

Harmonised Recycling Collections Costs Project: Phase One



The cost impact of implementing harmonised dry recycling collections in Welsh Authorities.

WRAP's vision is a world in which resources are used sustainably.

Our mission is to accelerate the move to a sustainable resource-efficient economy through re-inventing how we design, produce and sell products; re-thinking how we use and consume products; and re-defining what is possible through re-use and recycling.

Find out more at www.wrapcymru.org.uk

Written by: WRAP Collaborative Change Programme Unit

Funded by:



While we have tried to make sure this report is accurate, we cannot accept responsibility or be held legally responsible for any loss or damage arising out of or in connection with this information being inaccurate, incomplete or misleading. This material is copyrighted. You can copy it free of charge as long as the material is accurate and not used in a misleading context. You must identify the source of the material and acknowledge our copyright. You must not use material to endorse or suggest we have endorsed a commercial product or service. For more details please see our terms and conditions on our website at www.wrap.org.uk

Executive Summary

Welsh Government (WG) has commissioned WRAP to expand on previous recycling collection modelling projects and consider the potential cost savings across Wales should authorities operate a harmonised dry recycling, food waste recycling and residual domestic waste collection system.

This work comprises two phases:

- Phase one: A comparison of direct operational costs of alternative recycling collection methods;
- Phase two: An analysis of the cost implications of alternative delivery structures, specifically the regional and national delivery of waste and recycling services.

This report details the results of the first phase of the work. In this phase, the cost of an average urban, rural and valley authority providing one of three different dry recycling collections service profiles was modelled. It is assumed that the service is provided in house as this is the case for the majority of Welsh Authorities.

This report does not consider any potential costs or savings from waste services being provided by regional or national bodies.

Collection profiles

Three types of dry recycling collections based on the principal schemes in operation in Wales were modelled, namely;

- Co-mingled collections with single use bags as containers;
- A twin stream collection (glass collected separately) with a box for glass and single use bags for containers;
- Source separated collection using two boxes and one reusable bag as containers.

In line with WG policy and the majority of existing service profiles, it was assumed that all of the dry recycling and food waste collections would be collected weekly.

Residual waste was assumed to be collected fortnightly in 140 litre wheeled bins. It is accepted that there are alternative methods of residual restriction now being rolled out by Authorities, which are also effective. However, for the

purpose of keeping the residual collection consistent across the options, a single service profile was required so as to not impact on the relative total cost estimates.

All of the RCVs were assumed to be crewed with one driver and two loaders. The 7.5 tonne food vehicle and the RRVs were considered to be crewed with one driver and one loader. Examples of Authorities that currently crew their RRVs with a driver plus 1 include; Bridgend, Newport, Merthyr Tydfil, Anglesey, West Oxfordshire, Cotswolds, Newtownabbey, Belfast, Lisburn, Armagh, Gwynedd (in part).

The modelling was restricted to consideration of the above services. Other waste services such as garden waste collection, commercial waste collections, and household waste recycling centres were not included.

Results

Initial Outlay

The initial outlay required to set up each collection method is shown in the tables below, the results have been split into an urban, rural and valley authority, and then into the collection methods. Aspects included in the initial outlay include purchase of containers and depot build costs.

Initial outlay	Co-mingled	Twin Stream	Source Separated
Urban Authority	£3,099,053	£3,187,229	£4,238,565
Rural Authority	£4,409,251	£4,524,574	£5,593,608
Valley Authority	£3,070,237	£3,171,761	£4,208,385

For each type of authority, co-mingled collections would require the smallest initial outlay, and source separated collections would require the greatest. The requirements stated above are based on an Authority not having any form of a depot to begin with. Most Authorities will already have a depot which could be adapted to suit the relevant collection method, which would negate the need for full construction of a new depot. This would significantly reduce the initial outlay cost.

Annualised operating cost differences between collection profiles:

The annualised operating cost for each of the collection methods was calculated, costs included were the following:

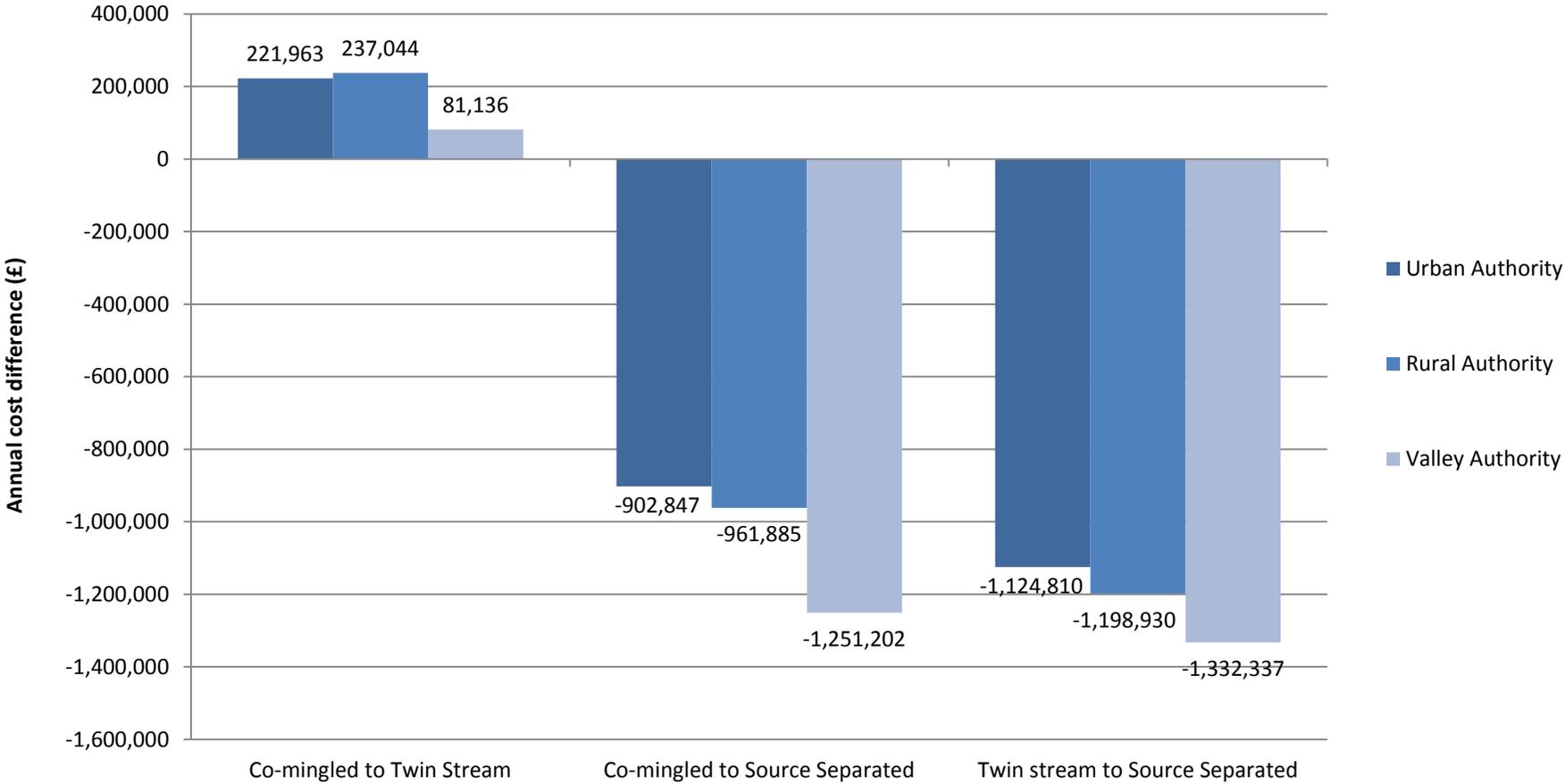
- *Vehicles:* Annualised capital costs, maintenance and fuel costs.
- *Staff:* Crew salaries (plus on-costs) and 16.5% cover.
- *Containers:* Required yearly replacements of containers.
- *Depot Operating Costs:* Operating costs (use of equipment, utilities, staff costs etc.) for the required depots for each service option.
- *Kerbside Dry Income/Gate Fees:* Processing costs/income for all dry recycling arisings, including haulage.
- *Kerbside Food Waste Processing:* Cost of food waste haulage and treatment.
- *Kerbside Residual Waste Disposal:* Cost of disposal of kerbside collected residual waste for each option, including haulage.

The following graph shows the operating cost differences between the three types of dry recycling collection. It shows what the cost differences would be if:

- An authority moved from a co-mingled collection to a twin stream collection;
- An authority moved from a co-mingled collection to a source separated collection;
- An authority moved from a twin stream collection to a source separated collections.

The graph shows the results for an urban authority, a rural authority, and a valley authority. In all instances source separation provides the lowest cost, followed by single stream commingled, with twin stream commingled the most expensive.

Annualised cost differences for average Welsh Authority



Initial Outlay Payback Period

Although source separated collections require the greatest initial outlay, they also offer the greatest annual savings. The table below details how long it would take to repay the initial outlay if switching from a co-mingled system given the possible yearly savings.

Capital Outlay Repayment Period	Source Separated		
	Urban	Rural	Valley
Total new containers (dry)	501,837	479,713	474,445
Total additional Depot	900,652	946,294	900,652
Total additional	1,402,489	1,426,006	1,375,096
Savings per year in comparison to co-mingled collection	902,847	961,885	1,251,202
Total payback period (months)	19	18	14

The table assumes that the Authority would look to pay back the entire initial outlay as soon as possible. It may be that an Authority would look to finance the outlay and pay it back over a longer period. This would enable them to still see a per annum revenue saving in comparison to operating a co-mingled collection, but this would be reduced to take account of the initial outlay repayments.

The payback period is calculated solely for the capital investment needed. Any change in service is likely to require additional expenditure on communications and planning as well as a period. It assumes that the authority operates with the same level of relative efficiency.

Contents

1. Introduction	10
1.1. Background	10
1.2. Scope	10
2. Service Profiles	11
3. Methodology and assumptions	12
3.1. Collection costs	12
3.2. Processing costs	16
3.3. Container use and costs	20
3.4. Depot set up and costs	22
4. Results	25
4.1. Urban Authority	25
4.2. Rural Authority	28
4.3. Valley Authority	31
4.4. Sensitivities – Pass rate changes	33
4.5. Initial Outlay Payback Period	35
4.6. Link between MRF gate fees and material income rates	36
5. Conclusion	37
5.1. Initial outlay	37
5.2. Annualised operating costs	37

Tables

Table 1: Average daily pass rates used in the modelling	13
Table 2: Vehicle unit costs	14
Table 3: Income rates used in the modelling (negative values show an income value)	18
Table 4: Gate fees used in the modelling	18
Table 5: Haulage rates used in the modelling	20
Table 6: Containers per household modelled for each option	21
Table 7: Depot set up assumptions used in the modelling	22
Table 8: Urban Authority Initial Outlay	26
Table 9: Urban Authority Annualised Costs	26
Table 10: Rural Authority Initial Outlay	28
Table 11: Rural authority annualised costs	29
Table 12: Valley Authority – Initial Outlay	31
Table 13: Valley Authority – Annualised Costs	32
Table 14: Pass Rate Sensitivity – Urban Authority	34

Table 15: Pass Rate Sensitivity – Rural Authority.....	34
Table 16: Pass Rate Sensitivity – Valley Authority.....	35
Table 17: Initial Outlay Payback Period.....	35

Figures

Figure 1: Urban Authority – Cost differences between service options	27
Figure 2: Rural authority – Annualised cost differences between service options	30
Figure 3: Valleys authority – Annualised cost differences between service options	33
Figure 4: Trend between income rates and MRF gate fees	36

1. Introduction

1.1. Background

During the past five years, WRAP has carried out a number of collections modelling projects on behalf of Welsh Local Authorities. The modelling has determined potential capital and revenue cost differentials for running different service profiles, including the Welsh Government Collections Blueprint. The work has helped shape current service provision in a number of authorities and has enabled a number of authorities to make significant revenue savings and increase recycling rates.

Following on from this, Welsh Government (WG) has commissioned WRAP to provide estimates of the costs of all Welsh local authorities providing harmonised recycling services.

This work comprises of two phases:

- Phase one: A comparison of direct operational costs of alternative recycling collection methods;
- Phase two: An analysis of the cost implications of alternative delivery structures, especially regional and national delivery of waste and recycling services.

This report details the outcomes of phase one.

1.2. Scope

There are a number of aspects that make up a Local Authority's waste budget. However, this project focuses only on the aspects that might be impacted by a change to an Authority's dry recycling collection profile, these are:

- Dry recycling collection costs;
- Food waste collection costs;
- Residual waste collection costs.

All other aspects, including garden waste, HWRC management, bulky waste collections, trade waste collections, adult hygiene products/nappy waste collections, and clinical waste collections are not included in the modelling results. Additionally, management and overhead costs have not been included in the modelling.

2. Service Profiles

Three collection profiles were modelled, these are as follows:

- Option 1: Single stream dry recycling (co-mingled), weekly collections.
- Option 2: Twin stream (co-mingled with separate glass), weekly collections.
- Option 3: Source separated collections, weekly collection.

For each of the above it was assumed that, as per standard kerbside recycling collections, the following would be collected:

- Mixed glass;
- Mixed plastics;
- Steel;
- Aluminium;
- Card;
- Paper.

In each of the above options the following profiles were assumed for food and residual waste:

- Food waste: Weekly collections;
- Residual waste: Fortnightly collections using 140 litre wheeled bins.

For each option, a model was developed for an urban, rural and valley Authority. Authority classifications were based on existing Welsh Government classifications, being:

- Urban: Cardiff, Newport, Swansea, Wrexham and Flintshire;
- Valley: Torfaen, Blaenau Gwent, Caerphilly, Merthyr Tydfil, Rhondda Cynon Taff, Neath Port Talbot, Bridgend;
- Rural: Isle of Anglesey, Monmouthshire, Powys, Vale of Glamorgan, Ceredigion, Carmarthenshire, Conwy, Gwynedd, Denbighshire and Pembrokeshire.

3. Methodology and assumptions

The modelling took place on an average sized Authority of 60,293 households. This number of households was used in the model for each type of Authority (i.e. urban, rural and valley).

It was assumed that service delivery would be provided 'in house' for all aspects of the service provision.

For each option, the following costs were calculated:

- *Vehicles*: Annualised capital costs, maintenance and fuel costs.
- *Staff*: Crew salaries (plus on-costs) and 16.5% cover.
- *Containers*: Required yearly replacements of containers.
- *Depot Operating Costs*: Operating costs (use of equipment, utilities, staff costs etc.) for the required depots for each service option.
- *Kerbside Dry Income/Gate Fees*: Income from all dry recycling and processing costs, including haulage.
- *Kerbside Food Waste Processing*: Cost of food waste haulage and treatment.
- *Kerbside Residual Waste Disposal*: Cost of disposal of kerbside collected residual waste for each option, including haulage.

It must be noted that all costs in this report are indicative and based on averages at a point in time, which may vary between Councils whilst the relative cost difference will remain true, absolute costs will vary. Additionally, we have assumed full replacement of all capital (vehicles, plant, containers); in reality much of this will already be in place.

3.1. Collection costs

3.1.1 Vehicle numbers and pass rates

In order to determine the required vehicle numbers for each option, average daily pass rates were used and these were divided between the number of households. The pass rates that were used were averages for urban, rural and valley Authorities. These were taken from a combination of previous local authority collections modelling work as undertaken by consultants (including WRAP) and known actual collection rounds. All pass rates are based on a 5 day collection week of 35 hours.

The average pass rates used are shown in table 1:

Table 1: Average daily pass rates used in the modelling

Collection Option	Materials collected	Vehicle Type	Urban	Rural	Valley
Option 1: Co-mingled	Co-mingled and food	Split back 26 tonne refuse collection vehicle (RCV)	1,558	1,026	1,375
Option 2: Twin Stream (separate glass)	Pass 1: Co-mingled recycling	Split back 26 tonne RCV for co-mingled and glass	1,558	1,026	1,375
	Pass 2: Separate pass for food	7.5 tonne non-compacting collection vehicle	1,477*	1,507	1,721
Option 3: Kerbsort	Source separated dry recycling and food	12 tonne resource recovery vehicle (RRV)	638	502	598
Residual Collections	Applies to all	26 tonne RCV with bin lift	1,041	827	1,047

* Pass rate for a separate food pass is lower in urban areas, than rural area, which is unlikely to be the case. However, there are limited data points available for this.

3.1.2 Vehicle Costs – capital, maintenance and fuel

Individual vehicle capital costs were determined using manufacturer quotes and the WRAP vehicle procurement framework (where applicable).

It was assumed that vehicles would be purchased by an authority through prudential borrowing of the required amount. The interest rate of 1.18% was used, based on the Public Works Loan Board online rates for borrowing over 7 to 7.5 years; however, it is appreciated that actual rates would be specific to an authority and some authorities may choose to purchase vehicles by other methods.

For each of the vehicles an assumed depreciation period of 7 years was used. This was determined from those typically used by Local Authorities at present.

Vehicle maintenance costs were determined using recent WRAP research¹.

The unit costs used for vehicle capital and maintenance are shown in the table below:

Table 2: Vehicle Unit Costs

Vehicle Description	Capital Cost	Assumed Depreciation (years)	Maintenance (per annum)
26 tonne RCV standard back with bin lift (for residual waste)	£149,000	7	£15,361
26 tonne RCV split back (co-mingled and twin stream collections)	£176,500	7	£18,505
12 tonne RRV	£126,968	7	£10,050
7.5 tonne non-compaction food waste vehicle	£69,113	7	£6,000
15 tonne flats recycling vehicle	£97,000	7	£12,634

Predicted yearly mileage per vehicle and fuel use was taken from the Eunomia Carbon Assessment² work. This was then projected out to determine the fuel use for the number of vehicles in the model. £0.92 (excluding VAT) was the unit cost used in the model for a litre of fuel; this was taken from recent WRAP research³.

3.1.3 Crew Numbers and Costs

Vehicle crewing levels were chosen on the most cost effective configuration for each system. In general, the lower cost the vehicle and the more sorting needed (and hence the higher the driver contribution) the lower the crewing.

All RCVs were considered to be crewed with one driver and two loaders. The 7.5 tonne food vehicle and the RRVs were considered to be crewed with one driver

¹ Taken from 2016 'Update of Kerbside Analysis Toolkit Default Data' report, written by Eunomia on behalf of WRAP.

² 'The Climate Change Impact of Recycling Services in Wales', written by Eunomia on behalf of WRAP, September 2016.

³ Taken from 2016 'Update of Kerbside Analysis Toolkit Default Data' report, written by Eunomia on behalf of WRAP.

and one loader. In addition, it is common for garden waste crews to reduce to driver and one loader over winter.

Examples of authorities that currently crew their vehicles with a driver plus one loader include; Bridgend, Newport, Merthyr Tydfil, Anglesey, West Oxfordshire, Cotswolds, Newtownabbey, Belfast, Lisburn, Armagh, Gwynedd (in part).

In addition to the above, cover levels of 16.5% were applied to staff costs.

Average unit crew costs (including on costs) and percentage cover rates were taken from recent WRAP research⁴.

It was assumed that there would be no difference in management, back office and other supervisory staff numbers between the options, so these costs were not included in the model.

3.1.4 Multiple occupancy housing (HMOs/flats) and narrow access properties

Narrow access collections were not included in the modelling. It was assumed that all households (except HMOs) would be served by standard access vehicles. It is appreciated that in reality a certain number of narrow access collections would be required, however these collections would be small in number so would not be likely to affect the overall outcome of the modelling. It was additionally assumed that each Authority would only use one size of vehicle for collections, it is accepted that currently some Councils use a range of vehicle sizes.

With regards to flats, it was assumed that not all flats in an Authority would require a separate 'flats based collection', but that only those flats that were not suitable for individual collections would. The total number of flats in Wales was taken from Census 2011 data and then an estimation of what proportion of the flats that would require a separate collection was determined using WRAP's experience from previous modelling projects. It was assumed that for the co-mingled and twin stream collections that the standard collection vehicle fitted with a bin lift would collect flats, whereas for the source separated collections the use of a separate flats collection vehicle was then built into the model.

⁴ Taken from 2016 'Update of Kerbside Analysis Toolkit Default Data' report, written by Eunomia on behalf of WRAP.

3.2. Processing costs

3.2.1 Waste arisings

In order to determine the waste arisings per household to use within the model, data of actual tonnages of residual, dry, and food waste, as collected by Welsh Local Authorities, was taken from Waste Data Flow for the 2014/15 financial year. This was split into urban, rural and valley Authorities. It was then used to calculate arisings per household per year for each of the Authority types.

Separately collected textile arisings were not included in the modelling. Where Local Authorities provided a separate collection for nappies and adult hygiene waste, this was included in the residual waste stream to ensure consistency between the data collected from different Councils. Commercial waste tonnages were also not included in the modelling.

This modelling work is predicated on Councils reaching the 70% recycling rate target. In order to achieve this Wales will need to further increase kerbside recycling, and combine this with improvements in household waste recycling centres, incinerator bottom ash recycling, reuse and trade waste recycling performance.

We do not consider the relative merits of targets here, but assume that they are achievable and observe that residual restriction where it has been implemented has seen significant increases in recycling yield (particularly food waste) at the kerbside.

In order to ensure that sufficient capacity for recycling collections has been modelled, we have assumed an uplift of 15% was applied per household for dry-recycling, and an uplift of 30% was applied to food recycling from 2014/15. This figure is in line with the changes in performance we have seen over the past 18 months from Councils introducing residual restriction. Residual waste arisings were then reduced accordingly.

The tonnages did not include any Material Recovery Facility (MRF) rejects or contamination. This was added to the co-mingled and twin stream collections based on the average percentage contamination as determined for such collections in the all Wales composition work⁵, as undertaken by WRAP in 2015/16. The rate of 10.7% was used for co-mingled collections, and 9.5% was used for twin stream collections.

⁵ 'National Municipal Waste Compositional Analysis in Wales', WRAP, 1/3/2016. Project code: WAL007-001

3.2.2 *Material Income rates*

The median value of WRAP's Material Pricing Report (MPR) for the period April 2015 to March 2016 was used to determine potential income returns from the sale of materials. The MPR is a nationally recognised material pricing index maintained by WRAP. The prices used are detailed in the table below. For mixed plastics and card, the mid-point value has been used due to higher rates of contamination being found in WRAP's experience to occur in these streams, for all other streams the high point value has been used.

Note: With regards to glass, the MPR was not deemed to be reflective of exclusively separately collected glass, as MRF glass is included in the average price. On this basis, rates as per the Lets Recycle index (which separates out MRF and container glass) were used as a means of determining a more relevant income rate.

The shaded values in table 3 are those that were used in the modelling.

All material income values are inclusive of haulage and are based on the use of domestic markets.

As a comparator, the column titled 'previous WRAP market analysis' shows prices derived from soft market testing undertaken by WRAP for a recent modelling exercise. The soft market testing has shown that the MPR values are broadly comparative to reality. The main difference is the rate for aluminium; however, this is due to the WRAP rate being based on 'spot buying', whereas the MPR rate being based on long term contracts.

Table 3: Income rates used in the modelling (negative values show an income value)

Material	Median			Previous WRAP market analysis
	Low point	High point	Mid-point	
Paper	-70	-80	-75	-78
Mixed plastics (mixed polymers)	-55	-95	-69	-62
Card (domestic, hard mix)	-45	-55	-50	-50
Glass	5	-8	-3	-12.5
Aluminium cans	-520	-600	-560	-725
Steel cans	-30	-53	-41	-50.0

3.2.3 Gate Fees

Median figures from the WRAP gate fees report 2015/16⁶ were used to determine gate fees within the model for anaerobic digestion (AD), energy from waste (EfW) and material recovery facilities (MRF). For twin stream collections, where co-mingled material is collected without glass, the gate fee report indicated that the co-mingled element of the twin stream collection would garner a £4 per tonne reduction in gate fee in comparison to co-mingled collections. However, soft market testing undertaken by WRAP indicated a reduction of nearer £10 per tonne was reasonable, so this figure was used in the modelling instead.

The gate fees used in the modelling are shown below:

Table 4: Gate fees used in the modelling

Facility	Price per tonne (excluding haulage)
Material Recovery Facility with glass (for dry recycling)	£47.42
Material Recovery Facility without glass (for dry recycling)	£37.42
Anaerobic Digestion (for food waste)	£42
Energy from Waste (for residual waste)	£92

⁶ 'Gate Fees Report 2016', WRAP

3.2.4 Haulage Rates

While the income rates included haulage, the gate fees did not, so these were calculated separately.

Through arranging haulage of different types of materials on behalf of Local Authorities, WRAP has built up a bank of data on price per load and price per mile for different materials. This data was used to determine haulage prices within the model.

It was assumed that 50% of the cost of a load was a standing cost and the other 50% was charged on a per mile basis. For the price per mile aspect of the charge, average distances from Local Authorities to the respective facilities that they currently use (or will use in new contracts) was determined. Using these figures, the price per mile aspect of the charge per load was calculated. The price per load was then converted into a price per tonne, which was used in the model.

The haulage rates used are stated in table 5:

Table 5: Haulage rates used in the modelling

Facility	Haulage rate (per tonne)
Material Recovery Facility with glass (for dry recycling)	£20.11
Material Recovery Facility without glass (for dry recycling)	£20.33
Anaerobic Digestion (for food waste)	£12.59
Energy from Waste (for residual waste)	£6.93

3.2.5 Material markets

It must be noted that both the gate fee and income rates have been taken for a period prior to the European Union referendum. Since the referendum, the materials markets have fluctuated and continue to do so. It is difficult at this point to predict the long term market effect; however, any effect seen is likely to be reflected eventually in both gate fees and material income rates.

3.3. Container use and costs

It was assumed in the modelling that an initial outlay of containers would be required for each of the services to be implemented, and that following this, a certain number of containers per year would need to be replaced.

3.3.1 Initial outlay

For the initial outlay it was assumed that the following containers would be provided to householders:

Table 6: Containers per household modelled for each option

Option	Dry recycling containers	Food container	Residual container
Option 1 (co-mingled)	<ul style="list-style-type: none"> • 104 single use sacks (based on use of 2 per week) 	<ul style="list-style-type: none"> • 23 litre kerbside caddy 	<ul style="list-style-type: none"> • 140 litre wheeled bin
Option 2 (twin stream)	<ul style="list-style-type: none"> • 78 single use sacks (based on use of 1.5 per week) • 1 x 55 litre recycling box for glass 	<ul style="list-style-type: none"> • 5 litre kitchen caddy • 156 caddy bags (based on use of 3 per week) 	
Options 3 (source separated)	<ul style="list-style-type: none"> • 1 x 55 litre recycling box for glass • 1 x 55 litre recycling box with lid for paper and card • 1 x 90 litre reusable sack for cans and plastics. 		

In addition to the above, an extra 10% of each container was modelled as being required as spares.

3.3.2 Replacement rates

It was assumed that for single use sacks, the same number would be required each year as was purchased for the initial outlay. For boxes and bins average replacement rates were taken from recent WRAP research⁷.

3.3.3 Container costs

Recent WRAP research⁸ determined that the majority of the Welsh authorities currently use the ESPO purchasing framework to purchase containers. On this basis ESPO (August 2016) costs were used as the container unit costs. For each of the items, the cost of the supplier that provided the cheapest unit price for a full load was used.

3.3.4 Container income

⁷ Taken from 2016 'Update of Kerbside Analysis Toolkit Default Data' report, written by Eunomia on behalf of WRAP.

⁸ Taken from 2016 'Update of Kerbside Analysis Toolkit Default Data' report, written by Eunomia on behalf of WRAP.

It was assumed that the containers would be provided free of charge, so the authority would not receive any income.

3.4. Depot set up and costs

3.4.1 Depot set up

For the purpose of the average authority model, it was assumed that there would be no existing bulking and transfer station, and that full construction and infrastructure costs would be required. In reality this is not the case as the majority of Welsh Councils already have transfer stations, though some would require changes for alternative collection systems

For each option it was assumed that the following would be required:

Table 7: Depot set up assumptions used in the modelling

Option	Urban and Valley Council	Rural Council
Co-mingled and twin stream	One depot, staffed by one supervisor and one operative, which will act as a transfer station for co-mingled, refuse and food.	Same as urban Council, but there will be two depots, each staffed by a supervisor and one operative.
Source separated	One depot, staffed by one supervisor and four operatives, which will act as a sorting and bulking station for dry recycling collections and a transfer station for refuse and food.	Two depots, one will operate as per the urban Council and one will operate as a 'feeder depot' that will be a transfer station for all materials. From this depot cans and plastics would be assumed to be transferred to the main depot to be sorted. The main depot will be staffed with one supervisor and four operatives, and the feeder depot will be staffed with one supervisor and one operative.

For each option it was assumed that a small office and staff mess area would also be required.

3.4.2 Depot initial build costs

Depot costs were split into construction and infrastructure costs and equipment and other items required.

Unit costs per square metre for the civils and buildings construction costs in each option were determined using actual construction costs data collected by WRAP through previous support to Authorities. These unit costs were multiplied by the average size of site based on data for similar sites to those required in the modelling to determine the estimated total construction costs.

Other costs were then built into the model for each depot, these were:

- An office building;
- The required bay walls;
- Two food waste skips;
- A weighbridge;
- Permit application.

For the source separated options, the cost of sorting equipment for cans and plastics was included, as well as a baler for main depots and a card compactor for the rural feeder depot. This cost again was taken from data collected from support previously provided by WRAP.

In addition to the above, 5% of the total cost was applied for design, supervision and planning, and an additional 5% was included as a contingency.

As costs of construction can vary greatly between sites, the figures used in the modelling are conservative estimates.

3.4.3 Annualised operating costs

Annualised operating costs per depot were split into staff, utilities, equipment, other and inter site haulage.

- Staff unit costs were taken from the WRAP survey of Councils⁹, and a cover rate of 16.5% (as per the vehicle crew cover rate) was applied.
- The utilities costs were taken from a Council currently providing a source separated collection and were increased or reduced accordingly, depending on the type of collection.

⁹ Taken from 2016 'Update of Kerbside Analysis Toolkit Default Data' report, written by Eunomia on behalf of WRAP.

- Equipment costs included the capital repayment and fuel costs for a loading shovel and fork lift trucks. It was assumed that source separated collection would require use of two fork lift trucks, and co-mingled and twin stream collections would require use of one fork lift truck (to unload containers etc.). In addition to the above, the costs included baling wire for the baling of cans, plastics and card where applicable.
- Other costs included permitting renewal costs and incidentals.
- Inter site haulage costs applied to the rural Council where the collection method was source separated. The costs referred to the movement of cans and plastics between the feeder site and the main site to be baled. The haulage rate per tonne of £51.06 was worked out in the same way as the haulage of other materials.

4. Results

The result of the modelling is shown in the following section. The results have been split into initial outlay costs and annualised costs.

As a reference, the tables include the following:

1. **Initial outlay:** The costs of the initial outlay include containers required for the applicable service profile and the costs of the required depot infrastructure. It was assumed for the purpose of the modelling that the authority would not have any form of a facility at present to use, and that a facility would need to be fully built. However in reality it is likely that most authorities would have some form of depot already in place, which would reduce the construction and infrastructure costs required.
2. **Annualised costs:**
 - *Vehicles:* Annualised capital costs, maintenance and fuel costs.
 - *Staff:* Crew salaries (plus on-costs) and 16.5% cover.
 - *Containers:* Required yearly replacements of containers.
 - *Depot Operating Costs:* Operating costs (use of equipment, utilities, staff costs etc.) for the required depots for each service option.
 - *Kerbside Dry Income/Gate Fees:* Processing costs/income for all dry recycling arisings, including haulage.
 - *Kerbside Food Waste Processing:* Cost of food waste haulage and treatment.
 - *Kerbside Residual Waste Disposal:* Refers to the cost of disposal of kerbside collected residual waste for each option, including haulage.

4.1. Urban Authority

4.1.1 Urban Authority – Estimated Initial Outlay

The table below shows the initial outlay required in an urban authority for each service option. Source separated collections require the greatest initial outlay, estimated to be over £4 million for an urban authority if built from scratch. However the exact outlay required would need to be determined on an authority specific level depending on the facilities that the authority already has.

Table 8: Urban Authority Initial Outlay

Initial Outlay	Urban Co-mingled	Urban Twin Stream	Urban Source Separated
Containers	£1,397,358	£1,469,494	£1,636,219
Depot	£1,701,695	£1,717,735	£2,602,347
Total	£3,099,053	£3,187,229	£4,238,565

4.1.2 Urban Authority - Annualised Costs

The table below shows the estimated annualised costs of operating each collection system in an average urban authority of 60,293 households.

Table 9: Urban Authority Annualised Costs

Annualised Costs	Urban Co-mingled	Urban Twin Stream	Urban Source Separated
Staff	1,108,047	1,538,600	1,557,825
Vehicles	841,752	1,033,616	1,063,187
Containers	311,117	277,548	173,105
Depot Operating Costs	124,863	125,016	258,439
Kerbside Dry Income / Processing	984,768	559,314	-739,221
Kerbside Food Waste Processing	341,733	341,733	341,733
Kerbside Residual Waste Disposal	1,502,738	1,561,154	1,657,103
Total	5,215,018	5,436,981	4,312,171
Rank - Most Economical	2	3	1

Source separated collection provides the lowest cost collection method, followed by co-mingled collections.

4.1.3 Urban Authority – Cost differences between service options

The graph below shows the annualised operating cost differences between the collection methods.

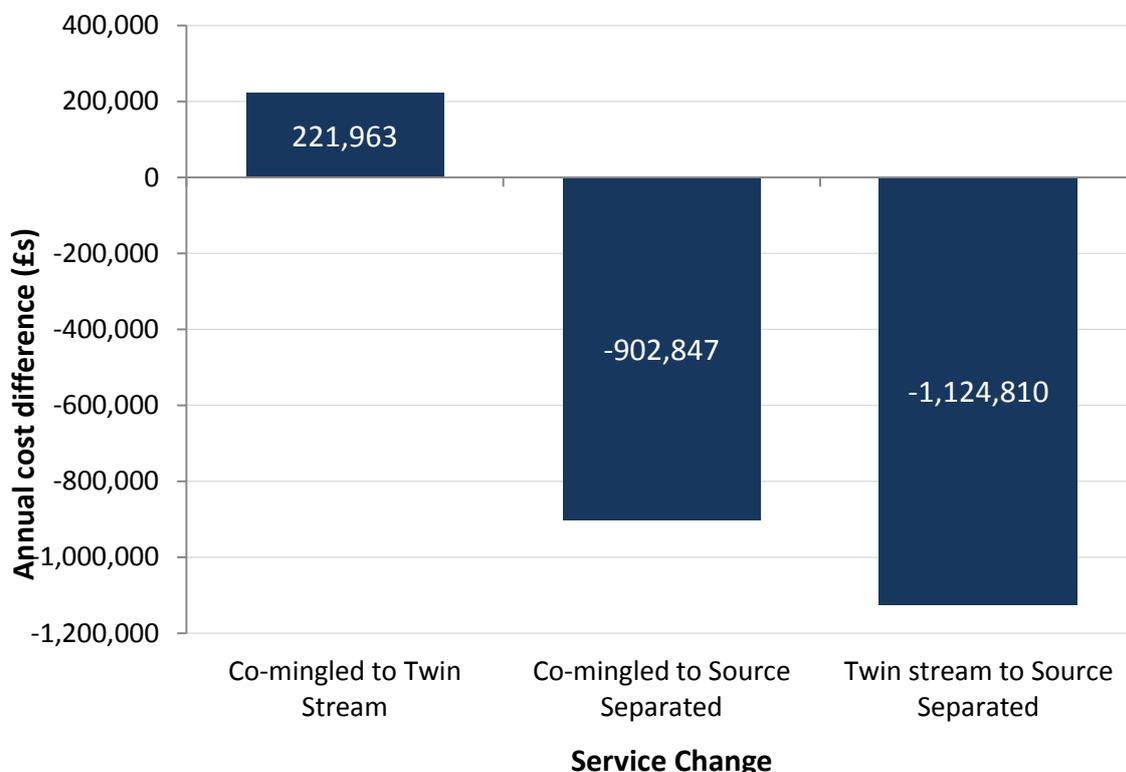


Figure 1: Urban Authority – Cost differences between service options

It is estimated that for an urban authority of 60,293 households, changing from a co-mingled to a twin stream collection would cost the authority £221,000 per annum. Conversely, moving from a co-mingled to a source separated collection would save the authority in the region of £902,000 a year, and moving from a twin stream collection to a source separated collection would save the authority over £1,000,000 per annum. These calculations are based on a well implemented service change and a settled service.

Although the source separated collections require more vehicles and staff, the vehicles are lower cost and more fuel efficient. Materials collected separately at source do not need to be re-separated and so bulking and sorting costs less. These factors account for the majority of the cost difference.

4.2. Rural Authority

4.2.1 Rural Authority - Initial Outlay

The table below shows the initial outlay required for each service profile. As with an urban authority, source separated collections in a rural authority require the greatest initial outlay in comparison to other collection options. The cost is estimated to be over £5.5 million if built from scratch. This is £1,184,357 more than a co-mingled system and £1,069,034 more than a twin stream system.

Table 10: Rural Authority Initial Outlay

Initial Outlay	Rural Co-mingled	Rural Twin Stream	Rural Source Separated
Containers	£1,374,570	£1,457,813	£1,612,634
Depot	£3,034,681	£3,066,761	£3,980,975
Total	£4,409,251	£4,524,574	£5,593,608

4.2.2 Rural Authority - Annualised Costs

The table below shows the estimated annualised costs of operating each collection system in an average rural authority of 60,293 households.

Table 11: Rural authority annualised costs

Annualised Costs	Rural Co-mingled	Rural Twin Stream	Rural Source Separated
Staff	1,584,161	2,026,510	1,988,472
Vehicles	1,185,059	1,387,940	1,372,691
Containers	318,183	283,444	173,738
Depot Operating Costs	250,335	250,640	439,290
Kerbside Dry Income / Processing	1,002,784	569,546	-752,745
Kerbside Food Waste Processing	296,701	296,701	296,701
Kerbside Residual Waste Disposal	1,426,594	1,486,079	1,583,783
Total	6,063,816	6,300,861	5,101,931
Rank - Most Economical	2	3	1

Source separated collection provides the lowest cost collection method, followed by co-mingled collection.

4.2.3 Rural Authority – Cost differences between service options

The graph below shows the annualised operating cost differences between the collection methods.

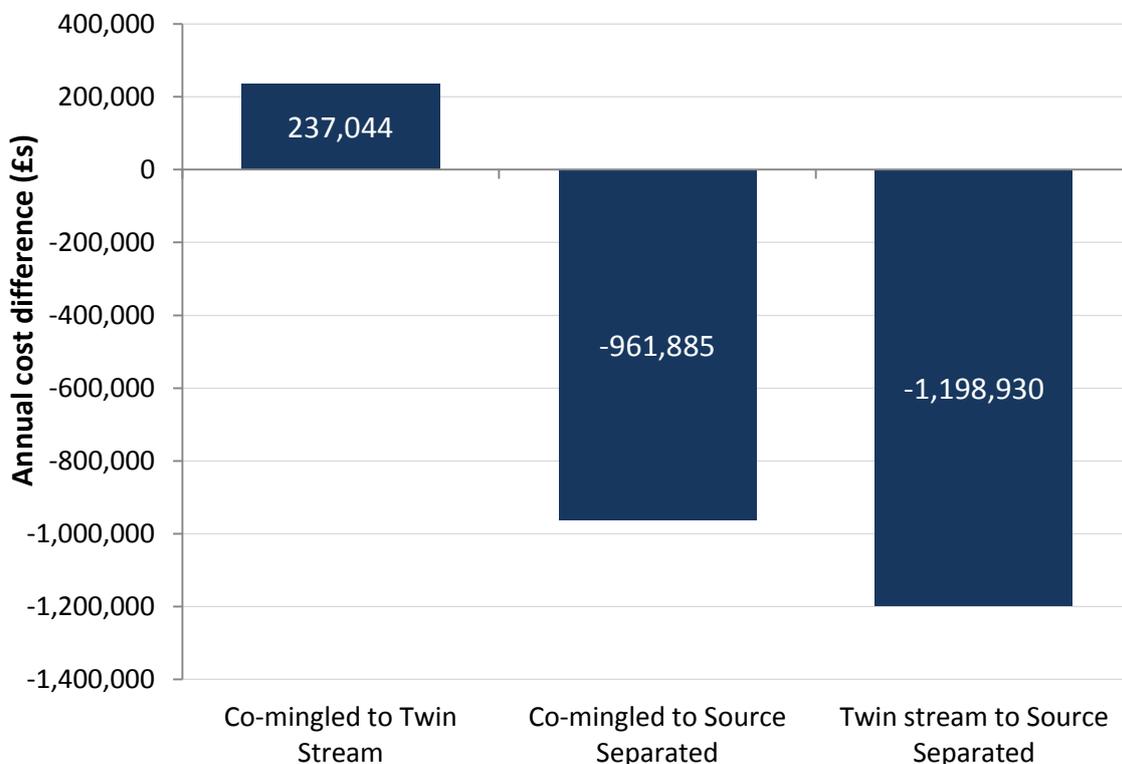


Figure 2: Rural Authority – Annualised cost differences between service options

A source separated collection system provides the lowest annualised cost, followed by a single stream commingled collection system with a twin stream co-mingled collection system the most expensive.

Although the source separated collections require more vehicles and staff, the vehicles are lower cost and more fuel efficient. Materials collected separately at source do not need to be re-separated and so bulking and sorting costs less. These factors account for the majority of the cost difference.

4.3. Valley Authority

4.3.1 Valley Authority - Initial Outlay

The table below shows the initial outlay required for each service profile. As with an urban and rural authority, source separated collections in a valley authority require the greatest initial outlay in comparison to other collection options. The cost is estimated to be in the region of £4.2 million if built from scratch. This compares to £3.1M for co-mingled and £3.2M for twin stream.

Table 12: Valley Authority – Initial Outlay

Initial outlay	Valley Co-mingled	Valley Twin Stream	Valley Source Separated
Containers	£1,368,542	£1,454,026	£1,606,038
Depot	£1,701,695	£1,717,735	£2,602,347
Total	£3,070,237	£3,171,761	£4,208,385

4.3.2 Valley Authority - Annualised Costs

The table below shows the estimated annualised costs of operating each collection system in an average valley authority of 60,293 households.

Table 13: Valley Authority – Annualised Costs

Annualised Costs	Valley Co-mingled	Valley Twin Stream	Valley Source Separated
Staff	1,220,583	1,609,850	1,658,091
Vehicles	935,647	1,096,712	1,114,643
Containers	319,631	284,596	173,784
Depot Operating Costs	124,863	125,016	260,332
Kerbside Dry Income / Processing	1,165,270	661,832	-874,716
Kerbside Food Waste Processing	312,353	312,353	312,353
Kerbside Residual Waste Disposal	1,695,929	1,765,052	1,878,588
Total	5,774,275	5,855,411	4,523,073
Rank - Most Economical	2	3	1

A source separated collection system provides the lowest annualised cost, followed by a single stream commingled collection system with a twin stream commingled collection system the most expensive.

4.3.3 Valley Authority – Cost differences between service options

The graph below shows the annualised operating cost differences between the collection methods.

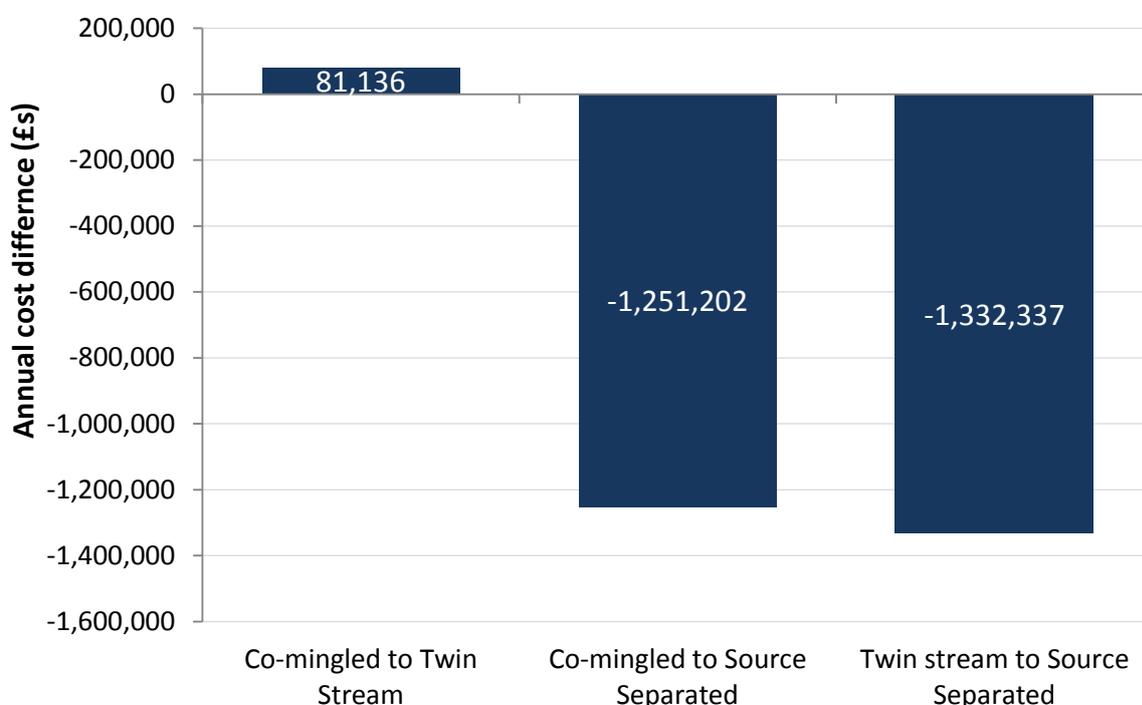


Figure 3: Valley Authority – Annualised cost differences between service options

A source separated collection system provides the lowest annualised cost, followed by a single stream commingled collection system with a twin stream co-mingled collection system the most expensive.

Although the source separated collections require more vehicles and staff, the vehicles are lower cost and more fuel efficient. Materials collected separately at source do not need to be re-separated and so bulking and sorting costs less. These factors account for most of the cost difference.

4.4. Sensitivities – Pass rate changes

A sensitivity was modelled to determine to the effect on the overall costs should the pass rate be increased or decreased by 10%. The tables 14, 15 and 16 below show the results of this in comparison to the core results. As can be seen there

is no difference in the relative ranking of options regardless of the variations in pass rates.

4.4.1 Urban Authority

Table 14: Pass Rate Sensitivity – Urban Authority

Urban Authority		Co-mingled	Twin stream	Source Separated
Core results	Total Cost	5,215,018	5,436,981	4,312,171
Pass rates increased by 10%	Total Cost	5,110,506	5,281,165	4,139,364
	<i>Cost difference from core</i>	<i>-104,512</i>	<i>-155,816</i>	<i>-172,807</i>
Pass rates decreased by 10%	Total Cost	5,408,708	5,684,243	4,578,343
	<i>Cost difference from core</i>	<i>193,690</i>	<i>247,262</i>	<i>266,172</i>

4.4.2 Rural Authority

Table 15: Pass Rate Sensitivity – Rural Authority

Rural Authority		Co-mingled	Twin stream	Source Separated
Core results	Total Cost	6,063,816	6,300,861	5,101,931
Pass rates increased by 10%	Total Cost	5,833,542	6,012,807	4,827,977
	<i>Cost difference from core</i>	<i>-230,274</i>	<i>-288,054</i>	<i>-273,954</i>
Pass rates decreased by 10%	Total Cost	6,336,481	6,636,831	5,383,537
	<i>Cost difference from core</i>	<i>272,6654</i>	<i>335,970</i>	<i>281,607</i>

4.4.3 Valley Authority

Table 16: Pass Rate Sensitivity – Valley Authority

Valley Authority		Co-mingled	Twin stream	Source Separated
Core results	Total Cost	5,774,275	5,855,411	4,523,073
Pass rates increased by 10%	Total Cost	5,568,728	5,598,131	4,290,340
	<i>Cost difference from core</i>	<i>-205,547</i>	<i>-257,280</i>	<i>-232,734</i>
Pass rates decreased by 10%	Total Cost	5,941,075	6,086,015	4,794,021
	<i>Cost difference from core</i>	<i>166,800</i>	<i>230,604</i>	<i>270,947</i>

4.5. Initial Outlay Payback Period

Although source separated collections require the greatest initial outlay, they also offer the greatest annual savings. The table below details how long it would take to repay the initial outlay given the possible yearly savings.

Table 17: Initial Outlay Payback Period

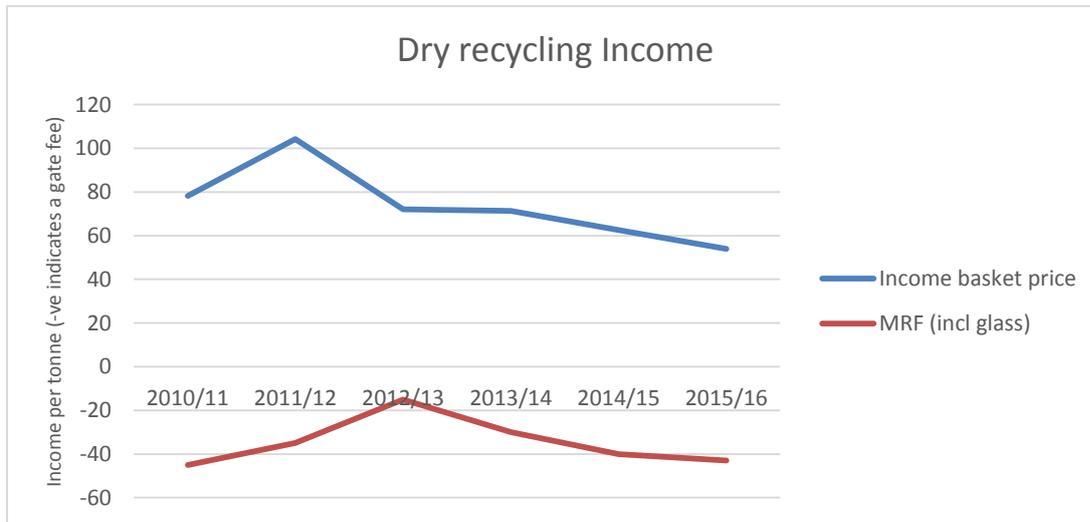
Capital Outlay Repayment Period	Source Separated		
	Urban	Rural	Valley
Total outlay required	4,238,565	5,593,608	4,208,385
Savings per year in comparison to co-mingled collection	902,847	961,885	1,251,202
Total payback period	5	6	4

The table assumes that the Authority would look to pay back the entire initial outlay as soon as possible. It may be that an Authority would look to finance the outlay and pay it back over a longer period. This would enable them to still see a per annum revenue saving in comparison to operating a co-mingled collection, but this would be reduced to take account of the initial outlay repayments.

4.6. Link between MRF gate fees and material income rates

The graph below shows how over the past five years the trend between income rates for materials and gate fees for MRFs. As the graph shows, there is a link between the two, with the trend being that as income rates reduce, gate fees increase.

Figure 4: Trend between income rates and MRF gate fees



Over the period the difference between MRF gate fees and average income is £108. This varies slightly over time, in part due to contract lags and in part due to less data points as several commingled Councils moved to source segregation over the time period.

Changes in material income, will impact on the overall cost of the options modelled, however they will not impact on the relevant performance of the option.

5. Conclusion

5.1. Initial outlay

For each of the options it was assumed that it would be necessary to fully purchase the required containers for the collection method, and that it would be necessary to construct a facility to accommodate the bulking, transfer and potentially sorting of the materials that are collected.

The source separated option required the greatest amount of investment for urban, rural and valley collections, ranging from in the region of £4,208,385 to £5,593,608, depending on the type of Authority. This was largely due to the need to set up a facility to bulk materials and sort cans and plastics, in comparison to the requirement to only set up a bulking facility for co-mingled and twin stream collections.

The construction costs determined in the model can be considered to be conservative. In most cases an Authority will already have some form of a depot that could be used as a base for the transfer, bulking and sorting facility (as required), which would reduce construction costs. Additionally, average sizes of sites and site buildings were used to determine the cost of civils and construction of site buildings. It may be the case that some existing sites have been developed over time and may be larger than that which is actually required. To gain a more definitive cost further work is likely to be required to consider waste flows and specific site requirements for each option.

Regardless of the above, each option will still require significant initial investment, particularly if Wales as a whole were to move towards a harmonised collection method. Even where Authorities currently provide the chosen harmonised collection method, there may be a required need to change, for example containment methods or colours of container. For many Councils capital funding available for waste infrastructure projects is minimal, so other sources of funding would need to be sought.

5.2. Annualised operating costs

In terms of annualised cost, only costs for food waste, dry recycling, and residual waste were included in the modelling. Aspects of costs that were included were vehicle costs (annualised vehicle capital repayments, maintenance and fuel costs), staffing costs including on-costs and cover, depot operating costs and material processing costs, and income.

The modelling for each authority type returned the same ranking of cost efficiency, this being (with 1 being the most cost efficient):

- 1 Source separated collections
- 2 Co-mingled collections
- 3 Twin stream collections.

The most expensive collection method was found to be twin stream commingled collections. The annualised operating cost was found to be between £80,000 and £222,000 more expensive than operating a co-mingled collection depending on the authority type, and over £1,000,000 more than operating a source separated collection system for all three authority types.

The increase in cost of twin stream collections from co-mingled collections was driven by the need to have a separate pass for food waste. The additional cost for vehicles and crew members resulted in there being a significant increase in the collection element of the overall cost in comparison to either co-mingled collections or source separated collections. While the dry recycling processing costs were far less for the twin stream collection than for the co-mingled collection, due to the ability to garner income from the glass in this method and a reduction of £10 per tonne in the gate fee of the co-mingled element in comparison to a full co-mingled collection, the reduction was not enough to counter the additional collection costs.

Both the twin stream collection and the co-mingled collections were deemed to be significantly more expensive to operate per annum than source separated collections. For an Authority of 60,293 households, annual savings in the region of between £900,000 and £1,200,000 are potentially achievable by switching from a co-mingled to a source separated collection, depending on the type of authority. Savings of over £1,000,000 are potentially achievable when switching from a twin stream collection to a source separated collection.

Although for each authority type the collection costs were higher for source separated collections than for other collections, the overall savings were driven by the dry processing costs generating an income, rather than being subject to a gate fee. The increase in collection costs for source separated collections was more than countered by the relative material income difference.

However, it must be noted that it may not be feasible for every Authority to make the same savings. It would depend on the size of the Authority, the current service provision, the Authority's inherent productivity, and the individual relative material income and processing costs.

www.wrapcymru.org.uk/recyclingcosts

