Plastic Bottle Recycling in Scotland

An overview of plastics recycling in Scotland, best practice and future opportunities.

RECOUP

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Executive Summary

This report follows on from previous work undertaken in partnership with Remade Scotland. The previous report, published in 2003, identified specific objectives and priorities based on research, workshops and interviews covering 34 relevant stakeholders, including detailed discussions with 20 Scottish Councils.

In 2003, a vision of efficient sustainable household plastic recycling was set out, where investment in a major increase in plastic bottle recycling levels, using proven operational techniques, could enhance sustainable waste management systems and attract reprocessing enterprises into Scotland.

A second phase of work has now been undertaken. The objective of this second phase has been:

- To review several existing household plastics collection programmes operating in Scotland
- To identify and advise on opportunities to improve performance of the plastics elements of schemes
- To develop and assess the case studies of schemes in Scotland and, in conjunction with experience of other operational techniques, highlight effective operational practice.

Current performance

It is estimated that 3,355 tonnes of plastic bottles were collected during 2005. This tonnage is equivalent to over 80 million plastic bottles, with a volume of 165,000 cubic metres. It represents an increase of 53% on the quantity collected in 2004, and an almost 6-fold increase on the quantity collected in 2003. The recycling rate for plastic bottles in 2005 was c. 6%. Average collections levels from Scottish households were higher than the UK national average in 2004.

The collections resulted from the following infrastructure:

- 25 (78%) of Scotland's 32 local authorities offer recyclables collection facilities for plastic bottles.
- Bring schemes (plastic bottle banks) are available in 21 (65%) local authority areas. There are now 825 sites where plastic bottles are collected.
- 768,000 (34%) of all Scottish households in 19 (60%) local authority areas are offered the opportunity for their dry recyclables including plastics to be collected at kerbside.
- The provision of plastic bottle recycling within kerbside collections is set to exceed 850,000 households during 2006/07. This will represent just fewer than 40% of Scottish households.

A more detailed analysis of collection programme performance showed that:

- There is a very wide range of reported participation rates and capture rates of plastics. There is considerable opportunity to increase the capture of bottles from existing collections by improving the participation of residents in the current services.
- Alternate weekly collections in the UK generate an almost 50% higher collection rates of plastics than weekly recyclables collection combined with a weekly residual collection service; 8.9kg vs. 6.3kg/household/annum.

- Schemes using less volume-restricted containers (e.g. wheeled bins rather than kerbside boxes) tend to generate higher quantities of plastics. However there is some interaction of container size and collection frequency.

Generally there are encouraging signs of progress. However, there remain over 55kt of plastic bottles with a current sales value in excess of £6m per annum being primarily landfilled. In addition there is a still larger quantity of other used plastics in domestic waste that could potentially be recycled or recovered.

The plastics component of Scotland's MSW is over 350kt, of which 99% is currently disposed of, mainly to landfill. As result the current cost to Scottish residents of disposing of this plastic (excluding collection) is estimated at over £10m per annum and this will increase. By 2012 years it is calculated that plastics wastestream in Scotland will be c.400-470kt per annum and the associated disposal cost alone of plastics in MSW will rise to £20-23.5m per annum[1].

A review of perceptions and attitudes of council recycling managers to plastics recycling found that:

- ***The current most significant operational challenges related to the high volume, low weight of plastics waste and the associated logistical problems this presents.***

- ***To a lesser extent three other issues were identified: contamination with other plastics, market concerns and service costs were reported as main challenges, each being reported by 4 Councils.***

The four most important reasons given by Scottish Councils for not operating a collection of plastic bottles for recycling were:

- No suitable local baling/handling facility (e.g. MRF)
- Cost: A scheme has been costed and viewed as too expensive
- Not confident in market outlets for collected plastic bottles
- Currently focussing on heavier materials to hit recycling targets

Scheme reviews

A key aspect of this phase of work was to work with Councils to review their schemes and seek to identify practical opportunities for improvement. This was achieved by a combination of site visits and discussion with operators and subsequent review of relevant data.

The areas where there were potential opportunities to enhance current schemes typically fell into one or more of the following categories:

- Operational infrastructure available but poor householder participation.
- Choice of kerbside collection vehicle limits opportunities to collect (more) plastics efficiently and effectively.
- Organic growth of collection service over time results in opportunities for rationalisation
- Limitations of sorting/handling facilities result in material or revenue losses from collected plastics
- Lack of performance benchmarking information results in perceived or real challenges when planning service development
- Lack of market or service charge benchmarking information results in potential losses in revenues or service charges that are higher than typical.

Examples of recommendations/information given included:

[1] *Based on 2%-5% growth per annum in plastics wastestream, and landfill tax escalator plus some growth in underlying landfill disposal costs to a combined level of £50/tonne by 2012.*

- Advice on the logistical implications of expanding from collection of HDPE bottles only to all plastic bottles (2 Councils). In one case the council expanded the range of plastics collected and also took up suggestions relating to piloting the use of side-loading compaction equipment to optimise the available capacity for plastics within the existing feet.
- Benchmarking advice on availability and pricing of markets, and of contract handling rates (3 Councils). In one case this highlighted relatively low revenues for materials, in two cases this highlighted relatively high charges by third parties for handling collected plastics.
- Suggestions for the inclusion of additional/alternative equipment to handle plastic bottles. In one case this highlighted that some collected bottles were being lost due to a lack of adequate baling systems at the MRF.
- Some existing contract arrangements did not appear to offer competitive prices for recovered plastics and collectors should consider market testing the prices available. There is also the opportunity to develop price benchmarking. Generally gate fees appear fair, although some prices for contract handling of plastic bottles (especially when materials are pre-sorted) appear excessive. In some cases Councils could consider if they may benefit from paying for toll baling and marketing the collected plastic bottles directly, rather than paying a gate fee or receiving a "free tip" at a local merchant.
- The use of multiple compaction points in very dispersed Councils in Northern Scotland is likely to be more efficient than transporting loose bottles long distances due to them being high volume low weight materials. The use of screw compactors may offer some benefits for remote sites handling more than a tonne of plastic bottles a week.
- Communication of messages "plastic bottles only" and, subject to the sorting equipment used, "tops off and squash" are very important and should be reinforced by suitable visual images in publicity material. The communication messages must match the markets and the sorting system employed. It is recommended that communication work to promote plastic bottle recycling by SWAG and individual Councils take account of and learn from the experiences highlighted in this report. Words and images should clearly emphasise the appropriate range of bottles and the best way for the householder to present them for collection.
- Collection of HDPE only can be successful but can lead to public confusion and demands for "all bottle" collections. The reason for collecting HDPE only is due to lack of resources to offer an "all bottle" collection, rather than any lack of markets for other bottles.

Improving the economics of plastics recycling

Analysis of operating costs suggests that 'kerbside sort' collection systems cost approximately £750-950/tonne of plastics collected, equivalent to c. £6-11.50/household per annum. Costs associated with combining a fortnightly or monthly plastics collection with alternate weekly collections of residual waste are much improved – with additional costs assessed at c. £85-140/tonne for three Councils using RCV, four weekly cycle collections of residual, recyclables and green waste, equivalent to under £1/household per annum.

The following specific issues were identified as central to improving the economics of sustainable plastics waste management:

- The single most significant driver to enable the affordable collection of plastic bottles (and other bulky packaging) is the move to alternate weekly residual collections (AWC). This should be encouraged where possible and appropriate financial support made available to support this transformation. Several schemes have plastics which are recovered at little or no extra cost to traditional landfill by this method. AWC services the same population more efficiently, reducing operational costs. These economics will continue to improve in favour of recycling.

- The choice of "kerbside sort" or "sort at MRF" will depend on a wide range of factors. Sorting at kerbside can offer opportunities to introduce plastics collection without the need for a capital intensive MRF. It is important to ensure that the selected vehicle has maximum possible handling capacity, given access restrictions. Once plastic bottles are added to schemes 10m^3 capacity vehicles will probably not offer the most cost effective collection arrangement. Plastic bottles are a high volume material and it is recommended that larger 13-14m^3 units should be evaluated. 7.5t and 12t chassis are available at these sizes. Councils should even consider selling existing smaller vehicles and purchasing larger units as this may prove more efficient than persevering with an existing under-size fleet that will not be suited to plastic bottle collection schemes.
- Large body kerbsider vehicles can now incorporate plastic bottle compaction that doubles the effective capacity of the plastic bottle compartment. Initial experience indicates there is a payback on this addition to the vehicle.
- It is recommended that the council 'clients' periodically review the operational efficiency of kerbside collection rounds and that round sizes are set at a level which is reasonably challenging and achievable – especially once the scheme is established. This could include checking that compartment/stillage sizes are appropriately allocated to the volumes of different materials being set out – with modifications being made as appropriate. In addition, there is a relatively large variation in the number of households covered, especially by "kerbside sort" vehicles, and there appears to be *prima facia* scope for improving round efficiency (i.e. increasing the households covered per collection vehicle per day) for some schemes.
- It is noted that RCV collections can compact collected plastics and typically cover 60% more households than kerbside sort vehicles in a day. Importantly as the quantities per household of collected plastic bottles grow and as potentially other plastic items are collected, kerbside collections without compaction are likely to prove increasingly less efficient in many situations.
- Where MRFs are used, optimising sorting arrangements and volumes could lead to a halving of the current co-mingled gate fees. This assessment is based on known data from other MRFs where over time gate fees have reduced from £35-50/tonne to, for example, under £20/tonne primarily as a result of increases in throughput and associated improvements of process economics.

Markets for plastics

Markets for PET, HDPE and mixed plastic bottles remain under-supplied. Recent analysis of the capacity for reprocessing plastics in the UK shows that reprocessors report capacity exceeds available supplies. Demand remains high in the UK, the EU and the Far East for collected bottles baled to specifications. Strong consumption of recycled plastics in Asia combined with low labour and freight costs provides a structurally competitive market for recyclable bottles from Europe.

The value trend of plastic bottles and other plastic packaging for recycling has been stable and generally almost entirely upward since 2002. For example, recent pricing for sorted PET and HDPE is £130-170/tonne and for mixed plastic bottles £75-95/tonne[2]. The market for raw material is considered as generally stable with underlying demand growing. The market for PRNs, which contributes to pricing, is currently considered relatively well balanced. Therefore sales values for baled recyclable plastics are not anticipated to vary significantly.

Evidence of plastic container collections exceeding at least 10kt per annum will be important to attract investment in plastic bottle reprocessing capacity. Ideally at least 20kt should be available – or be demonstrably coming on stream – to feed a commercial scale plant.

Several technologies are available to convert plastics into diesel fuel and into petrochemical feedstocks. Commentators suggest that oil prices would need to be sustained at over

[2] *ex works, Central Scotland, meeting specificatiions and shipment weights*

$40/barrel for these kinds of processes to be economically attractive. Oil price projections suggest that pricing through to 2030 ranging from the high $40s to high $50s a barrel, implying that the technology should become commercially viable.

Developments of diesel fuel production technology in Scotland are anticipated in 2006. This will be the first implementation of such a commercial-scale plant in the UK and it will be important to review the success of this process as it could, alongside mechanical recycling, provide a valuable tool for improved plastics waste management.

Other observations

The lack of significant collections in Edinburgh and Glasgow are major limiting factors to overall volumes of bottles being collected. It is recommended that there is continuing encouragement for Edinburgh to significantly expand its collections to include plastic bottles, and for increasing participation and capture of bottles in Glasgow.

The facility for Councils and contractors to gain specialist advice when considering implementing a collection programme or evaluating the effectiveness of an existing scheme is valuable. Discussions with Councils during this project have highlighted and identified scope for improvements both in sales revenues and in reducing operating costs.

Remade will therefore continue to promote the growth in collection levels and the investment incentives available to potential investors in reprocessing facilities.

Contents

1. Introduction and Methodology

1.1 Scope and outline of the report

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A second phase of work has now been undertaken. The objective of this second phase has been:

- To review several existing household plastics collection programmes operating in Scotland
- To identify and advise on opportunities to improve performance of the plastics elements of schemes
- To develop and assess the case studies of schemes in Scotland and, in conjunction with experience of other operational techniques, highlight effective operational practice.

This report is designed to summarise this second phase of work. In addition this information is provided within the context of an overview of plastic bottle recycling activities and infrastructure in Scotland. Markets, planned developments and future potential are also considered and discussed.

This report is broadly divided into four sections:

- An overview of the current extent of collection and handling infrastructure for post-consumer plastics in Scotland. Historic and comparative data is used to highlight trends in Scotland and relative to the rest of the UK. The overview is complemented by a more detailed analysis of information relating to collection, handling and perceptions of operators shown in Appendix 1.

- A summary of the specific areas of research undertaken and recommendations relating to performance improvement work with individual Councils. This section is complemented by specific, more detailed case studies for ten Councils in Scotland, developed as part of this study. There are also a further five case studies of collection schemes in England and Wales that illustrate a further range of operational approaches and associated performance and economic data.

- A review of key themes relevant to future planning and development of post-consumer plastics recycling in Scotland, comprising a commentary on markets, current projections for future infrastructure growth and likely enterprise opportunities that will emerge as collection levels increase.

- A summary of findings as they relate to good practice for collection and handling, and recommendations for further action.

Recoup would like to thank all the Councils that contributed information to enable development of the cases studies and analysis of trends in performance.

1.2 Background

Scotland collected an estimated 3,355 tonnes of plastic bottles for recycling during 2005, a capture rate of approximately 6% of all plastic bottles in the household waste stream. This is an improvement on both 2003 and 2004, when an estimated 475 and 2100 tonnes of plastic bottles were recycled respectively.

These are encouraging signs of growth. However, there remain over 55kt of plastic bottles with a current sales value in excess of £6m per annum being primarily landfilled. In addition there is a still larger quantity of other used plastics packaging in domestic waste that could potentially be recycled or recovered, certainly amounting to at least a further 125kt per annum.

The plastics component of Scotland's MSW assessed at 10.5% and the total MSW level at 3.4million tonnes per annum[3], plastics therefore represents over 350kt of waste, of which over 99% is currently disposed of, mainly to landfill. As a result the current cost to Scottish residents of disposing of this plastic (excluding collection) is estimated at over £10m per annum and this will increase as the result of both landfill cost/tax escalation, and as a result of growth in the size of the plastics wastestream, which currently is running at around 2-5% per annum. By 2012 years it is calculated that the plastics wastestream will be c.400-470kt per annum and the associated disposal cost alone of plastics in MSW will rise to £20-23.5m per annum[4]. Associated expenditure on plastics waste collection costs would more than double this figure.

A significant improvement is therefore still required to reduce the environmental impacts of this loss of resources, to increase efficiency of sustainable waste management programmes and to create the potential for a local market. Such improvements can be achieved by:

- highlighting the opportunities for affordable plastic recycling schemes,
- providing scheme support through funding and feasibility assessment,
- securing commitment to finance priority infrastructure and projects using comprehensive, integrated collection of recyclables and residual refuse
- informing and stimulating efficient local baling capacity
- building confidence and improving economics by providing information detailing how to maximise value of baled plastic bottles
- fully integrating considerations of plastics waste management into wider planning of sustainable waste management systems for Scotland, including extraction from mixed waste treatment processes such as MBT.

There is a limited window of opportunity to incorporate and demonstrate good practice and encourage handling infrastructure. The Waste Strategy for Scotland aims to provide 85% of Scottish households with appropriate local collection systems for recyclables and compostables by 2010. The growth needed to achieve the 2006 target will require over half of Scottish households to adopt effective kerbside collections.

By 2010 plastic bottle collection levels could grow to 30,000 tonnes as a result of embedding a recycling culture and widespread provision of plastic bottle collection as part of the overall waste management service in both the domestic and commercial waste streams. If plastics recycling is not one of the priorities of the Strategic Waste Fund, then it will be costly and difficult to change both infrastructure and public education to incorporate this material later.

This kind of growth will be important to attract reprocessing and remanufacturing enterprises to Scotland. Typically, reprocessing facilities for plastics require a minimum throughput of 10,000 tonnes per annum to operate economically and the global market is highly competitive.

1.3 Methodology

A shortlist of Councils was identified as potentially being able to benefit from discussions regarding scheme performance. The shortlist was based on a number of factors, principally in relation to size of the scheme and, following initial discussion, perceived opportunities to

[3] *Souce: SEPA published statistics*
[4] *Based on 2%-5% growth per annum in plastics wastestream, and landfill tax escalator plus some growth in underlying landfill disposal costs to a combined level of £50/tonne by 2012.*

identify improvements. These Councils were visited and development opportunities discussed. In several cases specific follow up work was undertaken to highlight opportunities.

Statistical analysis in this report has been based on survey work undertaken towards the end of 2005 and during the start of 2006. Recycling managers were contacted by e-mail to request participation in the survey and were encouraged to enter data directly into an electronic form accessible over the Internet, although postal/fax back forms were also made available on request.

E-mail reminders were sent to local authorities that did not respond to the initial invitation to participate in the survey. Local authorities that did not respond to the reminder were interviewed by telephone. Data was reviewed and any apparent anomalies verified with the relevant local authority before analysis.

Comparable data from 2004/5 has also been used in some parts of the analysis and has been sourced in the same manner.

The ten Scottish Councils on which the case studies are based were contacted by telephone for a more in-depth discussion of their collection schemes and their thoughts on plastic bottle recycling. Site visits have also been undertaken to a number of Scottish Councils and the collection schemes discussed with council staff and operational personnel.

Information on the Material Recycling Facilities (MRF) was primarily obtained through telephone conversations with the operators and supported by some site visits.

While much of the data in this report is specific to Scottish recycling activity, it is important to remember that the generic guidelines arising from these experiences can be applied more widely by those seeking to introduce or expand plastic bottle collections.

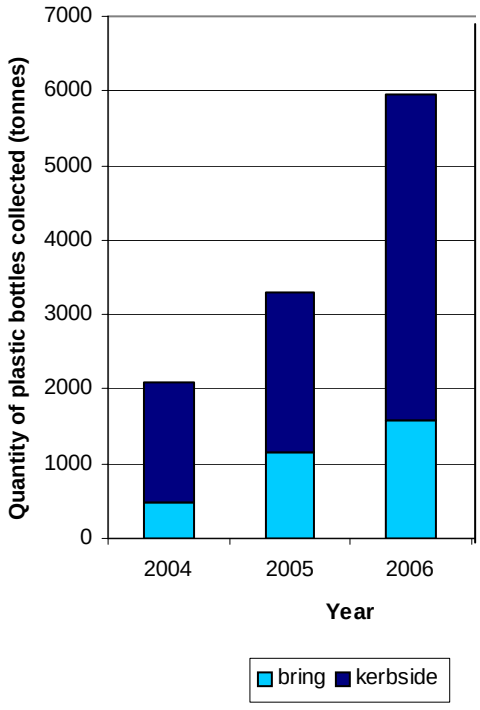
2. An Overview of Plastic Bottle Recycling in Scotland

This section of the report provides an overview of plastic bottle recycling in Scotland; comparing information on which Councils are operating recycling collections that include plastic bottles, the types of scheme and tonnage achieved. General perceptions of plastic bottle recycling are also discussed. Current MRF location and capacity is mapped out to show potential for growth and for further infrastructure development. Information presented in this section was gathered by Recoup on behalf of WRAP as part of a national survey and is complemented by further specific work in Scotland. WRAP's permission to use the data to provide a detailed assessment of plastics recycling in Scotland in this report is gratefully acknowledged.

2.1. Plastic bottle recycling rates & plastics waste generation

It is estimated that 3,355 tonnes of plastic bottles were collected during 2005 (Figure 1). This tonnage is equivalent to over 80 million plastic bottles, with a volume of 165,000 cubic metres. It represents an increase of 53% on the quantity collected in 2004, and an almost 6-fold increase on the quantity collected in 2003, resulting primarily from an increase in coverage and performance of kerbside collection schemes.

Figure 1: Household plastic bottle recovery in Scotland



Approximately 2160 tonnes per annum (64%) of the bottles are being recovered through kerbside collections, with the remaining 1,140 tonnes per annum (36%) are being recovered through bring schemes.

Responses from Scottish Councils indicate a continuing growth in kerbside plastic bottle collections through 2005 to 2007, with more limited growth in bring schemes. Based on current local authority declarations, it is forecast that 6,000 tonnes of plastic bottles will be

collected by the end of 2006 this will increase to at least 6,375 tonnes per annum of plastic bottles by the end of 2007.

The total quantity of plastic bottles entering the Scottish household wastestream is c. 58,015 tonnes per annum[5]. The current annualised recycling rate for plastic bottles from household sources is therefore 6.4% per annum.

The actual recycling rate for plastic bottles for 2004/05 has been calculated as 3.6%. While this is a significant increase on 2003, which showed a recovery rate of 0.8%, this rate remains relatively low, indicating that there is clear potential for combined growth.

2.2. Collection infrastructure for household plastics recycling

Collection infrastructure for plastic bottles has grown substantially in Scotland over the past two years. The largest area of growth has occurred in the number and coverage of kerbside collections that include plastic bottles, although the number of bring sites has also increased.

- 25 (78%) of Scotland's 32 local authorities offer recyclables collection facilities for plastic bottles.
- Bring schemes (plastic bottle banks) are available in 21 (65%) local authority areas. There are now 825 sites where plastic bottles are collected.
- Kerbside collections including plastic bottles now occur in 19 (60%) local authority areas.
- 768,000 (34%) of all Scottish households are offered the opportunity for their dry recyclables including plastics to be collected at kerbside.
- 15 Councils operate both bring and kerbside schemes within their council boundaries. In many cases, a combination of bring and kerbside collections are provided within a single local authority area to address local circumstances.

Figure 2 and Table 1 show current plastic bottle recycling activity by council. As can be seen, not all Councils operating kerbside collections that include plastic bottles are offering the service to all households within their area. Some of these collections are still being piloted and will be rolled out to the rest of the area over the next couple of years, assuming they are successful.

The bring schemes also vary between Councils, with some providing only one or two collections sites, designed to service a large number of households, and others providing a larger number of smaller sites.

[5] Recoup and Remade Scotland (2003) *Plastics Recycling in Scotland*, Remade Scotland

Figure 2: Geographical spread of plastic bottle recycling schemes across Scotland by waste collection authority

- Bring
- Bring and Kerbside
- Kerbside
- NA

Table 1: Plastic bottle recycling infrastructure by council

Local Authority	Scheme type	total plastic bottle bring sites	Average number of households per site	number of households offered kerbside collection including plastic bottles	% of all households
Aberdeen City	Bring and Kerbside	35	2,772	60,000	62%
Aberdeenshire	Bring and Kerbside	75	1,210	17,500	19%
Angus	Bring and Kerbside	28	1,677	34,000	72%
Argyll & Bute	Bring and Kerbside	66	590	4,500	12%
Clackmannanshire	Bring and Kerbside	1	20,558	18,000	88%
Dumfries & Galloway	NA	0	-	N/A	0%
Dundee City	Bring and Kerbside	4	16,727	5,718	9%
East Ayrshire	Bring	25	2,014	N/A	0%
East Dunbartonshire	Bring and Kerbside	18	2,345	36,000	85%
East Lothian	Kerbside	0	-	35,000	92%
East Renfrewshire	Bring	12	2,913	N/A	0%
Edinburgh, City of	Bring	246	832	N/A	0%
Eilean Siar	Bring and Kerbside	54	209	3,220	29%
Falkirk	Bring and Kerbside	1	62,598	61,000	97%
Fife	Bring	24	6,261	N/A	0%
Glasgow City	Bring and Kerbside	164	1,656	95,000	35%
Highland	NA	0	-	-	0%
Inverclyde	Bring and Kerbside	36	1,019	27,000	74%
Midlothian	Kerbside	0	-	33,000	100%
Moray	NA	0	-	N/A	0%
North Ayrshire	Bring	8	7,341	N/A	0%
North Lanarkshire	NA	0	-	N/A	0%
Orkney Islands	NA	0	-	N/A	0%
Perth & Kinross	Bring	16	3,645	N/A	0%
Renfrewshire	Kerbside	0	-	42,000	56%
Scottish Borders	NA	0	-	0	0%
Shetland Islands	NA	0	-	N/A	0%
South Ayrshire	Kerbside	0	-	53,342	100%
South Lanarkshire	Bring and Kerbside	2	63,248	110,000	87%
Stirling	Bring and Kerbside	1	38,500	38,500	100%
West Dunbartonshire	Bring and Kerbside	7	5,826	30,000	74%
West Lothian	Bring and Kerbside	2	32,448	64,738	100%
Total		**825**		**768,518**	

Appendix A.1 contains a more detailed review of the type of collection schemes currently in operation in Scotland, with some broader analysis of UK trends, and highlights a variety of factors related to scheme performance.

Key findings from the more detailed analysis of factors are:

- The average collection rate from bring schemes in Scotland is 2.2 tonnes per site per annum.
- Alternate weekly collections in the UK generate an almost 50% higher collection rates of plastics than weekly recyclables collection combined with a weekly residual collection service; 8.9kg vs. 6.3kg/household/annum. This is a statistically significant difference to 95% confidence.

- Schemes using less volume-restricted containers (e.g. wheeled bins rather than kerbside boxes) tend to generate higher quantities of plastics. However there is some interaction of container size and collection frequency.
- There is a wide range of reported participation rates and capture rates of plastics. There is considerable opportunity to increase the capture of bottles from existing collections by improving the participation of residents in the current services.

Appendix A.2 incorporates a detailed review of the perceptions and attitudes of council recycling managers to plastics recycling.

The main findings of this analysis of attitudes are summarised below:

- For those Councils currently operating schemes the most significant operational challenges related to the high volume, low weight of plastics waste and the associated logistical problems this presents. 44% of respondents (10 Councils) noted this was their major concern. It is worth noting that many of these features and logistical problems exist whether the bottles are collected for recycling or not, but become more visible as recycling services are implemented.

- To a lesser extent three other issues were identified: contamination with other plastics, market concerns and service costs were reported as main challenges, each being reported by 4 Councils (16% each).

- The Councils operating schemes rated the affordability of the service. Of 11 responses to this question, two Councils reported it cost little or no extra to recycle the plastic bottles than landfill them (both these schemes operated four weekly collections using RCVs); five reported that although expensive the plastic bottle collections were perceived as a worthwhile element of the recycling service; only two council reported that it believed the service had limited value although in one case this was due to the current collections being too small to provide an adequate response.

The four most important reasons given for not operating a collection of plastic bottles for recycling were:

- No suitable local baling/handling facility (e.g. MRF)
- Cost: A scheme has been costed and viewed as too expensive
- Not confident in market outlets for collected plastic bottles
- Currently focussing on heavier materials to hit recycling targets

From the responses it can be concluded that:

- Further work is required to demonstrate how plastic bottles can be recycled cost effectively and that there are strong market outlets for plastic bottles
- Weight based recycling targets are restricting the expansion of plastic bottles and potentially other lightweight high volume items from being recycled. These valuable items, therefore, continue to take up limited landfill space
- Existing baling/handling infrastructure in Scotland requires assessment and potential expansion to reduce the need to transport loose material long distances at high cost.

2.3 Material Recycling Facilities (MRFs)

There are fifteen Materials Recycling Facilities (MRF) in Scotland. As can be seen (Figure 3), the majority are located in the more highly populated region of the central belt. Typical gate fees at the MRFs range between £25 and £60 per tonne of material, depending on type and specific local arrangements. Micro-baling facilities are used in some of the more sparsely populated areas, such as Aberdeenshire to minimise the impact of transporting materials over long distances.

Figure 3: Map showing the location and total quantity per annum of plastic bottles processed at material recycling facilities in Scotland

Table 2 lists the MRF's and the tonnage of plastic bottles reported as handled at each facility at summer 2005.

Table 2: Material Recycling Facilities (MRFs) in Scotland

Location	Operator	Contact Name	Contact Number	Plastic Bottles Handled (tpa)
Altens Environmental Park, Aberdeen	SITA	Archie Russell	01224 249168	180
Aberdeenshire	Aberdeen Council	Alistair Black	01467 628667	140
Alloa	Alloa Community Enterprises	Tony Cassidy	01259 215090	360
Kilmarnock	East Ayrshire Council	Paul Todd	01563 576000	13
Perth & Kinross	Holden Environmental	Robin MacKenzie	01738 634747	40
Blochairn, Glasgow	Shanks	Edie Wheeler	01415 524347	50
Glasgow *	Biffa	Phil Conran	01494 521221	60
Polmadie, Glasgow	Glasgow City Council	Rolf Matthews	01412 872049	200
Brook Street, Glasgow *	Eden Waste Recycling	Nick Grove-white	07753 711058	20
Coltbridge Avenue, Edinburgh	Eden Waste Recycling	Nick Grove-white	07753 711058	360
West Shore Road, Edinburgh	Biffa	Phil Conran	01494 521221	50
Renfrewshire	Shanks	Robert Haw	01505 329594	100
Kilsyth	Stirling Fibres	John Connor	01236 824999	400
Irvine	Lowmac Recycling	Kenny Smith	01292 262548	330
Angus	Angus Council	Morag Grant	01241 435612	200

* These MRFs are currently handling plastic bottles from the commercial & industrial wastestream, rather than the domestic wastestream.

The MRF at Polmadie, Glasgow has been recently upgraded to improve throughput and capacity for all materials, including plastic bottles. It is currently the only MRF in Scotland that sorts plastic bottles by polymer type manually. Other MRF's sell plastic bottles in predominantly mixed polymer bales. Stirling Council only collects HDPE bottles at kerbside and therefore sells only HDPE, which commands a higher value.
The main reasons why a majority of the MRF's are not separating by polymer type, but are selling the plastic bottles mixed are:

- The comparatively high price currently offered for mixed bottles
- The relatively small differential between prices for mixed and prices for sorted material
- The costs involved in polymer sorting

When surveyed, some MRF operators expressed concern regarding the stability of the export markets and the price of mixed bottles. Some operators believed that in some circumstances sorting material by polymer type would insulate them against changes in global export markets.

There is an opportunity for new plastic bottle collection schemes to feed material into existing MRF's for sorting, although there is little infrastructure in the north of Scotland - the Highlands being one of the main areas in Scotland where plastic bottles are not currently collected for recycling.

3. Collection scheme review & performance improvement opportunities

3.1 Outline of scheme review

A key aspect of this phase of work was to work with Councils to review their schemes and seek to identify practical opportunities for improvement. This was achieved by a combination of site visits and discussion with operators and subsequent review of relevant data.

In some cases it proved possible to support Council changes to the collection or handling service arrangements. In others it was possible to quantify the implications to changes in operational practices relating to plastics, or to signpost alternate approaches to systems currently employed. For some Councils it was possible to provide benchmarks and standard costs from other broadly comparable schemes to highlight opportunities to either increase revenue or to renegotiate specific service charges[6].

The following council schemes were reviewed and in several cases follow up advice was provided with specific reference to plastics recycling.

- Aberdeenshire
- East Dunbartonshire
- Falkirk
- Glasgow City
- South Ayrshire
- Stirling

Other more general input was also provided during the study period to additional operators and stakeholders in Scotland with reference to plastics recycling issues.

3.2 Opportunities to enhance performance

The review of these schemes and also the development of other case studies in Scotland highlight opportunities for enhancing performance and efficiency relating to plastics recycling. Appendix B provides detailed case studies of the council schemes listed in 3.1 and a further five Scottish council schemes. Appendix C provides five further case studies of other schemes in England and Wales that illustrate particular aspects of performance or cost.

The main areas identified for potential development are summarised below, with comments made on guidance provided.

The areas where there were potential opportunities to enhance current schemes typically fell into one or more of the following categories:

- Operational infrastructure available but poor householder participation.
- Choice of kerbside collection vehicle limits opportunities to collect (more) plastics efficiently.

[6] *The support provided did not generally include resources for direct intervention and management/implementation of local changes; ultimately it was the decision of each individual council how they took forward advice provided.*

- Organic growth of collection service over time results in opportunities for rationalisation
- Limitations of sorting/handling facilities result in material or revenue losses from collected plastics
- Lack of performance benchmarking information results in actual or potential challenges when planning service development
- Lack of market or service charge benchmarking information results in potential losses in revenues or service charges that are higher than typical.

Examples of recommendations/information given included:

- Advice on the logistical implications of expanding from collection of HDPE bottles only to all plastic bottles (2 Councils). In one case the council expanded the range of plastics collected and also took up suggestions relating to vehicle modifications to provide on vehicle compaction that would enable more plastics to be collected within the available kerbside fleet.

- Benchmarking advice on availability and pricing of markets, and of contract handling rates (3 Councils). In one case this highlighted relatively low revenues for materials, in two cases this highlighted relatively high charges by third parties for handling collected plastics. On the basis of the handling fee and market pricing alone, revenue opportunities probably equivalent to an extra £40,000 per annum were identified.

- Suggestions for the inclusion of additional/alternative equipment to handle plastic bottles. In one case this highlighted that some collected bottles were being lost due to a lack of adequate baling systems at the MRF, in another the potential benefits of the use of screw compaction equipment as an alternative to baling on mid-sized household waste recycling centres was highlighted.

- Contracting arrangements involved a range of parties that appeared to offer scope for consolidation or improved efficiencies, based on benchmarking costs. Market testing of the service was proposed.

- Following an analysis of the composition of collections from once council, it was noted the that whilst overall plastics collection performance was high, the non-food containers (e.g. laundry liquid, household cleaners and bleaches, shampoo etc) were under-represented and so future communications could emphasise to residents that these bottles were recyclable too.

- In one case the quantities of plastics generated from the available collection infrastructure were notably low and focussed promotion was identified as key to improving collection efficiency.

- More general advice was given on use of clear images and messages highlighting both the availability of a plastic bottle collection service and that the service targeted plastic bottles only. Some same images were provided for use in local materials.

Several of the recommendations made were implemented by Councils. As a result we believe that the following benefits have been achieved:

- the capture rate of plastics from one kerbside scheme has been significantly improved
- the implementation of a kerbside roll out has been achieved more cost-effectively and without potentially serious practical disruption
- at least two Councils will have had the opportunity to either increase their plastics sales revenues or reduce handling fees based on the information provided

In some cases the opportunity to implement changes was not available, due to wider implications of handling systems, budgets etc. This highlights the importance of ensuring that plastic bottle collection are built into the initial scheme planning process and that good practice is followed, as in some cases certain decisions about collection or handling arrangements make the future addition or expansion of a plastics collection programme impractical or unaffordable.

There is an opportunity for many operators to learn from the current operator experiences studied and enhance their own operations. Some specific considerations relating to good practice in planning and operation considerations for plastics recycling, based on the case studies presented in this report and on wider research conducted by Recoup, are discussed in the next two sections.

4. The economics of plastics recycling programmes

The following section summarises case study costings and scheme performance for plastic bottles.

While “cost per tonne” is one way of comparing scheme performance, it is arguably more useful to compare the cost per household service and to consider cost allocations by volume not weight. Practically, vehicle collection costs for plastics are generally much more directly determined by rate of fill of vehicle storage space; i.e. whether the vehicle is ‘full’ (a capacity issue) rather than if vehicles are at weight limits (a material density issue).

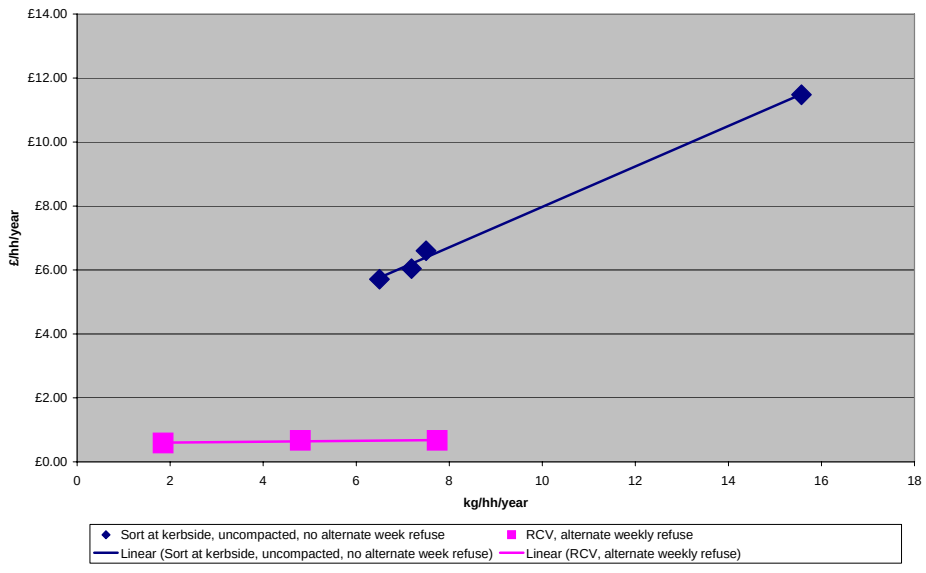
The following costings are an assessment made by Recoup based on the volume-related costs of collecting and handling plastic bottles. The space occupied on collection vehicles by plastic bottles has been assessed, and the cost of that space apportioned based on known direct vehicle operational costs. Allowance has been made for known handling costs, or else known typical costs of handling costs have been assumed.

The costs shown here are assessed as the additional costs incurred on top of the weekly RCV (residual) collection service. Therefore the Councils operating a four weekly collection cycle of dry recyclable, residual & green waste with RCVs show much lower *additional* costs.

Some Councils declined to provide costing data or requested that information discussed was not published.

The costs on which the following chart (Figure 4) is based are shown in Appendix A.3. We note that the specific costs per tonne for each council considered *should only be seen as broad indicators of some operational issues, not precisely derived detailed costings*. For example we note that some of the stillage vehicle collections occur linked to alternate weekly residual and green waste collections. It could be argued that the total cost distinction shown here are less prominent when the difference in the full waste management service, and different landfill diversion rates is considered. ***The analysis nevertheless helps to highlight some key general trends in operational costs and scheme performance (this is discussed in more detail later in the report).***

Figure 4: Calculated costs of plastic bottle kerbside collection per household, by *collection performance and scheme type*



The key observations from the analysis of seven kerbside collection schemes' costs are:

- This analysis emphasises the relative cost-effectiveness of the alternate weekly collection schemes, and the schemes on a 4-weekly cycle of recyclables, residual and green waste collections, which are significantly less expensive per household.

- The analysis highlights that costs of kerbside collection without compaction of plastic bottles increases broadly linearly with the collection levels achieved. This is because the volume collected is a major determinant of the collection service cost, rather than the time to complete a route. In this analysis the direct costs work out at approximately £1/household per kg of plastics collected.

- In the case of the RCV collections, the volume of plastics collected is not the main limiting factor on collection costs; the main limiting factor is time to service the round. For this reason we estimate that the cost of collection will be relatively independent of the weight of plastics collected – certainly up to around 20kg/hh/annum.

5. Best practice and increased plastic bottle recycling rates

The case studies of Scottish local authority plastics collection schemes in Appendix B and a sample of other UK schemes in Appendix C, highlight a number of key considerations and suggestions for Councils seeking to introduce or expand plastic bottle collections.

5.1 "Good practice" issues

Collection rates

- Most of the collections studied are achieving relatively high rates of collection of plastic bottles (ca.7.5kg/hh/annum), compared to an average performance of around 5.5kg/hh/an around the UK. This in part reflects higher consumption of plastic bottles in Scotland than the UK average, but still highlights encouraging performance of many schemes and relatively good participation in programmes.
- Some schemes have available infrastructure but low performance in terms of output plastics – warranting both increased promotion and consideration of other potential reasons for low capture rates, such as losses at the sorting stage.

Choice of collection vehicle and frequency

- The move to alternate weekly collection (AWC) is the single biggest enabler of affordable collection of plastic bottles and other recyclables. Several schemes show plastics are recovered at little or no extra cost to traditional landfill by this method. AWC services the same population more efficiently, reducing operational costs. These economics will continue to improve in favour of recycling.
- Sorting at kerbside without compaction can offer opportunities to introduce plastics collection without the need for a capital intensive MRF. However the design of kerbside sort vehicles should be selected carefully. In the long term, as the quantities of collected plastic bottles grow and potentially other plastic items are collected, kerbside sorting without compaction is likely to prove increasingly less efficient in many situations for reasons set out below.
    - RCV collections typically cover 60% more households than kerbside sort vehicles in a day
    - When sorting at kerbside, uncompacted plastic bottles can occupy 25-40% of the available vehicle capacity – and broadly this is the cost attributable to plastic bottles in the collection scheme.
    - Use large capacity vehicles when collecting plastic bottles – for kerbside sort systems 13-14m^3 capacity vehicles should be considered the minimum optimum capacity. 7.5t and 12t chassis are available at these sizes.
    - Large body kerbsider vehicles can now incorporate plastic bottle compaction that doubles the effective capacity of the plastic bottle compartment. Initial experience indicates there is a rapid payback on this addition to the vehicle.
    - Councils considering new kerbside collection vehicles may wish to consider the suitability of "stillage" vehicles with steps in light of growing health and safety concerns about these designs. New designs of smaller "side loading" kerbside system are becoming available that offer the mobility and low cost of 7.5t and 12t chassis combined with the improved operator arrangements of the large "kerbsiders".
- Some Councils may benefit from more frequent market testing of the value of their plastic bottles to buyers, particularly where bottles are being handled via a local merchant.

- Some Councils may benefit from paying for toll baling and marketing the collected plastic bottles directly, rather than paying a gate fee or receiving a “free tip” at a local merchant.
- Optimising MRF sorting arrangements and volumes could lead to a halving of the current co-mingled gate fees. This assessment if based on known data from other MRFs where over time gate fees have reduced from £35-50/tonne to, for example, under £20/tonne primarily as a result of increases in throughput and associated improvements of process economics.
- The use of multiple compaction points in very dispersed Councils in Northern Scotland is likely to be more efficient than transporting loose bottles long distances due to them being high volume low weight materials. The use of screw compactors may offer some benefits for remote sites handling more than a tonne of plastic bottles a week.
- Communication of messages “plastic bottles only” and “tops off and squash” are very important and should be reinforced by suitable visual images in publicity material.
- Collection of HDPE only can be successful but can lead to public confusion and demands for “all bottle” collections.

These points are described in more detail below with supporting evidence.

5.2 Discussion of good practice issues

The average collection rates in Scotland are strikingly high in most schemes. Where data was available the average collection level per household from kerbside schemes, excluding Glagow, was c.7.5kg/hh/annum. This is around 50% higher than the UK national average of 5.5kg. The high performance reported from Stirling was particularly impressive at 6.5kg/hh/year because the scheme only collects HDPE bottles. Collections were relatively appears low based on reported information at Glasgow. Glasgow in particular may benefit from improved local promotion of plastic bottle collection. It may also be worthwhile investigating capture efficiency at the sorting centres to ensure that collected plastic bottles are not being lost in the sorting stage.

The most striking finding is the efficiency gains from the transition to an alternate weekly collection system for residual and recyclables/green waste. Schemes such as Falkirk and South Ayrshire reported relatively small increases in overall waste management costs (5-10%) as a result of their alternative weekly, co-mingled systems using compaction vehicles and centralised sorting. These are delivering high levels of diversion from landfill at perhaps between £1.75-4/extra per household per year for the whole scheme. Allocating these additional costs to the plastic bottles element by volume suggests an additional cost per household of the plastic bottle recycling service of 17.5p-60p per year or £25-80/tonne. These schemes therefore include plastic bottles at little or no additional cost to landfilling.

These relative economics will improve as more efficient sorting operations are introduced. For example, MRF gate fees for the above schemes are nominally £25-30/tonne for the co-mingled material. Some operations in the UK are now receiving co-mingled recyclables on a commercial basis for under £15/tonne as a result of efficiency gains. Similar efficiency gains in Scotland, combined with the impact of the landfill tax escalator over the next 2 years could potentially enable schemes to offer collection of the dry recyclables, including plastic bottles, for lower cost than would be the case if the material was landfilled.

The findings are consistent with experience generally in the UK, where over 90 Councils now report that it costs them “little or no more to recycle plastic bottles than to landfill them” (e.g. Eastleigh, Milton Keynes, North West Leicestershire, Broxtowe, Exeter etc). In most of these cases this is the result of a move to alternate weekly collections, and in some cases through the use of split compartment RCVs.

In East Hampshire, the total cost of introducing AWC with residual/dry recyclables to the whole district was the same as the existing residual only contract. The equivalent price given in the tenders they received, to introduce the same fortnightly dry recyclables collection in addition to a weekly residual collection, was £350,000 per annum more on a £1.8m contract.

The cost of making the transition to the AWC system was a “one off” £140,000 expenditure, mainly on community liaison officers, to ensure the service was smoothly implemented.

As elsewhere in the UK there are some council in Scotland that have opted to collect dry recyclables co-mingled in RCVs and others that have adopted specialist “kerbside sort” compartmentalised vehicles. As mentioned, the most significant factor in improving collection economics is to use these collections in conjunction with an alternate weekly residual service. There are a number of specific observations in relation to kerbside sort systems.

There are three main systems in use – stillage vehicles (e.g. Angus and Clackmannanshire), ‘kerbsiders’ (e.g. East Dumbartonshire, Midlothian) and there is the trailer system used by Stirling Council.

It is much more challenging to optimise the efficiency of collections for “kerbside sort” systems than it is to optimise RCV collections. This is because multiple compartments inevitably limit the ability to gain maximum payloads for all materials, as compartments fill at different rates. In addition most kerbside sort systems do not have compaction systems to reduce the volume of bulky materials such as plastic bottles.

The most striking observation from the case studies is the wide range of collection efficiencies, measured in terms of households covered per vehicle per day. In the case of the RCV collections this ranges from 800-1175 households per vehicle per day (average ~1020). The large 28t RCVs operated by Falkirk can collect 7.5 tonnes of recyclables before needing to go “off round” to discharge (compared to perhaps 3 tonnes on a 7.5t kerbside vehicle). The kerbside sort systems achieve lower performance (375-800 households per vehicle per day, average ~640). In the systems studied the RCV co-mingled collections including plastic bottles typically service 60% more homes per vehicle per day.

The ability of the RCV system to handle greater quantities of material before having to discharge will be particularly important in Councils where their population density is low and large distances exist between collection and discharge points. For example a 7.5t 10m^3 vehicle that needs to discharge twice during the day may be “off round” for two hours as a result, when travel time to start and finish the round are also considered, the vehicle may spend over 40% of its time “off round” and not collecting. By comparison an RCV on a similar route will gain up to 50% more time actually servicing households per day.

Although the purchase price and fuel costs of, in particular, the smaller stillage vehicles are significantly lower than an RCV, the crew requirements and overheads are very similar. As a result the real extra cost of an RCV collection may be 30-40% more to achieve 60% greater collection efficiency, and the RCV service offers greater flexibility (e.g. for green waste and residual).

Increased success in capturing plastic bottles can put kerbside sort collections under increased pressure. In an uncompacted from, an “all bottle” collection can typically lead to plastics occupying between 25-40% of the space on a collection vehicle, depending on performance.

The use of the large ‘kerbside’ vehicles, for example by East Dunbartonshire and Midlothian, allows the possibility of the use of on vehicle compaction. Terberg have a compaction system that effectively doubles the capacity of plastic bottles that their kerbside vehicle can hold. The extra capital cost of the unit (around £12,000) is more than offset by the savings in collection costs. There are now several other Councils in the UK using this system (e.g. York, South Ribble, Kettering). Recoup's research of these schemes has indicated that the operators are positive about the value of the compaction unit and have gained additional time on route as a result. Midlothian is already using vehicles with the MVR technology and East Dunbartonshire have implemented trials of the unit with advice from Recoup.

Because adding plastic bottles to kerbside collections increases the requirements for on-vehicle capacity significantly it is important to provide as much space as possible on the collection vehicle. As a result the use of standard 10m^3 7.5t stillage vehicles/trailers is not

recommended. Larger capacity 7.5t and 12t vehicles with 13-14m^3 storage are available and operating costs are not significantly different to the traditional smaller stillage systems. In broad terms, the extra 3-4 m^3 offered by these vehicles is the capacity required to introduce plastic bottles onto a comparable round with little or no additional operating costs.

The ability to use larger vehicles will be dependent on access issues and in some cases maximum vehicle weights. This needs to be considered as part of detailed scheme planning.

The benefit of “kerbside sort” is that the material is pre-sorted and typically has a positive value at the central bulking/baling point compared to unsorted material from an RCV. The differential between these values and the gate fee of a co-mingled MRF are key considerations in selecting a kerbside system. In our experience this differential may typically range from £35-80/tonne delivered (all dry recyclables).

The value of kerbside sorted plastic bottles is particularly evident for the schemes collecting only HDPE bottles. On site handling costs once the bottles are discharged are unlikely to exceed £30/tonne and sales values in excess of £150/tonne are currently achievable: effectively these plastic bottle materials have a value of around £120/tonne, delivered to the local baling point.

Most of the handling facilities in Scotland are fairly rudimentary - based on manual picking of material - and this is arguably an area for development. Operators such as Eden, Lomac and Stirling Fibres, are already handling large quantities of material including plastic bottles and as these grow there will be opportunities to improve efficiency through additional capital. Glasgow City Council is now able to handle more material, with greater efficiency following development of sorting operations at the recently upgraded MRF.

Most other operators are using simple picking lines and smaller balers. Typically the capital equipment costs to bale plastic bottles at smaller sites will be £30,000-50,000. Communication is always a key element of a successful scheme. The performance of schemes and the feedback from operators highlighted some key issues.

The importance of a good quality public helpline is emphasised. This is particularly important at the scheme roll out, especially where alternate weekly collections and/or HDPE only collections are introduced. Falkirk received 6,400 calls from the public in the first month of the alternate weekly collection roll out, South Ayrshire received 2,500. Once the scheme was in place the calls reduced to “about 50 per month”. This experience is mirrored in other authorities. There needs to be enough staff to handle this kind of volume of enquiries appropriately as a new scheme is rolled out.

East Dunbartonshire reported that almost all calls received to their helpline were resulting from confusion/queries over the plastic element of the scheme. The scheme was promoting “number 2” plastics.

Feedback and our own observations highlight the following as important in the communication of plastic bottle collections:

It is key to refer to "Plastic *bottle* recycling" (rather than "plastics recycling") at all times to avoid encouraging contamination. (e.g. the EDC scheme refers to ‘plastics collection’ on its website and ‘number 2 plastics’ on its helpline which may cause confusion/contamination)

Where appropriate emphasise *all* plastic bottles. e.g.

“Now you can put all your household plastic bottles into your green box for recycling. All household plastic bottles, including those for milk, juices, soft drinks, water, cleaners and detergents can be included. In fact, the only bottles we don’t want are those that have had motor oil or pesticides in them.”

Our analysis of material collected (e.g. at Falkirk) suggests that non-beverage plastic bottles (e.g. for cleaning products) are not captured as successfully as milk and soft drinks bottles. Use of images showing detergents, fabric softener bottles etc should be used along with milk and soft drinks.

Note that is it only a scheme for plastic *bottles*:

e.g. “Please only plastic bottles: no plastic pots, tubs, bags or other plastic items; these items will not be collected.”

Emphasise the importance of the householder squashing the bottles and clarify what to do with tops:

e.g. “Please squash the plastic bottles before putting them into your recycling box (you'll need to loosen or remove the tops to do this). That will help you get more into your box, and help to save fuel collecting them. You can replace the caps once you have squashed the bottles.”

Avoid encouraging calls for extra boxes or bins:

e.g. “If you squash your bottles and cans there should be plenty of space in the box.”

Use visuals that reinforce these messages. One of the comments on the SWAG visuals is that whilst they are excellent professional images, they do not show ‘what is wanted from the public’ sufficiently. For example, images of well-packed kerbside boxes, squashed plastic bottles, ranges of plastic bottles types (i.e. not primarily milk bottles). During the project several Councils were supplied with some alternative images (Figure 5).

Figure 5: Examples of alternatives images showing what is required from the public

6. Looking to the Future

This section considers the future growth of plastic bottle recycling, based on information provided by the Scottish Councils, the overall potential of plastic bottle recycling and markets for plastic bottles.

6.1 Planned developments

The potential growth of Scottish plastic bottle recycling infrastructure can be assessed through feedback from recycling managers. The reported planned developments can be used to analyse growth within both bring and kerbside systems (Figures 6 & 7).

There are currently 768,518 households receiving a kerbside collection of recyclables in the UK. This represents 34% of Scottish households. The provision of plastic bottle recycling within kerbside collections is set to exceed 850,000 households during 2006/07. This will represent just fewer than 40% of Scottish households.

Figure 6: Scottish kerbside scheme coverage over time including planned growth

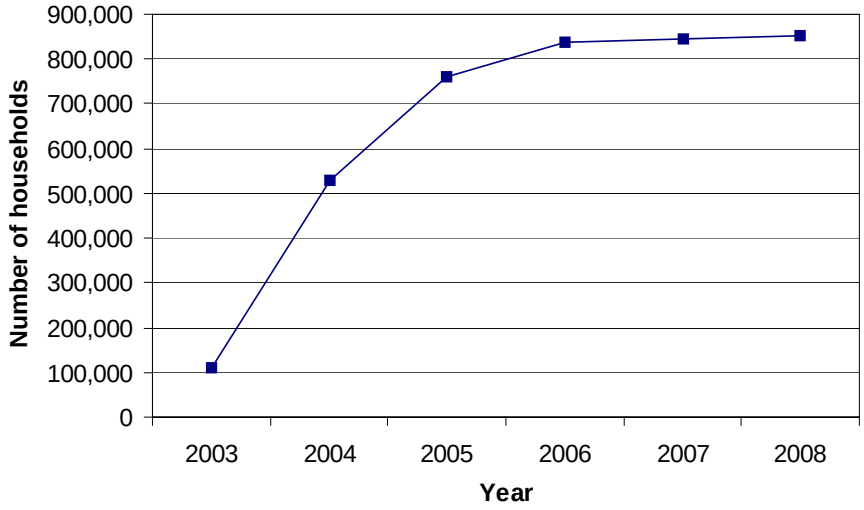
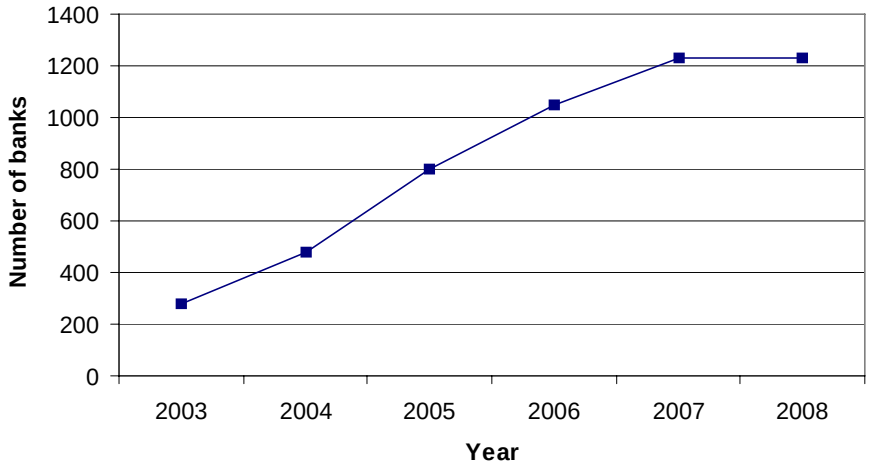


Figure 7: Scottish bring scheme coverage over time including planned growth

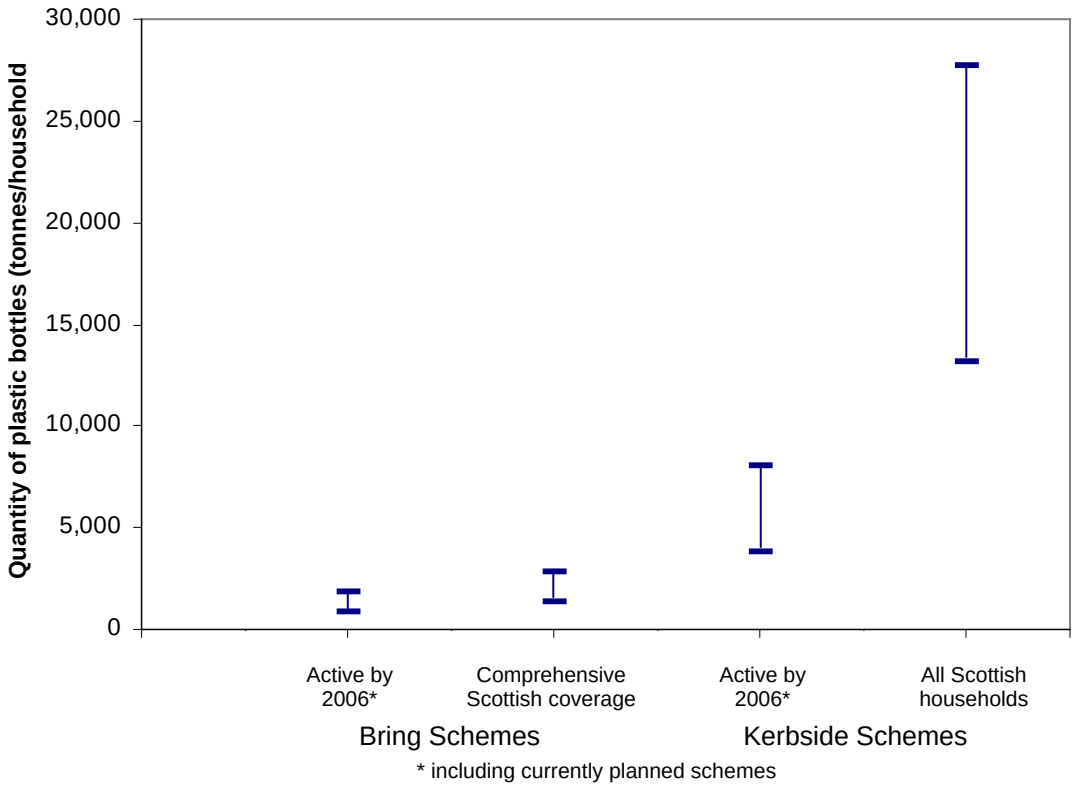


The plans suggest a continued rise in bring facilities over the next year as new sites and schemes are developed, with approximately 1000 sites expected to be operational by the end of 2007.

6.2 The potential of plastic bottle recycling

It has already been identified that there are wide variations in performance of current collection schemes, and that there is the potential to significantly improve performance of the existing infrastructure. Figure 8 highlights the potential collection levels that could be realistically achieved by the adoption of bring and kerbside schemes across Scotland based on current levels of performance. This highlights the importance of a comprehensive infrastructure for plastic bottle recycling and reinforces the advantage of extensive, well promoted kerbside collections in improving recycling and maximising recycling opportunities.

Figure 8: Potential scenarios for Scottish plastic bottle recycling



From Figure 8 it can be assumed that approximately 4,750 tonnes of plastic bottles will be collected through the current planned activities by the end of 2006. The majority of this material will be recovered through the kerbside systems. If Kerbside schemes achieved good performance levels with bring activity recovering 1.29kg per household per annum[7], and kerbside collecting 12.64kg per household per annum[7], a total recovery of 9,945 tonnes of bottles may be achievable from the infrastructure that will be available by the end of 2006. Achieving this performance level will also be dependent on greater communications and improved convenience for the householder. At this level of performance, planned activity could generate up to 17% recycling of plastic bottles in the Scottish household waste stream by the end of 2006.

[7] *The average of the top performing quarter of respondents*

6.3 The current market for plastic bottles in Scotland

A list of companies that have expressed an interest in purchasing post consumer plastic bottles can be downloaded from http://www.remade.org.uk/Plastics/Reprocessors.htm. Contact information for UK recyclers of post-use plastics is available on a free 'reprocessor locator' on http://www.recoup.org.

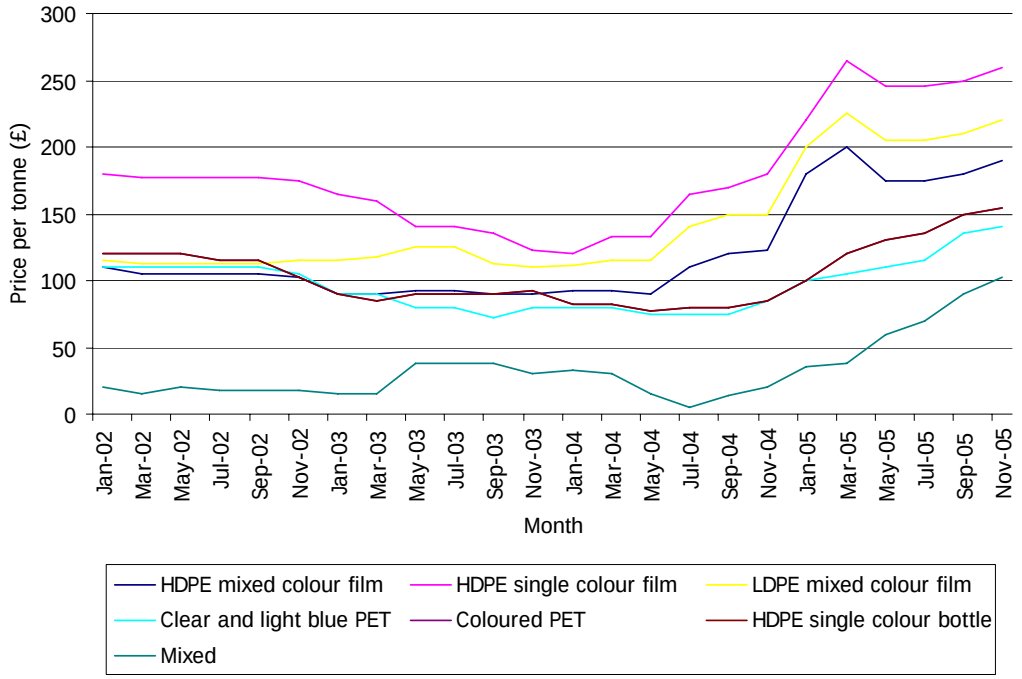
Collected bottles can either be sold once sorted by polymer type (which commands the highest value) or can simply be marketed as a mix of all types of bottle – 'mixed bottles'. The key factors for maximising income are: quantity of non-bottle contamination, tonnage commitment and tonnage shipped per load (a function of bale density and loading arrangements).

The price range indicators covering the October - December 2004 period for mixed plastic bottles, HDPE natural, HDPE all colours, PET clear, and PET coloured are given below.

Pricing information for the period is derived from a variety of sources including 7 buyers of plastic bottles and additional published indexes from a variety of sources. This information is published in good faith and is for guidance only.

The following graph, figure 9 summarises average prices reported through public price guides provided by Letsrecycle.com during the four year period Jan 2002 – December 2005.

Figure 9 – Price trends for collected plastics



The prices are based on material meeting established quality and form specifications. Based on Recoup's own experience of the market there are some anomalies in the data (e.g. mixed prices did not dip in July 2004) but the broad trend of a relatively steady market, with prices increasing from late 2003 and stabilising in 2005 as a result of increasing demand for raw materials, is representative.

Trades at the top end of the price ranges given in published indices such as letsrecycle.com and MRW reflect good quality baled material in 20-24 tonne shipments. Most traded volumes would be for the categories of mixed plastic bottles, clear/light blue PET and mixed coloured

HDPE. Limiting trading occurs for coloured PET and PVC, due to the low volumes and value. Some MRFs are also selling waste plastic film grades, and the value of these are also shown.

Ex-works pricing

Ex-works pricing for sellers in Scotland will vary considerably depending on location, shipment weight and quality of material. As a guide, shipments from the central belt of Scotland to UK plastic bottle recyclers may typically vary from £25-£70/tonne depending on the bale density and tonnage shipped, with lowest costs relating to loads exceeding 20 tonnes. Some further efficiency may be achieved by back-hauling arrangements. Shipments from more northern areas of Scotland will experience higher shipping costs, and so good bale density is essential to maximise revenues.

Sales for Asian export markets may need to be rebaled if densities are low – e.g. loads under 18 tonnes – and this will incur additional costs that will be deducted when buyers provide ex-works pricing. Lower pricing in the ranges quoted above may reflect a deduction for rebaling by a third party.

Price Indicator Summary

On the basis of review of available information, the guide prices below (table 3) reflect anticipated ex-works prices from central-belt locations for material meeting established quality and form specifications available in 20 tonne baled loads, loaded on a trailer or into a shipping container.

Table 3 - Price Indicator Summary

	July – September 2004	October – December 2004	January – June 2005	July – December 2005
clear and light blue PET	70 - 95	80-105	100-125	125-150
Coloured PET	25 - 40	35-55	50-70	65-85
HDPE single colour	70 – 90	80-105	120-145	145-170
HDPE mixed colour	65 - 80	75 - 95	110-130	130 –155
PVC	0 – 10	5-15	15-30	15-30
Mixed	10 - 30	30 - 50	55-75	75 – 95

Markets for PET, HDPE and mixed plastic bottles remain under-supplied. Demand remains high in the UK, the EU and the Far East for collected bottles baled to specifications. Strong consumption of recycled plastics in Asia combined with low labour and freight costs provides a structurally competitive market for recyclable bottles from Europe.

Historically high virgin plastic prices are being sustained and PRN prices increased at the end of 2004 and were relatively sustained moving in 2005, with only slight weakening in 2006. The 'PRN/PERN related' component of pricing represents, at Q1 2006, around £20 of the price paid for baled recyclable plastic packaging. The market for PRNs is currently considered relatively well balanced and so values are not anticipated to vary largely.

In the UK the main plastic bottle recyclers are JFC Delleve and Linpac Plastics Recycling, with Centriforce Products also purchasing HDPE, and shortly will be buying mixed baled plastic bottles. Baylis Recycling has entered the plastics recycling market and has opened an HDPE plastic bottle recycling plant near Slough. Evolution Polymers near Cardiff also recently report interest in sourcing bottles for their new plastics processing plant. In London, work continues to develop a mixed plastic bottle reprocessing facility in conjunction with Visy Recycling. A further new reprocessing operation is also under development in the North West of England to handle mixed plastic bottles.

There are a number of other companies buying plastic bottles on behalf of EU and Asian recyclers. SEPA and the Environment Agency can supply a list of exporters accredited under the packaging regulations.

Recent analysis of the capacity for reprocessing plastics in the UK shows that reprocessors report capacity exceed available supplies There is also evidence of further investment in new capacity for plastics. For example, in March 2006, BPI announced moves to double the capacity at their Dumfries operation to handle agricultural plastics film. This investment will take the capacity of the plant to 30,000 tonnes per annum.

Plastics to diesel

The Sustained high oil prices combined with innovative processing techniques mean that "green fuel technology" is becoming a more viable option for recovering post-use plastics. Several technologies are available to convert plastics into diesel fuel and into petrochemical feedstocks. There are reports of new plants being established internationally in Poland, Ireland and Scotland, and suppliers of "plastics to diesel" processes are bullish about future prospects.

Historically, the economics of production of petrochemical feedstocks from used plastics have required very large throughputs - hundreds of thousands of tonnes - to have the opportunity of commercial success. This has been a limiting factor – as guaranteeing such large supplies to underwrite investment has proved a barrier. More recently businesses have begun offering smaller scale, modular systems to convert waste plastics into diesel fuel.

One example of this modular approach is Ozmotech's "ThermoFuel" process. Australian based Ozmotech Pty Ltd is working in partnership with renewable energy company CynarPlc on a venture that they believe will result in up to 15 new operational "plastics to diesel" plants over the next four years.

The ThermoFuel technology is a ten-year-old technology with 11 plants operating in Japan. The system involves Pyrolysing waste plastic in the absence of oxygen to produce low sulphur, diesel fuel that meets international standards for pump forecourt diesel (EN590). The plants have a capital cost of around €5m and modules can handle c.7,000t of plastics per annum. At this kind of capacity it is much simpler to gain the supply commitments required to justify investments. It is also simpler to negotiate planning approvals to establish the sites for this technology.

The economics of these processes are not well reported but, for example, Cynar expect that the input pricing for the plastics will be lower than the landfill cost – offering the prospect of diesel production for less than the cost of disposal for pre-separated plastics streams. PET & PVC are not desired in process but system can cope with up to 5% PVC.

Commentators suggest that oil prices would need to be sustained at over $40/barrel for these kinds of processes to be economically attractive. Oil price projections suggest that pricing through to 2030 ranging from the high $40s to high $50s a barrel[8], implying that the technology should become commercially successful.

Developments of diesel fuel production technology in Scotland are anticipated in 2006. This will be the first implementation of such a commercial-scale plant in the UK and it will be important to review the success of this process as it could, along mechanical recycling, provide a valuable tool for improved plastics waste management.

[8] *Annual Energy Outlook 2006. Report #:DOE/EIA-0383(2006), http://www.eia.doe.gov/oiaf/aeo/index.html*

6.4 The opportunities for new markets in Scotland

Currently BPI is the largest recycler of plastics in Scotland. Its operations are based on input of polythene films are not geared to handle plastic bottles, although they could handle HDPE bottles to some extent within their profile manufacturing. The Caledonian Tree Company has undertaken relatively small-scale work in recycling tree protectors from HDPE bottles. Solway Recycling have worked to develop agricultural plastics collections and collections of plastic bottles from bring sites, and provide a dry granulation of HDPE bottles that are then shipped to a UK recycler for production of extruded profile products. PET Processors UK are 'recycling' business that provide contract upgrading of, predominantly, PET resin and industrial scrap (not post consumer) by solid state processing (SSP). Other material handled by PET Processors include PEN, PTT, PTB and PENT. There are other businesses (e.g. Snowie, Hannay) acting as baling/dry granulating centres for industrial scrap plastics. Some businesses have historically been accredited by SEPA as plastic packaging recyclers based on remanufacture with pre-consumer plastics scrap and these business typically handle limited volumes.

Evidence of collections exceeding at least 10kt per annum will be important to attract investment in plastic bottle reprocessing capacity. Ideally at least 20kt should be available – or be demonstrably coming on stream – to feed a commercial scale plant.

The current levels of collection are unlikely to attract serious investment in reprocessing capacity within the next 2-3 years. By comparison the London area has been attracting new reprocessing capacity (e.g. Baylis Recycling) and further interest in large-scale plastics recycling plants as a result of the strong growth in the availability of plastic bottles in the South East of England.

Recoup therefore believe that an emphasis on generating collection and highlighting to potential investors the supply forecast (particularly as it nears 10kt per annum) and investment incentives will prove most effective in generating local reprocessing capacity.

The collection volumes can also be augmented by "away from home" collections as an increasing volume of plastic bottles (especially PET) will be available in offices, schools, leisure facilities, litter etc.

There may be merit in considering the opportunity for investigating a more diverse business model for post-consumer plastics recycling in Scotland. For example, Linpac Plastics Recycling in Yorkshire handles a range of different plastics (vending cups, coat hangers, tubs, trays) as well as bottles. The company has a washing plant and its business model is based on producing recycled compounds precisely engineered for customers needs. Whereas some businesses have a heavy emphasis on a small number of markets (e.g. JFC Delleve in the UK use HDPE almost entirely for pipe manufacture and PET is sold into fibre applications), the Linpac model is more diversified and so investment may be attractive if a combination of bottles and other relevant plastic materials could collectively exceed, say, a supply of 10kt per annum. We believe that Evolution Polymers, setting up a new plant new Cardiff, Wales have broadly this kind of business model. This kind of business requires a particularly high level of both technical skill and market understanding.

With a longer-term perspective, we note the recent efforts of BP/Innovene/Ineos and partners in developing a new feedstock recycling process. This long-term programme is being taken forward under the new business ownership of Ineos. This is an exciting and positive project, however, in our view it would be unwise for Councils to operate on the expectation that the technology for large scale mixed plastics recycling will become available at Grangemouth in the next few years.

7 Conclusions and Recommendations

There is still significant scope to expand plastics recycling in Scotland. Collections are increasing as shown by the larger amounts of material collected by authorities, but much more is required to attract more local reprocessing facilities in the Scottish economy.

Key conclusions and recommendations to make progress are summarised below:

- There has been notable growth in the provision of, in particular, kerbside collection of plastics. Coverage is expected to reach around 40% of all households in Scotland within 2 years.
- The single most significant driver shown to enable the affordable, efficient collection of plastic bottles (and other bulky packaging) is the move to alternate weekly residual collections. It is recommended that this should be encouraged where possible and appropriate financial support is available to support this transformation.
- The lack of significant collections – relative to the local populations - in Edinburgh and Glasgow are major limiting factors to overall volumes of bottles being collected. It is recommended that there is continuing encouragement for Edinburgh to significantly expand its collections to include plastic bottles, and for increasing participation and capture of bottles in Glasgow.
- Recyclable plastics arise not only in the household wastestream but also in commercial collections serviced by Councils and private contractors. There is significant potential to expand, for example, plastic bottle collections from these sources.
- It should be recognised that although the most readily recyclable, bottles are only one aspect of the plastics waste stream. Current collections of plastic bottles for recycling represent only 1% of all plastics in Scottish MSW. By 2012 years it is calculated that plastics wastestream in Scotland will be c.400-470kt per annum and the associated disposal cost alone of plastics in MSW will rise to £20-23.5m per annum. Much of this material can be recycled or recovered. This highlights the importance of finding better solutions to managing this resource.
- There are strong markets for plastic bottles, and market demand for other plastic packaging. There are also emerging technologies to convert plastics to diesel fuel. The introduction of this technology into Scotland should be monitored closely to verify economics.

The study has identified several areas where economics of current and potential plastics recycling schemes could be enhanced, and highlights some issues of good operational practice.

- The choice of “kerbside sort” or “sort at MRF” will depend on a wide range of factors. When considering “kerbside sort” systems it is important to ensure that the selected vehicle has maximum possible handling capacity, given access restrictions. For example, once plastic bottles are added to schemes, 10m^3 capacity vehicles will probably not offer the most efficient collection arrangement. It is recommended that larger 13-14m^3 units should be evaluated, and Councils should even consider selling existing smaller vehicles and purchasing larger units as this might prove more cost-effective than persevering with an existing under-size fleet.
- It is recommended that the council ‘clients’ periodically review the operational efficiency of kerbside collection rounds and that round sizes are set at a level which is reasonably challenging and achievable – especially once the scheme is established. This could include checking that compartment/stillage sizes are appropriately allocated to the volumes of different materials being set out – with modifications being made as appropriate. In addition, there is a relatively large variation in the number of households covered, especially by “kerbside sort” vehicles, and there appears to be

prima facia scope for improving round efficiency (i.e. increasing the households covered per collection vehicle per day) for some schemes.

- It is recommended that more emphasis be placed on market testing when both selling materials and also negotiating gate fees. Generally gate fees appear fair, although some prices for contract handling of plastic bottles (especially pre-sorted materials) appear excessive. Where baling facilities exist and throughputs are increased they are shown to improve economic efficiency.
- Capture rates of available plastic material within current schemes can be improved. It is recommended that communication work to promote plastic bottle recycling by SWAG and individual Councils take account of all the experiences highlighted in this report. Words and images should clearly emphasise the appropriate range of bottles and the best ways for the householder to present them for collection.

- The facility for Councils and contractor to gain specialist advice when considering implementing a collection programme or evaluating the effectiveness of an existing scheme is valuable. For example discussions with Councils during this project have identified success and highlighted scope for improvements both in sales revenues and in reducing operating costs. We believe that it will be beneficial to retain this advisory facility both to assist Councils currently collecting plastics, and to advise those planning new collection programmes.

- It is recommended that Remade continues to promote the growth in collection levels and the investment incentives available to potential investors in reprocessing facilities.

Appendix A

A.1 Collection Infrastructure

A.1.1 Bring collection schemes

Of the 32 Scottish Councils 21 operate bring sites for the collection of recyclables that include facilities for plastic bottles. There are 825 banks provided for plastic bottles. This represents a 72% increase in the number of sites available in2004.

There are a range of different container types used in plastic bottle bring schemes. Table A.1 shows the proportion of each bank type in use in Scotland. The 1100 litre wheeled bins are particularly popular; they are compact enough to place on smaller bring sites, however, if these sites become popular, frequent servicing requirements can make these schemes expensive to operate.

Skips and other large containers are frequently used at larger bring sites. They can accommodate greater volumes of material and generally require servicing less frequently than smaller banks.

Table A.1 : Containers used for plastic bottle bring schemes

Wheeled bins	1100L	278
	360L	0
	240L	0
Banks	10 cubic yard	1
	8 cubic yard	16
Cages	Triple	0
	Single	0
	Skip	35
	Other	469
Not specified		26

Bring schemes are calculated to have produced some 1,142 tonnes of recyclable plastic bottles in 2005. This is a 138% % increase since 2004, when 479 tonnes of plastic bottles was reported as collected for recycling.

The average annual recovery per site has increased from 1.48 tonnes of plastic bottles in 2004 (2.05 tonnes if annualised from data provided at end of 2004/start 2005) to 2.2 tonnes in 2005

A.1.2 Kerbside collection schemes

There are now 19 kerbside schemes including plastic bottles in Scotland, representing 768,518households. The coverage of households has seen a massive increase since the end of 2004, from 24% of households to 35% now having the opportunity to include plastic bottles in their local kerbside collection programme. (Stirling Council collect HDPE bottles only).

Participation in these schemes is essentially voluntary, so not all households within a scheme will participate. The reported participation for schemes is between 15 - 100% (an average of 61%), indicating the potential to achieve much greater levels of collection from current kerbside infrastructure.

Understanding the mechanisms that influence kerbside systems is fundamental if effective practice is to be identified. This is especially crucial for plastic bottle recycling, with a number of variables influencing a scheme's economic efficiency and recovery performance. Each

local authority will have unique features within their kerbside scheme; yet common elements such as container type, frequency of collection and relation to residual refuse collection can be compared and analysed.

A.1.3 Container type

As can be seen (Figure A1), wheeled bins are the most popular container type used for the collection of dry recyclables. This may reflect the fact that a majority of the kerbside schemes that collect plastic bottles in Scotland have been introduced relatively recently - post 2000. Historically in the UK as a whole, the box has been the preferred container for kerbside collections; however, the number of households being provided with wheeled bins for their dry recyclables is on the increase.

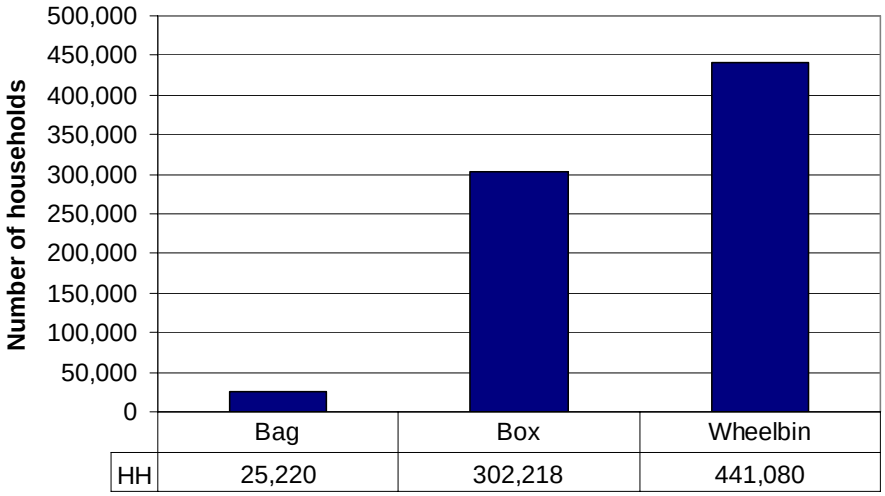
It is the additional capacity of the wheelbin, together with servicing benefits where on-vehicle sorting is not required, that has encouraged recycling managers to adopt it - boxes typically have a 55 litre capacity and wheeled bins generally have either a 120 or 240 litre capacity. The additional capacity provided by the wheelbin is of particular importance when high volume items, such as plastic bottles, are included in a dry recyclables collection. This highlights the success of using expertise when planning and leading by example.

It is common practice to use different coloured containers to distinguish which materials the householder should place in each receptacle.

The third major container option in use is the bag. These can either be supplied to the householder, or the householder can be encouraged to use carrier bags. As with boxes and wheeled bins, different coloured bags can be provided for different materials. Clear or tinted bags are frequently used as this assists with quality control at the kerbside, enabling collection crews to identify heavily contaminated bags. Perforated bags are sometimes used, as they can be opened more quickly and efficiently by handling operatives. Kerbside collection bags can be separately baled and sold for recycling following use.

There is some evidence, based on a larger UK dataset, that use of wheelbin collections generate higher average collection levels of plastics (8.8k3031 g/hh/annum) than boxes and possibly bags (c.5.7kg/hh/year). This difference is statistically significant to a 95% confidence interval. Anecdotally, the increased volume available in a wheelbin should make it easier to capture higher volume items like plastic bottles for recycling. It is also likely that in part this difference is due to the interaction of a combination of factors – for example, use of wheeled bins is more prevalent in alternate weekly collections.

Figure A.1: Containers used for kerbside schemes including plastic bottles



A.1.4 Frequency of collection

The frequency with which the container is collected is a major factor in recycling schemes. This also has a controlling influence on the type of container used, as capacity becomes an issue. Weekly or fortnightly collections are most common, although some collections are every four weeks, or on a set day each month. An increasing number of local authorities are also moving to alternate weekly collections, where residual is collected in week 1 and dry recyclables are collected in week 2.

A fortnightly collection service of recyclables is particularly popular (Table A.2), as it reduces servicing costs per household compared to weekly collections. Monthly collections are least popular and data for the UK has shown them to have the lowest performance. However, when undertaken as part of an alternate weekly system, such as that operated by Falkirk, they can be highly effective.

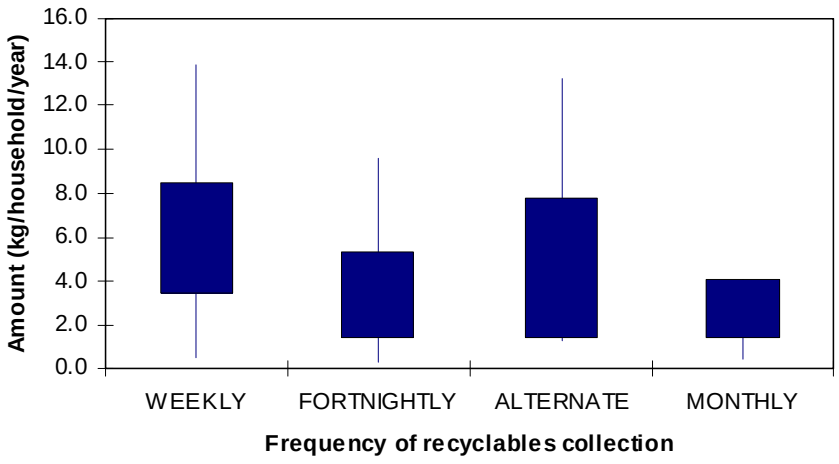
Table A.2: Frequency of kerbside collection

	Number of households				Number of schemes
	Box	Wheelbin	Bag	Total	Total
Weekly	123,500	0	0	123,500	4
Fortnightly	173,000	0	7,720	180,720	6
Alternate	0	262,738	17500	280,238	5
Monthly	0	178,342	0	178,342	3
Other	5718	0	0	5,718	1
TOTAL	302,218	441,080	25,220	768,518	19

The container capacity has an obvious relationship with collection frequency. Table A.2 shows that a greater proportion of box schemes operate a weekly or fortnightly collection, while wheeled bins tend to have a collection frequency of fortnightly or less, due to large capacity.

If the performance in terms of the weight of plastics per household (kg) of each scheme frequency is plotted (Figure A.2) weekly and alternate weekly schemes are seen to collect the greatest volumes. The limited number of data points from schemes in Scotland makes it difficult to draw statistically valid conclusions. However, when using a larger data set for the whole UK, alternate weekly collections in fact exhibit a statistically significant higher recovery of plastic bottles than other collection frequencies[9].

Figure A.2: Relationship of collection frequency to kilograms/household/annum

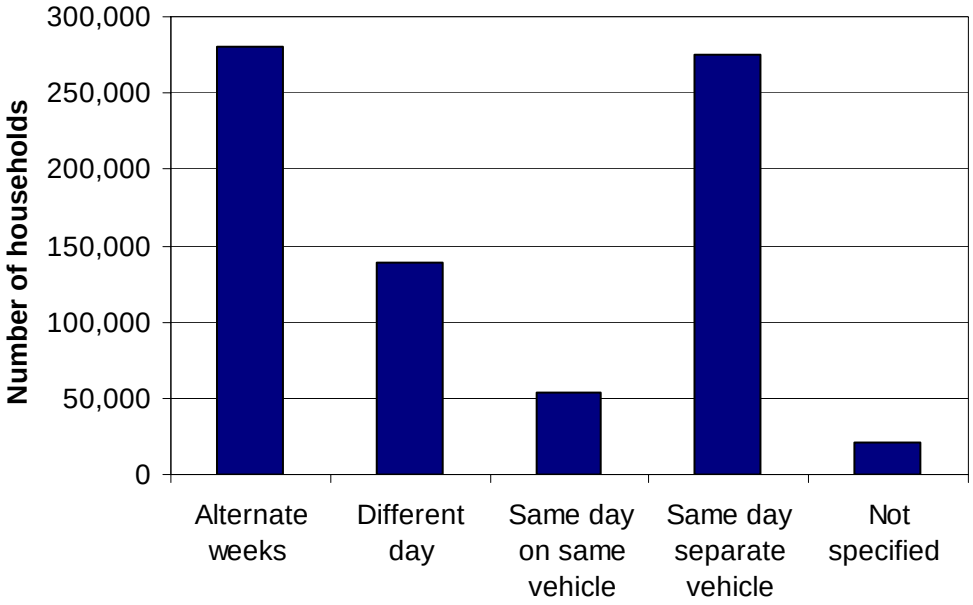


[9] *alternate weekly collections deliver a statistically higher prerformance (8.9kg/hh/year compared to c.6.5kg/hh/year for weekly collections) at a 90% confidence interval.*

A.1.5 Relationship to residual collection

The majority of Scottish Councils operate recyclables collections either on alternate weeks to residual refuse (FigureA.3), or on the same day as residual refuse. The reasoning behind this is that it is easier for householders to remember one collection day for everything, than to remember a separate collection day for dry recyclables in addition to the collection day for residual refuse. There appears to be little obvious difference in terms of performance however.

Figure A.3: Dry recyclables kerbside scheme relationship to residual refuse collection



A.2 Perceptions of plastic bottle recycling

Local authority perceptions of plastic bottle recycling are helpful to establish potential operational challenges, benefits and barriers to implementation. This information is useful for local authorities considering the introduction of a plastic bottle collection and to organisations wishing to encourage plastic bottle recycling, helping to identify key messages and where action may be required.

A.2.1 Operational challenges of plastic bottle recycling

Scottish Councils already operating plastic bottle recycling schemes (25 in total) were asked the question 'What are the biggest operational challenges you face in running your plastic bottle collection programme?' Responses from 23 authorities were grouped into categories represented in TableA.3. There were four main responses to this question:

Table A.3: Operational challenges of plastic bottle recycling to Scottish authorities

Challenge	Percentage of Councils	Number of authorities
Contamination by other plastic items	16%	4
Cost	16%	4
Logistics/volume to weight ratio	44%	10
Markets	16%	4
None	4%	1
Other	4%	1

Plastic bottles are a low weight, high volume item and therefore rapidly fill collection vehicles, often leading to more frequent trips to the drop-off point during collection rounds. This is particularly true for kerbside sort vehicles where plastic bottles are confined to one compartment, which may have a tendency to fill before compartments in which other recyclables are placed, leading to inefficiencies in collection rounds.

The issue of distance to market is also related to the fact that plastic bottles are a low weight, high volume item and, therefore, costly to transport.

What many local authorities fail to realise is that they are already paying to transport and dispose of plastic bottles as residual refuse and by doing so realise no material value whatsoever from them. 'Linked thinking' needs to be encouraged to enable local authorities to balance the expense of recycling with the potential cost savings in residual waste management.

The design of the scheme will also impact on the cost of collection. For example, alternate weekly collections, where dry recyclables are collected on week 1 and residual refuse is collected on week 2 maximise the use of existing resources, thereby minimising cost.

Markets for plastic bottles in either mixed baled form or sorted by polymer type are becoming increasingly more competitive as a result of strong international demand for HDPE and PET material[10]. Contamination of plastic bottle streams by other plastic items can be a serious challenge for local authorities to overcome. At present there are no markets for recycling mixed plastics (i.e. a mix of bottles and other plastic packaging) in the UK, although there are some UK Councils selling mixed packaging bales for export markets at lower prices. Maintaining and increasing plastic bottle volumes is hindered by members of the public who frequently fail to understand that not all plastic is the same. When presented with the opportunity to recycle their plastic bottles they find it difficult to understand why they can't recycle all of their plastics, dense and mixed[11].

In fact, there are numerous plastic polymer types, all with different properties. In order to recycle plastic items into high value products it is necessary to separate the items into distinct polymer types and to recycle these separately. It is relatively simple to do this with plastic bottles as they are made from a limited number of polymer types, which are easy to distinguish and separate. Other plastic items can be made from a wider variety of polymers but it is less easy to distinguish and separate these.

Until a sustainable market is available for mixed plastics collected in Scotland, well structured, targeted educational and promotional campaigns are the most effective method of meeting this challenge. These issues are discussed later in this report.

A.2.2 Value of plastic bottle recycling

- Scottish Councils already operating plastic bottle recycling schemes were asked 'Overall, how would you rate the value of your current plastic bottle collection scheme?'

11 responses were given. The results were encouraging, with five of the local authorities indicating that, while expensive, plastics recycling is a worthwhile ongoing element of the service provided (Figure A.4). A further two local authorities stated that it actually costs them little or no extra to collect plastic bottles for recycling compared to collecting them for landfill.

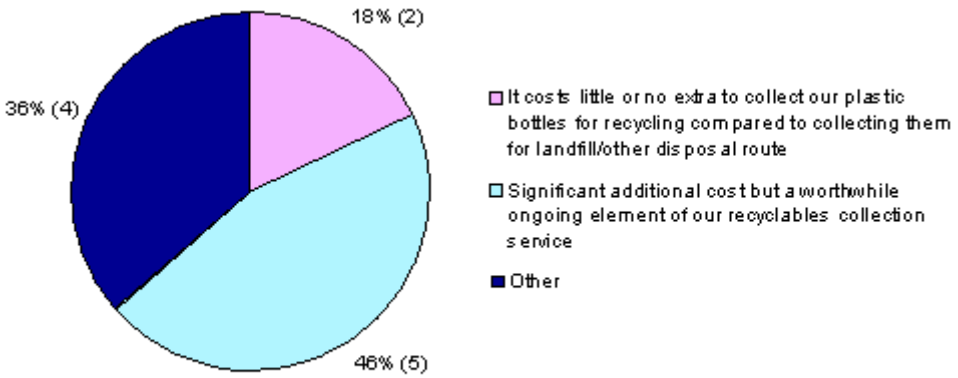
[10] The term “mixed plastic bottles” refers to streams of plastic bottles only, primarily comprising PET and HDPE bottles. The term “mixed plastics“ refers to a wider range of polymer types and formats (e.g. commingled films, bags, tubs, bottles, trays and potentially non-packaging plastic items). Polymer in mixed plastics streams include PET, HDPE, PS, PP, PVC, LDPE and LLDPE.

[11] The development of markets for mixed plastics, both for recycling and recovery into products such as diesel is discussed in the markets section of this report.

Other responses were as follows:

- Happy for other groups to undertake the service
- Volume to weight ratio, collection & reprocessing make it an expensive operation but avoids landfill
- Limited value
- Current plastic uplift system is too small to give adequate response

Figure A.4: Value of plastic bottle recycling



(Number of local authorities in brackets)

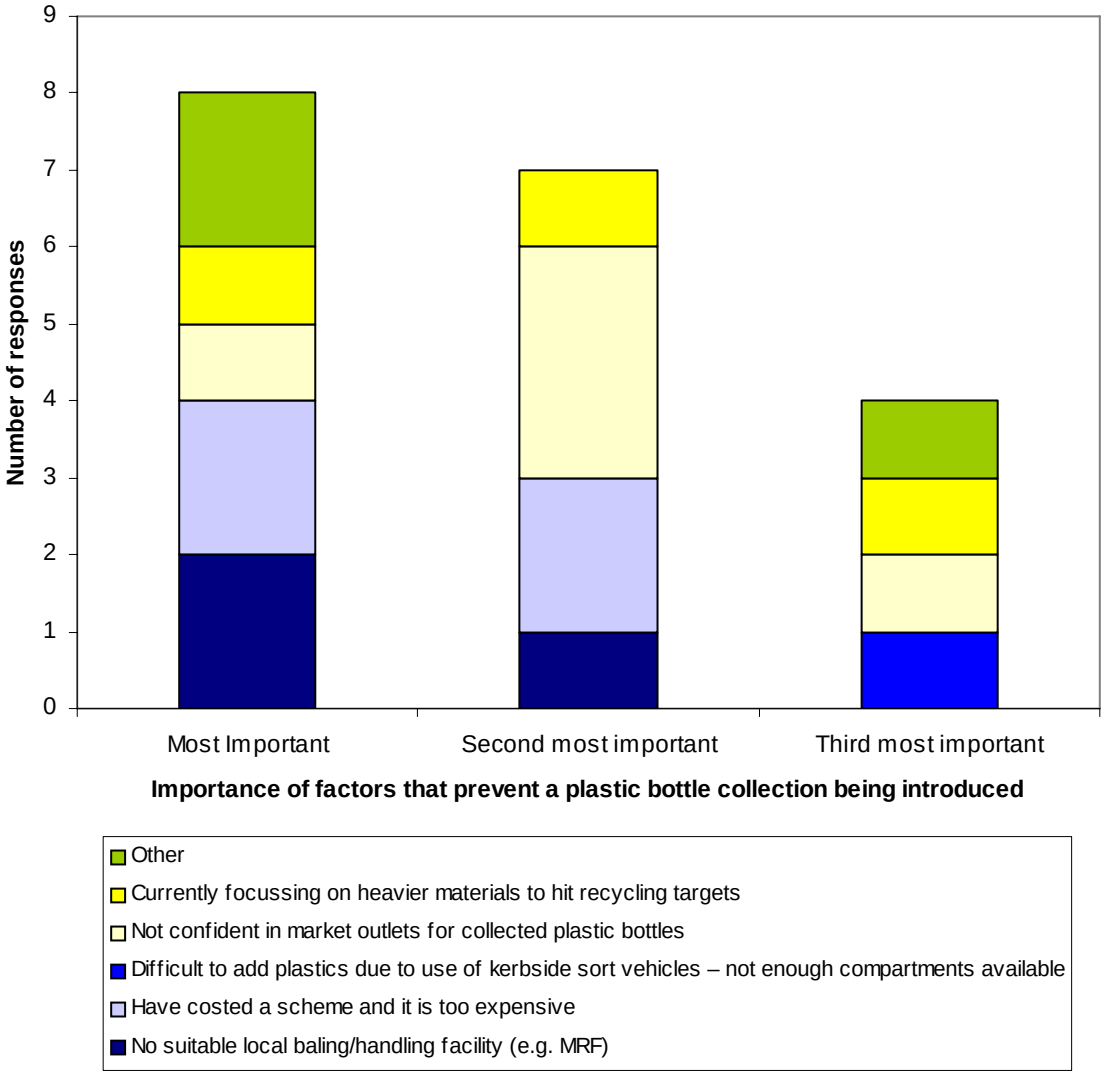
A.2.3 Factors that prevent a plastic bottle collection scheme being established

Recycling Managers not currently operating a plastic bottle recycling scheme were asked to rank the three most important reasons for this from the following:

- Existing waste/recyclables collection contract is inflexible, making it difficult to add plastic bottles
- Insufficient information available on plastic recycling
- No suitable local baling/handling facility (e.g. MRF)
- Not convinced of environmental benefit
- Have costed scheme and it is too expensive
- Difficult to add plastics due to use of kerbside sort vehicles - not enough compartments available
- Not confident in market outlets for collected plastic bottles
- There is little political interest in plastic recycling within council
- Currently focussing on heavier materials to hit recycling targets
- Lack of available skills and/or time to plan/implement scheme
- Other

Responses are shown in Figure A.5.

Figure A.5: Factors that prevent a plastic bottle collection scheme being introduced



The four most important reasons given for not recycling plastic bottles were:

- No suitable local baling/handling facility (e.g. MRF)
- Cost: A scheme has been costed and viewed as too expensive
- Not confident in market outlets for collected plastic bottles
- Currently focussing on heavier materials to hit recycling targets

Other reasons included:

- Government targets are not conducive to collection of plastic bottles
- Contamination issues

The following can be concluded:

- Further work is required to demonstrate how plastic bottles can be recycled cost effectively and that there are strong market outlets for plastic bottles
- Weight based recycling targets are restricting the expansion of plastic bottles and potentially other lightweight high volume items from being recycled. These valuable items, therefore, continue to take up limited landfill space
- Existing baling/handling infrastructure in Scotland requires assessment and potential expansion to reduce the need to transport material long distances at cost.

A.3 Indicative costs of collecting plastics for recycling

The following costings (Table A.3.1) are an assessment made by Recoup based on the volume-related costs of collecting and handling plastic bottles. The space occupied on collection vehicles by plastic bottles has been assessed, and the cost of that space apportioned based on known direct vehicle operational costs. Allowance has been made for known handling costs, or else known typical costs of handling costs have been assumed.

The costs shown here are assessed as the additional costs incurred on top of the weekly RCV (refuse) collection service. Therefore the Councils operating alternate weekly scheme with RCVs show much lower *additional* costs.

Some Councils declined to provide costing data or requested that information discussed was not published.

We note that the specific costs per tonne for each council considered *should only be regarded as broad indicators of some operational issues, not precisely derived detailed costings*. For example we note that some of the stillage vehicle collections occur linked to alternate weekly residual and green waste collections. It could be argued that the total cost distinction shown here is less prominent when the difference in the full waste management service, and different landfill diversion rates is considered. ***The analysis is therefore shown, and is still valid, to highlight some key general trends in operational costs and efficiency discussed later.***

A.3.1 Collection costs for 7 different collection schemes studied

Scheme	Total cost per annum	Cost per tonne	Cost per household	Performance kg/hh/year	Refuse collection frequency	RCV or kerbside sort	Comment
1	£52,800	£880	£6.60	7.5	Weekly	Kerbside sort	Additional fortnightly collection of dry recyclables.
2	£72,505	£840	£6.04	7.19	Alternate weekly with green waste	Kerbside sort	Additional weekly collection of dry recyclables.
3	£210,541	£731	£11.48	15.57	Alternate weekly with green waste	Kerbside sort	Additional weekly collection of dry recyclables.
4	£31,331	£86	£0.67	7.74	Four weekly rotation, using one fleet of RCVs; wk 1 - residual wk 2 - recyclables wk 3 - residual wk 4 - green waste	RCV	Actual additional cost is minimal as still only a weekly RCV visit to household.
5	£46,176	£962	£7.70	-	Alternate weekly with green waste	Kerbside sort	Additional weekly collection of dry recyclables.
6	£32,167	£139	£0.67	4.8	Four weekly rotation, using one fleet of RCVs; wk 1 - residual wk 2 - recyclables wk 3 - residual wk 4 - green waste	RCV	Actual additional cost is minimal as still only a weekly RCV visit to household.
7	£38,481	£321	£0.59	1.85	Four weekly rotation, using one fleet of RCVs; wk 1 - residual wk 2 - recyclables wk 3 - residual wk 4 - green waste	RCV	Actual additional cost is minimal as still only a weekly RCV visit to household.

Appendix B - Scottish Council Case Studies

This section details the recycling activities of ten of the Scottish Councils already collecting plastic bottles through their schemes, with the aim of highlighting different approaches and best practice relating to plastics recycling.

The case studies are based on a combination of site visits and interviews with council staff and operational personnel and the survey work discussed earlier in this report. Further information was gathered from telephone conversations and e-mail correspondence with the Councils. Due to the different timings of data collection during the production of the report, differences in case study data and tabulated data in the main body of the report may be experienced.

The information presented in this section is based on data provided by the Councils. In a number of the case studies standard costs have been used for vehicles and crews to assess the likely costs of the scheme, where Councils have been unable to provide this data. These costs are based on known actual costs experienced by other local authorities, a sample of which is included in Appendix C.

Case studies include:

- Aberdeenshire
- Angus
- Clackmannanshire
- East Dunbartonshire
- Falkirk
- Glasgow City
- Midlothian
- South Ayrshire
- Stirling
- West Lothian

B.1 Aberdeenshire

Key facts

Scheme type: *Bring and Kerbside*

Population: *226,871*

Area: *631,259 hectares*

Number of households: *90,736*

Number of bring sites for plastic bottles: *58*

Bank type: *1100 litre wheeled bin*

Quantity of plastic bottles collected through bring scheme: *120 tonnes per annum*

Estimated cost of collecting plastic bottles through the bring scheme: *>£700 per tonne*

Number of households on plastic bottle kerbside collection: *8,000*

Collection frequency: *Fortnightly*

Collection container: *55 litre box*

Sort at: *Kerbside*

Vehicle type: *Logan Inglis Top Loader 6.5 tonne with stillages*

Total crew per vehicle: *3 (1 driver, 2 loaders)*

Average number of households per round: *800 households*

Estimated cost of collecting plastic bottles from kerbside: *£880 per tonne*

Quantity of plastic bottles collected per household: *7.5 kg per household per annum*

Quantity of plastic bottles collected through kerbside: *60 tonnes per annum*

Aberdeenshire operate both a bring scheme and a kerbside collection that include plastic bottles.

The bring scheme is well established, with a network of 150 sites throughout Aberdeenshire, 53 of which accept plastic bottles. Six of these are CA sites, which are operated directly by the Council and collect glass, cans, paper and card, plastic bottles, textiles, lead acid batteries and engine oil.

Each CA site has a small Orwak 60/40 baler. Bottles are collected in 1100 litre wheeled bins and then emptied into the baler, producing 20-25kg bales that can be stacked on pallets.

The smaller bring sites are serviced by three community groups:

- BEAT, covering the Banff & Buchan area, with material going to a site at Banff
- Ellon Can Do, covering the Ellon area, with material going to a site at Ellon
- Recycle Banchory, covering the Deeside area, with material going to a site at Banchory

Collectively these three groups service 47 sites, with BEAT providing the largest volumes of materials.

The aim of the community groups is to provide work-related experience for adults with learning difficulties. Interaction with the public is part of the learning experience; hence it is usual practice to operate with a driver plus four, where normal practice would be to operate with a driver plus one.

Each community group is provided with a baler as used at the recycling centres, nets and 1100 litre wheeled bins and is paid for provision of service.

The nets are fastened inside the containers into which the bottles are deposited. The nets are then lifted out manually by two operatives and placed into a caged vehicle or transit van. A replacement net is then put into the container ready for use. The vans can hold up to 10 full nets of plastic bottles – or a maximum of 250kg.

The bottles are then transported back to the local depots for sorting and baling. The bottles are normally sorted into polymer types, although when material volumes are high, some material is baled as mixed bottles. The Council collects the material from the community group sites once it has been baled.

In 2003/4 105 tonnes of plastic bottles were collected, of which 72 tonnes of plastic bottles we collected from the council bring schemes. It appears that BEAT generated around 33t of the bottles.

The cost per tonne of the service appears to be something in excess of £700 per tonne – this is relatively costly compared other services in the UK. It is accepted that there are unusually long transport distances involved, which will account for some of the additional cost. It is worth considering if the scheme could either reduce costs or to generate more bottles within the existing facilities paid for – for example the community groups may be able to service more sites within their budget.

One of the limiting factors may be that the vehicles used (transit vans) have too small a capacity and so a disproportionate amount of time is being spent "off round". Larger capacity 7.5t vehicles are more commonly used for this kind of system.

There may be merit in market testing the service to ensure that the bring scheme operators are offering good value. As the kerbside coverage increases the value of retaining the banks at this cost may decrease.

The kerbside collection is a pilot scheme, introduced in July 2004 and covering 8,000 households in Portlethen and Stonehaven, collecting plastic bottles, glass and food and drink cans fortnightly from a 55 litre box, a sack is provided for paper. One 6.5t Logan Inglis Top Loader stillage vehicle is used. The 6.5t vehicle has a limited payload, and so a larger 18t vehicle is under consideration for the scheme.

The materials are sorted at the kerbside. The plastic bottles are then loaded into a 40 cubic yard skip and sent for contract baling. Each skip load averages about 700kg of plastic bottles. The Council is collecting two skip loads of plastic bottles per week, which equals approximately 5 tonnes per month. The loose bottles are transported in bulk to a contract-baling site in Aberdeen, where a charge of £60 per skip is made. It is estimated that this is equivalent to around £85 per tonne baling fee. The plastic bottles are then sold in mixed form in the UK. A review of pricing achieved in Q1 2005 suggested that the Council could benefit from market testing, as notably higher prices are achievable in the UK as a whole. However, the council did note a desire to supply material to recyclers in the UK as a factor in their sales policy.

In 2004/5, 135 tonnes of plastic bottles were collected in the first 9 months of the year, including the 5 tonne per month contribution from the kerbside scheme.

The council intends to expand the scheme to cover all settlements over 300hh in size. This will capture 75% of all households (c. 75,000 homes).

The relatively large travel distances in Aberdeenshire (up to 80 miles North-South and 70 miles East-West) mean that consideration of optimising bulking is extremely important. By comparison, for example, Aberdeenshire Council is only 5% smaller than Devon in land area, but has a fifth of the population. Devon – considered a rural area in the UK - has four MRFs, and other smaller baling operations. The combination of long journey times and relatively limited volumes of recyclables mean that Aberdeenshire has to consider a carefully tailored solution.

The council is considering shipping material to a series of small depots for handling, and using screw compaction to provide bulking of the plastic bottles. The screw compaction system may enable reduction in the costs of shipping plastic bottles in bulk where quantities of over, nominally, a tonne a week are handled. Based on the performance of the current kerbside scheme it appears that given the units are located on existing sites where labour is available at marginal cost, the installation of several such facilities could be justified, possibly 4-5. An analysis suggests that with 5 centres strategically sited, most settlements would be within a 30-minute travel time.

Given the potentially large route mileage, should the council plan to roll-out the wider scheme with a 'kerbside sort' vehicle then the use of the MVR compaction system, or similar, should be considered as it can provide approximately double the payload of plastic bottles. There may also be merit ultimately in considering a co-mingled RCV collection of materials in some areas to increase payloads.

Further information: http://www.aberdeenshire.gov.uk

B.2 Angus

Key facts

Scheme type: *Bring and Kerbside*

Population: *108,400*

Area: *218,178 hectares*

Number of households: *46,945*

Number of bring sites for plastic bottles: *16*

Bank type: *1100 litre wheeled bins*

Quantity of plastic bottles collected through bring scheme: *93.93 tonnes per annum*

Estimated cost of collecting plastic bottles through the bring scheme: *£287 per tonne*

Number of households on plastic bottle kerbside collection: *12,000 (23,000 as of March 2005)*

Collection frequency: *Weekly*

Collection container: *55 litre box with lid*

Sort at: *Kerbside*

Vehicle type: *5 stillage vehicles*

Total crew per vehicle: 2 *(1 driver, 1 loaders)*

Average number of households per round: *600 households*

Estimated cost of collecting plastic bottles from the kerbside: *£840 per tonne*

Quantity of plastic bottles collected per household: *7.19 kg per household per annum*

Quantity of plastic bottles collected through kerbside: *86.32 tonnes per annum*

Angus council is located in East Scotland, with 46,945 households spread across 2,200 square kilometres.

In 2004 Angus Council implemented a kerbside collection system. 12,000 residents in Arbroath were provided with a 55 litre box for the collection of dry recyclables and the residual waste collection frequency was changed from a weekly collection to a fortnightly collection.

A 240 litre capacity green wheeled bin with ventilation built in was also provided for the collection of compostable garden waste and kitchen vegetable waste. This is collected on alternate weeks to the residual refuse, also collected using 240 litre wheeled bins.

In March of this year (2005) the scheme was rolled out to a further 11,000 households. This means that 23,000 residents in Angus now have the opportunity to recycle cans, glass bottles and jars, news and pams and plastic bottles (PET and HDPE) at the kerbside. In September 2005 an additional 10,500 residents will receive their lidded kerbside box and by the end of 2006 there will be 11 vehicles servicing 43,975 households in Angus.

The recycling crew sorts the materials at the kerbside and deliver them to the Material Recycling Facility (MRF) operated by Angus Council, where they are baled and sold.

It is estimated that it currently costs the Council approximately £840 per tonne to collect plastic bottles from the kerbside for recycling.

It has been calculated that the plastic bottles occupy 29% of the collection vehicle capacity, so account for 29% of the total collection cost for the dry recyclables. This means that the Council is currently spending approximately £72k per annum to recycle plastic bottles from the kerbside. This will increase as the scheme is rolled out.

It may be possible to increase efficiency and decrease scheme costs through rearranging collection routes and checking that the compartments on the vehicle are sized proportionally to enable maximum efficiency, thus ensuring that the vehicles don't have to return to tip unnecessarily when only one compartment is full.

Strongly promoting the "tops off and squash" message to members of the public may also help to decrease the volume that the plastic bottles occupy on the vehicles.

In addition to the kerbside collection, the Council operate 16 bring sites that include plastic bottles, 7 of these sites are in Angus and 9 sites are in the rural areas. There are 4 1100 litre drop front bins at each of the 7 recycling centres for the collection of plastic bottles, and 2 at each of the 9 neighbourhood recycling points in rural areas.

All of the banks are serviced using a transit van with a large trailer. The recycling centres are serviced weekly and the neighbourhood recycling points are serviced twice a week. This means that the van makes 25 pickups per week.

It is estimated that it costs the Council approximately £287 per tonne to collect plastic bottles through the bring scheme - a fairly typical cost for a plastic bottle bring scheme.

The Council is planning to increase the number of bring sites located across the District. Angus has a large rural community that is unable to participate in the kerbside scheme for logistical reasons. The council feel that by increasing the number of bring sites in these areas they will be giving more residents the opportunity to recycle their waste.

Angus Council is very pleased with the success of their scheme. They have experienced a few minor problems, such as the lids blowing off the recycling boxes, but have been able to overcome this problem by providing residents with nets that can be fitted over the top of a full box.

Angus believe that the success of their scheme can be partly attributed to their investment in a mini MRF, which has reduced transport costs and increased the Council's control over material sales.

Further information:
http://www.angus.gov.uk

B.3 Clackmannanshire

Key facts

Scheme type:
Bring and kerbside

Population:
48,077

Area:
15,864 hectares

Number of households: *20,558*

Number of bring sites for plastic bottles*: 1*

Bank type:
1100 litre wheeled bin

Quantity of plastic bottles collected through bring scheme:
Unknown

Number of households on plastic bottle kerbside collection:
18,500

Collection frequency:
Weekly

Collection container:
55 litre blue box

Sort at: *Kerbside*

Vehicle type: *5 stillage vehicles*

Total crew per vehicle:
3 (1 driver, 2 loaders)

Average number of households per round:
740

Estimated cost of collecting plastic bottles from the kerbside: *£731 per tonne*

Quantity of plastic bottles collected per household: *15.57 kg per household per annum*

Quantity of plastic bottles collected through kerbside:
288 tonnes per annum

Clackmannanshire, known as 'The Wee County', is Scotland's smallest County. Situated just across the Firth of Forth, with a population of 48,077 and 20,558 households, it covers 159 square kilometres.

The Council operates a comprehensive kerbside collection system, covering 90% of households.

Residual refuse and green waste are collected on alternate weeks using wheeled bins and dry recyclables are collected weekly using 55 litre blue boxes. Included in the dry recyclables collection are cans, glass, paper, plastic bottles and textiles.

The dry recyclables are sorted at the kerbside using 7.5 tonne stillage vehicles, which have separate compartments for each material. 20% of vehicle capacity is allocated to plastic bottles, which are kept in a netted area at the rear.

Every month 24 tonnes of plastic bottles are collected for recycling, which equates to 288 tonnes per year. Each household in Clackmannanshire therefore recycles an average of 15.57 kg of plastic bottles a year.

The plastic bottles are collected by Alloa Community Enterprises (ACE) and taken to a transfer station where they are stored and transported in bulker lorries to Stirling Fibre.

It is estimated, based on volume, that it costs the Council approximately £210k per annum to collect plastic bottles from the kerbside. This takes into account collection costs, transport costs, the gate fee at Stirling Fibre and avoided disposal costs. It equates to £731 per tonne of plastic bottles. The Council has expressed concern about the cost of their plastic service.

It may be possible to decrease costs by increasing the number of households serviced per round and/or decreasing the number of times the vehicles have to return to tip. It may be possible to achieve this through rearranging collection routes and checking that the compartments on the vehicle are the best sizes proportionally to enable maximum efficiency, thus ensuring that the vehicles don't have to return to tip unnecessarily when only one compartment is full. Calculations, based on existing data for Clackmannanshire, suggest that at least 30-40% of vehicle capacity should be allocated to plastic bottles.

Strongly promoting the "tops off and squash" message to members of the public may also help to decrease the volume that the plastic bottles occupy on the vehicles.

Despite concerns about cost, the scheme has been a great success. When it was being rolled-out last year, Graeme Cunningham, Integrated Waste Manager said: *"I would thank the members of the public who are recycling so enthusiastically, we've*

given householders exactly what they wanted, recycling right on their doorstep. With some terrific support from the refuse collection staff the whole operation has gone really smoothly."

The Scottish Waste Awareness Group (SWAG) recently carried out 400 face-to-face interviews with Clackmannanshire residents to assess public attitudes and behaviour towards the Council's kerbside recycling service. The results showed that 97% of those questioned are using the kerbside recycling service and that there is a high level of satisfaction among users of the service.

Clackmannanshire Council has also provided a range of recycling sites around the county in association with Alloa Community Enterprises. Plastic bottle recycling facilities are only currently available at one site, however.

Further information:
http://www.clacksweb.org.uk

B.4 East Dunbartonshire

Key facts

Scheme type: *Bring and Kerbside (HDPE only)*

Population: *108,243*

Area: *17,461 hectares*

Number of households: *42,206*

Number of bring sites for plastic bottles: *9*

Bank type: *14 Citybulle 4 cubic metre units*

Quantity of plastic bottles collected through bring scheme: *61 tonnes per annum*

Estimated cost of collecting plastic bottles through the bring scheme: *£500 per tonne*

Number of households on plastic bottle kerbside collection: *41,000 households*

Collection frequency: *Fortnightly*

Collection container: *55 litre box*

Sort at: *Kerbside*

Vehicle type: *8 Terberg Kerbsiders*

Total crew per vehicle: *3 (1 driver, 2 loaders)*

Average number of households per round: *600 households*

Quantity of plastics collected from households: *unavailable*

Estimated cost of kerbside bottle collection: *£960 per tonne*

There are both bring and kerbside systems for plastic bottles in East Dunbartonshire. There are 14 banks on 9 sites collecting mixed plastic bottles. These currently generate 61 tonnes of plastic bottles per annum. These are serviced by Macglass near Edinburgh at £195 per round, and three rounds are currently required per week. The bottles are delivered to Stirling Fibres for baling and onward sales. The cost of the bring scheme is equivalent to c. £500 per tonne.

The bring banks are Citybulle 4 cubic metre units with a single hook HIAB system and a single trap door. There is also a single deposit hole, with a second larger hole added. The containers appear to have inadequate capacity on some sites, and would benefit from being refurbished or replaced. The contractor uses a large HIAB vehicle for servicing, although the single hook mechanism on the current units does not allow the contractor to lift them efficiently.

When the containers are serviced, the contractor, Macglass, is willing to collect additional side bags of plastic bottles placed around them, however, it was noted that certain sites had up to 2 cubic metres of additional overflow bottles, which were not collected. These bottles are collected separately by the supermarket and landfilled as trade waste.

There may be opportunity for improvements in the cost-effectiveness of the bring scheme, as the £500 per tonne rate appears relatively high – particularly in light of increased revenues achievable for plastic bottles during 2004-5. The expansion of the kerbside programme may provide opportunities to reconsider the current arrangements.

In February 2005 the council rolled out a new kerbside collection service to 41,000 households. The scheme collects glass, paper, cans and HDPE plastic bottles. The decision to take only HDPE bottles appears to have resulted from two concerns – first, that the volume of plastic bottles would overwhelm the scheme and second that there were no reliable local outlets for the PET.

The collection is carried out using eight Terberg kerbsider vehicles divided into six compartments. Plastic bottles are deposited into the rear section of the vehicle. A visual inspection suggested that the compartment for plastic bottles represented one third of the available capacity in the vehicle body. Surprisingly the crews were reporting that even though only HDPE bottles were collected, the plastic bottle compartment was filling faster than the other compartments and was the primarily influence on the requirement to break off the round to tip.

The rounds are serviced using a ‘driver + 2 crew’ on a five day week, collecting on a fortnightly cycle. The collection container used

is a box. Typically the rounds take 6.5 hours per day to cover the rounds. The operators (Connect Services) reported that there is some spare capacity within the existing fleet, as the current round times are relatively short and because of the configuration of the rounds, for 6 out of 10 days there are two vehicles that are not operating. On this basis the vehicles appear to be covering around 600 households per day.

The recyclables are tipped at Stirling Fibres. The council have an arrangement with Stirling Fibres, Croy and pay a gate fee of approximately £30/tonne for the HDPE bottles delivered on site. Stirling Fibres bale and sell the bottles and, it appears, retain all revenues from sales. Shipments are made in loads of 17-18tonnes in shipping containers and material is exported for recycling.

The council has run its own promotions in conjunction with SWAG, and have gained endorsement from the musician Sting for their 'message in a bottle' campaign. This endorsement has been one of the mechanics of the local promotion.

The response to the inclusion of plastics in the kerbside collection scheme has been surprising. The council reports that when the scheme was rolled out it received thousands of calls specifically querying the arrangements for plastic recycling, and in particular asking why only HDPE was being collected, and that these queries represented over 90% of enquiries. The crews report no major contamination problems with the plastics being presented by householders.

All 42,000 households in East Dunbartonshire receive a weekly residual collection service. The weekly waste collection & disposal cost for the average householder in this district is £1.

Due to the strong public demand for other plastics to be collected, the Council has committed to extend the collection to include all plastic bottles. The roll out of the new scheme is scheduled for end August 2005.

In light of the feedback received from the crews on the high volumes of HDPE bottles alone that are being collected, the Council has been advised to trial a compaction unit on the plastic compartment. At the time of writing the Council had taken delivery of a loan vehicle from Terberg fitted with their 'MVR' ('Materials Volume Reduction') technology and was evaluating the impact of the unit.

On the basis of the current allocation of volume on the vehicles to plastic bottles, a third of the total collection costs are attributable to the plastic bottles. Broadly savings through avoided disposal negate the gate fee at Stirling Fibres. On this basis it could be argued that the provision of plastic bottle collection should be allocated a direct cost of approximately £210k per annum[12]. There appears to be distinct potential for improvements in economics, as noted below.

The collection round coverage for the kerbsiders appears to be low. Two vehicles have been assigned to one traditional refuse collection round. Each vehicle is passing around 600 households per day. Typically, given the relatively large capacity of the Terberg vehicles, coverage in excess of 700 homes per day could be achievable. The discharge point at Croy is only 10 miles from Bishopbriggs and so the off-route time should not be excessive. A lower coverage could be justified by very high participation rates. It is not possible to evaluate this point further as weight data from the scheme is not currently available. Recoup has highlighted this issue of potential for efficiency gains to the council.

The other area where economics may be improved is in relation to the value of the plastic bottles. There does not appear to be any revenue share with Stirling Fibres for the bottles being sold. Currently baled HDPE bottles can achieve sales values over of £150/tonne. The material being delivered to Stirling Fibres is pre-sorted and so the handling costs should be limited. A fee of £30-45 for contract baling, storage and loading into a container would not be unreasonable. On this basis the Council should consider whether they could negotiate revenue for the bottles as this would be justified.

[12] *Assuming £100,000 per vehicle per year (crew, capital and fuel) and 7 vehicles in full time operation.*

In the absence of actual data it has been estimated that the current collection for HDPE could be around 250 tonnes per annum. On this basis, a renegotiation of the gate fee could generate significant additional net revenue.

On the basis of improvements in the collection round efficiency to, say, 700 households per round; the service could be delivered using 6 full time vehicles, rather than 7.

The use of the MVR system to reduce the volumes of plastic bottles should enable about twice the quantity of plastic bottles to be collected in the existing compartment. This should enable the inclusion of PET and other plastic bottles without substantial impact on the round sizes.

Reviewing both collection and handling arrangements, it is estimated that the inclusion of all plastic bottles and the use of the MVR could lead to a significant improvement in the direct economics of plastic bottle collections from a cost of around £960/tonne (£5.82/property per annum) to around £366/tonne[13] or approximately £4.46 per property per annum, excluding avoided disposal benefits.

With high volumes of dry recyclables diverted from the traditional waste bin, the ability to reduce the frequency of residual refuse collections to alternate weeks provides the opportunity for further significant improvements in the economics of the overall waste collection service – probably of the order of £15/household per annum[14].

Further information:
http://www.eastdunbarton.gov.uk

[13] *Based on 6 vehicles to cover the full district, 500 tonnes per annum of plastic bottles collected and £30/tonne payment for mixed plastic bottles at delivery to the discharge point.*
[14] *Based on refuse collection costs from Audit Scotland (2000)*

B.5 Falkirk

Key facts

Scheme type:
Kerbside

Population:
145,191

Area:
29,737 hectares

Number of households: *62,598*

Number of bring sites for plastic bottles:
none

Number of households on plastic bottle kerbside collection:
47,000

Collection frequency:
Once every four weeks, alternating with green waste

Collection container:
240 litre blue wheeled bin

Sort at: *MRF*

Vehicle type: *8 RCVs (26t)*

Total crew per vehicle:
3 (1 driver, 2 loaders)

Average number of households per round:
1,175 household

Estimated cost of collecting plastic bottles from the kerbside:
£86 per tonne

Quantity of plastic bottles collected per household:
7.74 kg per household per annum

Quantity of plastic bottles collected through kerbside:
240 tonnes per annum

Falkirk occupies a 297 square kilometre area in a central location in Scotland. It has a population of 145,191 occupying 62,598 households.

The areas main towns and population centres are Falkirk, Grangemouth, Bo'ness, Denny, Larbert, Stenhousemuir and Polmont. There are also many smaller settlements and significant rural and agricultural areas.

Falkirk started to roll out a kerbside system that includes plastic bottles in 2004. The first phase covered 12,500 properties in Larbert, Stenhousemuir and Denny. It was planned to introduce the system gradually to the remainder of the local authority area over a period of 18 months. Currently 47,000 households receive collections.

A 240 litre blue bin is used to collect cans, paper, and plastic bottles; a brown bin is used to collect garden waste and a green bin is used for residual refuse. The scheme operates on a four weekly rotation as follows; week 1 green bin, week 2 blue bin, week 3 green bin, week 4 brown bin.

A result of the fortnightly residual collection and 4 weekly recyclable collection is that the scheme participation rates are up to 95%, as people are encouraged to maximise residual capacity through use of the recycling bin.

Standard 26t RCVs, with compaction, are used for the collections. Each RCV can hold 7.5 tonnes of mixed dry recyclables before having to return to tip, compared with 11.5 tonnes of residual refuse. The recyclables from the blue bin are collected co-mingled and are delivered to the MRF at Snowies, Eden, or Hannays for sorting and baling.

Based on volume, it is calculated that this system enables the Council to recycle their plastic bottles at c. £86 per tonne. This includes collection costs, gate fees at the MRFs and avoided disposal costs.

Due to the type of alternate weekly collection system that the council is operating, however, they are actually using very few additional resources compared to the previous weekly collection system for residual refuse.

The same vehicle fleet is used to collect residual refuse, dry recyclables and compostables on different weeks, therefore the only additional costs are the gate fee at the MRF and additional transport costs associated with tipping at the MRF instead of at the landfill site. These are offset by a great degree by avoided disposal costs.

The Council has estimated that it costs 5-10% more to operate this system compared to a weekly residual refuse collection. This design of collection system is therefore extremely cost-effective, although it

relies on having access to a MRF to sort the collected material.

Promotions have included press coverage, council newspaper, stickers on bins, leaflets with a collection calendar, information on the website, and local posters.

Each resident received an information pack before they received a blue bin. This included information on when the scheme was going to start, how to use the bins, and the collection day for each bin. There is a SWAG branding for promotions.

The system is comprehensive and is performing well. The Council has even indicated that damage to vehicles has been reduced due to less frequent trips to landfill.

Falkirk Council also maintains 62 recycling centres although no plastic bottles are collected from these facilities.

Further information:
http://www.falkirk.gov.uk

B.6 Glasgow City

Key facts

Scheme type: *Bring and Kerbside*

Population: *577,869*

Area: *17,549 hectares*

Number of households: *271,596*

Number of bring sites for plastic bottles: *60*

Bank type: *1100 litre wheeled bins and 10 cubic yard banks*

Estimated cost of collecting plastic bottles through the bring scheme: *Unknown*

Number of households on plastic bottle kerbside collection: *93,000*

Collection frequency: *Once every four weeks*

Collection container: *240 litre or 140 litre wheeled bin*

Sort at: *MRF*

Vehicle type: *4 RELs*

Total crew per vehicle: 3 *(1 driver, 2 loaders)*

Average number of households per round: *1,163 households*

Estimated cost of collecting plastic bottles from the kerbside: *Unknown*

Quantity of plastic bottles collected per household: *0.87 kg per household per annum*

Quantity of plastic bottles collected through bring and kerbside: *83 tonnes per annum*

Glasgow is primarily an urban area, covering 175 square kilometres, with a population of 600,000 and 271,596 households. Much of the housing is high-rise; this type of accommodation can present a challenge to the effective collection of dry recyclables.

Glasgow Council provides a number of plastic bottle recycling systems to householders including a kerbside scheme, bring facilities and tenement collections.

In 1998, a green box service was introduced, which included plastic bottles. This collection covered 40,000 households throughout the city.

To further develop their recycling services, Glasgow City Council introduced a new collection service in April 2003 utilising blue 140 and 240 litre bins. This service is now available to 93,000 householders.

The 240 litre blue bins/green boxes are collected once every four weeks. Materials accepted include plastic bottles, paper and cans; no glass or cardboard is accepted.

This service is operated using standard compaction REL vehicles with bin lift equipment, in addition to the residual collection.

As the blue bin system is rolled out, it is hoped that the additional recycling capacity will boost tonnages. No significant promotions have been completed, although the Council is considering the adoption of independent promotions, without SWAG branding.

The material is taken to the Council's MRF, for sorting and baling.

The quantity of plastic bottles being generated through the scheme is comparatively low. This may be due to a number of factors, including:

- The collection frequency - research has shown that schemes that collect monthly or once every four weeks have a lower performance than those that collect weekly or fortnightly. The exception is where these monthly/4 weekly collections are made as part of an alternate weekly system, such as Falkirk operates.
- Insufficient promotion - there has been no significant promotion of the scheme, which can lead to poor participation.
- The high proportion of high-rise accommodation - this type of accommodation can present a challenge to the effective collection of dry recyclables.

The tenement recycling scheme covers 6,000 households, with 240 litre blue wheeled bins provided, as with the kerbside scheme. This

was due to be expanded, but Strategic Waste Fund money was not awarded.

The plastic bottle bring system currently consists of 60 sites. Plastic bottles, Cans and paper are collected in 1280 litre recycling banks and separated at the Council's MRF.

Further information:
http://www.glasgow.gov.uk

B.7 Midlothian

Key facts

Scheme type: *Kerbside*

Population: *80,941*

Area: *35,369 hectares*

Number of households: *32,922*

Number of households on plastic bottle kerbside collection: *6,000*

Collection frequency: *Weekly*

Collection container: *Two 55 litre boxes (one red and one blue)*

Sort at: *Kerbside*

Vehicle type: *2 Kerbsiders with Terberg MVR units installed to compact the plastic bottles*

Total crew per vehicle: 4 *(1 driver, 3 loaders)*

Average number of households per round: *600 households*

Estimated cost of collecting plastic bottles from the kerbside: *£962 per tonne (assuming 8kg of plastic bottles per household)*

Quantity of plastic bottles collected per household: *Unknown - scheme only recently rolled-out*

Quantity of plastic bottles collected from kerbside: *Unknown - scheme only recently rolled-out*

Midlothian is situated to the south of Scotland's capital city of Edinburgh. It covers an area of 354 square kilometres and has a population of 80,941 and 33,563 households.

The main towns are Penicuik, Bonnyrigg, Dalkeith, Mayfield and Easthouses, Loanhead and Gorebridge.

Midlothian Council has recently introduced a kerbside collection for paper, card, glass, plastic bottles and cans.

The first 6,000 homes received their kerbside collection boxes in May 2005 and the Council is rolling out the service to offer a kerbside collection to all areas of Midlothian by early 2006.

Householders will be provided with two 55-litre boxes with lids to store the dry recyclables and put them out for collection. The blue box is for paper, card and plastic bottles and the red box is for glass and cans.

The materials are sorted at the kerbside into separate compartments of the collection vehicle. The kerbsider collection vehicles in use have been fitted with Terberg MVR (Material Volume Reducing) units, which compact the plastic bottles on the vehicle, enabling a greater quantity of material to be collected on the vehicle before it is emptied.

This is particularly useful, as it reduces unnecessary vehicle movements. The only issue Midlothian has found with the MVR is that it won't squash bottles that still have caps on, so it is important that the "caps off" message is taken onboard by the public.

Each vehicle has a driver and three loaders.

As part of the kerbside system a brown wheeled bin is provided to all suitable households for green waste. Once the kerbside collection of recyclables has been implemented, residual refuse will be moved to one uplift every two weeks.

Currently, the kerbside-collected recyclables are taken to a MRF (Material Reclamation Facility) in Edinburgh.

The Council has indicated that the scheme is providing high quality recyclables and has improved recycling figures.

Further information:
http://www.midlothian.gov.uk

B.8 South Ayrshire

Key facts

Scheme type: *Kerbside*

Population: *112,097*

Area: *122,199 hectares*

Number of households: *53,284*

Number of households on plastic bottle kerbside collection: *53,284*

Collection frequency: *Once every four weeks, alternating with green waste*

Collection container: *Wheeled bin*

Sort at: *MRF (Lowmac Recycling)*

Vehicle type: *12 RCVs*

Total crew per vehicle: *3 (1 driver, 2 loaders)*

Average number of households per round: *806 households*

Estimated cost of collecting plastic bottles from the kerbside: *£140 per tonne*

Quantity of plastic bottles collected per household: *4.76 kg per household per annum*

Quantity of plastic bottles collected through kerbside: *232 tonnes per annum*

Situated on the West Coast of Scotland, South Ayrshire covers an area of 1,220 square kilometres, with 53,284 households. There are 5 main population centres and about 25 smaller towns. Residual waste is collected on a fortnightly basis, alternating with recycling collections, using a 240L wheeled bin; there are 13 collection routes.

In 2003 South Ayrshire Council implemented a 3-bin kerbside recycling system. This system saw the introduction of 2 additional 240 litre wheeled bins: a brown bin for compostable waste and a blue bin for dry recyclables (including plastic bottles). The blue and brown bins are emptied every four weeks and the green (residual waste) is collected every two weeks.

A 55-litre black box is used to collect glass bottles and jars. The black boxes are collected once a fortnight on the same days as the blue or brown bins. The dry recyclables are collected in a co-mingled format at the kerbside using a RCV. The co-mingled material is taken to a local recycling centre in Irvine, where it is sorted and sold.

In 2005 the kerbside scheme was made available to every householder in South Ayrshire. The participation level is high and the council is very pleased with the success of the scheme.

South Ayrshire Council attributes the success of this scheme to thorough planning and publicity.

Stratton McDonald, Assistant Manager – Waste Strategy for South Ayrshire Council said:

"The cost and productivity need to be assessed before implementing a kerbside recycling scheme. The public also need to be fully aware of the scheme before, during and after implementation"

The recycling results have been excellent and the residents are now recycling and composting over 42% of their household waste. 18-20 tonnes of plastic bottles are being generated by the scheme per month, which equates to approximately 232 tonnes per annum.

The quality of the recyclables placed in the bins has been of a very high standard, with only minimal contamination being evident. The collection crews only had to place stickers on the bins of 2% of households, who had inadvertently placed the wrong type of materials in the wrong bin.

All co-mingled recycables collected from South Ayrshire are delivered to Lowmac Recycling in Irvine, which is approximately 10 miles away from South Ayrshire.

The materials are then sorted and baled.

Based on volume, it is calculated that this system enables the Council to recycle their plastic bottles at c. £140 per tonne. This includes collection costs, gate fees at the MRFs and avoided disposal costs.

Due to the type of alternate weekly collection system that the council is operating, however, they are actually using very few additional resources compared to the previous weekly collection system for residual refuse. The same vehicle fleet is used to collect residual refuse, dry recyclables and compostables on different weeks, therefore the only additional costs are the initial cost of the extra wheeled bins, the gate fee at the MRF and additional transport costs associated with tipping at the MRF instead of at the landfill site. These are offset to a great degree by avoided disposal costs. This design of collection system is therefore extremely cost-effective, although it relies on having access to a MRF to sort the collected material.

The majority of the increased costs associated with the recycling service in South Ayrshire were directly related to the purchase of new vehicles and crew for the additional glass collection. The Council has estimated that the overall additional cost of the kerbside recycling service is £12 per tonne, based on total waste arisings.

The team at South Ayrshire are very proactive when it comes to the publicity and promotion of their recycling schemes and find the following methods very effective; the council website, a quarterly newsletter, poster campaigns and a Household waste information pack. In order to maintain a consistent approach with other Scottish Councils the recycling team approached SWAG for advice and resources.

Despite the success of the recycling schemes there have been a few problems along the way. For example Lowmac Recycling (local MRF operator) were becoming concerned about residents leaving tops on the plastic bottles before putting them into the recycling bins, this resulted in the bottles becoming difficult to handle and bale. In order to overcome this issue the Council developed additional publicity, using information and images provided by SWAG and Recoup, to encourage residents to remove the lids and squeeze the air out of the bottles before putting them into the blue bins.

The Council is currently focusing on increasing the amount of materials being recycled at schools and offices in South Ayrshire; this scheme will include plastic bottles. Three Waste Aware Officers will implement this project during 2005.

South Ayrshire is also investigating the possibility of recycling materials collected in litter bins located across the council area.

Further information:
http://www.south-ayrshire.gov.uk

B.9 Stirling

Key facts

Scheme type: *Kerbside (HDPE milk bottles only)*

Population: *86,212*

Area: *218,735 hectares*

Number of households: *37,000*

Number of households on plastic bottle kerbside collection: *37,000*

Collection frequency: *Weekly*

Collection container: *55-litre blue box*

Sort at: *Kerbside*

Vehicle type: *11 purpose built articulated trailers*

Total crew per vehicle: *3 (1 driver, 2 loaders)*

Average number of households per round: *673 households*

Estimated cost of collecting plastic bottles from the kerbside: *Not for publication*

Quantity of plastic bottles collected per household: *6.49 kg per household per annum*

Quantity of plastic bottles collected through kerbside: *240 tonnes per annum*

Located in the middle of Scotland's central belt Stirling covers 2,190 square kilometres, with 37,000 households. Over half of Scotland's population lives within an hour of the city and 80% within two hours.

Stirling Council piloted a kerbside recycling scheme in specific areas in and around Stirling from June 2001. There were around 12,100 properties in the trial area and more than 50% participated.

The scheme was rolled out in phases to include over 90% of all households in the Stirling Council area. Items are collected in a 55-litre blue box and include cans, aerosols, foil, bottles, paper, HDPE plastic bottles, and textiles.

As part of the new kerbside service, householders were also provided with a brown wheeled bin for compostable items and a grey wheeled bin for residual waste. Compostables and residual refuse are collected on alternate weeks, with dry recyclables collected weekly.

The dry recyclables are separated at the kerbside into compartments on the collection vehicle. Crews work on a four-day rota, although the collection vehicles go out five days a week.

Approximately 20 tonnes of HDPE bottles are collected each month, equating to 240 tonnes per annum. The material is taken to the Council depot and baled using a Scarpa 40-50t continuous baling press. This produces bales of approximately 175kg.

It may be possible to decrease costs by increasing the number of households serviced per round and/or decreasing the number of times the vehicles have to return to tip. It may be possible to achieve this through rearranging collection routes and checking that the compartments on the vehicle are the best sizes proportionally to enable maximum efficiency, thus ensuring that the vehicles don't have to return to tip unnecessarily when only one compartment is full.

Strongly promoting the "tops off and squash" message to members of the public may also help to decrease the volume that the plastic bottles occupy on the vehicles.

The Council has employed a Waste Aware Campaigns Assistant, who is working in areas of Stirling that have problems with the new waste collection service. When householders put the wrong things into their brown bin or recycling box the collection crew log the address and the addresses are then inputted into a centralised database. The Waste Aware Campaigns Assistant visits these households to find out what problems the householders are having with the scheme and to give them advice and guidance on how to use their recycling box and brown bin to decrease the

contamination.

The Council also operates a network of bring banks where the public can deposit a range of dry recyclables. Plastics are not currently accepted at these sites, but the Council plan on including banks for PET bottles across the district in the near future. Including PET bottles in the kerbside collection would be preferable, but there are issues relating to vehicle capacity, which would need to be overcome.

Stirling is now recycling over 30% of household rubbish or turning it into compost instead of dumping it in landfill sites. It has seen a significant increase in recycling since the establishment of the new kerbside system.

When talking about recycling last year (2004) Gillie Thomson, Convener of the Council's Environment Committee, said:

"The public response to Stirling's recycling scheme has been amazing. Getting local communities involved in recycling from the very start has been the key to its success."

Further information:
http://www.stirling.gov.uk

B.10 West Lothian

Key facts

Scheme type: *Bring and Kerbside*

Population: *162,843*

Area: *42,733 hectares*

Number of households: *70,000*

Number of bring sites for plastic bottles*: 2*

Bank type: *One 360 litre wheeled bin and one skip*

Quantity of plastic bottles collected through bring scheme: *2 tonnes per annum*

Number of households on plastic bottle kerbside collection: *64,400*

Collection frequency: *Once every four weeks, alternating with green waste*

Collection container: *Wheeled bin*

Sort at: *MRF (Eden Recycling)*

Vehicle type: *14 RCVs*

Total crew per vehicle: 3 *(1 driver, 2 loaders)*

Average number of households per round: *1300 households*

Estimated cost of collecting plastic bottles from the kerbside: *£321 per tonne*

Quantity of plastic bottles collected per household: *1.85 kg per household per annum*

Quantity of plastic bottles collected through kerbside: *120 tonnes per annum*

West Lothian is situated near the East Coast of Scotland just west of Edinburgh. West Lothian Council covers an area of 427 square kilometres, including 70,000 households.

In an effort to increase the amount of material recycled, West Lothian Council introduced a trial kerbside collection to selected areas in 2001. The trial was a success and the scheme has now been rolled out to the whole of West Lothian.

Householders are provided with three wheeled bins: a grey one for residual refuse; a brown one for the collection of green waste; and a blue bin for dry recyclables.

Dry recyclables collected for recycling include paper and magazines, cardboard; aluminium and steel cans; and plastic bottles. Karen King, the Waste Strategy Officer at West Lothian stated that it is important to recycle the plastic bottles, as this "makes more room in the grey wheeled bins, so that they can be collected fortnightly."

The bins are emptied on a four-weekly cycle with the grey bins for residual refuse being lifted once a fortnight and the others once every four weeks.

All residual, compostables and dry recyclables are collected using the same fleet of 14 RCVs. The dry recyclables are collected co-mingled and delivered to Eden Recycling for sorting.

The scheme generates approximately 120 tonnes of plastic bottles per annum. Based on volume, it is calculated that this system enables the Council to recycle their plastic bottles at c. £321 per tonne. This includes collection costs, gate fees at the MRF and avoided disposal costs.

Due to the type of alternate weekly collection system that the council is operating, however, they are actually using very few additional resources compared to the previous weekly collection system for residual refuse. The same vehicle fleet is used to collect residual refuse, dry recyclables and compostables on different weeks, therefore the only additional costs are the gate fee at the MRF and additional transport costs associated with tipping at the MRF instead of at the transfer station. These are offset to a great degree by avoided disposal costs. This design of collection system is therefore extremely cost-effective, although it relies on having access to a MRF to sort the collected material.

The biggest issue the Council encountered in rolling out the scheme was educating the public to only place plastic bottles in the blue bin, as some householders place all plastics into the bin. Many of the items, such as margarine tubs, microwave trays and yoghurt pots have to be removed at the sorting facility and landfilled at a cost.

In addition to the kerbside collection, West Lothian Council also operate a network of 33 bring sites for dry recyclables. Two of these sites collect a comprehensive range of dry recyclables; providing a 360 litre wheeled bin and a skip respectively, for the collection of plastic bottles. The remaining sites mainly collect glass and textiles.

Two tonnes of plastic bottles are generated through these two bring sites.

Further information:
http://www.westlothian.gov.uk

Appendix C: Five UK Case Studies

The following case studies are included for reference and comparison purposes:

- Newport
- Bracknell Forest
- Broxtowe
- Lichfield
- Derby

C.1 Newport

Key facts

Scheme type: *Kerbside*

Population: *137,011*

Area: *19,044 hectares*

Number of households: *56,535*

Number of households on plastic bottle kerbside collection: *52,500 (now being rolled out to flats as well)*

Collection frequency: *Weekly*

Collection container: *2 55-litre boxes (1 green & 1 blue)*

Sort at: *Kerbside*

Vehicle type: 10 *7.5t Stillage vehicles with 14.5 cubic metre capacity and 1 6t SPOVs*

Total crew per vehicle: *2 (1 driver, 1 loader) on 7.5t stillage vehicles & driver only on 6t SPOVs*

Average number of households per round: *800-1000 households 400-500 SPOV*

Estimated cost of collecting plastic bottles from the kerbside: *£200 per tonne*

Quantity of plastic bottles collected per household: *15.8 kg per household per annum*

Quantity of plastic bottles collected through kerbside: *829.5 tonnes per annum*

Newport, South Wales covers 190 square kilometres, encompassing 56,535 households, with a population of 137,011 (2001 national census).

Newport City Council work in partnership with Newport Wastesavers - a local community recycling organisation, established in the mid eighties - to provide a kerbside recycling service to it's householders.

Newport was the first Authority in Wales to provide multi-material kerbside collections to all households and it continues to work to develop the service.

The service was initially launched in 1998; collections of paper, cans, glass and textiles, using 55-litre green boxes, were made fortnightly. In a drive to increase Newport's recycling rate, an additional box was supplied to householders and plastic bottles were included in the collection. Collections were changed from fortnightly to weekly and a comprehensive awareness raising strategy was implemented.

The inclusion of plastic bottles in the collection presented a number of challenges for Newport Wastesavers, because of the items low weight and high volume. The main issue was fitting the plastic bottles onto the collection vehicle without significantly affecting the payload and crowding out other recyclables.

Newport Wastesavers overcame this problem by redesigning the collection vehicles to create additional capacity. Wastesavers maintained it's fleet of 7.5t stillage vehicles, but increased the vehicle capacity by extending the vehicle body to overhang the chassis at the rear. This provided the additional capacity required for the collection of plastic bottles, without the need for a significant increase in the number of collection vehicles.

The following tables set-out the cost of the scheme and compare the cost and performance with the previous collection service that did not include plastic bottles.

Revenue costs of collection including plastic bottles

Collection cost	£62 per tonne
Processing/sorting cost	£12 per tonne
Management/administration cost	£12 per tonne
Material income	£44 per tonne
Net cost	£42 per tonne

Scheme comparisons

	Original scheme (fortnightly collection of paper, cans, glass and textiles)	New scheme (weekly collection of paper, cans, glass, textiles and plastic bottles)
Participation	20% - 70%	69% - 94%
Diversion rate	80 kg per household	177 kg per household
Capital cost	£412,000 over 5 years	£750,000 over 18 months
Revenue cost	£25 per tonne	£42 per tonne

These costs are weight based; it is calculated, based on volume, that it costs Newport approximately £200 per tonne to collect and handle plastic bottles as part of it's kerbside scheme, which equates to approximately £3.20 per household per annum.

In 2004, Newport attained a recycling rate of 25%. To increase this further the Council has introduced a pilot alternate weekly collection to 9,000 households. These households are offered a green waste collection service one week and have their residual refuse collected every other week; they retain the weekly collection of dry recyclables. If successful, the Council plans to roll this system out throughout the Newport area.

Further information:
http://www.newport.gov.uk
http://www.wastesavers.co.uk

C.2 Bracknell Forest

Key facts

Scheme type:
Bring and Kerbside

Population:
109,617

Area:
10,938 hectares

Number of households: *43,650*

Number of bring sites for plastic bottles: *36*

Bank type:
26 8 cubic yard banks and 10 other banks

Quantity of plastic bottles collected through bring scheme:
216 tonnes per annum

Number of households on plastic bottle kerbside collection:
43,650

Collection frequency:
Fortnightly

Collection container:
55 litre green box

Sort at: *Kerbside, then further sort at transfer station*

Vehicle type: *3 cage vehicles*

Total crew per vehicle:
3 (1 driver, 2 loaders)

Average number of households per round:
1,455 households

Estimated cost of collecting plastic bottles from the kerbside:
£517

Quantity of plastic bottles collected per household:
3.34 kg per household per annum

Quantity of plastic bottles collected through kerbside:
146 tonnes per annum

Bracknell Forest Borough Council has demonstrated that the benefits of adding plastics to a recycling scheme are not something to be underestimated.

After five years of collecting material for recycling from the kerbside, Bracknell found that public enthusiasm was deteriorating. After researching public attitudes to the scheme, Bracknell decided to add plastic to the list of materials collected. As a result, participation and the yield of other materials collected increased greatly; this combined with the plastic collected has contributed significantly to meeting recycling targets. The addition of plastics has also met consumer demand for a plastics recycling facility and reduced bulk in the regular residual collection.

Since 1996 Bracknell Forest has operated a fortnightly kerbside recycling scheme, working toward a statutory government target to recycle 27% of household rubbish by 2005/6. Initially this was just for card, then in 1999 tins, cans and newspapers were added.

The green box scheme proved extremely popular with around 50% of residents participating every two weeks and the total kerbside tonnage for 2000/01 had risen to 1916 tonnes. However in 2001 participation in the scheme declined with tonnage for 2001/02 reducing to 1763 tonnes. Despite this, Bracknell achieved a 17.7% recycling rate in 2002/03, although this was due mainly to initiatives at the Civic Amenity site.

It was felt that many people failed to participate because it seemed easier to put everything into their wheeled bin and they had no real incentive to just recycle cans and papers when other materials were not separately collected. Some people opted for the “one stop shop approach”, returning all recyclables to one of the 36 recycling sites which were becoming so well used that it was difficult to cope with the increased requirement for emptying of containers.

ADAS undertook an analysis of the wheel bin waste for various borough areas in May and November 2002. This indicated that 3 - 4% in weight of plastic bottles were discarded in the wheeled bins, equating to around 1,300 tonnes per annum of collected waste. The analysis also revealed that in spite of the provision of the kerbside box scheme and the recycling sites for newspapers, magazines and food and drinks cans there was still 4-5% of newspapers and 2% of cans being discarded in wheeled bins destined for landfill.

It was felt that adding plastics to the kerbside collection would stimulate the diversion of the other two materials away from the wheeled bins into recycling boxes. The potential tonnage was up to 3,800 tonnes, which would go a long way to helping achieve government recycling targets.

In April 2002 a project team was set up to look at revitalising the kerbside collection scheme. The first activity was to choose four areas of the borough and carry out customer surveys. The results of the surveys would determine initiatives that could be trialed in those areas.

One of the main questions asked was “What would encourage you to recycle more at the kerbside?” - 70% of those questioned requested a kerbside collection of plastics, as it gave them the most problem with bulk when disposing of rubbish.

Following the results from the survey the main kerbside collection pilot scheme was carried out in North Ascot from July to October 2002, collecting plastics in the green box to see how effective this would be. The area was chosen as participation had dropped from 50-55% in 1999 to 11%. The trial proved very successful, with participation increasing to around 28% and the tonnage collected of cans with plastic increasing by 53%.

Through the addition of plastics, the overall tonnage of all materials collected via the kerbside green box scheme has increased by 21% for the first quarter (April to June 2003) compared to the same period last year. Participation in the kerbside scheme has increased, with a considerable number of residents requesting additional boxes.

Janet Dowlman, Waste & Recycling Manager at Bracknell Forest Borough Council, said

“The council is very pleased with the success of adding plastic bottles to their kerbside box collections. Collecting bulky plastic bottles with cans and newspapers from the kerbside definitely encourages more residents to participate in kerbside recycling. Although plastic alone as a lightweight material does not significantly increase recycling tonnage it does help to increase the amount of other materials collected and make residents feel that it is worthwhile using their kerbside recycling box.”

Based on volume, it is estimated that it cost Bracknell Forest Borough Council approximately £517 per tonne to collect plastic bottles from the kerbside. While the Council view plastic bottle recycling as a significant additional cost, it maintains that it is a worthwhile ongoing element of its recyclables collection service.

Further information:
http://www.bracknell-forest.gov.uk

C.3 Broxtowe

Key facts

Scheme type: *Bring and Kerbside*

Population: *107,570*

Area: *8,010 hectares*

Number of households: *47,000*

Number of bring sites for plastic bottles: *5*

Bank type: *1100 litre wheeled bins*

Quantity of plastic bottles collected through bring scheme: *36 tonnes per annum*

Estimated cost of collecting plastic bottles through the bring scheme: *£10,001 - £15,000 per annum (£300-£400 per tonne)*

Number of households on plastic bottle kerbside collection: *47,000*

Collection frequency: *Fortnightly (Alternate Weekly)*

Collection container: *240 litre green-lidded grey wheeled bin*

Sort at: *MRF*

Vehicle type: *9 RCVs*

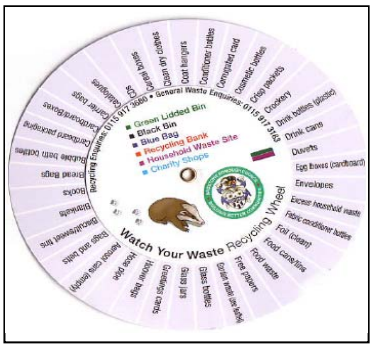
Total crew per vehicle: *3 (1 driver, 2 loaders)*

Average number of households per round: *1,044 households*

Estimated cost of collecting plastic bottles from the kerbside: *£123 per tonne*

Quantity of plastic bottles collected per household: *13.28 kg per household per annum*

Quantity of plastic bottles collected through kerbside: *624 tonnes per annum*



Broxtowe Borough Council, located in South West Nottinghamshire, covers approximately 80 square kilometres and has both rural and urban conurbations. Broxtowe's 47,000 households have access to both bring and kerbside recycling facilities for plastic bottles.

The current kerbside collection is a twin bin system and was introduced in 2002, initially to 9,000 households. Householders are provided with two wheeled bins, one for the collection of residual refuse and the other for the collection of dry recyclables, including co-mingled paper, card, cans/tins and plastic bottles.

The twin bin scheme is an alternate weekly collection, whereby the wheeled bin for residual refuse is collected one week and the wheeled bin for dry recyclables is collected on the following week. This enables the same fleet of vehicles and crew to collect both residual refuse and dry recyclables, making the most of existing resources.

The scheme was such a success, that the decision was taken to roll it out to the rest of the borough during 2003 and 2004. Now all households in the Borough are on the twin bin scheme. For properties such as flats, where there is no room for a second bin, larger communal bins (1100 litre) are provided. Or, instead of additional bins for recyclables, half of the existing wheeled bins are converted to recyclables.

Road shows were held to promote the scheme and a leaflet and calendar were delivered to each household with the new recyclables wheeled bin.

Initially contamination was a problem, with residents confused about what plastics could be placed in the recycling bin. This issue was addressed through improved education. A 'recycling wheel' was sent to every household, which showed the most appropriate disposal route for specific items.

The scheme was well received by members of the public. Results from a questionnaire sent to 20% of the borough showed that over 90% of respondents were satisfied with the collection system.

Plastic bottles are popular materials for householders to recycle, not just fizzy pop and milk bottles, but household cleaning shampoo and shower gel bottles as well.

Based on volume it is calculated that it costs the Council approximately £123 per tonne to recycle plastic bottles. However, as the Council is using the existing refuse collection fleet to collect dry recyclables, in reality it is costing very little extra to recycle the plastic bottles, rather than landfill them.

The Council also operates a network of bring sites throughout the borough, five of which provide plastic bottle recycling facilities.

Further information: http://www.broxtowe.gov.uk

C.4 Lichfield

Key facts

Scheme type: *Kerbside*

Population: *93,200*

Area: *33,200 hectares*

Number of households: *40,055*

Number of households on plastic bottle kerbside collection: *39,055 households*

Collection frequency: *Weekly*

Collection container: *55 litre green box*

Sort at: *Kerbside*

Vehicle type: *9 Terberg kerbsiders*

Total crew per vehicle: *4 (1 driver, 3 loaders)*

Average number of households per round: *870 households*

Estimated cost of collecting plastic bottles from the kerbside: *£645 per tonne*

Quantity of plastic bottles collected per household: *6.91 kg per household per annum*

Quantity of plastic bottles collected through kerbside: *270 tonnes per annum*

With an overall recycling rate of almost 50%, Lichfield now boasts one of the highest recycling rates in the UK.

Lichfield District is located in southern Staffordshire. It has two distinctive urban centres - Lichfield City and Burntwood - and a number of rural communities. It covers an area of 332 square kilometres, with just over 40,000 households and a population of 93,200.

In 2000, with limited remaining landfill capacity in Staffordshire and government recycling targets to be met, Lichfield Council decided to consult it's residents on waste and recycling services in the district. A summary consultation document was sent to every household in the district and 250 full-length versions of the document were placed in libraries and public buildings. Twenty-one roadshows were held all around the district to support the consultation.

One of the most frequent comments was that recycling plastics would benefit the community and the environment. 80% of respondents indicated that the dry recyclables and compostables collections should be extended and 60% said that they would find alternate weekly collections of residual and recyclables acceptable.

In 2002 the council implemented a new fully integrated service. Householders were provided with a brown 240 litre wheeled bin for green waste and a black 240 litre wheeled bin for residual refuse. These are collected on alternate weeks. In addition, two kerbside boxes were provided for dry recyclables. The smaller 38 litre box is used for paper and card, and the larger 55 litre box is used for glass bottles and jars, food and drink cans, textiles and plastic bottles.

Dry recyclables are collected weekly using a fleet of 9 Terberg Kerbsiders. These side-loading vehicles have separate compartments for the different recyclables, which enable items to be sorted at the kerbside.

The scheme has been a great success, enabling the Council to increase recycling in the district from 27% in 1999/2000 to 46% in 2003/2004. The Council is now running a two-year campaign to tie in with the national campaign 'Recycle Now' organised by WRAP, in an effort to attain a >50% recycling rate.

Based on tonnage figures and converting these to volume, it is estimated that plastic bottles take up approximately 24% of room on collection vehicles. Therefore, if based on volume, it is estimated that it costs the council approximately £645 per tonne to collect plastic bottles for recycling.

It should be noted, however, that because the Council is operating an alternate weekly collection of green waste and residual refuse the cost per tonne of the waste and recyclables collection system as a whole is be significantly less than this. It is more likely to be in the £30 to £35 per tonne range.

Further information: http://www.lichfielddc.gov.uk

C.5 Derby

Key facts

Scheme type:
Bring

Population:
221,708

Area:
7,803 hectares

Number of households:
92,405

Number of bring sites for plastic bottles:
84

Average number of households per bring site:
1,100 households

Number and type of collection bank:
77 1100 litre wheeled bins and 7 triple net cages

Number and type of vehicles used to service the banks:
1 HIAB vehicle

Servicing frequency: *3 times a week on average*

Quantity of plastic bottles collected through bring scheme:
270 tonnes per annum (equivalent to 3 kg per household per annum)

Estimated cost of collecting plastic bottles through the bring scheme:
£75-£200 per tonne

The Derby bring scheme has been running for 10 years. All plastic bottles deposited at supermarket recycling centres are collected using a triple net cage system, allowing segregation at the point of deposit. In addition, mixed plastic bottles are collected at 77 community recycling centres in 1100 litre wheeled bins.

The net cage system involves a stand-alone metal frame, which has three walled sides and an open fourth side. Open top nets are then placed into the frames and bottles can be deposited.

Derby utilises the different compartments to collect different types of plastic bottles. This helps to encourage householders to segregate the bottles, enabling Derby to achieve a higher value per tonne for the material.

The material is segregated at the point of deposit into HDPE, PET and other plastic bottles.

A HIAB vehicle is used to service the containers by hooking the net onto the crane and lifting it into the body of the vehicle. The vehicle is capable of holding up to 7 full nets at any one time. This is the equivalent of 630 kg of bottles.

The 1100 litre wheeled bins provide a collection service on smaller community recycling sites around the area. Mixed bottles can be deposited into these bins, which are lined with sacks to aid emptying using the HIAB vehicle.

Full nets and sacks are stored at the Derby Council depot where the bottles are then sorted and baled using a T40 horizontal baler.

The scheme operates at a net cost of £75-£200 per tonne (this takes account of collection, handling, material revenue and avoided disposal costs) and recovers an average of 5 tonnes of bottles per week. The containers are serviced 3 times per week on average, depending on the popularity of the individual sites.

Further information:
http://www.derby.gov.uk