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Front cover photography: Examples of food waste (WRAP)

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Executive summary

Background

WRAP has published data on household food waste (HHFW) regularly since 2007, and these have constituted the principle source of UK-level data on this topic. The last major study published in 2013¹ showed that an absolute reduction of 15% in HHFW occurred between 2007 and 2012 (and a 21% reduction in avoidable HHFW).

Two reports² suggested that the interventions delivered by WRAP and partners aimed at helping people reduce food waste at home (such as through the Love Food Hate Waste campaign and changes to food products and labelling, including the simplification of date marking) contributed to around half of the reduction seen to 2012. A range of economic factors also stimulated action by the public, the majority of this effect coming from the impact of rising food prices.

In 2013 WRAP also announced the results of the second phase of the Courtauld Commitment (Courtauld 2), which included a target to reduce HHFW by 4% between 2009 and 2012³. A 3.7% absolute reduction in HHFW was achieved, and analysis published at that time revealed that the rate of reduction was much greater from 2007 to 2009 compared to subsequent years. It concluded that a number of factors were likely to have influenced this, including economic conditions (which will have affected consumers directly, as well as the levels and types of interventions deployed by WRAP and partners), some of the 'easy wins' being achieved early on (for example raising awareness of the implications of food waste amongst those consumers with the skills to readily take action), and an increasing rate of growth in UK household numbers.

The third phase of the Courtauld Commitment (Courtauld 3) was launched in 2013 and had a target to reduce HHFW by 5% by 2015, compared to 2012⁴. This report provides an update on HHFW levels in the UK, in the context of the Courtauld 3 target.

Results

- The estimated amount of HHFW in the UK for 2015 was 7.3 million tonnes, compared to 7.0 million tonnes in 2012, an apparent increase of 4.4%. On a per person basis, the apparent increase was 2.2%⁵. Neither of these increases was statistically significant.
- The amount of **avoidable** (i.e. the food that could have been eaten) HHFW in 2015 was 4.4 million tonnes, compared to 4.2 million tonnes in 2012 (an apparent increase of 5.1%, or 2.8% on a per person basis). Again, neither of these increases was statistically significant.

¹ Household food and drink waste in the UK 2012, WRAP (2013) <http://www.wrap.org.uk/content/household-food-and-drink-waste-uk-2012>

² Reduction in household food & drink waste – Estimating the influence of WRAP and its partners; WRAP 2011, and Econometric modelling and household food waste, WRAP (2014), both at <http://www.wrap.org.uk/content/econometric-modelling-and-household-food-waste>

³ The Courtauld Commitment Phase 2 Final Results; WRAP (2013), <http://www.wrap.org.uk/content/courtauld-commitment-2-1>

⁴ <http://www.wrap.org.uk/content/courtauld-commitment-3>

⁵ The UK's population increased by 2.2% between 2012 and 2015.

- Food with a retail value of around £13 billion was thrown away rather than being eaten in 2015. This avoidable HHFW was associated with 19 million tonnes of CO₂e, which is equivalent to the emissions generated by 1 in 4 cars on UK roads.

Up until 2013, economic conditions were conducive to HHFW prevention: food prices were increasing and wages (in real terms) decreasing. However, during 2014 and 2015, this picture changed with food prices entering a period of deflation and real incomes starting to increase. These trends are likely to have put upward pressure on levels of HHFW, although the magnitude of the influence on HHFW is not possible to estimate.

There is an absence of data to be able to reliably compare changes in HHFW across the different nations of the UK from 2012 to 2015. Results do exist for 2009 and either 2014 (Scotland) or 2015 (Wales). The estimates for Scotland and Wales given below relate to HHFW collected by local authorities, where two-thirds of the HHFW resides.

In Wales, there is evidence that HHFW levels reduced between 2009 and 2015 (by 12% on a per person basis) and are now lower than the rest of the UK (by around 9%). Both of these are statistically significant⁶.

In 2014, HHFW levels in Scotland were similar to those in the rest of the UK. The estimated amount of HHFW was 6% lower (on a per person basis) in 2014 compared to 2009⁷; however, this difference was not statistically significant.

Whilst this data suggests that levels of HHFW in Wales for 2015 were lower than those in 2009, there is no data from intervening years to determine when any change might have occurred. Any reductions between 2009 and 2012 would have contributed to the previously published reduction at a UK level.

Conclusions

The estimated amount of HHFW in the UK for 2015 was 7.3 million tonnes or 112.6 kg per person per year. The apparent increase on 2012, both in absolute terms (4.4% higher) and on a per person basis (2.2%), is not statistically significant. An increase in the UK population explains the difference between the apparent increase in HHFW at a UK level versus that seen on a per person basis. Food deflation and increases in earnings since 2014 will have reduced the incentive for individuals to avoid wasting food.

Overall there has been no statistically significant change in the estimated levels of HHFW between 2012 and 2015, and it is clear that the Courtauld 3 target to reduce HHFW by 5% by 2015 compared to 2012 has not been achieved.

Considerable efforts have been made over the last three years to help reduce HHFW, particularly since the end of 2013, and some of these interventions have undoubtedly

⁶ Methodological issues may have influenced these results to a small degree, see comments in Appendix A of Synthesis of Food Waste Compositional Data 2014 & 2015, WRAP (2017), <http://www.wrap.org.uk/hhfw2015>

⁷ Household Food and Drink Waste in Scotland 2014, Zero Waste Scotland, <http://www.zerowastescotland.org.uk/content/how-much-food-waste-there-scotland>. There are two approaches to scaling national HHFW estimates (as discussed in Synthesis of Food Waste Compositional Data 2014 & 2015) and Scotland has chosen a slightly different approach to the UK and Wales to better reflect the collection context in 2009/10 in Scotland (the two approaches make very little difference to the 2014 estimates for Scotland). Using the same method as the UK or Wales in Scotland would suggest a larger apparent reduction (more in line with that seen for Wales), though still within the formal confidence intervals.

helped groups of people to reduce their food waste⁸. However, the scale, targeting and effectiveness of these interventions, against a backdrop of easing economic pressures and an increasing population, were not sufficient to deliver a significant reduction in HHFW.

There is evidence that levels of HHFW are lower in Wales than the rest of the UK. Potential reasons include Wales having lower income levels than the rest of the UK (which might provide a greater motivation for action), having more widespread and better used separate food waste collections⁹ (which could have helped raise awareness of the amounts wasted), differences in interventions made to help reduce HHFW, cultural differences relating to food or a combination of all or some of these. Further research is needed to better understand this, and identify any lessons that could help reduce further HHFW across the UK.

It is important to recognise that measuring HHFW is challenging. With 95% confidence intervals of ca. $\pm 300,000$ tonnes for total UK HHFW ($\pm 2.7\%$), HHFW levels could have ranged from 6.7 to 7.3 million tonnes in 2012 and from 7.0 to 7.6 million tonnes in 2015, thus the exact magnitude of change is uncertain. Monitoring change reliably when there are only relatively small trends over time is very difficult, and WRAP will be working with relevant stakeholders to reduce the uncertainties associated with measuring HHFW in the future.

The Courtauld Commitment 2025 was launched in March 2016, with a target to reduce food waste across the UK food system by 20% on a per capita basis by 2025¹⁰. Achieving significant further reductions in HHFW will be essential to meeting this target, and the UN Sustainable Development Goal (SDG) 12.3 (By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses)¹¹.

HHFW in the UK was 960,000 tonnes lower in 2015 compared to 2007, which equates to a 12% reduction. Avoidable HHFW levels were 17% lower in 2015 compared to 2007, equivalent to £2.7 billion less food being wasted in 2015 compared to 2007¹².

WRAP research suggests that it is feasible to make significant further reductions, provided the necessary mechanisms are in place¹³. In a separate document WRAP will

⁸ For example see Appendix F in UK food waste – Historical changes and how amounts might be influenced in the future, WRAP (2014), [http://www.wrap.org.uk/sites/files/wrap/UK%20food%20waste%20-%20Historical%20and%20future%20changes%20\(FINAL\)_0.pdf](http://www.wrap.org.uk/sites/files/wrap/UK%20food%20waste%20-%20Historical%20and%20future%20changes%20(FINAL)_0.pdf); Asda 2016 Green Britain Index: Our Everyday Experts have their say on food waste, <https://www.2degreesnetwork.com/groups/2degrees-community/resources/asda-customers-save-ps57-year-by-reducing-food-waste/>; Sainsbury's Modern Life is Rubbish, <http://www.j-sainsbury.co.uk/media/latest-stories/2016/0906-modern-life-is-rubbish/>; Love Food Hate Waste - Celebrating '10 Cities', (2016), <https://www.lovefoodhatewaste.com/content/celebrating-10-cities>; Courtauld Commitment 3: Signatory Case Studies, WRAP (2015), <http://www.wrap.org.uk/sites/files/wrap/CC3%20Case%20Studies%202014.pdf>; Evaluating the impact of cascade training, WRAP (2012), <http://www.wrap.org.uk/content/evaluating-impact-wrap%E2%80%99s-cascade-training-programme-england-201112>; WRAP Retailer Survey 2015 (to be published early 2017).

⁹ Around 90% of Welsh households have access to a separate food waste collection, compared to just over 25% for the UK as a whole. Use of these collections in Wales, as measured by the proportion of HHFW collected via these collections, is also much higher in Wales than for the UK as a whole (see Synthesis of Food Waste Compositional Data 2014 & 2015, WRAP (2016), <http://www.wrap.org.uk/hhfw2015>)

¹⁰ The Courtauld Commitment 2025, WRAP (2016), <http://www.wrap.org.uk/content/courtauld-commitment-2025>

¹¹ See <https://sustainabledevelopment.un.org/sdg12>

¹² On a per person basis total HHFW reduced by 17% between 2007 and 2015, and avoidable HHFW reduced by 22% over the same time period

outline what it and partners plan to do to further reduce the levels of HHFW and to put the UK on track to achieve the UN-SDG 12.3 by 2030¹⁴.

¹³ See Section 6.1 and Appendix E in *UK food waste – Historical changes and how amounts might be influenced in the future*, WRAP (2014), [http://www.wrap.org.uk/sites/files/wrap/UK%20food%20waste%20-%20Historical%20and%20future%20changes%20\(FINAL\)_0.pdf](http://www.wrap.org.uk/sites/files/wrap/UK%20food%20waste%20-%20Historical%20and%20future%20changes%20(FINAL)_0.pdf)

¹⁴ *Reducing the Amount of Food & Drink That Gets Wasted in the Home*, WRAP (2016), <http://www.wrap.org.uk/hhfw2015>

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Glossary

Avoidability of food waste – a classification of the extent to which household food and drink waste could have been avoided.

- Avoidable – food and drink thrown away because it is no longer wanted or has been allowed to go past its best. The vast majority of avoidable food is composed of material that was, at some point prior to disposal, edible, even though a proportion is not edible at the time of disposal due to deterioration (e.g. gone mouldy). In contrast to ‘possibly avoidable’ (see below), the category of ‘avoidable’ includes foods or parts of food that are considered edible by the vast majority of people.
- Possibly avoidable – food and drink that some people eat and others do not (e.g. bread crusts and potato skins). As with ‘avoidable’ waste, ‘possibly avoidable’ waste is composed of material that was, at some point prior to disposal, edible.
- Unavoidable – waste arising from food and drink preparation that is not, and has not been, edible under normal circumstances. This includes egg shells, pineapple skin, apple cores, meat bones, tea bags, and coffee grounds.

HHFW: Household food waste

Synthesis report: *Synthesis of Food Waste Compositional Data 2014 & 2015*, published by WRAP alongside this report in 2017.

1.0 Introduction

The United Nations Food and Agriculture Organisation (FAO) estimated that 280 million tonnes of food were wasted by consumers in 2011, a fifth of all global food waste, with 80% of consumer-related food waste occurring in Europe, North America & Oceania and Industrialized Asia¹⁵. In 2014 WRAP estimated that global levels of consumer-related food waste could double by 2030, which could take the cost of consumer food waste to more than US\$600 billion a year¹⁶.

A recent study by the FUSIONS project revealed that more than half of all EU food waste arises in households, amounting to 46.5 million tonnes and costing EU citizens almost a €100 million a year¹⁷.

The amount of food being wasted post-farm gate in the UK is around 10 million tonnes a year, worth around £17 billion, and 70% of this comes from households¹⁸. Preventing food waste has been a priority for UK Governments and WRAP for a decade, and a range of mechanisms have been put in place to deliver this, notably voluntary agreements with key sectors and the Love Food Hate Waste campaign, informed by a comprehensive evidence base.

WRAP has published detailed data on household food waste (HHFW) arisings regularly since 2007, based on bespoke household compositional, diary and survey research, and syntheses of relevant local authority compositional analyses¹⁹. There are no other sources of UK-level data on HHFW. The last major study in to HHFW published by WRAP in 2013 suggested that a reduction of 15% in total HHFW had occurred between 2007 and 2012. Avoidable HHFW had reduced by 21% over the same period, meaning that in 2012 around £3.3 billion less food was thrown away compared to 2007.

WRAP published two reports²⁰ in 2011 and 2014 which investigated this reduction, attempting to disaggregate the effects of exogenous factors such as population changes and economic factors, from the interventions delivered by WRAP and partners which aimed to help people reduce food waste at home. Econometric modelling suggested that around 40% of the reduction was the result of the interventions (the model couldn't capture all of the intervention effects) whilst a broader review of the evidence suggested around 60% of the reduction was the result of the full range of interventions.

The majority of the effect of economic factors on HHFW came from the impact of rising food prices (more than 85% of the economic influence; with a 1% increase in food prices leading to a decrease in food waste of 0.5%).

¹⁵ *Global Food Losses and Food Waste*, FAO (2011), <http://www.fao.org/docrep/014/mb060e/mb060e00.pdf>

¹⁶ *Strategies to achieve economic and environmental gains by reducing food waste*, WRAP (2014), <http://www.wrap.org.uk/content/benefits-reducing-global-food-waste>

¹⁷ *Estimates of European food waste levels*, FUSIONS (2016), <http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf>

¹⁸ *Estimates of Food Surplus and Waste Arisings in the UK*, WRAP (2017), <http://www.wrap.org.uk/content/uk-handly-waste-facts-and-figures-retail-sector>

¹⁹ *See Household food and drink waste in the UK 2012*, WRAP (2013), <http://www.wrap.org.uk/content/household-food-and-drink-waste-uk-2012>

²⁰ *Reduction in household food & drink waste – Estimating the influence of WRAP and its partners; WRAP 2011, and Econometric modelling and household food waste*, WRAP (2014), both at <http://www.wrap.org.uk/content/econometric-modelling-and-household-food-waste>

In 2013 WRAP also announced the results of the Courtauld 2 agreement, which included a target to reduce HHFW by 4% between 2009 and 2012²¹. A 3.7% absolute reduction in HHFW was achieved (270,000 tonnes), and although the target was narrowly missed, avoidable HHFW reduced by 5.3%, an achievement that saved the UK public £700 million and local authorities £20 million in 2012 alone. Analysis published at that time revealed that the rate of reduction was much greater from 2007 to 2009 compared to subsequent years, and concluded that a number of factors were likely to have influenced this, including for example economic conditions (which will have affected the public directly, as well as the levels and types of interventions deployed by WRAP and partners), some of the 'easy wins' being achieved early on (for example raising awareness of the implications of food waste amongst those consumers with the skills to readily take action), and increasing household numbers.

The third phase of the Courtauld Commitment (Courtauld 3) was launched in 2013 and had a target to reduce HHFW by 5% by 2015, compared to 2012²². This report provides an update on HHFW levels in the UK, the context of the Courtauld 3 target.

²¹ *The Courtauld Commitment Phase 2 Final Results*, WRAP (2013), <http://www.wrap.org.uk/content/courtauld-commitment-2-1>

²² *Courtauld Commitment 3*, WRAP (2013), <http://www.wrap.org.uk/content/courtauld-commitment-3>

2.0 Estimates of household food waste

2.1 Background to estimates

Recent trends in the amount of HHFW collected by local authorities are reported in Synthesis of Food Waste Compositional Data 2014 & 2015²³ (subsequently referred to as the synthesis report), published alongside this report. This covered the food waste in the following waste streams:

- **Kerbside residual:** (i.e. 'general' waste collected from the households).
- **Kerbside collections targeting food waste:** this includes collections from households of either separate food waste or mixed garden and food waste.
- **Kerbside dry recycling:** food waste contamination of kerbside dry recycling collections from households.
- **Household Waste Recycling Centre (HWRC) residual waste.**

The synthesis report did not cover food items not eaten and disposed of from the home via other routes, which in 2012 made up around a third of total HHFW. This section provides an estimate for these other disposal routes, which include:

- The sewer (mostly down the kitchen sink);
- Home composting; and
- Fed to animals.

These three disposal routes (illustrated in Figure 1) are estimated as part of the current report.

The categorisation of food and drink waste used in this report is consistent with previous WRAP studies (e.g. *Household Food and Drink Waste in the UK 2012*). Food and drink waste includes the three fractions described below:

Avoidable – food and drink thrown away because it is no longer wanted or has been allowed to go past its best. The vast majority of avoidable food is composed of material that was, at some point prior to disposal, edible, even though a proportion is not edible at the time of disposal due to deterioration (e.g. gone mouldy). In contrast to 'possibly avoidable' (see below), the category of 'avoidable' includes foods or parts of food that are considered edible by the vast majority of people.

Possibly avoidable – food and drink that some people eat and others do not (e.g. bread crusts and potato skins). As with 'avoidable' waste, 'possibly avoidable' waste is composed of material that was, at some point prior to disposal, edible.

Unavoidable – waste arising from food and drink preparation that is not, and has not been, edible under normal circumstances. This includes egg shells, pineapple skin, apple cores, meat bones, tea bags, and coffee grounds.

The estimates have been calculated for 2014 and 2015 and are as comparable as possible with the estimates previously published by WRAP for 2007²⁴ and 2012²⁵, which

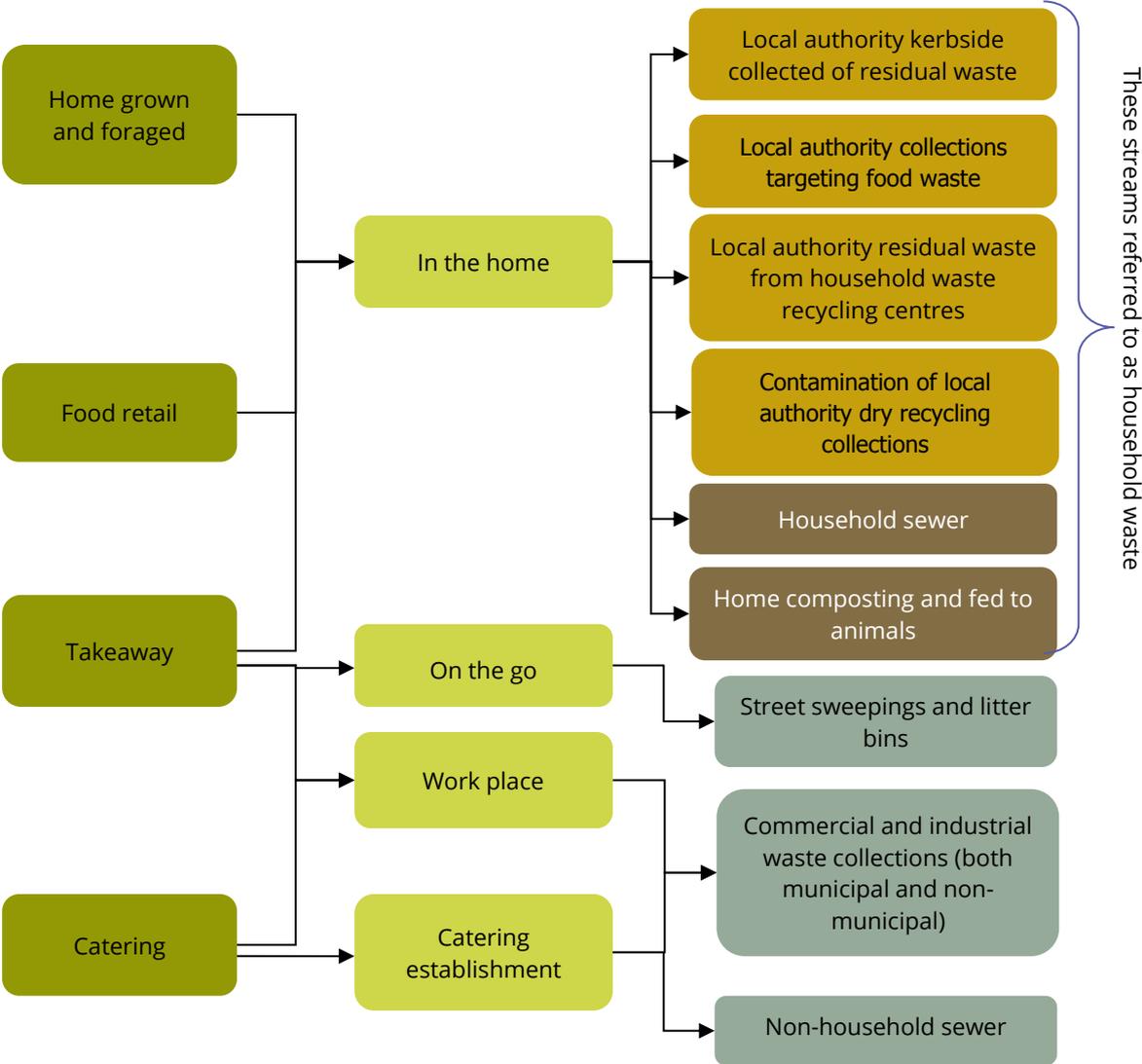
²³ See <http://www.wrap.org.uk/hhfw2015>

²⁴ *Household Food and Drink Waste in the UK 2007*, WRAP (2009), <http://www.wrap.org.uk/sites/files/wrap/Household%20food%20and%20drink%20waste%20in%20the%20UK%20-%20report.pdf>

²⁵ *Household Food and Drink Waste in the UK 2012*, WRAP (2013), <http://www.wrap.org.uk/content/household-food-and-drink-waste-uk-2012>

are also presented below. The details of the methods and calculations can be found in Appendix A.1.

Figure 1: Schematic of major flows of food and associated waste routes

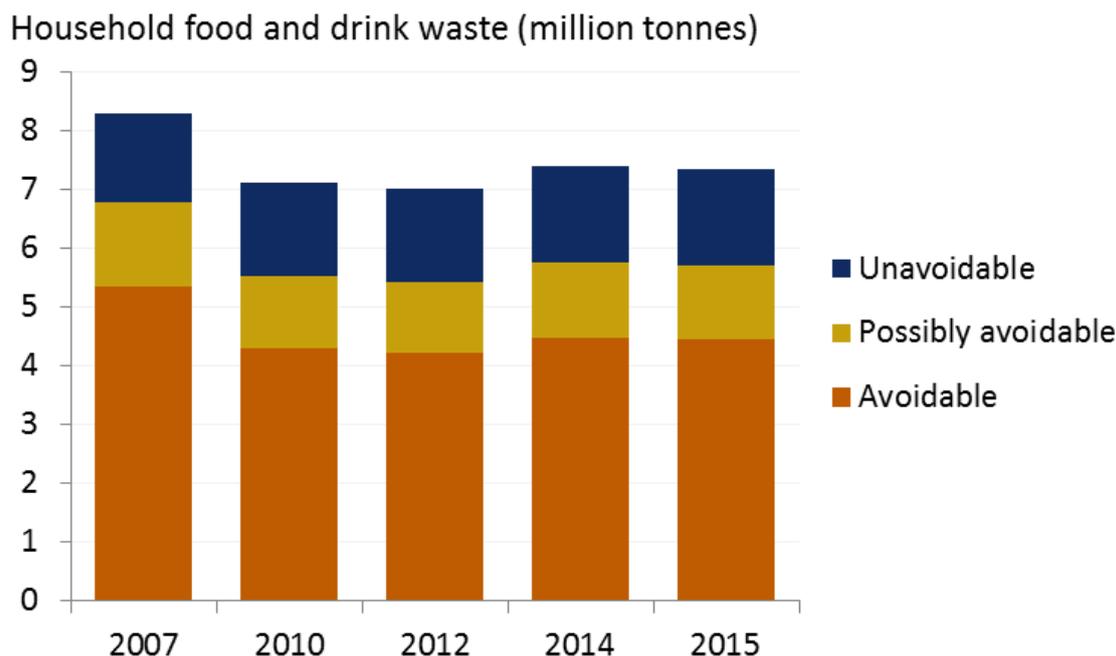


Adapted from: the previous *Household Food and Drink Waste in the UK* report

2.2 UK estimates by weight

Figure 2 shows that, as previously published by WRAP, there was a substantial reduction in HHFW from 2007 to 2012, with the majority of the reduction occurring between 2007 and 2010. Levels of HHFW in 2014 and 2015 were 7.4 million tonnes and 7.3 million tonnes respectively, compared to 7.0 million tonnes in 2012. The changes from 2012 to 2015 were not significant at the 95% confidence level, but the estimated levels of HHFW were 5.1% higher in 2014 than in 2012, and 4.4% higher in 2015 than 2012.

Figure 2: Total household food and drink waste in the UK, split by avoidability



Levels of avoidable HHFW in 2014 and 2015 were 4.5 million tonnes and 4.4 million tonnes respectively, compared to 4.2 million tonnes in 2012 (Table 1). The estimated levels of avoidable HHFW were 6.2% higher in 2014 than in 2012, and 5.1% higher in 2015 than 2012.

Table 1: Household food waste in the UK, split by avoidability, rounded to the nearest thousand tonnes²⁶ ('000 tonnes)

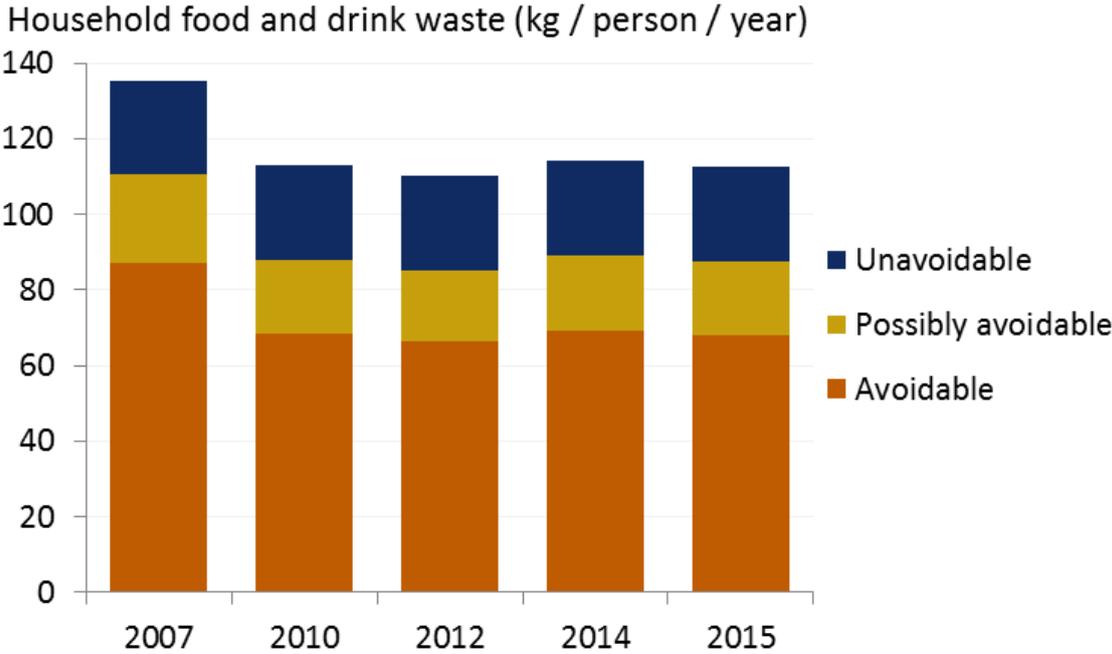
	2007	2010	2012	2014	2015
Avoidable	5,342	4,299	4,221	4,480	4,436
Possibly avoidable	1,433	1,226	1,203	1,277	1,264
Unavoidable	1,521	1,575	1,598	1,620	1,633
Total	8,296	7,100	7,022	7,377	7,333

Figure 3 shows the change in HHFW levels expressed on a per person basis. Again, and as previously published by WRAP, there was a substantial reduction in HHFW from 2007

²⁶ Since the previous reporting, there have been a number of improvements to the methodology (see the synthesis report). This has meant that the estimate for 2012 is now approximately 3,000 tonnes higher than previously stated (in Household Food and Drink Waste in the UK 2012).

to 2012, with the majority of the reduction occurring between 2007 and 2010. Levels of HHFW in 2014 and 2015 were 114.2 kg / person / year and 112.6 kg / person / year respectively, compared to 110.2 kg / person / year in 2012. The changes from 2012 to 2015 were not significant at the 95% confidence level, but the mean levels of HHFW were 3.7% higher in 2014 than in 2012, and 2.2% higher in 2015 than 2012.

Figure 3: Household food and drink waste in the UK, split by avoidability expressed as kg / person / year



Levels of avoidable HHFW in 2014 and 2015 were 69.4 kg / person / year and 68.1 kg / person / year respectively, compared to 66.2 kg / person / year in 2012. The mean levels of avoidable HHFW were 4.8% higher in 2014 than in 2012, and 2.8% higher in 2015 than 2012.

Figure 4 and Figure 5 show the levels of HHFW over time by disposal route, in total and on a per person basis. The majority of the HHFW is collected by local authorities, 4.9 million tonnes in 2015, of which 640,000 tonnes was separately collected. In addition 1.6 million tonnes was estimated to be disposed of via the sewer and 0.8 million tonnes either home composted or fed to animals.

Figure 4: Total household food and drink waste in the UK, split by disposal route

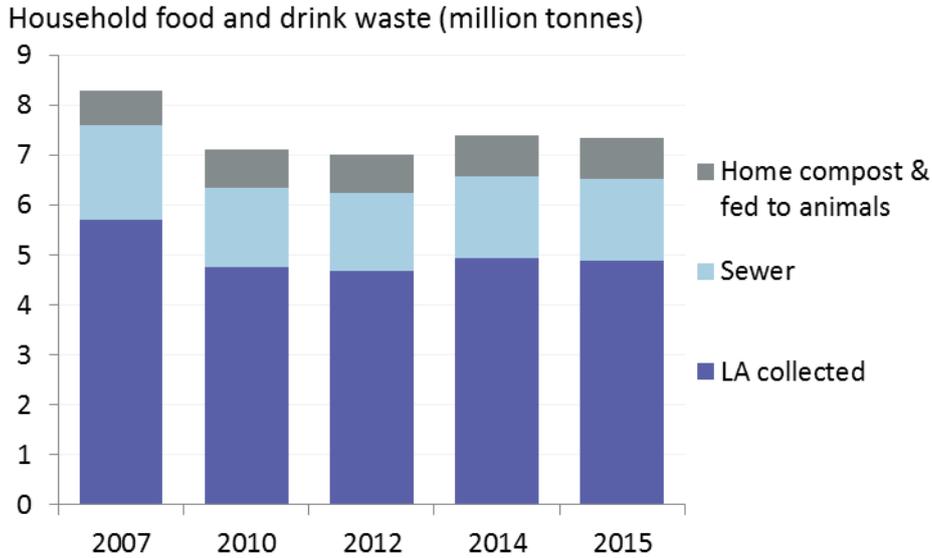
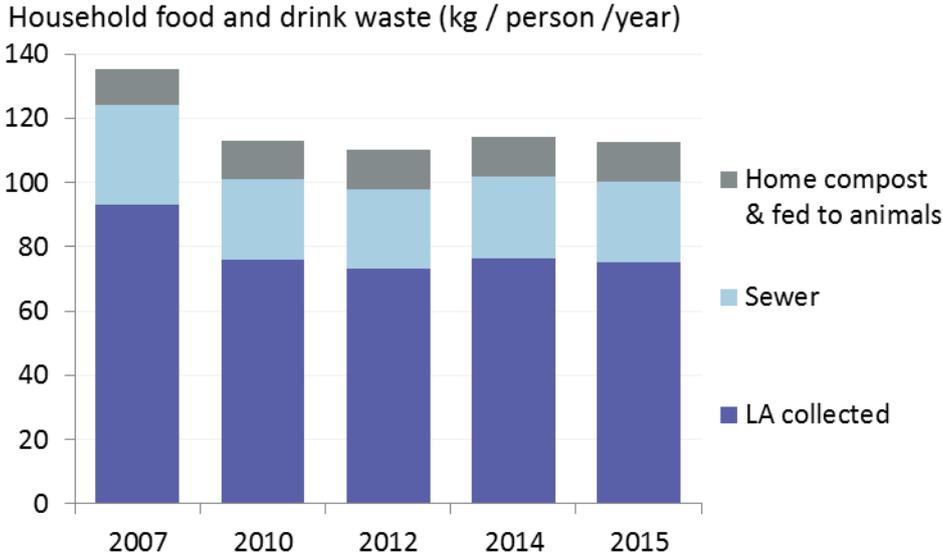


Figure 5: Total household food and drink waste in the UK, split by disposal route expressed as kg / person / year



There are a number of uncertainties associated with the estimates of HHFW. For those associated with sampling, these contribute to a 95% confidence interval of c. $\pm 300,000$ tonnes or just under 5 kg / person / year²⁷. For 2015, this means the 95% confidence interval is approximately 7.0 to 7.6 million tonnes or 108 to 117 kg / person / year.

In conclusion, the estimated amount of HHFW in 2015 was 7.3 million tonnes, compared to 7.0 million tonnes in 2012, an apparent increase of 4.4%, which is not statistically

²⁷ More details about uncertainties can be found in Chapter 13 of *Methods used for Household Food and Drink Waste in the UK 2012*, WRAP (2013), <http://www.wrap.org.uk/sites/files/wrap/Methods%20Annex%20Report%20v2.pdf>

significant. On a per person basis, the apparent increase was 2.2% (again, not statistically significant)²⁸.

The amount of avoidable (i.e. the food that could have been eaten) HHFW in 2015 was 4.4 million tonnes, compared to 4.2 million tonnes in 2012 (an apparent increase of 5.1%, or 2.8% on a per person basis). Again, neither of these increases was statistically significant.

2.3 UK estimates: financial implications

The updated financial value of food thrown away by UK households is estimated at £2,938 per tonne (see Appendix A). Based on the 2015 estimate for avoidable HHFW, this means that for the UK as a whole, food with a retail value of around £13.0 billion was thrown away rather than being eaten in 2015. This compares with the previous published estimate of £12.5 billion a year for 2012 (in 2012 prices).

The 2015 estimate is equivalent to £470 a year for the average household, £700 a year for the average family or £200 a year for the average person in the UK.

2.4 UK estimates: environmental implications

The estimate for greenhouse gas emissions (in tonnes of CO₂ equivalent) associated with HHFW has been updated as described in Appendix A. Avoidable HHFW is associated with 19 million tonnes of CO₂e, which is equivalent to the emissions generated every year by around 30% of the cars on UK roads. If the other fractions of HHFW are included (possibly avoidable and unavoidable) the figure increases to 25.5 million tonnes of CO₂e.

2.5 Estimates by nation within the UK

Estimates have been produced for some of the nations within the UK for years in which there was sufficient data. The estimates discussed below only cover food waste in two waste streams: residual (i.e. general) waste and kerbside collections targeting food waste (i.e. separately collected food waste and mixed food and garden waste): these cover around 65% of the total HHFW. Differences between the nations relating to the remaining 35% of HHFW (mainly going down the sewer and home composted) are not known.

In Wales, the amount of HHFW per person in 2015 was significantly lower – by around 9% – compared to the average for the UK. In addition, between 2009 and 2015 there was a 12% decrease in the amount of HHFW in Wales (again, a statistically significant change)²⁹.

In Scotland, the amount of HHFW per person in 2014 (the last year of an estimate) was not significantly different to that in the UK. The estimates for Scotland showed no

²⁸ The UK's population increased by 2.2% between 2012 and 2015.

²⁹ Methodological issues may have influenced these results to a small degree, see comments in appendix A of Synthesis of Food Waste Compositional Data 2014 & 2015 (2017), <http://www.wrap.org.uk/hhfw2015>

statistically significant difference between 2009 and 2014 (the apparent reduction of 6% per person³⁰ was not statistically significant).

There are no estimates for HHFW in Northern Ireland due to a lack of waste compositional data for this nation. For England, estimates for 2009 and 2015 are not totally comparable.

More details and discussion of these results – and the caveats associated with them – can be found in *Synthesis of Food Waste Compositional Data 2014 & 2015*.

Table 2 provides data for Scotland and Wales for 2009 and either 2014 or 2015. For reference, the 2015 UK estimate for the same waste streams is 73.1 kg / person / year³¹.

Table 2: Household food waste in Scotland and Wales for 2009 and either 2014 (Scotland) or 2015 (Wales). Data for HHFW collected by local authorities (residual and collections targeting food waste) expressed on per person basis.

	HHFW (kg / person / yr)			Change	
	2009	2014	2015	kg / person / yr	%
Scotland	75.1	70.8	n/a	-4.3	-5.7%
Wales	75.4	n/a	66.2	-9.2	-12.2%

In conclusion, there is evidence that HHFW levels in Wales have declined over recent years and are now lower than the rest of the UK. In contrast, HHFW levels in Scotland are similar to those in the rest of the UK.

2.6 Food categories and food types

This current research does not allow the detailed estimates for different food and drink categories (e.g. dairy, bakery) or food and drink types (e.g. apples, pork) to be updated. WRAP recommends therefore referring to the 2012 data published in 2013³².

³⁰ Household Food and Drink Waste in Scotland 2014, Zero Waste Scotland (2016), <http://www.zerowastescotland.org.uk/content/how-much-food-waste-there-scotland>. There are two approaches to scaling national HHFW estimates (as discussed in *Synthesis of Food Waste Compositional Data 2014 & 2015*) and, in discussion with WRAP, ZWS has used the 'alternative' method to estimate HHFW. This is because for 2009, the data available and the coverage of collections targeting food waste led to the 'standard' method (used elsewhere for estimates) not being as accurate. The 'alternative' method was deemed to be more robust in this situation. Had the standard method been used, it would have resulted in a bigger apparent reduction between the 2009 and 2014 estimates, but one that was still not statistically significant.

³¹ A comparable estimate for HHFW in the UK in 2009 does not exist; a previous estimate for the same waste streams was 76.6 kg / person / year (4.6% higher than the 2015 estimate), but the methodology used is slightly different and this may have influenced the results

³² Household Food and Drink Waste in the UK 2012, WRAP (2013), <http://www.wrap.org.uk/content/household-food-and-drink-waste-uk-2012>

3.0 Influencing factors

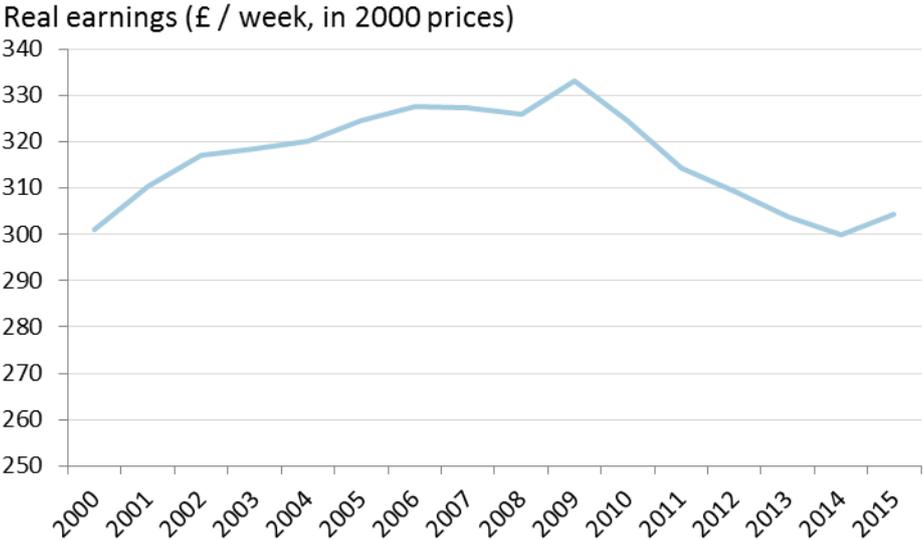
This section contains information relating to some of the factors that can influence the amount of food waste generated by households. It includes data on food prices, changes in household income and on the relative amount of food eaten outside the home.

3.1 Trends in economic factors

Economic factors have been shown to correlate with the level of HHFW³³, specifically food prices and earnings. This section provides information on these factors up to the end of 2015.

Figure 6 shows regular weekly earnings adjusted for inflation. Real earnings declined from a high point in 2006 through to 2014. Since then they have picked up and were 1.4% higher in 2015 compared to 2014. This recent increase is likely to have put upward pressure on the amount of food waste generated, although the scale of the upward pressure is difficult to estimate.

Figure 6: Real earnings in the UK, based on average weekly earnings for the whole economy, regular pay only, adjusted for inflation by RPI for all items

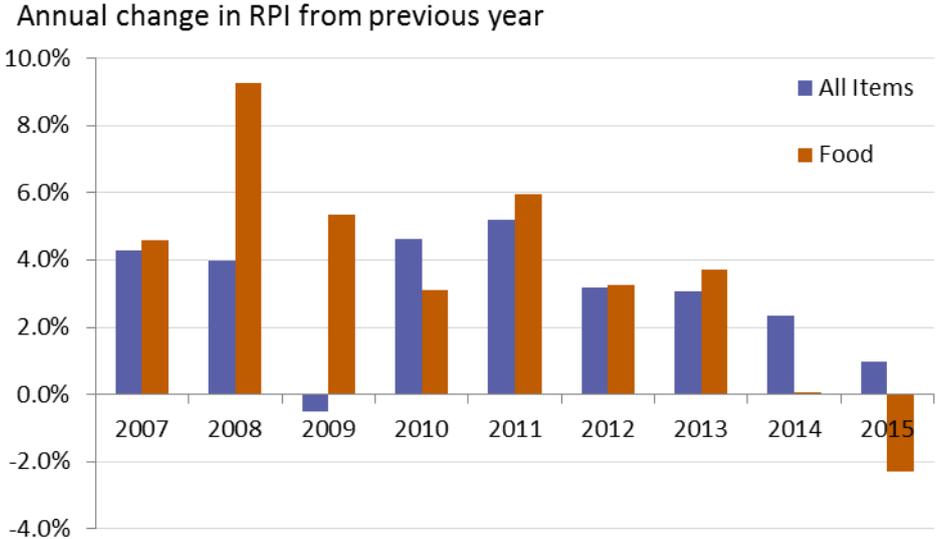


Source: Office of National Statistics

Figure 7 and Figure 8 illustrate the change in food prices relative to the change in retail prices for all items. Between 2007 and 2013, food-price inflation was generally high, averaging 5.1% per year over this time period. This outstripped the increase in retail prices for all items (3.2% per year over this time period). However, since the end of 2013, food-price inflation first decreased and then turned negative. Figure 8 illustrates how the trend of RPI for food contrasted to that for all items since early 2012, with an abrupt divergence between the two occurring in early 2014.

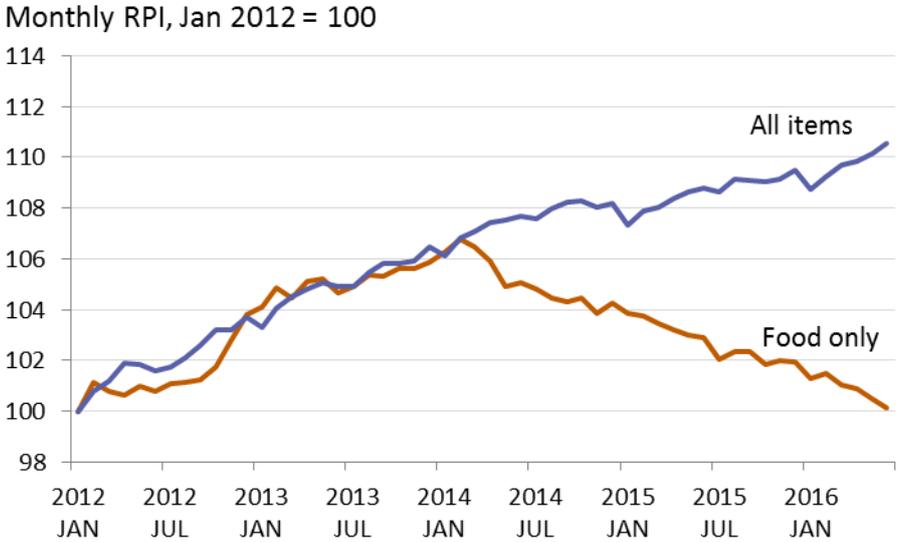
³³Econometric modelling and household food waste, WRAP (2014), <http://www.wrap.org.uk/content/econometric-modelling-and-household-food-waste>

Figure 7: Inflation: RPI compared to previous year for UK: a) all items (blue bars), b) food only (red bars)



Source: Office of National Statistics

Figure 8: Inflation: RPI for all items (blue bars) and food only (red bars), rebased to January 2012 to illustrate changes since then



Source: Office of National Statistics

In summary, up until 2013, economic conditions were conducive to HHFW prevention: food prices were increasing and wages (in real terms) decreasing. However, during 2014 and 2015, this picture changed with food prices entering a period of deflation and real incomes starting to increase. These later trends are likely to put upward pressure on levels of HHFW, although the magnitude of the influence this has on HHFW is not possible to estimate.

3.2 Trends in eating out

The amount of HHFW can be influenced by the proportion of food eaten in the home compared to that eaten outside the home. The number of meals eaten outside the home³⁴ indicates a 2.1% increase between 2012 and 2015 – similar to the population increase in the UK over this period. This suggests that there has not been a large shift between eating out and eating in during this time period.

3.3 Trends in UK population

The UK's population has increased steadily recently, averaging 0.73% per annum in the three years to 2015, equating to 2.2% between 2012 and 2015. The upward trend in the UK's population is taken into account in the HHFW figures represented on a per person basis.

4.0 Conclusion

The estimated amount of HHFW in the UK for 2015 was 7.3 million tonnes or 112.6 kg per person per year. The apparent increase on 2012, both in absolute terms (4.4% higher) and on a per person basis (2.2%), is not statistically significant. An increase in the UK population explains the difference between the apparent increase in HHFW at a UK level versus that seen on a per person basis. Food deflation and increases in earnings since 2014 will have reduced the incentive for individuals to avoid wasting food.

Overall there has been no statistically significant change in the estimated levels of HHFW between 2012 and 2015, and it is clear from the above results that the Courtauld 3 target to reduce HHFW by 5% by 2015 compared to 2012 has not been achieved.

Considerable efforts have been made over the last three years to help reduce HHFW, particularly since the end of 2013, and some of these interventions have undoubtedly helped groups of people to reduce their food waste³⁵. However, the scale, targeting and effectiveness of these interventions, against a backdrop of easing economic pressures and an increasing population, were not sufficient to deliver a significant reduction in HHFW.

Whilst this data suggests that levels of HHFW in Wales in 2015 were lower than those in 2009, there is no data from intervening years to determine when any change might have occurred. Any reductions between 2009 and 2012 would have contributed to the previously published reduction at a UK level. There is also evidence that levels of HHFW

³⁴ As measured by Horizons FS Limited, see <http://www.hrzns.com/>

³⁵ For example see Appendix F in UK food waste – Historical changes and how amounts might be influenced in the future, WRAP (2014), [http://www.wrap.org.uk/sites/files/wrap/UK%20food%20waste%20-%20Historical%20and%20future%20changes%20\(FINAL\)_0.pdf](http://www.wrap.org.uk/sites/files/wrap/UK%20food%20waste%20-%20Historical%20and%20future%20changes%20(FINAL)_0.pdf); Asda 2016 Green Britain Index: Our Everyday Experts have their say on food waste, <https://www.2degreesnetwork.com/groups/2degrees-community/resources/asda-customers-save-ps57-year-by-reducing-food-waste/>; Sainsbury's Modern Life is Rubbish, <http://www.j-sainsbury.co.uk/media/latest-stories/2016/0906-modern-life-is-rubbish/>; Love Food Hate waste - Celebrating '10 Cities', (2016), <https://www.lovefoodhatewaste.com/content/celebrating-10-cities>; Courtauld Commitment 3: Signatory Case Studies; WRAP (2015), <http://www.wrap.org.uk/sites/files/wrap/CC3%20Case%20Studies%202014.pdf>; Evaluating the impact of cascade training, WRAP (2012), <http://www.wrap.org.uk/content/evaluating-impact-wrap%E2%80%99s-cascade-training-programme-england-201112>; WRAP Retailer Survey 2015 (to be published early 2017)

are lower in Wales than the rest of the UK. Potential reasons include Wales having lower income levels than the rest of the UK (which might provide a greater motivation for action), having more widespread and better used separate food waste collections³⁶ (which could have helped raise awareness of the amounts wasted), differences in interventions made to help reduce HHFW, cultural differences relating to food or a combination of all or some of these. Further research is needed to better understand this, and identify any lessons that could help reduce further HHFW across the UK.

It is important to recognise that measuring HHFW is challenging. With 95% confidence intervals of ca. $\pm 300,000$ tonnes, HHFW levels could have ranged from 6.7 to 7.3 million tonnes in 2012 and from 7.0 to 7.6 million tonnes in 2015, thus the exact magnitude of change is uncertain. Monitoring relatively small year to year changes reliably is very difficult, and WRAP will be working with relevant stakeholders to reduce the uncertainties associated with measuring HHFW in the future.

The Courtauld Commitment 2025 was launched in March 2016, with a target to reduce food waste across the UK food system by 20% on a per capita basis by 2025. Achieving significant further reductions in HHFW will be essential to meeting this target, and the UN Sustainable Development Goal 12.3 (By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses’).

HHFW in the UK was 960,000 tonnes lower in 2015 compared to 2007, which equates to a 12% reduction. Avoidable HHFW levels were 17% lower in 2015 compared to 2007, equivalent to £2.7 billion less food being wasted in 2015 compared to 2007³⁷.

WRAP research suggests that it is feasible to make significant further reductions, provided the necessary mechanisms are in place³⁸. In a separate document WRAP will outline what it and partners plan to do to further reduce HHFW and to put the UK on track to achieve the UN-SDG 12.3 by 2030³⁹.

³⁶ Around 90% of Welsh households have access to a separate food waste collection, compared to just over 25% for the UK as a whole. Use of these collections in Wales, as measured by the proportion of HHFW collected via these collections, is also much higher in Wales than for the UK as a whole (see Synthesis of Food Waste Compositional Data 2014 & 2015, WRAP (2017), <http://www.wrap.org.uk/hhfw2015>).

³⁷ On a per person basis total HHFW reduced by 17% between 2007 and 2015, and avoidable HHFW reduced by 22% over the same time period

³⁸ See Section 6.1 and Appendix E in UK food waste – Historical changes and how amounts might be influenced in the future, WRAP (2014), [http://www.wrap.org.uk/sites/files/wrap/UK%20food%20waste%20-%20Historical%20and%20future%20changes%20\(FINAL\)_0.pdf](http://www.wrap.org.uk/sites/files/wrap/UK%20food%20waste%20-%20Historical%20and%20future%20changes%20(FINAL)_0.pdf)

³⁹ Reducing the Amount of Food & Drink That Gets Wasted in the Home, WRAP (2016), <http://www.wrap.org.uk/hhfw2015>

Appendix A - Methods

A.1 Methods for calculating HHFW amounts

This section describes the methods used for calculating food disposed down the sewer, home composted or fed to animals, the financial value of avoidable HHFW and the CO₂e associated with HHFW.

A.1.1 Estimate of sewer waste

There is less information for other disposal routes than for food waste collected by local authorities, including disposal of food and drink to the sewer (mainly via the kitchen sink). Data for 2014 and 2015 has been calculated using the same method used for 2012 and outlined in *Methods used for Household Food and Drink Waste in the UK 2012*⁴⁰. The original data source was kitchen diaries, in which participants recorded the amount of food and drink disposed of down the drain.

Similar to the 2012 estimates, it was assumed that the amount of food waste going down the sewer changed in line with the trends seen in food waste within waste streams collected by local authorities (residual and any collections targeting food waste). This assumes that the trends in the amount of food waste are similar for foods commonly being collected by local authorities compared to foods that are usually disposed of down the sewer. It also assumes that there has been no substantial shift favouring one form of disposal over the other. (In 2012, 66% of HHFW was collected by local authorities, 23% disposed of via the sewer, 7% home composted and 4% fed to animals.)

A.1.2 Estimate of home composting and fed to animals

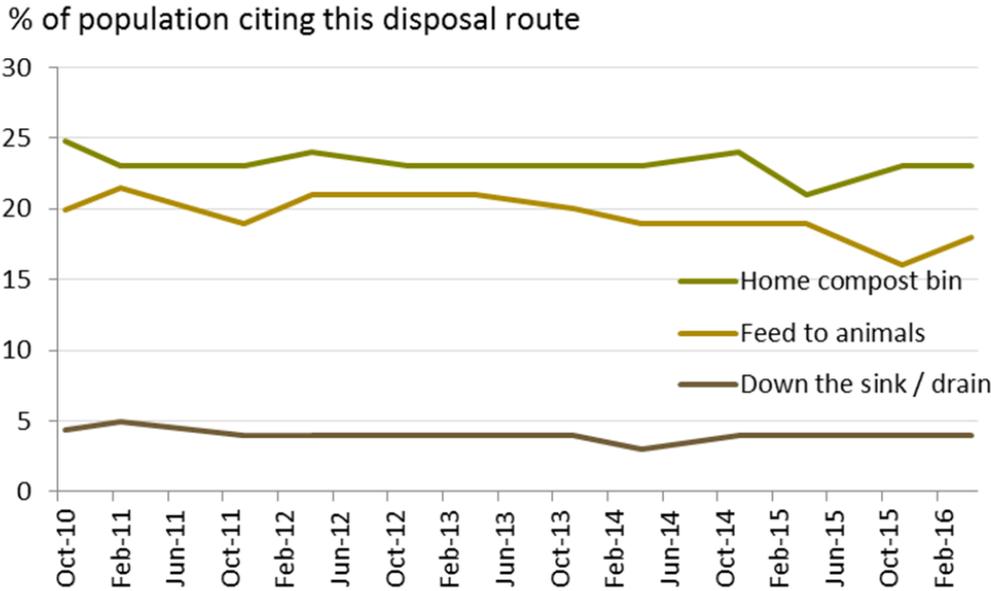
There is less information for the amount of food and drink going to home composting and fed to animals. It is a relatively minor disposal route for household food waste.

For 2012, 2014 and 2015, it was assumed that a total of 12.3 kg / person / year of food and drink waste went to these two routes. This is based on the 2012 data for the UK, taken from kitchen diaries for 948 households. There has been no evidence of change in the amount going to these two routes (for example from the biannual consumer survey WRAP undertakes, which asks how respondents dispose of HHFW): there were no statistically significant differences between 2007 and 2012 in the amount measured in kitchen diaries.

Similarly, the proportion of the population self-reporting that they dispose of food waste to home composting has not changed significantly over time (Figure 9). However, there has been a small downward shift in the proportion of respondents reporting that they feed wasted food to animals. Despite this, as this is a very small proportion of total food waste (c. 3%), the assumption that the amount of food waste fed to animals is constant per person will have very little impact on the overall results.

⁴⁰ See Sections 2.3 and 3.2 of *Methods used for Household Food and Drink Waste in the UK 2012*, WRAP (2013), <http://www.wrap.org.uk/sites/files/wrap/Methods%20Annex%20Report%20v2.pdf>

Figure 9: Trend in percentage of participants citing relevant disposal routes for household food waste



Source: WRAP household food waste tracker; on-line; effective sample size >1,800 for all waves

A.1.3 Approach to estimating the avoidable fraction

There is no recent data on the proportion of HHFW that is avoidable. However, total levels of HHFW were similar in 2012, 2014 and 2015 on a per person basis. The 2014 and 2015 estimate of household food waste are based on the assumption that the amount of unavoidable food waste per person has remained constant, leading to an increasing total amount of unavoidable food waste reflecting population growth. For 2014 and 2015, the remaining food waste is split between avoidable and possible avoidable food waste in the same proportions as was found in 2012.

A.2 Method for calculating the value of avoidable HHFW

The financial value of food thrown away has been calculated using the latest published value of the food that is typically wasted (£2,960⁴¹ per tonne for food wasted at household in 2012), inflated to 2015 prices (£2,987 per tonne), reflecting food and non-alcohol beverage inflation between 2012 and 2015⁴². In the original (2012) calculation for the value of food waste, the bulk of the financial values for the food thrown away came from the Defra Family Food Survey, which means they would reflect the average actual price paid by the public, including for any food on promotion. However, around 20% of the foods could not be costed in this way, and so were costed on the basis of retail prices sourced from a number of retailers. These may not have included the potential impact of promotions. To be conservative the value of food wasted has therefore been adjusted downwards to account for some food potentially being bought at a cheaper

⁴¹ Derived from data in Household Food and Drink Waste in the UK 2012, WRAP (2013), www.wrap.org.uk/household-food-waste
⁴² Source: ONS

price⁴³, leading to a revised 2015 estimate of £2,938. This value multiplied by the amount of avoidable HHFW in 2015 gives an overall estimate of £13 billion for the amount of food that could have been eaten but was thrown away.

To be clear the value of food wasted at home is based on estimates for the price paid for that food, and does not take in to account any depreciation in value between purchase and disposal. It could be argued that the value of food depreciates from the moment of purchase, particularly for shorter shelf-life and more perishable foods. However there is little evidence upon which to base a depreciation factor. This is an area which may benefit from more work in the future, but for the purposes of this report the value given to the food will equate to the price paid for it.

A.3 Method for calculating the CO₂e associated with HHFW

A.3.1 Calculations of CO₂e associated with HHFW

The methodology used to calculate the greenhouse gas emissions associated with avoidable HHFW in 2015 is the same as in the previous (2013⁴⁴) report. The key updates are to the emissions associated with landfill⁴⁵, the global warming potential of methane⁴⁶ and an update to the quantity of gas derived through Anaerobic Digestion based on information from WRAP and USEPA⁴⁷.

The emissions associated with avoidable HHFW calculated on this basis are 4.4 tonnes per tonne of food waste. UK avoidable HHFW would therefore be associated with 19 million tonnes of CO₂e. If the emissions associated with possibly avoidable HHFW (using the same factor as for avoidable HHFW, as this food is edible and is eaten by a proportion of the population) and unavoidable HHFW (using only the emission associated with disposal of the food [0.3 tonnes of CO₂e per tonne of food waste]), this would give an overall total of 25.5 million tonnes of CO₂e for UK HHFW.

A.3.2 Calculations of equivalent impacts (cars off the road)

This section contains a calculation to compare the impact of avoidable household food and drink waste with vehicle emission. This allows the relative scale of the emissions associated with food waste to be visualised.

In 2013, there were 29.1 million cars licensed in Great Britain⁴⁸. Annual Greenhouse Gas emissions from private cars and taxis in 2013 were 62.8 million tonnes CO₂e⁴⁹. This gives

⁴³ Around 33% of food and drink is bought on promotion, and the average discount is around 25%. It has therefore been assumed that a third of the 20% of food not costed via the Defra Family Food Survey may have been purchased at a 25% discount. See <http://competitionpolicy.ac.uk/documents/8158338/8199490/CCP+Working+Paper+14-2.pdf/aa2afd7d-4a04-4d78-b963-9fd1d62b7dfe> and <http://www.brandview.com/2013/01/promotions-analysis-on-the-ambient-grocery-category/> for source material

⁴⁴ Household food and drink waste in the UK 2012, WRAP (2013), <http://www.wrap.org.uk/content/household-food-and-drink-waste-uk-2012>

⁴⁵ MacCarthy J, Broomfield M, Brown P, Buys G, Cardenas L, Murrells T, Pang Y, Passant N, Thistlethwaite G, Watterson J (2015) UK Greenhouse Gas Inventory, 1990 to 2013: Annual Report for submission under the Framework Convention on Climate Change

⁴⁶ Climate Change 2013; IPCC (2014), The Physical Science Basis, <http://www.climatechange2013.org/>

⁴⁷ Turning Food Waste into Energy at the East Bay Municipal Utility District (EBMUD); USEPA (2016), <https://www3.epa.gov/region9/waste/features/foodtoenergy/ebmud-study.html>; Food Waste Resources Portal; WRAP (2014), <http://www.wrap.org.uk/content/foodwaste-resources-portal>

⁴⁸ TSGB0906 - Licensed cars, by region, Great Britain, annually from 2000

⁴⁹ TSGB0306 - Greenhouse gas emissions by transport mode: United Kingdom

a figure of 2.15 tonnes CO₂e per vehicle. Thus, emissions associated with avoidable food waste are equivalent to around 30% of those from private vehicle journeys in the UK. This can be expressed conservatively as equivalent to the emissions of around 1 in 4 cars on UK roads.

www.wrap.org.uk/HHFW2015