

Calculation method and assumptions:

- As at May 2011, 47% of local authorities in the UK are providing a food waste collection service (Reference: WRAP www.wrap.org.uk/content/collection-and-recycling-food-waste-0)
- Total number of local authorities in the UK in 2011 is 433
- Therefore, the total number of local authorities yet to introduce a food waste collection scheme is $433 \times (1-47\%) = 230$
- Assumes each council requires a similar level of £0.6 million capital investment to introduce a borough wide food waste collection scheme as per Sutton council estimate. This figure also includes saving made on landfill disposal. (Source: conversation with Amy Harris, Waste Strategy and Community Engagement Manager at Sutton council on 20 June 2013.)

Table 9 Number of jobs created through food waste collection schemes

	Unavoidable food waste (tonnes pa)	LA-collected food waste from kerbside organics collection (tonnes pa)	Food waste that has not been collected separately (tonnes pa)	Number of jobs created in collection per 1000 tonnes of green waste	Approximate number of jobs created
Household	2,800,000	305,764	2,494,236	0.5	1250

Calculation method and assumptions:

- LA-collected food waste from kerbside organics collection in 2010 is 305,764 tonnes (Reference: Table 4.1, Page 15, Synthesis of Food Waste Compositional Data, WRAP 2010)
- According to a study by Friends of the Earth, about 0.5 jobs will be created in collection/sorting per 1,000 tonnes of green waste. (Reference: Table 9, Page 18, More jobs less waste, FOE 2010)

AD facilities

Table 10 Investment for expanding AD facilities

	Potential generating capacity (MW)	Median capital cost (£'000/MW)	Total investment (£ million)
AD facilities	145	5,241	758

Calculation method and assumptions:

- Potential renewable energy generation is 1,157TWh p.a, equivalent to 145MWe installed capacity as per calculations shown in Table 2.
- DECC estimated median capital cost for AD plants is £5,241,000 per MW. (Reference: Table 74, Page 182, Review of the generation costs and deployment potential of renewable electricity technologies in the UK, DECC 2011)

