Assessment of Waste Minimization

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The Evaluation of Waste Prevention Programmes: a WRAP Perspective

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Abstract
The need for a greater emphasis on waste prevention measures is found in waste strategies across Europe, but accounting for the impacts of such measures presents new challenges. Over the last few years WRAP has been actively engaged in waste prevention measures on a national scale, aimed at deflecting the rate of increase in household waste arisings. This paper outlines the evolution of WRAP's waste prevention programmes, how targets were set and how progress was measured. Three main activities were rolled out between 2004 and 2006: home composting, a programme to promote washable nappies and a retailer initiative to reduce post-consumer packaging and food wastes.

For the value of waste prevention initiatives to be fully realised, it is important to build up the evidence base and to meet the challenges in measuring the impact of such interventions. Macro-level indicators, such as total household waste arisings, are difficult to interpret and must be complemented by more direct measurement of the impacts of specific waste prevention measures. Inevitably the latter can only be achieved if research is an integral and adequately resourced part of programme delivery.

1 The context
Although waste prevention initiatives have been a priority objective for both national and EU waste management policies for many years, limited progress has been made in translating theory into action and a particular failing has been the lack of quantitative evaluation of such initiatives.

Against this backdrop, in 2002 the Prime Minister's Strategy Unit reviewed England's waste strategy and concluded that new waste prevention initiatives were needed to address the growing quantities of municipal waste. The reported rate of increase for household waste in England was then 3% per annum: faster than the growth in GDP. With a household waste recycling rate of 12% and 80% of municipal waste sent to landfill, the review identified the dangers of not moving fast enough to meet European Landfill Directive targets (Strategy Unit, 2002). Across Europe municipal waste generation during the same period matched GDP, increasing by 19% between 1995 and 2003 (European Commission, 2005).

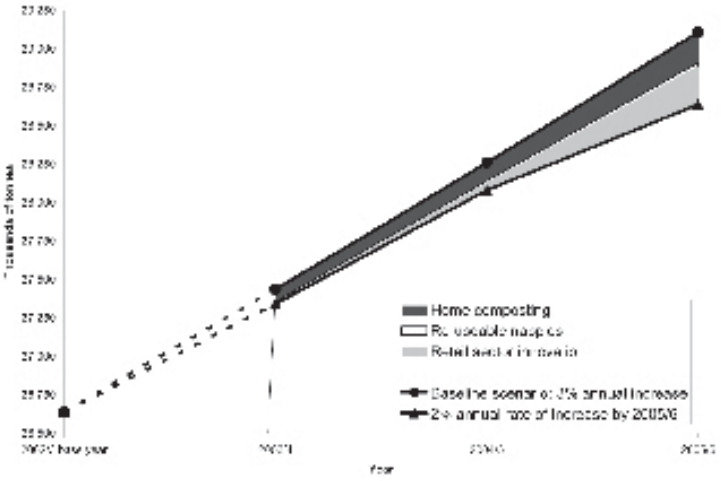


Fig: 1: Strategy Unit Projections for household waste growth 2002/03-2005/06, with estimated deflection through national waste prevention measures

As part of a package of measures, the Strategy Unit proposed short-term investments to bring about a 1% per annum reduction in the rate of growth in household waste from 3% to 2% by 2005/06 (figure 1), equivalent to about 745,000 tonnes over two years, through three key measures:

- an extension of householder participation in home composting;
- a greater use of re-usable/washable nappies;
- a retailer initiative focused on the top supermarkets;

For each of these measures the Strategy Unit set out a rationale and targets were developed based on the best evidence then available.

2 WRAP Waste prevention initiatives: rationale and target setting

The short-term investments proposed in the Strategy Unit's 'Waste Not Want Not' report were translated into delivery plans and a set of targets within the 2004-2006 Waste and Resources Action Programme business plan (WRAP, 2004), through work streams funded by the Department of the Environment Food and Rural Affairs (DEFRA).

WRAP was created in 2000 in response to the Government review of waste strategy, and is a not-for-profit agency with the overall mission to accelerate resource efficiency by creating efficient markets for recycled materials and products, while removing barriers to waste minimisation, re-use and recycling. WRAP's current annual budget is about € 110m.

Table 1 provides a summary of the three waste prevention measures and the rationale put forward by the Strategy Unit for pursuing them. The first two mea-

Tab. 1: Waste prevention measures proposed by Strategy Unit and targets set in WRAP's 2004 -06 business plan

Prevention measure	WRAP business plan targets and evidence base	Rationale
1. Home composting A programme to help households start home composting and to improve composting rates for those who already participate.	**Target:** to reduce arisings by a total of 400,000 tonnes over the business plan period. **Evidence base:** no robust data available on home composting diversion rates, no consistent methodology to measure diversion, reasonable national data on home composting participation rates.	Home composting carried out to high standards is an effective way of reducing organic component of waste arisings and contribute towards compliance with the Landfill Directive through the diversion of biowastes away from landfill. Around a third of households in England have participated in some form of composting activity in the last 12 months. Local authorities are estimated to have rolled out 1.5 million composting bins since 1995/6. However, the lack of sustained support for householders is a major factor in the relative lack of demonstrable success of current home composting activities.
2. Re-usable nappies Promotion of reusable nappies and developing nappy washing businesses. The main feature envisaged by the SU was a pump priming grant aid for SMEs and new start-ups for nappy washing businesses.	**Target**: 35,000 tonnes minimised over the business plan period. **Evidence base:** limited data on quantities of avoided nappy waste from one or two local authority schemes.	Disposable nappies estimated to comprise between 2-3% of household waste. Even modest initiatives to displace disposable nappy use with reusable nappies can have a significant waste minimisation impact. Promotion and education form an integral part of any nappy washing initiative, and more successful schemes have also included an element of financial incentives to households.
3. Retailer initiative and innovation fund Engaging the top 5 supermarket chains at a high level to secure agreement to reduce packaging, plastic film, introduce refillable bottles and help households reduce food waste, for example through improved labelling of sell by/use by dates. Establish an innovation fund for waste minimisation including mechanisms for targeting products that impact on the municipal waste stream, particularly biodegradable waste. The fund to be based on key criteria linked to reduction in tonnage of material. The fund should be sufficient to identify and develop five new innovative products that will reduce biodegradable MSW.	**Target:** 310,000 tonnes minimised over the business plan period. **Evidence base:** potential for innovation fund not known as no precedent; no systematic attempt to analyse packaging weights/ materials. Data on food waste and extent to which 'avoidable' ~ largely anecdotal. No large-scale behavioural change initiatives carried out in relation to food waste in UK.	WRAP has established that between 35-40% of all household waste which ultimately ends up in landfill began its life as a purchase from one of the top 5 supermarket chains. The supermarkets link massive supply chains with households and behaviour and are therefore best-placed to influence change. Further work is needed to challenge industry and the retail sector to develop innovative ways of minimising material use in products, design for minimum material use and maximum recyclability

sures were extensions of work that had already been conducted by some local authorities in the past.

Home composting is only 'waste prevention' in the sense that that the material (largely food and garden waste) that is composted contributes to the minimisation of collected household waste that would need to be disposed of or diverted into treatment options.

Although the evidence base for target setting was limited in 2002, making much of the work experimental, priority was given within the WRAP strategy to building the evidence base alongside programme delivery.

3 Programme evaluation and supporting research

3.1 Home composting

The WRAP home composting scheme was launched in March 2004 with the first phase containing partners across 40 English districts and has since been extended into Scotland and to 90% of local authorities in England.

The scheme was designed to supply a variety of low cost compost bins to householders, including a range of different bin capacities to suit different gardens and composting needs. An essential element of this programme has been the parallel development of a comprehensive suite of support services comprising literature, website, home visits, telephone helpline and local promotions and support from a network of home compost advisors. All of these support activities have helped new recruit households to compost successfully at home and also have enhanced the contribution made by existing home composting households.

The WRAP home composting programme has provided an opportunity to develop a consistent diversion methodology based on data collected across a broad range of different area types. This work was particularly timely as the introduction of the Landfill Allowance Schemes across the UK has highlighted the difficulty that home composting faces in competition with more readily quantifiable 'collect and treat' options (Parfitt, 2006). Currently, local authorities cannot claim for the biowastes diverted through home composting schemes in the same way that separate collections of garden or kitchen waste for centralised composting can be counted as 100% biowaste diversion under mass-balance calculations.

WRAP embarked on an extensive research programme in 2004 to establish more robust diversion estimates for home composting and to provide a more detailed picture of how home composting participation varied nationally. The key elements of this research were:

- Household level research that included attitudinal and behavioural surveys, observational studies of garden use and compost bins, household-level waste analysis with repeat samples from the same households at three different points in time.
- Analysis of local authority operational statistics and development of a series of multiple regression models to explain variation in collected household waste, with householder participation in home composting as one of a num-

ber of explanatory variables.

- Survey of home composting participation and behaviours with 20,000 households across Great Britain to inform the regression models (the largest questionnaire survey on an environmental topic yet undertaken in the UK).

The regression models provided diversion estimates of 60 kg/household/year for composting households with prior experience, and 220 kg/household/year for new recruits to home composting. In order to evaluate the programme's effectiveness, these estimates were combined with surveys to determine the ratio of 'new recruits' to 'enhanced existing' home composters. The combination of the appropriate diversion factors with the number of WRAP bins distributed gave estimates for total biowastes diverted by the programme. Currently a consultation exercise is underway to consider how to use the WRAP research to provide proper account for home composting initiatives within the UK Landfill Allowance Schemes ~ the implementation mechanism for the Landfill Directive targets to reduce the landfilling of biowastes.

3.2 Washable nappies

WRAP developed a suite of promotional materials, good practice guidance, a website, campaign events such as Real Nappy Week, and direct support for key groups such as midwives, all to support the promotion of re-useable nappies as an alternative to disposable nappies, in order to reduce the impact of this waste stream on landfill.

The ultimate aim of washable nappy scheme monitoring was to estimate the quantity, in tonnes, of disposable nappies that would have gone to landfill, had the parents opted for disposables rather than washable nappies. As part of the effort to account for the impact of the direct support activities, a tool was devel-

enter age profile of babies

Age	No. of babies
0-6 months	500
6-12 months	305
12-18 months	120
18-24 months	71
24-30 months	4

Or enter total no. of babies	
Total weight of nappies p.a. (tonnes)	1,206
Landfill cost/tonne	£55.00
Landfill tax/tonne £18/tonne from 01/04/05 increasing by at least £3/tonne p.a. to a rate of £35/tonne by 2010	£21.00
Annual avoided total landfill cost & tax	£91,655

Fig. 2: Nappy calculator - example of per annum diversion estimated for 1000 babies using washable nappies, with associated local authority cost savings

oped for use by WRAP funded real nappy schemes to help them calculate the savings that using real nappies bring (WRAP, 2007). This estimator, part of which is shown in Figure 2, was calibrated using primary data derived from a study of 61 households' used nappies (870 nappies in total) which were collected from three local authorities and weighed as part of a waste composition study commissioned by WRAP in 2005.

The average of 450 kg minimised per year per participating household, based on the WRAP research, was approximately twice the diversion estimate used by the Strategy Unit in 2002, based on limited data from a single local authority. The tool was designed to be used in two ways, depending on whether the number of babies or the number of households in a washable nappy scheme was known. The calculator estimates the quantity if disposable nappy waste avoided by converting babies recruited to real nappies, alongside the avoided local authority landfill tax and disposal costs.

The type of monitoring carried out by washable nappy schemes funded by WRAP involved establishing the number and ages of babies converted to washable nappies, working out which age bands they were in and working out the relevant number of nappies used in the period being assessed. These numbers were then combined with the typical nappy weights within the nappy calculator to produce a scheme diversion estimate. A good practice guide to monitoring and evaluation has been issued by WRAP (2006) that includes the monitoring of washable nappy schemes and other waste reduction initiatives.

3.3 Retailer initiative

The purpose of the programme is to reduce the amount of packaging and food that consumers throw away, in order to help the UK meet its obligations under the EU Landfill Directive and contribute to the overall resource efficiency of the retail sector.

The main activity that was pursued during the 2004-06 was the reduction of packaging and food waste through the work of the Innovation Fund, with work still underway to develop a consumer-focused food waste minimisation campaign. In relation to the monitoring of packaging reduction, both 'top down' and 'bottom-up' approaches have been developed: this is illustrated by the project-based monitoring of the Packaging Innovation Fund and the high-level monitoring of packaging weights in the 'best in class' dataset.

The impact of Innovation Fund R&D funding has been assessed through feedback from the funded projects, through the use of independent Project Monitors. Achieved tonnages of avoided packaging and food waste has been obtained for each project along with anticipated future reductions for that project and also an estimate of what would be expected if the innovation was fully commercialised across the sector. WRAP has also developed a toolkit for those in receipt of Innovation Fund support to use to assess quantities of food waste avoided.

Whilst the Innovation Fund seeks to support research to set new 'best in class'

standards for optimal packaging, Table 2 illustrates the opportunities that are

	Product category	Packaging weight in 2003/4 (tonnes)	Packaging weight reduction if all moved to BIC (tonnes)
1	Wine (bottles)	472,295	20,000
2	Ready meals (frozen)	32,675	19,880
3	Carbonates (cans)	47,725	18,503
4	Beer (cans)	48,762	15,545
5	Pizza (frozen)	23,344	13,598
6	Beer (bottles)	87,470	13,234
7	Whisky (bottles)	53,445	12,756
8	Cooking sauce (jars)	108,752	12,152
9	Fruit juice (cartons)	51,144	10,283
10	Pet food (cans)	32,97[illegible]	9,212
11	Carbonates (plastic)	74,215	8,533
12	Ketchup table sauce	21,222	7,720
13	Cows milk (cartons)	12,876	7,433
14	Eggs (tray & boxed)	12,854	6,897
15	Vodka (bottles)	27,045	6,273
	TOTAL	**1,150,829**	**280,291**

already available and the yield in waste savings that would be achieved if this selection of leading contributors to packaging waste in the home all moved to 'best in class' for packaging weight within a particular product size. These data are supplied to WRAP under a purpose-built database that covers 3.5 million retail products.

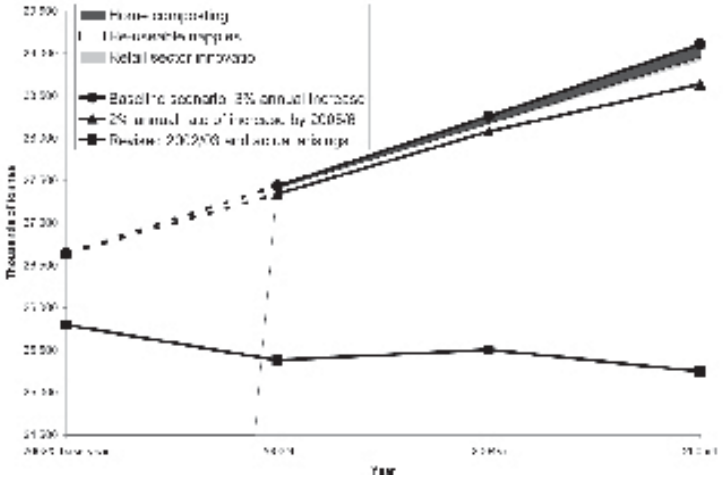
Tab. 2: Product categories analysed by 'best in class' data store, with estimated weight reduction if all within category moved to 'best in class'

4 Achievements against 2004-2006 targets

Using the methodologies and supporting research described in the previous section, the achievements against WRAP's 2004-06 business plan targets were reported last year, as shown in Table 3 (WRAP, 2006). The challenging target of a 1% deflection in the rate of increase of household waste, set by the Prime Minister's Strategy Unit, was only partially met during the period, based on the evidence generated by the WRAP programmes. However, the actual 'deflection' in household waste arisings that occurred during the period was significant, with quantities declining from a revised value for the 2002/03 base year - as shown in the bottom line in Figure 3. This highlights a general problem with macro-level targets for overall waste prevention: there are many factors outside the planned in-

terventions that can mask the impacts of those interventions. Possible exogenous factors that might explain the trend in Figure 3 would be a general shift away from consumer expenditure on goods (and linked household waste creation) towards services (financial products, leisure, eating out) and changes in waste categorisation by local authorities. Statistics derived from the National Expenditure and Food Survey suggest that a significant shift away from goods and towards services has occurred in England over the last 5 years.

Tab. 3: WRAP waste prevention measures ~ achievements against targets 2004-06



Diversion achieved in England	Business Plan Target	Performance
Home composting	400,000 tonnes	274,926 tonnes
Re-useable nappies	35,000 tonnes	22,954 tonnes
Retail sector	310,000 tonnes	29,400 tonnes
	745,000 tonnes over 2 years	327,280 tonnes over 2 years

Fig. 3: Original Strategy Unit trajectory to 2005/6, compared with actual household waste arisings and achieved WRAP waste prevention

During the Business Plan period:

- Over one million home compost bins were distributed to new and existing composting households in the three growing and gardening seasons. This gave the capacity to divert over 274,926 tonnes of biodegradable municipal waste.

- The washable nappies programme directly diverted 22,954 tonnes from landfill by the end of the business plan period through direct grant support for a wide range of nappy projects developed by local groups and local authorities. Many local authorities continue to promote real nappies as an alternative to disposables for social reasons and to reduce biodegradable waste going to landfill.
- The Retail Innovation Fund supported 28 projects to research, develop and trial innovations to reduce packaging and food waste. The early success of some of these projects led to 29,400 tonnes of household waste reduction during the Business Plan period. However, their real benefit is in the potential reduction which could be achieved if the project partners and the wider market adopt those innovations, which for these early projects alone could result in 187,000 tonnes of reduction. In its new business plan period, WRAP is therefore focusing on 'mainstreaming' these innovations, as well as on building an even stronger portfolio of new projects.

5 Conclusions

Perhaps the most significant outcome from WRAP's initial work on waste prevention has been to demonstrate that the measures can effectively reduce waste at source, and that home composting and retail packaging reduction and innovation can have significant impacts on reducing waste, provided active programmes in these areas continue in the future.

An important aspect of this initial period of work has been to construct a more robust evidence base, so that future interventions can be better planned and more realistic targets set. The experience also points at the dangers of macro-level waste prevention targets and the need for them to be complemented by innovative methodologies that measure impacts more directly, using research that is properly resourced and designed as an integral part of programme delivery.

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