



# DYNAMIX policy mix evaluation



Preventing food waste in the UK

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## DYNAMIX PROJECT PARTNERS



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# 1 Resource/Issue

*Name of resource targeted (or focus of the case study, if the policy mix is broader than the specific resource(s) we have decided to analyse).*

Food and drink waste prevention and management.

# 2 Geographical area of policy mix coverage

*Country name, and region or city if appropriate (if policy mix is applied regionally or locally)*

The area analysed is the UK (England, Wales, Scotland, Northern Ireland).

# 3 Policy context

## 3.1 Needs assessment: The environmental problem /resource challenge

*What is the environmental problem/concern (consider both quantity and quality), e.g. soil erosion, excessive use of non-renewable or renewable resources and the crossing of environmental thresholds/tipping points for impact, resource scarcity concerns?*

*Are there any economic or social problems related to the issue and environmental problems – e.g. is there important price volatility, (risk of) unavailability of resources for the economy or society?*

*Who is the target group affected that have been, are or will be beneficiaries of the policy response?*

The reduction of food waste has a huge potential to reduce pressures on (agricultural) land use and resource input (see e.g. PBL 2011, Noleppa and Witzke 2012).<sup>1,2</sup> According to FAO (2011)<sup>3</sup> data, about one-third of all food production worldwide is lost or wasted in the food production and consumption systems. Of the estimated total 89 Mt of food waste generated in the EU, households produce the largest proportion (42% of the total), representing 179 kg of food waste generated per capita. Evidence indicates that over 60% of this waste may be avoidable. Significant industrial (39%), wholesale/retail (5%) and food service sector (14%) food waste also occurs (Bio Intelligence Service 2012).<sup>4</sup>

According to 2008-2010 data, the UK is the second largest producer of household food waste in the EU (behind Germany and just ahead of France) and the largest producer of wholesale/retail and food service/restaurant food waste (just ahead of Spain in both categories) (Bio Intelligence Service 2010).<sup>5</sup> Table 1 provides an overview of the amount of

food and drink waste (hereafter referred to as 'food waste') produced from different sources within the UK (based on 2011 figures).

**Table 1: Sources and total food waste produced per year in the UK (2010)**

Source of waste		Food waste (tonnes/yr)
Households		7,200,000
Grocery supply chain	Retail	363,000
	Distribution	4,000
	Manufacturing	3,170,000
Hospitality and food service		at least 700,000*
Other		3,300,000**
Total		14,737,000

Source: WRAP. 2011a. Handy facts and figures: UK Retail and Hospitality/ Foodservice. 14 November 2011. United Kingdom: Waste & Resources Action Programme.

This means that huge amounts of land, water, energy and other resources used in food production are misused. As Defra (2011)<sup>6</sup> states, "clearly a high, unnecessary cost occurs from producing, transporting and ultimately disposing of food that ends up being wasted". Reductions in food waste can therefore lead to multiple benefits, including reduced land use and use of resources along the production cycle as well as a number of climate-related benefits. Figures and analysis of the environmental impacts of the UK food waste problem are limited, with the exception of climate effects for which some reduction potentials and de facto saved emissions as well as estimates of the water and carbon footprint of household food waste<sup>i</sup> are available. The EU project FUSIONS<sup>ii</sup> will provide further insights on the social and environmental dimensions of food waste.

In terms of impacts on land, calculations on the amount of **(agricultural) land** that can be saved by reducing food waste vary due to different methodologies used, a lack of data and a range of uncertainties. All estimates however show significant potential for more efficient and less wasteful practices. For example PBL (2009)<sup>7</sup> estimates that food waste reduction measures can reduce the land claim for agriculture by approx. 5 million km<sup>2</sup> to 2050. For Germany, Noleppa and Witzke (2012)<sup>8</sup> estimate that 1.2 million hectares can be gained if avoidable food waste is cut by half, whereas the total reduction of food waste can save 2.4 million hectares which would reduce Germany's land footprint by 10%.

In terms of **greenhouse gas (GHG) emissions**, food production contributes to 19-29% of worldwide GHG emissions (Vermeulen et al. 2012)<sup>9</sup>, hence any avoided food and drink waste would help reduce these emissions. According to the UK Waste and Resource Action Programme (WRAP), every tonne of food waste prevented has the potential to save an estimated 4.2 tonnes of CO<sub>2</sub>e emissions (accounting for the lifecycle emissions and including emissions from landfills) (WRAP 2009).<sup>10</sup> The most recent figures from 2010 estimate the total avoidable household food and drink waste within the UK to be 4.4 million tonnes per

<sup>i</sup> See e.g. <http://www.wrap.org.uk/content/water-and-carbon-footprint-household-food-and-drink-waste-uk-1>

<sup>ii</sup> <http://www.eu-fusions.org/>

year<sup>iii</sup>, which is equivalent to 17 million tonnes of CO<sub>2</sub> emissions (WRAP 2011b).<sup>11</sup> Within the grocery supply chain, the 3.6 million tonnes of food waste each year is estimated to generate 8.4 million tonnes of CO<sub>2</sub> emissions (WRAP 2010a).<sup>12</sup>

In addition to potential GHG emissions saved from avoided food waste, another climate relevant dimension that has played a significant role in designing food waste policies in the UK relates to the amount of **biodegradable waste sent to landfills**. At least 40% of the food waste produced in Britain is estimated to be disposed in landfill (Defra 2011)<sup>13</sup>, large volumes of which are biodegradable. Decomposition of this waste results in the production of the greenhouse gas methane, which can contribute to climate change if not properly managed.

## 3.2 Policy context and policy needs

*What policy challenge(s) did the problem pose and what policy challenges does it still pose?*

*What is the policy context related to the policy mix being evaluated? What policies have been put in place to address the issues, what policies are currently in place and which ones are already foreseen for future introduction (e.g. to address past, existing and future objectives)?*

*What sort of policy response did (and does) the problem call for?*

Until now, the complex issue of food waste outlined above has been mainly addressed on a national (UK) or country (Scotland, England, Northern Ireland, Wales) level, under the umbrella of EU guidance and legislation (see section 6 for more details). The 1999 EU Landfill Directive along with UK policy instruments such as the 1996 Landfill tax served as precursors to the policy mix investigated in this report (defined by the authors as spanning from 2006/2007 to the present day).

The EU Landfill Directive requires all Member States to progressively reduce the amount of biodegradable waste sent to landfill (see section 6 for specific targets). The UK Landfill Tax is a key mechanism to support this objective. The focus on biodegradable waste reductions and the overarching landfill reduction targets instigated the creation of WRAP (Waste & Resources Action Programme) in 2000, as there was a need for a focused organization to support these efforts (Quested 2013).<sup>14</sup>

Given the important role of WRAP in the efforts to reduce UK food waste sector, it is important to understand its institutional and financial structure. WRAP is an independent not-for-profit company limited by guarantee. Funding is predominantly received from the Department for Environment, Food and Rural Affairs (Defra), the Scottish Government, the Welsh Government and the Northern Ireland Executive. Additional funding comes to a limited degree from the EU. WRAP works closely with its target audience of businesses, individuals and communities to help reduce waste, develop sustainable products and use resources in an efficient way and thereby support progress towards the landfill targets.

Despite this policy framework, a large-scale focus on food waste did not begin in the UK until 2006/2007 when WRAP launched a major research programme on the subject<sup>iv</sup>. This was instigated by emerging evidence that food waste was the largest single component of the residual waste stream (comprising around 30% of household waste) and the existence of

<sup>iii</sup> Of total consumer food waste, which is estimated to be 7.2 million tons/year – see Table 1.

<sup>iv</sup> All WRAP's research can be viewed at: <http://www.wrap.org.uk/waste-resource-listing>

large knowledge gaps on the topic. WRAP's initiatives are believed to be "the first of its kind in the world, to quantify the nature, scale, origin and causes of post-consumer food waste" (WRAP 2008b).<sup>15</sup> The programme consisted of several linked elements, including:

- a qualitative and ethnographic study to investigate why people throw away food;
- a pilot study to investigate the feasibility of quantifying the nature, scale and origin of food waste through a compositional analysis technique whereby waste is collected, sorted, categorised and weighed, which resulted in an analysis protocol;
- quantitative research to better understand why people throw food away;
- a food waste diary to provisionally quantify the amounts and types of food being thrown away and link reasons for disposal with the types of food disposed; and
- a major study to estimate in detail the nature, scale and origin of food waste through a compositional analysis technique combined with survey work on household attitudes, claimed behaviour and socio-demographics.

These studies provided the foundation for WRAP and the UK's policy mix and strategy for addressing food waste, as they indicated the areas in which behavioural changes and intervention were needed and which potential instruments could be utilized. The studies found that the majority of food waste was a result of poor planning and storage, and a lack of confidence and knowledge around using 'leftovers'. Awareness of the amount of food waste was also low, necessitating an increase in society's awareness/consciousness of the issue to facilitate more sustainable habits (e.g. via the provision of tools and information/guidelines) and support better choices, e.g. in supermarket selection. This served as the basis for the "Love Food, Hate Waste" campaign in 2007 (see chapter 6c for a more detailed description).

The studies also found that the cooperation of multiple stakeholders (e.g. retailers and brands) via voluntary agreements (e.g. the Courtauld Commitment) can help customers reduce food waste, while legislative measures and fiscal drivers can serve as a disincentive to continue producing waste (e.g. landfill fees). In addition, the studies found that improving infrastructure surrounding food waste collection services can help SMEs divert food waste from landfills (e.g. by integrating SMEs in household food waste collection schemes) (Defra 2011).<sup>16</sup> The main insights from the studies were reflected in the policy mix (see chapter 6).

A number of studies have indicated that approximately 60% of household food waste is the result of products *not being used in time* (mainly products that are perishable or with a short shelf-life).<sup>v</sup> This indicates the need for integrated research on food waste and food packaging to develop innovative solutions aimed at helping consumers keep food fresh for longer and thereby save money and reduce the impact of food waste on the environment.

A number of initiatives are underway at different levels. For example, at the **UN level**, a global campaign "Think. Eat. Save. Reduce Your Footprint" was launched in January 2012 by the UN Environment Programme (UNEP), the Food and Agriculture Organization (FAO) and partners. The campaign is in support of the Save Food Initiative run by the FAO and trade fair organizer Messe Düsseldorf and the UN Secretary General's Zero Hunger Initiatives. The

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<sup>v</sup> <http://www.wrap.org.uk/fresherforlonger>

Think.Eat.Save website is meant to be a portal to showcase ideas, provide a one-stop shop for news and resources, and mobilize civil society.

At the **EU level**, food waste is a topic within the “Roadmap to a resource-efficient Europe” (European Commission 2011)<sup>17</sup> which identified food as a key sector and seeks incentives to *halve the disposal of edible food waste in the EU by 2020*. Moreover, the European Commission is analyzing in cooperation with stakeholders, experts and Member States how to reduce food waste. For example, the Working Group on Food Waste in the context of the Advisory Group on the Food Chain, Animal & Plant Health discusses good practices, obstacles and options for EU action to reduce food waste. In parallel, the Commission is disseminating information and compiling good practices on food waste reduction initiatives. In June 2013, representatives from across Europe’s food supply chain announced the launch of a joint effort to address the food waste problem entitled ‘Every Crumb Counts’<sup>vi</sup>. The EU-funded FUSIONS project (Food Use for Social Innovation by Optimising Waste Prevention Strategies) aims to contribute to the harmonisation of food waste monitoring, assess the feasibility of social innovative measures for optimised food use in the food chain and the development of a Common Food Waste Policy for the EU. Utilising the policy and behavioural change recommendations, the FUSIONS European multi-stakeholder platform is expected to enable and encourage key actors across Europe in delivering a 50% reduction in food waste and a 20% reduction in resource inputs in the food chain by 2020.

### 3.3 Historical performance and projections into the future: Insights on decoupling

*What has been the trend vs. GDP (or other economic performance metrics, such as sectoral growth) and what type of decoupling has been achieved?*

The following figures indicate trends in UK food waste compared to changes in national GDP. Figure 1 shows the trend of GDP and general food waste in the UK between 2003 and 2014. General food waste includes food and drink waste from households, food production and sales and public institutions, as well as from the hospitality sector. While limited data is available for food waste on a national level, the graph nevertheless indicates an initial growth in the amount of food waste which peaks in 2009 at 15,700,000 tonnes. In contrast, the GDP curve decreases between 2007 and 2009. Thereafter, the amount of total food waste starts to decrease while GDP increases.

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<sup>vi</sup> See <http://fooddrinkeurope.eu/industry-in-focus/food-wastage-declaration/> for more information.

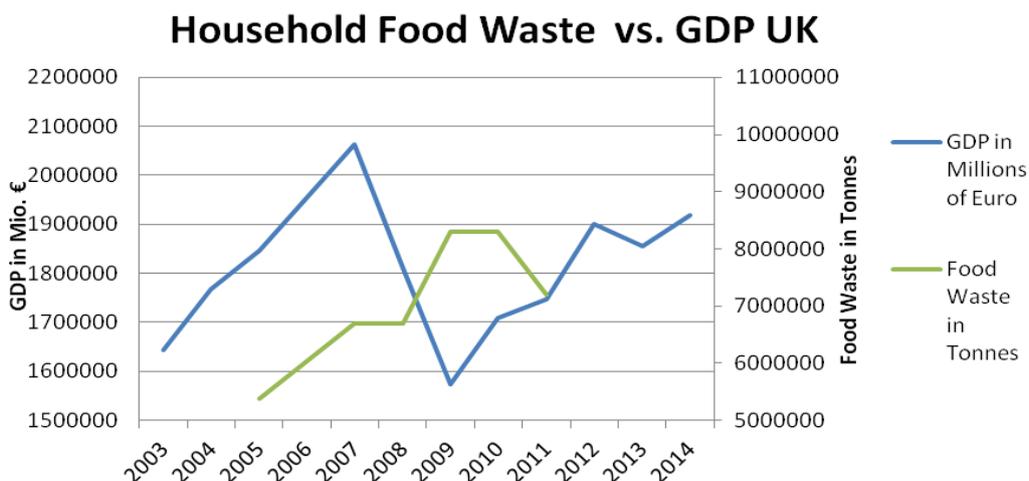
**Figure 1: UK GDP at market prices in million Euro (at current prices) vs food waste production**



Source: Eurostat website

Figure 2 again presents the development of GDP, but as compared to household waste production in the UK. This provides additional insights into the food waste - GDP relation as households represent the largest waste producer category. As was the trend with total food waste, the available data indicates an increase in household food waste production between 2005 and 2009. Until 2007, the GDP also grew, and decreased from 2007 to 2009 due to the global financial and economic crisis. In 2009/2010, a peak of 8,900,000 tonnes of household food waste was reached in 2009 after which time household food waste production stabilised and then started to decline.

**Figure 2: UK GDP at market prices in million Euro (at current prices) vs household food waste production**



Source: Eurostat website; Hogg, Dominic, et al. 2007. *Dealing with Food Waste in the UK*. Report for WRAP by Eunomia Research & Consulting Ltd.

However, while the figures suggest a link between the GDP and food waste trends, the available data is not (yet) robust enough to draw conclusions. It also needs to be proven if there is indeed a trend that in economically difficult times more food is wasted (as suggested by the available data), which seems unlikely at least for people with low income.

## 4 Drivers affecting change: resource use/ environmental issues

*What are the drivers affecting resource use (driving demand for the resource and leading to resource overuse) or other environmental impacts?*

Multiple factors drive changes in the amount of food waste generated. Amongst the most central are food prices, levels of disposable income, waste prevention interventions (campaigns and changes to food products) and potentially also collection system in place for food waste (although evidence is lacking on this aspect) (WRAP 2011b).<sup>18</sup>

In 2011, approximately 47% of local authorities in the UK provided a food waste collection service to households. Increases in the provision of such services for small businesses and schools are also being seen (WRAP 2010b).<sup>19</sup> Collecting food waste separately from other types of waste contributes to targets for diverting biodegradable waste from landfill, improves recycling rates, reduces GHG emissions by removing the putrescent content from landfill sites, generates heat and power through anaerobic digestion (AD), and reduces waste disposal costs (WRAP 2011b).<sup>20</sup>

Between the second half of 2007 and the end of 2008, high levels of inflation in the UK resulted in a 16% increase in consumer food prices, as compared to a 4% rise in consumer prices during the same time (as measured by the Consumer Price Index) (WRAP 2011b).<sup>21</sup> Moreover, between June 2007 and June 2011, food prices rose by approximately 26%, to over 12% when inflation is taken into account (Defra 2012a).<sup>22</sup> Such changes can influence behaviors and thereby personal expenditure patterns (e.g. how much food is eaten at home as opposed to externally, what type and quantity of food is purchased, etc.). The overall effect of these variables is however difficult to estimate as figures on food waste generation during past recessions or periods of price increases are not available. That being said, WRAP has commissioned work on this subject; preliminary findings were published in 2010<sup>vii</sup> and an update to this work is expected to be published in summer 2013.

Disposable income levels have also been linked with food waste, albeit acknowledging that a correlation where waste increased at the same time as income does not (alone) imply that one caused the other (Quested 2013).<sup>23</sup> According to EUROSTAT data<sup>viii</sup>, the quantities of food waste generated in the EU 27 Member States increased by 23% between 2004 and 2006 while disposable income increased by approximately 11.1% during the same period (Bio Intelligence Service 2010).<sup>24</sup> Studies by WRAP, however, indicate that households with higher disposable incomes and higher levels of education waste less food per capita (WRAP 2008b).<sup>25</sup> These findings imply that the effect of increased disposable incomes remains unclear, but that beyond a certain threshold, it is possible that higher incomes may result in

<sup>vii</sup> See <http://warr.org/751>

<sup>viii</sup> As part of the EU project FUSIONS, an evaluation has been undertaken to understand how national waste statistics in Europe related to food waste/waste are registered and reported, to assess how they are further used by Eurostat to establish a common European statistical basis for waste statistics, and to provide input on how FUSIONS can contribute to the methodological basis for these statistics (D1.2 Review of EUROSTATs reporting method and statistics). See <http://www.eu-fusions.org>.

decreased levels of food waste (Bio Intelligence Service 2010)<sup>26</sup> or, alternatively, that higher incomes may lead to less worry about wasting food.

In terms of market failures, split incentives can act as an inhibitor of waste prevention actions by removing positive financial incentives (Defra 2013).<sup>27</sup> For example, while a manufacturer would incur the added costs of re-designing packaging to increase the shelf-life of a food product, the consumer (or environment, down the line) will ultimately be the beneficiary of this investment. This mismatch may discourage investment by the manufacturer. It also highlights the problem of non-internalisation of environmental externalities as the manufacturer's investment decision fails to take into consideration environmental consequences arising from the disposal of the food product later in its lifecycle. Furthermore, as the UK landfill tax is incurred by local authorities, it offers no direct incentive for households to reduce the quantity of their waste streams. The tax does however indirectly affect resource use as the penalties incurred by local waste authorities motivate them to run food waste prevention campaigns within their collection areas in a bid to reduce household waste generated (Quested 2013).<sup>28</sup> Such campaigns were implemented by over 50% of local waste collection authorities in the UK between 2008 and 2010 (see below).

## 5 Situation/trend prior to introduction of policy mix

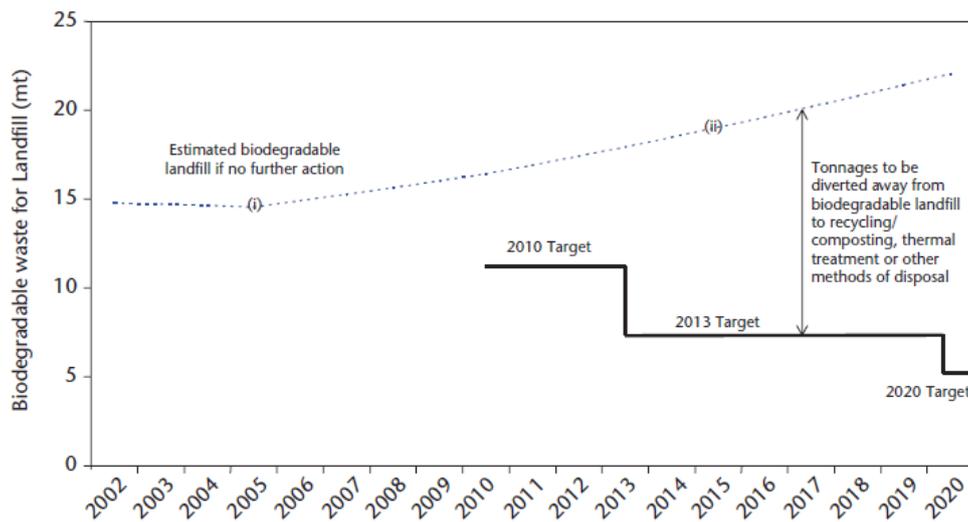
### *Information on the baseline situation before the policy mix was introduced.*

In 1995, the UK government released a proposed strategy entitled 'Making Waste Work' (MWW) which outlined the government's sustainable waste management policy goals for England and Wales in line with the UK's Sustainable Development Strategy (published the previous year). The ultimate aim of MWW was to change resident behavior so they would throw away less and increase recycling performance. Monumentally, the UK then introduced a **Landfill Tax** in 1996 (the first environmental tax in the UK), which intended to increase the attractiveness of alternative waste treatment technologies via increases in landfill costs. This instrument is seen as a key mechanism in enabling the UK to meet its targets under the **EU's Landfill Directive** of 1999<sup>ix</sup>, which sets goals for reducing the amount of biodegradable municipal waste (BMW) landfilled. Figure 3 illustrates the three headline targets for BWM in the EU Directive and compares this to the projected BMW for England (should no action be taken), indicating the amount of effort necessary to curb this estimation.

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<sup>ix</sup> Council Directive 99/31/EC of 26 April 1999 on the landfill of waste entered into force on 16.07.1999; the deadline for implementation of the legislation in the Member States was 16.07.2001.

**Figure 3: Estimated biodegradable waste for landfill in England versus the EU Landfill Directive Targets (million tonnes)**



Source: Strategy Unit analysis which (i) takes account of incinerator capacity coming on stream; and (ii) assumes incinerator capacity does not increase and all additional waste goes to landfill

From 1999 - 2001, finalized waste strategies were released for England, Wales, Scotland and Northern Ireland. Scotland's waste strategy (1999), for example, sets specific goals for reducing BMW going to landfill by 75% of baseline (1995) levels by 2006 and 50% by 2009.

In 2006/2007, WRAP began to focus a large amount of its efforts on the issue of food waste. Prior to this, there was very limited information regarding the amounts and types of food waste produced. Several smaller publications were, however, published which introduced the issue, including the 2002 "Waste not, want not" report (see section 3.2) and the 2004 "Soggy Lettuce Report" (Prudential 2004)<sup>29</sup> detailing the areas in which money is wasted (including from uneaten food). "According to the Environment Agency, the UK's food and drink sector produces between seven and eight million tonnes of waste per year" (Thankappan 2005).<sup>30</sup>

Where data existed prior to WRAP's efforts, it tended to concern waste more generally. For example, a study from Defra in 2002 noted that "current trends in municipal waste show that the total amount of waste has continued to rise, although the proportion of that waste being recycled or composted has also risen. For the first time in the recent years, the actual tonnage of municipal waste landfilled has registered a slight decrease, from 22.3 million tonnes in 2001-02 to 22 million tonnes in 2002-03" (Thankappan 2005)<sup>31</sup>, in line with the EU's Landfill Directive goals. An Industrial Waste Survey conducted in Wales in 2003 did look specifically at food waste focusing on disposal rates by commercial generators – see Table 2.

**Table 2: Commercial food disposal rates in Wales (2003)**

Type of food waste generator	Average tonnes of waste generated annually
Food manufacturers	1881.59
Hospitality and leisure (hotels and restaurants)	93.86
Other business activities	156.46
Hospitals and nursing homes	376.91

Source: Thankappan, S. 2005. *From Fridge Mountains to Food Mountains? Tackling the UK Food Waste Problem*. Cardiff University.

## 6 Description of policy mix(es)

*This section presents the main policy mix that will be the focus of this ex-post assessment.*

**Lifecycle focus (point of application(s) of the policy mix):** Entire life cycle of food waste (production, distribution, retail, consumption and disposal)

**Sector(s) covered:** Food and drinks

**Scale of application of policy mix:** UK (England, Scotland, Wales, Northern Ireland)

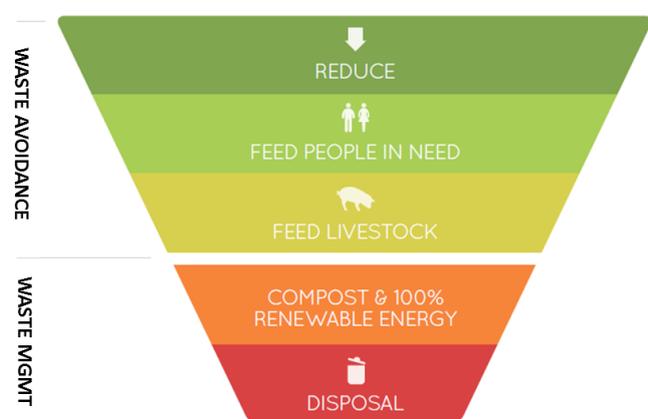
**Implementing body:** WRAP, among others

The complexity of the food waste issue and the number of actors involved necessitate multiple instruments to achieve desired waste reduction targets. The UK food waste policy mix focuses on the entire lifecycle of food waste, including production, distribution, retail, consumption and disposal. The guiding principle is to follow the waste hierarchy, consisting of five steps for dealing with waste, ranked according to their environmental impact as set out in Article 4 of the revised EU Waste Framework Directive (Directive 2008/98/EC). Waste prevention, which is the best option for the environment, is the highest priority, followed by preparing for re-use, recycling, other recovery and disposal (see **Figure 4** below and **Error! Reference source not found.** for a specific food waste hierarchy). Accordingly, targeted sectors include manufacturing and processing, wholesale and retail, food service and restaurants, and households (with a main focus on households given the large proportion of total food waste produced). Importantly, a key element in delivering this hierarchy is to understand how it is defined.<sup>x</sup>

**Figure 4: Waste hierarchy**



**Figure 5: Food waste hierarchy**



<sup>x</sup> Under FUSIONS, D1.1, a standard approach on system boundaries and definitions of food waste are being established to improve its quantification of across the EU27.

Source: WRAP. 2013b. "Would you believe it?"  
<http://www.wrap.org.uk/blog/2012/02/wood-you-believe-it> Accessed on 03.07.13.

Source: Feeding the 5000. n.d. "Food waste pyramid."  
<http://www.feeding5k.org/businesses.php> Accessed on 03.07.13.

Given the diversity of instruments included in the policy mix, it follows that the scale of application also varies. EU legislation and strategies are one element, as well as instruments at the national (UK), country (Wales, Scotland, England and Northern Ireland) and local levels. Accordingly, there are a number of implementing bodies responsible for the instruments which are listed below along with their main roles within the policy mix:

- **European Union** - development and implementation of EU legislative measures which set out necessary actions and targets to be met by the UK; contributes funding to WRAP via projects and small grants (e.g. FUSIONS project).
- **UK regulators** (Environment Agency, Natural Resources Wales, Scottish Environmental Protection Agency and Northern Ireland Environment Agency) - regulation of waste management facilities, monitoring and enforcement issues, licensing and monitoring waste movement, including exports.
  - E.g. for the Landfill Allowance Trading schemes, the Environment Agency is responsible for monitoring both the Landfill Allowance Trading Scheme (LATS) and Landfill Allowance Schemes (LAS) performance in England and Wales. Scottish Environmental Protection Agency is responsible for monitoring LAS in Scotland. The Northern Ireland Landfill Allowance Scheme (NILAS) is monitored by the Department of Environment and Heritage Service.
- **Respective country governments** (i.e. Department for Environment, Food and Rural Affairs (Defra) in England, the Northern Ireland Executive, the Scottish Government and the Welsh Government) - contribute funding to WRAP and implement national country-specific campaigns targeting food waste reduction; develop national waste strategies and set targets in line with national priorities.
- **Local authorities** - household and business waste collection services, waste disposal, enforcing waste legislation, and encouraging good waste management (e.g. recycling) in their areas through information campaigns etc. (in part to reduce the amount of landfill taxes they incur).
- **Waste and Resources Action Programme (WRAP)** - supports businesses, local authorities, communities and individuals to reduce waste and use resources in a more efficient way by increasing the evidence base, raising awareness, highlighting target areas with maximum potential impacts, influencing decisions around food product design, processes, purchase and use, etc.

#### Objective of policy mix:

The overarching goal of the UK food waste policy-mix is to **reduce the amount of food and drink waste which is produced on a whole, and subsequently the food waste which ends up in landfills<sup>xi</sup>**, in line with the waste hierarchy (see above). This can be viewed as a sub-objective of wider UK waste goals which are moving towards a circular economy - to be

<sup>xi</sup> Note: liquid waste is not allowed in landfills.

accomplished in part by reducing the amount of biodegradable waste ending up in landfills (thereby fulfilling national waste reduction strategies and EU Directive requirements). The specific targets of the individual policy mix instruments vary, with largely sector-specific ambitions. The most relevant, more explicitly food waste-focused goals (often within the category of biodegradable municipal waste, BMW) are as follows.

The **EU Landfill Directive** (1999) serves as a crucial policy item which has had significant impacts on waste policy development in the UK. The Directive requires that a strategy on biodegradable waste be put in place that sets targets for the diversion of BMW from landfills (Articles 5(1) and (2)). The Directive sets targets which require Member States to progressively reduce the amount of BMW which is landfilled. These targets have been incorporated into the respective country waste strategies of Wales, England, Northern Ireland and Scotland.

At a UK level, the EU Landfill Directive has been implemented through the **Waste and Emissions Trading (WET) Act 2003** (Defra 2010)<sup>32</sup> with the setting of a maximum amount of BMW sent to landfill from each country, the allocation of landfill allowances and the preparation of country strategies for reducing the amount of biodegradable waste going to landfills.

- In **England and Wales**, the Directive was transposed into law as the Landfill (England & Wales) Regulations 2002 and Waste Strategy 2007 which requires a reduction in biodegradable waste sent to landfill by 75% by 2010, 50% by 2013 and 35% by 2020 (compared to 1995 levels)<sup>xii</sup>. The WET Act 2003 introduced the **Landfill Allowance Trading Scheme (LATS)** that sets out restrictions for disposal for each local authority in England and Wales.
- In **Scotland**, the Landfill (Scotland) Regulations 2003 implement most of the requirements of the Directive. The Landfill (Scheme Year and Maximum Landfill Amount) Regulations 2004 and Landfill Allowance Regulations (Scotland) 2005 implement Section 4 of the WET Act 2003 making an allocation of allowances of BMW sent to landfill by local authorities for each scheme year.
- In **Northern Ireland**, the Landfill Regulations (Northern Ireland) 2003 implement the Landfill Directive. Furthermore, the Landfill Allowances Scheme (Northern Ireland) Regulations 2004 (NILAS) was set up under the WET Act 2003.

The revised **EU Waste Framework Directive** (2008) defines food as 'bio-waste' and sets targets in Article 22, placing greater emphasis on the waste hierarchy than in the previous version of the Directive. Article 22 requires Member States to take measures to encourage: separate collection of bio-waste with a view to its composting and digestion; treatment of bio-waste in a way that fulfils a high level of environmental protection; and the use of environmentally safe materials produced from bio-waste.

This Directive is implemented in England, Scotland and Wales via the **Environmental Protection Act of 1990**, aiming to strengthen pollution controls and support enforcement with steeper penalties (Drew 2013).<sup>33</sup> This Act also outlines the statutory duties of waste collection

<sup>xii</sup> See <http://www.larac.org.uk/key-waste-legislation>

and disposal authorities to provide waste collection and disposal services and is complemented by the Controlled Waste Regulations of 1992. Some countries also have their own specific targets as part of its waste strategy or waste regulations which can go beyond what is established in UK documents. Each regulation contains the requirement to establish a Waste Prevention Programme by December 2013 (Drew 2013)<sup>34</sup>:

- **Waste (Scotland) Regulations 2012:**
  - By 31 December 2013: businesses (except in rural areas) are to present dry recyclables and food waste of more than 50kg/week for separate collection;
  - By 31 December 2015: Local Authorities are to provide households with food waste collection services and businesses to present food wastes of less than 50kg/week for separate collection
  - A ban on biodegradable waste going to landfill will be introduced by the end of 2020.
- **Waste Regulations (Northern Ireland) 2011:**
  - Regulation 17 introduced a duty on waste operators to comply with the waste hierarchy, starting from October 2011

Finally, **EC Regulation No 1221/2008** (2008) - approved the phasing out of regulations on the size and shapes of fruit and vegetables, thereby preventing the unnecessary discard of various types of produce which are aesthetically imperfect but edible.

The objectives of **WRAP**, as set out in the 2011-2015 Business Plan, include reducing the amount of biodegradable waste going to landfill each year by 3 million tonnes and reducing CO<sub>2</sub> equivalent emissions associated with avoidable food and drink waste by 3.2 million tonnes a year (WRAP 2011d).<sup>35</sup>

As noted in section 6b, a number of **voluntary agreements** are also in place. This includes the Courtauld Commitments between actors in the **grocery supply chain** with the following objectives:

- Courtauld Commitment 1: reduce UK household food waste by 155,000 tonnes in 2010 compared to 2008 levels (Defra 2007:67).<sup>36</sup>
- Courtauld Commitment 2: reduce UK household food and drink waste by 4% between 2010 and 2012, against 2010 baseline; reduce waste in the grocery supply chain (WRAP website)
- Courtauld Commitment 3: reduce UK household food and drink waste by 5% between 2012 – 2015, against 2012 baseline, representing a 9% reduction in real terms to counter the expected increase in food purchased; reduce waste in the grocery supply chain (WRAP website).

The voluntary agreement among actors in the **hospitality and food service sector** (2012) includes the following objectives:

- Reduce food and associated packaging waste arising by 5% by the end of 2015 (against a 2012 baseline, measured by equivalent CO<sub>2</sub> emissions);

- Increase the overall rate of food and packaging waste being recycled, sent to AD or composted to at least 70% by the end of 2015 (WRAP 2012b)<sup>37</sup>

A Government review of waste policy in England in 2011 identified food waste as a top priority, and was followed up on with a progress report in 2012 (Defra 2012b).<sup>38</sup> The identified actions and progress achieved in England are set out in Table 3.

**Table 3: Progress on achievement of food waste-related goals in England**

Action	Update on progress
<b>Voluntary Responsibility Deal with the hospitality sector</b>	On track –The Hospitality and Food Service Agreement was launched in 2012. The agreement has two targets; to reduce food and packaging waste and; to increase the proportion of waste being recycled, composted or sent to AD. Signatories will report on their waste arisings and waste management and will receive support from WRAP to meet the targets. WRAP is encouraging businesses to sign up to the agreement in advance of the launch date.
<b>Food waste - collections</b>	On track - The Government will encourage local authorities to sustainably manage their food waste, providing technical support and advice on collections and appropriate treatment options.
<b>Food waste</b>	On track – Defra is helping consumers through WRAP’s ‘Love Food Hate Waste’ campaign, working with the food industry to improve products and practices through the Courtauld Commitments, and developing the evidence base on food waste causes and quantities. New guidance on date labelling was published in September 2011.
<b>Food waste – Successor to Courtauld 2</b>	On track – In December 2011, WRAP published results of the first year (2009 to 2010) of the Courtauld Commitment (Phase 2). Defra are working with WRAP and industry on Courtauld 3 (launched early May 2013 and running until 2015).
<b>Food waste – incentives</b>	On track - Defra will further explore the role of incentives in reducing food waste and ensuring it is managed in the most sustainable way possible.
<b>Food waste – leading by example</b>	On track – Government Buying Standards for Food are in place for Departments and their agencies for the procurement of food and catering. They require caterers to take steps to minimise food waste and improve how waste is dealt with. Defra will look to improve these standards as the evidence base develops and is also working with Government Departments on their role as supporters (and clients) of the Hospitality and Food Service Sector Responsibility Deal.

Source: Adapted from Defra. 2012b. *Progress with delivery of commitments from the Government’s Review of Waste Policy in England (2011)*. Department for Environment, Food and Rural Affairs

Potential **future objectives** are also being discussed at a UK-level to complement existing instruments and targets. According to Defra (2011)<sup>39</sup>, such ambitions include: exploring the role of *incentives* in reducing food waste and managing it sustainably, a new *Responsibility Deal* with businesses in the hospitality and food service sector<sup>xiii</sup>, and setting *minimum buying standards* for Government Departments and agencies for procurement of food and catering.

<sup>xiii</sup> This has now been launched, see: [www.wrap.org.uk/hafs](http://www.wrap.org.uk/hafs)

## 6a. Supplementary context questions including elements pertinent to paradigm discussions in DYNAMIX

*Timeline for the different phases of the policy cycle (i.e. rationale & objective-setting; appraisal; implementation & monitoring).*

*Description of the government in power during each of the three following policy phases: rationale and objective-setting; appraisal; and implementation and monitoring.*

*Does the mix contain policies that are unusual or not typical of the country/ies or regional/local administration that implemented it?*

*Names of resource efficiency concepts, terms, models, ranking/classification systems, accounting methods etc. used or relied upon in each of the three phases of the policy cycle: rationale and objective-setting; appraisal; and implementation and monitoring, and how they were used (e.g.: ‘waste hierarchy’ – used in objective-setting to link policy objectives to more desirable uses for waste).*

Although the main components of the policy mix were implemented starting in 2004, a crucial precursor to food waste related legislation was the UK Landfill Tax implemented in 1996. This policy was introduced by the then conservative Secretary of State for the Environment, John Gummer (now Lord Deben) and served as the UK’s first environmental tax.

The main rationale behind the development of (food) waste policies in the UK was to reduce the amount and types of waste (including but not only targeting food waste) winding up in landfills in order to meet the EU Landfill Directive targets and address the top of the waste hierarchy. Accordingly, priority is given to reducing waste at source (prevention), reusing products, recycling materials before disposal, other recovery (e.g. energy recovery). Should food waste necessitate management, AD is the preferred treatment/recovery route.

This rationale is different to the policy context in other countries, e.g. the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) in Germany started many initiatives against food waste in 2012, with the underlying focus of ethical considerations (food insecurity in other countries), economic (costs avoided for consumers and at the level of disposal) and avoided environmental impacts<sup>xiv</sup>.

## 6b. Instruments and orientation of policy mix

*Instruments in the mix and whether one type of tool (i.e. regulatory, economic, information) is dominant.*

*For each instrument, what is its aim? What requirements does it place on relevant players (for example, phasing out a certain substance, meeting minimum recycling targets, etc.)? What reporting requirements exist?*

Extensive research shows that influencing decisions around food product design, production processes, purchase and use is a major challenge (WRAP 2013).<sup>40</sup> While prescriptive policies and legislation drive action and can help to address the problem, the provision of tools and

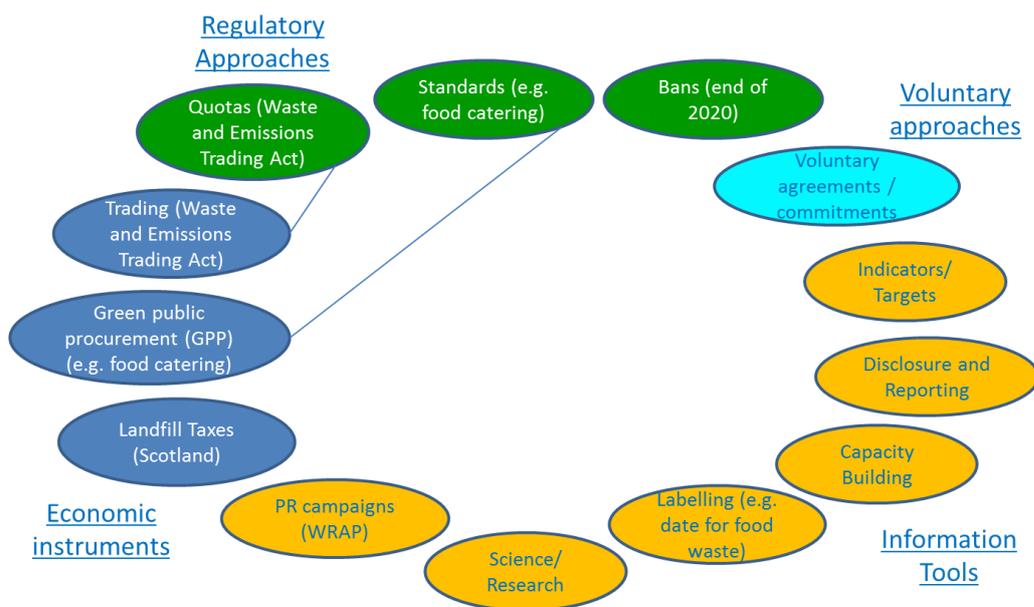
<sup>xiv</sup> See website of the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) and food waste initiative “zu gut für die Tonne”: <https://www.zugut fuer dietonne.de/index.php?id=7>

guidelines to facilitate positive choices by consumers, retailers and brands as well as information and advice on alternatives are often central to success (WRAP 2008a).<sup>41</sup> Accordingly, the issue of food waste calls for a multifaceted policy response which prioritizes waste prevention, minimisation and valorisation over 'end of pipe' solutions (Sanders and Crosby 2004)<sup>42</sup>, addressing both supply chain waste production and the average citizen's behaviours.

Thus, while a number of different types of instruments have been applied to address the food waste issue in the UK, the most relevant tend to be voluntary/cooperation agreements, information-based and market-based schemes, as well as, fiscal instruments aiming to drive behaviour changes. The instruments that have played an integral role within the UK food waste policy mix, as well as those functioning in a supporting role, are outlined and illustrated in

Figure 6 below.

**Figure 6: Main instrument categories involved in the UK food waste reduction policy mix**



Source: Own compilation

Specific instruments at UK, country and local/regional levels relating to each instrument category illustrated in

Figure 6 are listed below.

Regulatory instruments

- **Waste and Emissions Trading (WET) Act 2003** based on the Waste Strategy 2000
  - Sets the maximum amount of BMW to landfill from each country in the UK
  - Sets up a system of tradable landfill allowances, believed to be the first of its kind in Europe

- Requires the preparation in each country of a strategy for reducing the amount of biodegradable waste going to landfills
- Implemented via: Landfill (England & Wales) Regulations 2002; Landfill (Scotland) Regulations 2003; Landfill Allowance Regulations (Scotland) 2005; Landfill Regulations (Northern Ireland) 2003)
- **Waste (England and Wales) Regulations (2011)** – Implements the revised EU Waste Framework Directive in England and Wales. The Regulations place larger emphasis on the waste hierarchy to ensure waste is dealt with in the priority order.
- **Waste (Scotland) Regulations (2012)** - Amongst other provisions includes a ban on BMW going to landfill from 1 January 2021.

#### Market-based instruments:

- **UK Landfill Tax (1996)** – The tax is seen as a key mechanism in enabling the UK to meet its targets under the Landfill Directive to reduce the landfilling of biodegradable waste. Through increasing the cost of landfill, other advanced waste treatment technologies with higher gate fees become more financially attractive. The amount of tax levied is calculated according to the weight of the material disposed and whether it is active or inactive waste. While the landfill site operator is responsible for paying the tax, they pass the cost onto businesses and local councils on top of normal landfill fees. VAT is charged on the full cost of landfilling including landfill fees and landfill tax.
- **Landfill Tax (Scotland) Act (2013)** - Represents a “major change” to the current UK – wide landfill tax system in terms of, amongst other aspects, its level of stringency. Under the Act, for example, any organization which is caught disposing of material without a permit is liable to pay the landfill tax they evaded in addition to any possible environmental/court penalty (unlike the UK tax, which only charges legal activities).
- **Landfill Allowance Trading Scheme (LATS) and Landfill Allowance Scheme (LAS)** — The schemes seek to help reduce the amount of biodegradable municipal waste sent to landfill to contribute to achievement of EU Landfill Directive targets (see section on Regulatory instruments below for further information). Each ton of waste landfilled requires local authorities to pay the appropriate landfill tax and ensure that they possess sufficient LATS allowances for the biodegradable portion of that ton.
  - In England, the LATS began on 1 April 2005 and all waste disposal authorities are able to trade, bank and borrow allowances. The scheme will run until the end of 2012/13 with the conclusion of trading on 30 September 2013.<sup>xv</sup>
  - In Wales, Scotland and Northern Ireland, the scheme is known as the Landfill Allowances Scheme (LAS) with no trading between waste disposal authorities (WDAs) permitted. The Environment Agency is responsible for monitoring both the LATS and LAS performance in England and Wales; Scottish Environment Protection Agency (SEPA) is responsible for monitoring LAS in Scotland; the

<sup>xv</sup> <http://www.environment-agency.gov.uk/business/topics/waste/32130.aspx>

Northern Ireland Landfill Allowance Scheme (NILAS) is monitored by the Department of Environment and Heritage Service.<sup>xvi</sup>

#### Information-based instruments

- WRAP's **research and technical reports** (ongoing) – evidence base to support change via identification of key areas to focus attention, outlining ways to optimise packaging and products, creating tools and guidance for specific sectors (e.g. household food and drink waste, manufacturing and retail, packaging, including drinks<sup>xvii</sup>).
- **Love Food Hate Waste** campaign (2007-ongoing) – launched and run by WRAP, with support from Defra's Environment Minister Joan Ruddock MP. Targets households, aiming to raise awareness of the need to reduce food waste and help individuals take action via the provision of tools, information, guidelines and practical suggestions on behavioural changes.
- **Love Your Leftovers** campaign (2008) - Sainsbury's introduced new storage guidance to customers both in-store and on its website, advising shoppers on how to store loose fruit and vegetables in the fridge to keep it fresher for longer (WRAP 2011b).<sup>43</sup>
- **Great Taste, Less Waste**<sup>xviii</sup> campaign (2009-ongoing) - Morrison's campaign aims to help customers waste less food, including 'best kept' labeling to inform customers how best to store products, and promote effective meal planning through recipe suggestions that use the same core ingredients. Morrison's was the first UK retailer to print storage advice for loose fresh produce on their bags.
- **Guidance on waste hierarchy** (2011) - Defra published guidance, highlighting the value of AD as compared to composting and other recovery options.
- **Waste reduction campaigns** by local authorities (LA) – by early 2000, LA were paying large fees for the landfill tax due to high household waste production levels. Thinking about potential long-term cost savings, waste collection authorities launched campaigns and workshops and distributed fliers to households to encourage reduced food waste production. These campaigns were particularly active from 2006-2008, and continue today.

#### Strategies, Plans and Directives

- **Waste Strategy 2000 (England Wales)** – issued as a White Paper; acts as a precursor to the Waste and Emissions Trading Act (2003).

<sup>xvi</sup>[http://www.ciwm.co.uk/CIWM/InformationCentre/AtoZ/LPages/Landfill\\_Allowance\\_Trading\\_Scheme.aspx](http://www.ciwm.co.uk/CIWM/InformationCentre/AtoZ/LPages/Landfill_Allowance_Trading_Scheme.aspx)

<sup>xvii</sup> <http://www.wrap.org.uk/node/9993> for more information

<sup>xviii</sup> <http://www.morrisons.co.uk/food-and-drink/GreatTasteLessWaste/>

- **Waste Not, Want Not:** a strategy for tackling the waste problem in England (2002) - outlines the various components of the UK waste stream, including a focus on food from households.
- **Waste Strategy England (2007)** - supports collecting food waste for treatment by AD, stating that “AD has significant environmental benefits over other options for food waste” and therefore “the government wishes to encourage more consideration of the use of AD both by local authorities and businesses” (Friends of the Earth 2007).<sup>44</sup>
- **Household Waste Prevention Plan (Scotland) (2007)** - contains 20 targeted actions aimed at halting the growth in Scottish household waste by 2010 (WRAP 2008a).<sup>45</sup>
- **Food 2030 Strategy (2010)**<sup>xix</sup> – as a follow-up to the publication of the Cabinet Office Strategy Unit’s report in July 2008 ‘*Food Matters*’, this Strategy of the National Government provides direction and coherence to food policy not only within Whitehall and its agencies but also across the private and voluntary sectors. Its actions include measures to reduce food waste via (HM Government 2010).<sup>46</sup> Diversion of food waste from landfill, Meal planning, Helping consumers reduce food waste, Clear, unambiguous date labeling, food storage and usage guidance, Processors and retailers reducing waste, and Reducing waste in the food supply chain.

#### Voluntary agreements

- **Courtauld Commitments** (launched in 2005) - voluntary agreements between leading retailers, brand owners, manufacturers and suppliers which aim to improve resource efficiency and reduce the carbon and wider environmental impact of the grocery supply chain, thus supporting the UK governments' policy goal of a 'zero waste economy'. WRAP is responsible for the agreement and works in partnership with signatories to deliver a number of targets.
  - *Commitment 1 (2005-2010)* - Helped to implement new solutions and technologies so that less food, products and packaging end up as household waste. It took shape at a Ministerial summit in 2005 which brought together the then Environment Minister, the Chief Executive of WRAP, senior representatives from leading UK grocery retailers and the British Retail Consortium.
  - *Commitment 2 (2010-2012)* - Moves away from solely weight-based targets, aiming to achieve more sustainable use of resources over the entire lifecycle of products throughout the whole supply chain.
  - *Commitment 3 (2013-2015)* - Aims to further reduce the weight and carbon impact of household food waste, grocery product and packaging waste, both in households and the UK grocery sector. The agreement is funded by English, Scottish, Welsh and Northern Ireland governments and delivered by WRAP.
- **Hospitality and food service agreement (2012–2015)** - Voluntary agreement to support the sector to reduce waste and increase recycling. The Agreement is flexible

<sup>xix</sup> At the time of writing this report, no further information on progress reports or the achievement of these targets was able to be identified.

to allow any size of organisation to sign up, from multi-national companies to smaller businesses, from sector wholesalers/distributors to trade bodies. WRAP will deliver this Agreement across the UK through its national programmes, including Zero Waste Scotland.

### Technical changes

This category encompasses concrete changes to reduce the amount of food waste produced. Examples include changes to packaging (to increase the shelf-life of products, to enable longer freshness in the fridge after opening, easier freezability, etc.), storage guidance and date labels (e.g. 'use by', 'best before' or 'display until' dates), as well as *how* products are offered and sold. Such actions are monitored through WRAP's technical programme under the Courtauld Commitments and retailer survey<sup>xx</sup>. Some examples include:

- **Fridge pack launch** (2010; trial) - Heinz launched an innovative pack for baked beans in 2010 which could be kept in the fridge for up to five days after opening (WRAP 2011b).<sup>47</sup>
- **"Buy one, get one free later"** (2010) - Tesco allowed customers buying perishable goods to collect their free item the following week as a voucher system.
- Marks and Spencer's **packaging change trial** (2012; trial) – utilized new packaging for enabling strawberries to be stored for up to two days longer than with the standard packaging.
- Tesco **food packaging trial** (2012; trial) – tested new packaging to prolong the freshness of tomatoes and avocados. The packaging contains a strip that absorbs ethylene, the hormone that causes fruit to ripen and then turn mouldy.

## 6c. Evolution of policy mix

*Evolution of the policy mix throughout its existence –details of the introduction of the first policy tool(s), then all subsequent relevant tools, and related revisions/reforms (e.g. progressive increases in rates applied through economic tools, broader extension of regulation requirements, etc.).*

The management of (food) waste in the UK has been transformed in the last 15 years. It began with the revolutionary UK Landfill Tax in 1996 and has moved progressively up the social and political agenda in the UK since 2007 in large part due to the publication of detailed reports by WRAP<sup>xxi</sup> on the amount and types of waste produced nationally, as well as more recently rising up the EU and international agenda.

One major shift within UK food waste reduction efforts has been to broaden the scope of targeted actors by moving from only waste-based organizations to a more inclusive approach which also addresses food-based organizations and consumers (Quested 2013).<sup>48</sup> WRAP

<sup>xx</sup> See <http://www.wrap.org.uk/content/helping-consumers-reduce-food-waste-retail-survey-2011> for more information.

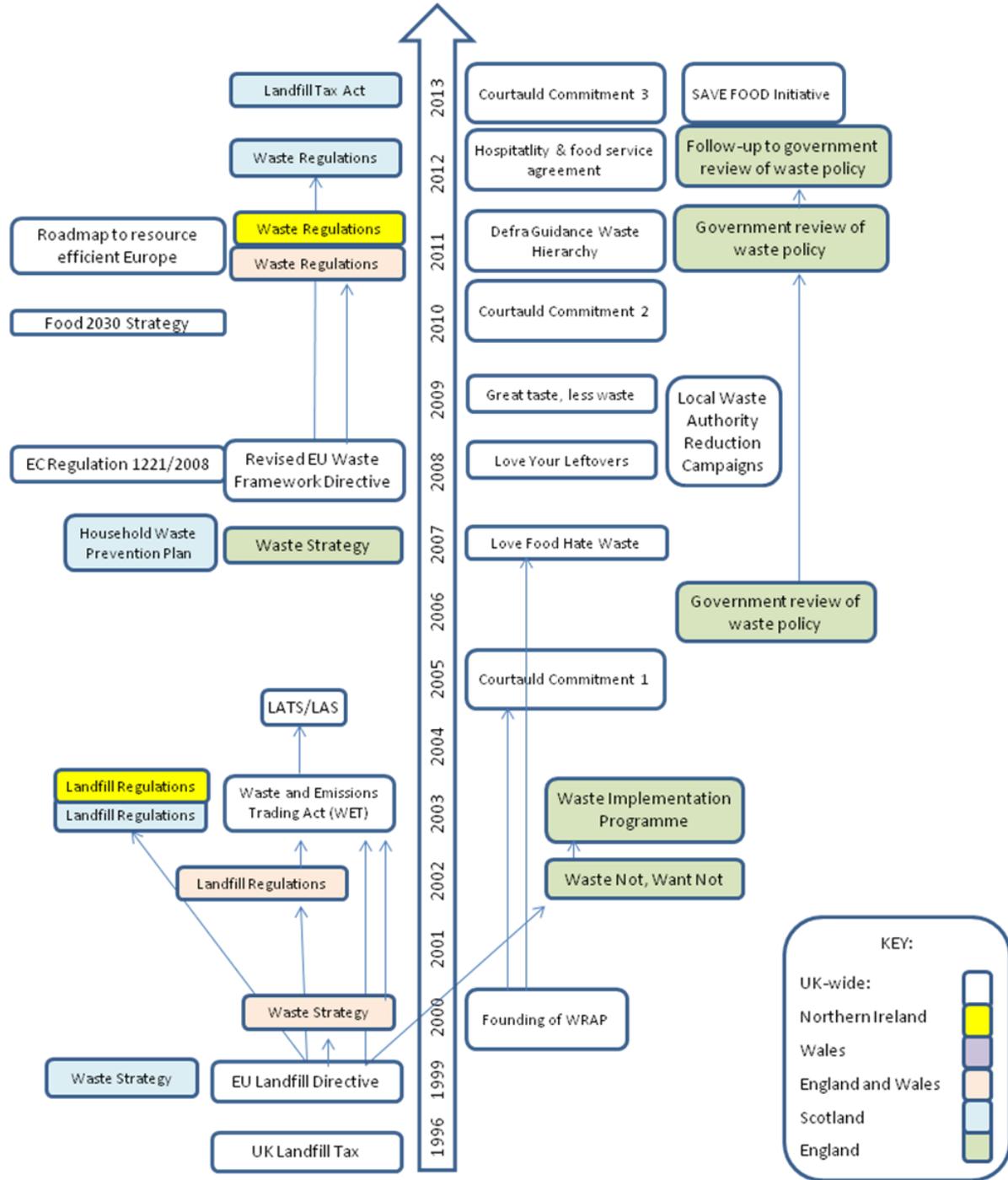
<sup>xxi</sup> <http://www.wrap.org.uk/waste-resource-listing>

has mirrored these efforts to broaden their campaigns and now targets food-based organizations, retailers and manufacturers alongside its original target groups.

In addition, there are a number of continuous changes with individual policies. New targets are set under voluntary agreements over time (e.g. each Courtauld Agreement sets new, more ambitious targets than the last). The UK Landfill Tax also increases its tonnage rates annually following a so-called “escalator” system. According to the UK’s emergency budget from 2010, the standard rate of landfill tax will increase by £8 per tonne each year from 1 April 2011 until at least 2014; the rate will not fall below £80 per tonne from April 2014 until at least 2020. In 2013-2014, the standard rate for active waste is £72 per tonne and £2.50 per tonne for inactive waste.

A visual diagram of the chronology of the evolution of the policy mix since 1996 is presented in Figure 7 below. It should be acknowledged that while the crucial UK level instruments (in white) are all included, additional country-level instruments (in colour) from Scotland, England, Wales and Northern Ireland have not all been included.

Figure 7: Evolution of the UK-relevant food waste policy-mix (1996 to present)



Source: Own compilation

## 7 Evaluation of policy mix: effectiveness (environmental sustainability)

*Does/did the policy mix result in a positive environmental outcome?*

*Were its stated objective(s) met? Were the instruments used sufficient to meet the objectives?*

*Did other, unforeseen/unintended positive outcomes or impacts (environmental, social, economic) result? Did other such negative outcomes or impacts result?*

*Were these objectives set at a level to meet environmental needs (e.g. avoid crossing environmental thresholds/tipping points or achieve more sustainable levels of resource use/extraction (e.g. maximum sustainable yield (MSY) in fisheries)?*

*Which sectors/actors were identified as having key impacts/influences on the problem/issue? (e.g. specific industrial/ business sectors, consumers, economy as a whole?) Did any of the instruments specifically target these key sectors/actors? Was there significant take-up/implementation of (voluntary) instruments by these sectors?*

*Was the policy mix applied to a sector previously not targeted by policies on the issue under question, or in a new area/issue – thereby aiming to stimulate change?*

*What were the anticipated and actual outcomes, impacts and effects of the policy mix on the behaviour of sectors and actors targeted? (e.g. reductions in emissions from industry, increased recycling rates, increase/decrease in certain product purchases, etc.).*

*Relationships between the instruments, identifying positive/negative influences on the overall policy mix or on key instruments in the mix, as well as any positive or negative impacts from changes to the mix (introduction or termination of instrument(s), increase or decrease in tax/levy/charge, etc.). Level of ‘connectivity’ (strong, weak) between each instrument and the primary one(s).*

*Are there any indicators, monitoring systems, review processes or other monitoring mechanisms in place to track progress?*

When evaluating the environmental effectiveness of the UK’s food waste reduction policy mix, difficulties arise in distinguishing between the specific effects of individual instruments (e.g. a specific campaign, technical change, etc.). In particular, within a national context, it is challenging to separate the influence of WRAP and the work of other food waste focused organizations’ from the effect of food price rises and income changes (WRAP 2011b).<sup>49</sup> These two aspects can (but do not necessarily) work synergistically. For example, WRAP’s campaigns to reduce household waste have often directly referred to the economic situation and cited the financial benefits of reducing food waste in times of economic hardship (e.g. in the ‘Love Food Hate Waste’ campaign). This campaign has been cited as having led to an overall reduction of 137,000 tonnes of food waste between 2008 and 2010 and achieving a 35% reduction of food waste among UK schools in the same time period (Bio Intelligence Service 2010).<sup>50</sup> According to a study estimating the influence of WRAP and its partners on reducing household food waste, around 60% of the reduction between 2006/2007 and 2010 is likely to have been due to these contributions, and around 40% can be attributed to rising food prices and the recession (Parry 2013).<sup>51</sup>

Given these challenges in disaggregating results some general results are provided. At the **overall, UK level**, WRAP (2013)<sup>52</sup> states that between 2006/2007 and 2010, 1.1 million tonnes of food waste has been prevented in the UK, (950,000 tonnes of which could have been eaten, representing an 18% reduction) (WRAP 2013).<sup>53</sup> Additional indications of the environmental impacts can be found at the **country level**. In England, for example, there has been an 18% reduction in food waste collected by local authorities between 2006/2007 - 2010 (i.e. 4,650,000 tonnes to 3,820,000 tonnes); this reduction has taken place despite growth in household numbers (4.2% between 2006/07 and 2010) (WRAP 2011c).<sup>54</sup> Finally, positive environmental impacts have also been observed on a **local level**. For example, the implementation of Love Food Hate Waste activities by Worcestershire County Council included a compositional analysis before and after their activities in spring 2011. The results indicate that around 15% less avoidable household food waste was collected after their intervention (significant at a 95% confidence level) (WRAP 2011b).<sup>55</sup>

Significant environmental results have been credited to the **Landfill Allowance Trading Scheme (LATS)** after its first five years in operation. A report by the Environment Agency (2010)<sup>56</sup> found that 32% less BMW was landfilled in 2009 than in 2001/2002 (12.4 to 8.4 million tonnes). In 2011/12, English waste disposal authorities (WDAs) sent 6,401,199 tonnes of BMW to landfill, 1,375,160 tonnes less than the previous year and 2,305,468 tonnes less than the 8,706,667 original allocation for 2011/12. Seven years after the start of the scheme, local authorities landfill 52% less BMW (a reduction from 12,380,966 to 6,401,199 tonnes), and collectively sent 59% less BMW to landfill than in 2001/02 when the base data was collated (Environment Agency 2013).<sup>57</sup> Despite these positive trends, according to a 2012 review of the LATS by Defra (Neville 2012)<sup>58</sup>, the scheme is no longer considered an effective policy tool and will be phased out in 2013. Weaknesses include the incentive for some authorities to turn to 'quick fixes' to meet their allowances, e.g. incineration or the large-scale biological treatment of household waste (Friends of the Earth 2007).<sup>59</sup>

Several **voluntary agreements** targeting food and related waste have potentially significant environmental impacts although evaluations of actual results are limited to date. For example, food retailer and manufacturer signatories to the **Courtauld Commitment** have committed under the second phase (2010-2012) to reduce UK household food and drink waste by 4%. An assessment of the commitment is currently being conducted and results are expected in autumn 2013. The **Hospitality and Food Service Agreement** (launched in 2012) is foreseen to similarly reduce avoidable food waste and divert unavoidable waste to anaerobic digestion. However, the first impact evaluation survey is only being conducted in 2014.

## 8 Evaluation of policy mix: efficiency (economic sustainability)

*Is/was the policy mix considered cost-effective?*

*What has been the level of impact on resource use of the policy mix (the effect)?*

*What have been the costs of implementing the policy mix for target audience (e.g. business, households, etc.)?*

*What are the costs (financial, human) of implementing the policy mix for the implementing authority – i.e. the administrative/transaction costs?*

*Were sufficient resources made available to ensure an effective implementation of the policy-mix?*

*Was anything foreseen in the policy-mix to address competitiveness concerns (e.g. use of exemptions) or minimise transaction costs (e.g. thresholds below which monitoring wasn't required)?*

*Did the policy mix involve providing financial support (e.g. subsidies, low interest loans, tax breaks etc.) to key actors (e.g. sector, households, etc.)?*

*Did the measures generate revenues (e.g. in the case of taxes) and if so, was revenue recycled/re-injected into the economy, and to what levels and activities? Did revenue recycling have positive amplifying effects?*

*In synthesis - was the policy mix cost-effective?*

*What elements of the mix were (un)helpful in improving cost-effectiveness?*

*How was relative/absolute decoupling achieved?*

*Were resource limits or other thresholds taken into account and how were they addressed?*

While it is not possible to evaluate the economic sustainability of the UK food waste reduction policy mix as a whole, several aspects can be highlighted to provide some insights in this regard. Furthermore, research by Defra (2013)<sup>60</sup>, for example, indicates that the costs of preventing food waste are far smaller than the benefits (including e.g. environmental, financial, etc). Further information on the subject will also be made available by WRAP in summer 2013 as a follow-up to their preliminary findings published in 2010<sup>xxii</sup>.

Almost half of the UK's total food waste comes from households. The portion of this waste that is avoidable is estimated to be around 60%, which is equivalent to £12 billion per year. This represents an average of £480 spent unnecessarily per UK household and £680 per UK household with children (WRAP 2011b).<sup>61</sup> Not only is the food itself paid for and not eaten, but society additionally covers the costs of disposal, usually in landfill sites, through a council tax (in England, Scotland and Wales) (WRAP 2007)<sup>62</sup> while local authorities spend hundreds of millions of pounds collecting and landfilling waste produced (WRAP 2013).<sup>63</sup>

There is also a large opportunity cost of the food and drink waste produced that does not get separated for compost or undergo AD to produce renewable energy. Research by WRAP indicates that if avoidable food waste was prevented and unavoidable food waste was diverted to AD, the potential savings to industry would be more than £720 million a year (WRAP 2012a).<sup>64</sup> It has been further estimated that by treating even 5.5 million tonnes of the annually produced food waste by AD, between 477 and 761 GWh of electricity could be produced annually. Based on 2007 figures, however, only 5% of the UK's food waste was composted and 0.4% was treated with AD (Friends of the Earth 2007).<sup>65</sup>

Finally, waste in supply chains comprises approximately 25% of UK food waste and costs the retail sector an estimated £5 billion per year (Defra 2011).<sup>66</sup> Presented differently, estimated cost savings from waste prevention within the UK food and drink supply chain were estimated at £500/ton in manufacturing, £1088/ton in distribution and £1676/ton in the retail sectors,

<sup>xxii</sup> See <http://warr.org/751> for further information.

according to 2010 data (updated figures are expected to be provided by WRAP in 2013). These savings compare with £70/ton cost of landfill diversion (Defra 2013).<sup>67</sup>

Taking one instrument of the policy mix as an indicative example of the cost-benefit ratio, the **'Love Food Hate Waste'** campaign cost approximately £600,000, which was predominantly allocated to carrying out initial research to locate sources and causes of food waste and thereby maximize the impact of targeted communication efforts (Bio Intelligence Service 2010).<sup>68</sup> After this initial scoping phase, the implementation costs of the campaign are approximately £2 million per year (covering advertising, public relations, events, website maintenance and the production of new communication materials).

According to a self-evaluation by WRAP, the following economic impacts have been achieved since the start of their campaigns in 2006/2007 until 2010 (WRAP 2013)<sup>69</sup>:

- For every pound spent on reducing household food waste, more than £100 of food has been prevented from being wasted over the course of their activities. This has an added effect of helping to mitigate the impact of rising food prices via a reduction in the quantity of food purchased and then thrown away.
- Lifestyle changes by more than 2 million people in the UK (regarding e.g. methods of shopping, preparing, storing and using food) serves as an indicator of continued returns on initial and ongoing investments.
- Local authorities in the UK have saved around £80 million in avoided gate fees and landfill charges.
- Although food price inflation means that the value of avoidable food waste is similar to that in 2007, consumers would be spending approximately £2.5 billion more per year on food and drink waste without the achieved reduction.

The Landfill Tax and LATS are intended to act as revenue generators, but have been questioned for their economic sustainability. Between 1997 and 2012, the **landfill tax** generated over £10 billion for the UK Government (treasury<sup>xxiii</sup>), with fluctuations (e.g. a decrease in 2009/2010 as a result of the recession and over £1 billion collected in 2011 alone). Factors influencing future revenue to the Government include:

1. Increased investments in and development of alternative infrastructure to meet the Landfill Directive targets;
2. Meeting the escalator's medium-term target of £80 per ton in 2014 (resulting in a peak in revenues at approximately £1.5 billion, after which they will fall);
3. Decreasing landfill volumes until 2020.

The Environmental Services Association (ESA) estimates that while the landfill tax will have contributed over £10 billion to the HM Treasury by 2020, revenues are likely to be almost

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<sup>xxiii</sup> It should be noted that the government allows some of the landfill tax money it levies on operators of landfill sites to be used to benefit communities and the environment through what is called the Landfill Communities Fund. Previously, up to 6.5% of the landfill tax liability could be contributed to environmental type bodies in return for a tax credit.

£200 million less in 2020 than at their 2014/15 peak (ESA 2012).<sup>70</sup> Thus careful consideration should be given to the economic sustainability of raising the landfill tax escalator further versus the environmental impacts that would be generated (see section 9).

The tax overlaps to an extent with the **LATS**. While this instrument served as a key impulse to divert biodegradable waste from landfills, it has been evaluated as no longer being economically efficient and is currently being phased out. According to an evaluation by Defra (2012), ending LATS in 2012/2013 would lead to a reduction in administrative burdens for local authorities in the amount of £5.58m over the period to 2020 (Neville 2012).<sup>71</sup> With the end of the LATS, local authorities will only have to pay the landfill tax.

## 9 Evaluation of policy mix: welfare (social sustainability)

*What social impacts have you found associated with the policy mix? E.g. jobs created, reduced health impacts, distributional impacts etc.*

*Were social aspects included in an ex-ante impact assessment of the policy mix if one was undertaken? What were these?*

*Has monitoring of social impacts been included in implementation, to identify actual effects compared to anticipated ones?*

*Was the policy mix designed to not be socially regressive? What measures were undertaken to ensure this?*

*Were equity concerns addressed and, in case of re-structuring of the economy/sector, measures in the area of reskilling of the workforce foreseen?*

*What other public acceptability elements were addressed or considered?*

The main *positive* social impacts of the policy-mix include: **cost savings** to various sectors (see sections 3 and 7), **potential job creation**, and **increased public awareness** of the issue as well as potential **nutrition benefits** and the **social benefits** of cooking and eating with others, alleviating food poverty through redistributions, etc. The potential for job creation has been highlighted by the Labour Party in their new waste policy document: *‘Resource security: jobs and growth from waste’*<sup>xxiv</sup> which outlines the opportunity for the waste and resources industry to be a driver of green growth and creator of new jobs. The potential for sparking the development of food waste management infrastructure via a ban on sending food waste to landfills has also been highlighted by former secretary of state for the environment John Gummer, implying potential job creation and stimulation of the local economy. Information-based instruments facilitate an increased level of awareness amongst the general public, thereby supporting more informed decision-making and increasing cost savings – particularly for households.

xxiv

Available for download at:  
[http://www.resource.uk.com/sites/default/files/Policy\\_Review\\_Growth\\_and\\_jobs\\_from\\_waste\\_5.pdf](http://www.resource.uk.com/sites/default/files/Policy_Review_Growth_and_jobs_from_waste_5.pdf)

While the current **landfill tax** level is considered a strong disincentive to landfill, further measures are foreseen to penalize waste producers and – in particular – local authorities (ESA 2012).<sup>72</sup> The predicted costs to waste producers are estimated to outweigh the monetized environmental benefits which would result from an increase in the escalator beyond the current level. More specifically, the ESA estimates that until 2020, the value of the carbon savings resulting from an increased tax escalator would only reach 40% of the cost of the tax on waste producers (ESA 2012).<sup>73</sup> There is therefore a need to concentrate efforts on the implementation of (fiscal) instruments targeting higher levels of the waste hierarchy. Examples of potential future measures include e.g. landfill bans, macerator bans and legislation around ensuring source segregation of all food waste from commercial premises.

## 10 Overall assessment

*What is your overall view on the success(es) or failure(s) of this policy mix?*

*How did the policy mix enable decoupling?*

*How could it have been improved to achieve its original objective(s) and to achieve absolute decoupling?*

The success to date of the outlined policy mix targeting food and drink waste in the UK indicates the potential to reach reduction goals despite (or perhaps partly even as a result of) contextual factors (e.g. the economy and food prices). A key consideration in the success of the UK policy mix is the existence of a dual framework for addressing the food waste issue which is comprised of: **(1) an underlying market-based instrument (the Landfill Tax) and parallel regulations and (2) the support of numerous complementary information-based instruments.**

Given the complex nature of the issue, as introduced at the beginning of this case study, it follows that such a multifaceted policy-mix is necessary to achieve the desired reduction impacts. Behavioural changes are central to reducing the environmental, social and economic consequences arising from unnecessary food waste and are therefore the main focus of information-based instruments. While these instruments targeted only a limited number of sectors in their infancy, they have expanded to address food waste prevention and minimization in hospitals, schools, households, different actors along the supply chain, restaurants and the tourism sector. This broader target group means that the instruments can achieve a much greater impact than was possible at their inception. The development of voluntary agreements to complement the findings of the informational campaigns is a further step which underlines the policy mix's success, e.g. in working with the packaging sector to optimize the design and functionality of packaging to enable a longer shelf-life and thus reduce the likelihood of being wasted.

The market-based instruments in the policy mix are, however, not without their flaws and can be considered as representing the main shortcomings of the policy mix. Based largely on a 2012 review by Defra<sup>74</sup>, the LATS was deemed to no longer be an effective policy tool and is currently in the process of being phased out (to be completed in late 2013). This indicates the value of monitoring and conducting impact assessments to enable informed evaluations of policy instruments on a regular basis.

While the Landfill Tax remains a key instrument in the UK for waste in general, it has limitations within the food waste area. Since food waste is more likely to be weighed at the point of disposal than at the point of collection (for individual households), there is a lack of incentive for individual food waste producers (i.e. households) to reduce the quantity of food waste produced. This could potentially be addressed by the introduction of 'pay as you throw' schemes (also called trash metering, unit pricing, variable rate pricing, or user-pay), which charge users a rate based on how much waste they present for collection to the municipality or local authority. Currently, however, as the landfill taxes and fees are paid by local collection authorities, they have a larger motivation to start campaigns or other efforts targeting the reduction of household (food) waste production.

## 11 Relevance to the EU and transferability

*Can the policy mix be applied at the EU level? Is it transferable to other Member States/countries?*

*What lessons are there that may be of general interest regarding policy mixes and what issues are there as regards transferability of the insights?*

The general aim of EU waste management policies is to prevent waste generation (addressing the top of the waste hierarchy) and, should it be produced, to recycle and treat it in the most optimal way (i.e. AD for food waste). On a European scale, data indicates that the quantity of food waste is increasing despite EU legislative items. Possible explanations of this could relate to population growth, demographic changes and economic growth (affluence) trends (Bio Intelligence Service 2010).<sup>75</sup> Despite the contested influence of EU legislation on waste production, the case examined in the UK indicates the important role EU waste legislation has had in shaping national policy. EU waste policy has significant potential to impact the treatment of food waste once it has been generated and ensure that (1) no or minimal amounts are deposited in landfills and (2) the use of AD is increased as the preferable disposal method.

Additionally, the predominance of information-based instruments within the policy mix and their successful realization of set goals to date hold immense potential across Europe. While guidance and information documents are useful on an EU level to provide an indication of the EU's situation as a whole, national / local campaigns targeting the specific context and drivers of a given country hold the most promise for high impact, as the UK case shows. The potential cost savings for households, industry, and other targeted stakeholders serve as a positive incentive for individuals to change their behaviours and adapt their habits to be more environmentally (and economically) friendly. Furthermore, the economic sustainability analysis clearly indicates the higher savings potential of such efforts compared to their costs.

It also needs to be mentioned that within the EU and worldwide, the UK has been amongst the frontrunners and pioneers in tackling the issue of food waste and raising public and media awareness. An increasing number of countries both within and outside of the EU are now also

taking action, such as Germany<sup>xxv</sup>, Denmark, Belgium, the Netherlands<sup>xxvi</sup> etc.. These initiatives may have partly been induced by the UK's initiatives and actions. Furthermore, the fact that the UK is a national partner in global initiatives such as the UN's "Eat.Think.Save" campaign serves as another potential indication of the relevance of UK policies.

## 12 Stakeholder contribution

### *What insights did stakeholders provide?*

Tom Quedsted - Research Analyst at WRAP (Waste and Resources Action Programme)

Debbie Palfrey – Sector Specialist at WRAP

Sophie Easteal – Sector Specialist at WRAP

Andrew Parry – Special Advisor at WRAP

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<sup>xxv</sup> See e.g. German initiative against food waste "Too good for the bin" ("Zu gut für die Tonne"), see the campaigns website <https://www.zugutfuertietonne.de>

<sup>xxvi</sup> See also European Commission website "Food Waste – Good practices" that disseminates information and compiles good practices on food waste reduction initiatives ([http://ec.europa.eu/food/food/sustainability/gp\\_policy\\_awards\\_certifications\\_en.htm](http://ec.europa.eu/food/food/sustainability/gp_policy_awards_certifications_en.htm) Good practices).

## 13 References

- <sup>1</sup> PBL. 2009. *Growing within Limits: A report to the Global Assembly 2009 of the Club of Rome*. PBL publication number 500201001. Bilthoven, The Netherlands: Netherlands Environmental Assessment Agency.
- <sup>2</sup> Noleppa, S and von Witzke, H. 2012. *Tonnen für die Tonne*, January 2012. Berlin, Germany: WWF Germany.
- <sup>3</sup> FAO. 2011. *Global Food Losses and Food Waste. Extent, Causes and Prevention*, Study conducted for the International Congress “Save Food!” at Interpack2011 Düsseldorf, Germany. Rome: Food and Agriculture Organisation of the United Nations.
- <sup>4</sup> Bio Intelligence Service. 2012. *Assessment of resource efficiency in the food cycle*. Final report, prepared for European Commission (DG ENV) in collaboration with AEA, Dr Donal Murphy-Bokern, Institute of Social Ecology Vienna and Institute for Environmental Studie
- <sup>5</sup> Bio Intelligence Service. 2010. *Preparatory study on food waste across the EU 27*. Final report as part of Contract #: 07.0307/2009/540024/SER/G4 for the European Commission, DG Industry.
- <sup>6</sup> Defra. 2011. *Government Review of Waste Policy in England 2011*. London, United Kingdom: Department for Environment, Food and Rural Affairs.
- <sup>7</sup> PBL. 2009. *Growing within Limits: A report to the Global Assembly 2009 of the Club of Rome*. PBL publication number 500201001. Bilthoven, The Netherlands: Netherlands Environmental Assessment Agency
- <sup>8</sup> Noleppa, S and von Witzke, H. 2012. *Tonnen für die Tonne*, January 2012. Berlin, Germany: WWF Germany.
- <sup>9</sup> Vermeulen, S. J., Campbell, B. M. and Ingram, J. S. I. “Climate Change and Food Systems”, *The Annual Review of Environment and Resources* 37: 195-222
- <sup>10</sup> WRAP. 2009. *Household food and drink waste in the UK*. Final report. United Kingdom: Waste & Resources Action Programme.
- <sup>11</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK*. Final report (version 1.1) United Kingdom: Waste & Resources Action Programme
- <sup>12</sup> WRAP. 2010a. *Waste arisings in the supply of food and drink to UK households*. Final report. United Kingdom: Waste & Resources Action Programme.
- <sup>13</sup> Defra. 2011. *Government Review of Waste Policy in England 2011*. London, United Kingdom: Department for Environment, Food and Rural Affairs.
- <sup>14</sup> Quested, Tom 2013. Interview McKenna Davis with Tom Quested Research Analyst at WRAP (Waste and Resources Action Programme), June 13 2013

- 
- <sup>15</sup> WRAP. 2008b. *The food we waste*. Food waste report v2. United Kingdom: Waste & Resources Action Programme
- <sup>16</sup> Defra. 2011. *Government Review of Waste Policy in England 2011*. London, United Kingdom: Department for Environment, Food and Rural Affairs.
- <sup>17</sup> European Commission. 2011. "Roadmap to a Resource Efficient Europe", COM(2011) 571 final
- <sup>18</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK*. Final report (version 1.1) United Kingdom: Waste & Resources Action Programme
- <sup>19</sup> WRAP. 2010b. *Food waste collection guidance*. Final report. United Kingdom: Waste & Resources Action Programme.
- <sup>20</sup> WRAP. 2010b. *Food waste collection guidance*. Final report. United Kingdom: Waste & Resources Action Programme.
- <sup>21</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK*. Final report (version 1.1) United Kingdom: Waste & Resources Action Programme
- <sup>22</sup> Defra. 2012a. *Food statistics pocketbook 2012*. Department for Environment, Food and Rural Affairs.
- <sup>23</sup> Quested, Tom 2013. Interview McKenna Davis with Tom Quested Research Analyst at WRAP (Waste and Resources Action Programme), June 13 2013
- <sup>24</sup> Bio Intelligence Service. 2010. *Preparatory study on food waste across the EU 27*. Final report as part of Contract #: 07.0307/2009/540024/SER/G4 for the European Commission, DG Industry.
- <sup>25</sup> WRAP. 2008b. The food we waste. Available for download at: <https://www.ns.is/ns/upload/files/pdf-skrar/matarskyrsla1.pdf>
- <sup>26</sup> Bio Intelligence Service. 2010. *Preparatory study on food waste across the EU 27*. Final report as part of Contract #: 07.0307/2009/540024/SER/G4 for the European Commission, DG Industry..
- <sup>27</sup> Defra. 2013. *Waste prevention programme for England: Call for evidence. March 2013*. London, United Kingdom: Department for Environment, Food and Rural Affairs.
- <sup>28</sup> Quested, Tom 2013. Interview McKenna Davis with Tom Quested Research Analyst at WRAP (Waste and Resources Action Programme), June 13 2013
- <sup>29</sup> Prudential. 2004. *Soggy lettuce report: Are we a nation of wasters?* London, United Kingdom: PRUDENTIAL.
- <sup>30</sup> Thankappan, S. 2005. *From Fridge Mountains to Food Mountains? Tackling the UK Food Waste Problem*. Cardiff University.
- <sup>31</sup> Thankappan, S. 2005. *From Fridge Mountains to Food Mountains? Tackling the UK Food Waste Problem*. Cardiff University

- 
- <sup>32</sup> Defra. 2010. *Environmental Permitting Guidance: The Landfill Directive. For the Environmental Permitting (England and Wales) Regulations 2010. Updated March 2010, Version 3.1.* United Kingdom: Department for Environment, Food and Rural Affairs.
- <sup>33</sup> Drew. 2013. *Revised Waste Framework Directive, Transposing Legislation: Key Changes.*
- <sup>34</sup> Drew. 2013. *Revised Waste Framework Directive, Transposing Legislation: Key Changes.*
- <sup>35</sup> WRAP. 2011d. *Working together for a world without waste.* Business plan: 2011-2015. United Kingdom: Waste & Resources Action Programme..
- <sup>36</sup> Defra. 2007. *Waste Strategy for England 2007.* United Kingdom
- <sup>37</sup> WRAP. 2012b. *The hospitality and food service agreement: Signatory pack.* June 2012. . United Kingdom: Waste & Resources Action Programme.
- <sup>38</sup> Defra. 2012b. *Progress with delivery of commitments from the Government's Review of Waste Policy in England (2011).* Department for Environment, Food and Rural Affairs.
- <sup>39</sup> Defra. 2011. *Government Review of Waste Policy in England 2011.* London, United Kingdom: Department for Environment, Food and Rural Affairs.
- <sup>40</sup> WRAP. 2013a. *Reducing household food waste in the UK.* Information Sheet. United Kingdom: Waste & Resources Action Programme
- <sup>41</sup> WRAP. 2008a. *Towards resource efficiency.* WRAP Business plan 2008-2011. A report on Impact. United Kingdom: Waste & Resources Action Programme.
- <sup>42</sup> Sanders, B and Crosby, KS. 2004. *Waste legislation and its impact on the food industry*, pp. 16-28. In: IFR. 2004. Total Food Institute of Food Research Proceedings, 249 pp.
- <sup>43</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK.* Final report (version 1.1) United Kingdom: Waste & Resources Action Programme
- <sup>44</sup> Friends of the Earth. 2007. *Food waste collections.* Briefing. September 2007. London, United Kingdom: Friends of the Earth
- <sup>45</sup> WRAP. 2008a. *Towards resource efficiency.* WRAP Business plan 2008-2011. A report on Impact. United Kingdom: Waste & Resources Action Programme.
- <sup>46</sup> HM Government. 2010. *Food 2030.* London, United Kingdom: Department for Environment, Food and Rural Affairs.
- <sup>47</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK.* Final report (version 1.1) United Kingdom: Waste & Resources Action Programme
- <sup>48</sup> Quested, Tom 2013. Interview McKenna Davis with Tom Quested Research Analyst at WRAP (Waste and Resources Action Programme), June 13 2013
- <sup>49</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK.* Final report (version 1.1) United Kingdom: Waste & Resources Action Programme

- 
- <sup>50</sup> Bio Intelligence Service. 2010. *Preparatory study on food waste across the EU 27*. Final report as part of Contract #: 07.0307/2009/540024/SER/G4 for the European Commission, DG Industry.
- <sup>51</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK*. Final report (version 1.1) United Kingdom: Waste & Resources Action Programme
- <sup>52</sup> WRAP. 2013a. *Reducing household food waste in the UK*. Information Sheet. United Kingdom: Waste & Resources Action Programme
- <sup>53</sup> WRAP. 2013. *Reducing household food waste in the UK*. Information Sheet. United Kingdom: Waste & Resources Action Programme
- <sup>54</sup> WRAP. 2011c. *Synthesis of food waste compositional data 2010*. An assessment of the arisings of household collected food waste in the UK. United Kingdom: Waste & Resources Action Programme
- <sup>55</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK*. Final report (version 1.1) United Kingdom: Waste & Resources Action Programme
- <sup>56</sup> Environment Agency. 2013. *Report on the Landfill Allowance Trading Scheme 2011/12*. Report LIT 7851 Version 1 18/01/2013. Bristol, United Kingdom: Environment Agency
- <sup>57</sup> Environment Agency. 2013. *Report on the Landfill Allowance Trading Scheme 2011/12*. Report LIT 7851 Version 1 18/01/2013. Bristol, United Kingdom: Environment Agency
- <sup>58</sup> Neville, G. 2012. *The Landfill Allowance Trading Scheme Impact Assessment (IA)*. Conducted on behalf of Defra
- <sup>59</sup> Friends of the Earth. 2007. *Food waste collections*. Briefing. September 2007. London, United Kingdom: Friends of the Earth
- <sup>60</sup> Defra. 2013. *Waste prevention programme for England: Call for evidence. March 2013*. London, United Kingdom: Department for Environment, Food and Rural Affairs
- <sup>61</sup> WRAP. 2011b. *New estimates for household food and drink waste in the UK*. Final report (version 1.1) United Kingdom: Waste & Resources Action Programme
- <sup>62</sup> WRAP. 2007. *Understanding food waste*. Research Summary. United Kingdom: Waste & Resources Action Programme.
- <sup>63</sup> WRAP. 2013a. *Reducing household food waste in the UK*. Information Sheet. United Kingdom: Waste & Resources Action Programme.
- <sup>64</sup> WRAP. 2012a. *The nature and scale of food waste in the UK Hospitality and Food service industry: completing the evidence base*. Project summary. United Kingdom: Waste & Resources Action Programme.
- <sup>65</sup> Friends of the Earth. 2007. *Food waste collections*. Briefing. September 2007. London, United Kingdom: Friends of the Earth
- <sup>66</sup> Defra. 2011. *Government Review of Waste Policy in England 2011*. London, United Kingdom: Department for Environment, Food and Rural Affairs

- 
- <sup>67</sup> Defra. 2013. *Waste prevention programme for England: Call for evidence. March 2013*. London, United Kingdom: Department for Environment, Food and Rural Affairs.
- <sup>68</sup> Bio Intelligence Service. 2010. *Preparatory study on food waste across the EU 27*. Final report as part of Contract #: 07.0307/2009/540024/SER/G4 for the European Commission, DG Industry.
- <sup>69</sup> WRAP. 2013a. *Reducing household food waste in the UK*. Information Sheet. United Kingdom: Waste & Resources Action Programme.
- <sup>70</sup> ESA. 2012. *Beyond landfill: Using green taxes to incentivize the waste hierarchy*. London, United Kingdom: Environmental Services Association.
- <sup>71</sup> Neville, G. 2012. *The Landfill Allowance Trading Scheme Impact Assessment (IA)*. Conducted on behalf of Defra.
- <sup>72</sup> ESA. 2012. *Beyond landfill: Using green taxes to incentivize the waste hierarchy*. London, United Kingdom: Environmental Services Association.
- <sup>73</sup> ESA. 2012. *Beyond landfill: Using green taxes to incentivize the waste hierarchy*. London, United Kingdom: Environmental Services Association.
- <sup>74</sup> Neville, G. 2012. *The Landfill Allowance Trading Scheme Impact Assessment (IA)*. Conducted on behalf of Defra.
- <sup>75</sup> Bio Intelligence Service. 2010. *Preparatory study on food waste across the EU 27*. Final report as part of Contract #: 07.0307/2009/540024/SER/G4 for the European Commission, DG Industry