Technical report – Final

Preparation for re-use: a roadmap for a paradigm shift in Wales

Preparation for re-use: a roadmap for a paradigm shift in Wales

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Front cover photography: Preparing a chair for re-use at FRAME, Pembrokeshire.

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Glossary

Bulky waste – any article of waste which exceeds 25 kilograms in weight; and/or any article of waste which does not fit, or cannot be fitted into: (a) a receptacle for household waste provided in accordance with section 46 of the Environmental Protection Act 1990. or (b) where no such receptacle is provided, a cylindrical container 750 millimetres in diameter and one metre in length.

CIWM – Chartered Institute of Wastes Management

CO_2e – a universal unit of measurement that allows the global warming potential of different Greenhouse Gases (GHGs) to be compared.

DRS – deposit return scheme.

EfW – energy from waste.

ETS – emissions trading system.

FTE – full-time employee.

Greenhouse Gases (GHGs) – gases in the atmosphere, which absorb thermal infra-red radiation emitted by the Earth's surface, the atmosphere and clouds e.g. water vapour, carbon dioxide, methane and nitrous oxide.[1]

HWRC – Household Waste and Recycling Centre.

In-scope re-useable items (IRIs) – the model calculates the impacts of increasing preparation for re-use of specific items. These items were chosen as they are deemed to be items that can be commonly re-used and broadly relate to categories of waste recorded in WasteDataFlow. The IRIs are listed below with category groups assigned to aid reporting.

Category	IRI
Furniture	Hard furniture
	Soft furniture
	Office furniture
Clothing, shoes and textiles	Clothing, shoes and textiles
WEEE	TVs & monitors
	Fridges & freezers
	Large domestic appliances
	Small domestic appliances

[1] https://www.metoffice.gov.uk/climate-guide/climate-change/glossary

Category	IRI
	Electrical & electronic toys
	Automotive batteries
	Post-consumer, non-automotive batteries
Paint & varnishes	Paint & varnishes
Wood	Wood
Carpets and underlay	Carpets and underlay
Other	Books
	Mattresses
	Gardening tools
	Toys
	Bicycles
	Baby equipment

LACMW – Local Authority Collected Municipal Waste.

ONS – Office for National Statistics.

Paradigm shift – a fundamental change in approach.

Preparing for re-use – the Waste Framework Directive 2008/98/EC, article 3.16 defines 'preparing for re-use' as "checking, cleaning or repairing recovery operations, by which items or components of items that have become waste are prepared so that they can be re-used without any other pre-processing".

Recycling – the Waste Framework Directive 2008/98/EC, article 3.17 defines 'recycling' as "any recovery operation by which waste materials are reprocessed into items, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations".

Re-use – the Waste Framework Directive 2008/98/EC, article 3.13 defines 're-use' as "any operation by which items or components that are not waste are used again for the same purpose for which they were conceived".

TSO – 'third sector organisation', such as a charity or other not-for-profit organisation.

TSRO – 'third sector re-use organisation', e.g. a charity or other not-for-profit organisation which accepts items for re-use for later sale. Revenue typically funds the TSO's charitable aims. Charitable aims are also often furthered by the donation or low sale price of furniture and other items to those on low incomes. Preparation for re-use activities themselves provide social value through training and volunteering opportunities. Encompasses voluntary and community organisations, charities, social enterprises, social firms, cooperatives and mutuals, both large and small. The term Civil Society which includes these, but is broader in its coverage, is used in England.

Waste – any substance or object in the categories set out in Annex 1 of the Waste Framework Directive 91/156/EEC which the holder discards, or intends or is required to discard.

WasteDataFlow (WDF) – WasteDataFlow is the web-based system for municipal waste data reporting by UK local authorities to government.

Waste electrical and electronic equipment (WEEE) – electrical and electronic equipment or EEE means equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1,000 volts for alternating current and 1,500 volts for direct current.

WRAP – WRAP is a not-for-profit that works with governments, businesses and citizens to create a world in which we source and use resources sustainably.

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ao.com
Blaenau Gwent County Borough Council
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FCC Environment
Isle of Anglesey County Council
Powys County Council
RREUSE
St Vincent De Paul Society of Lane County, Oregon, USA

1.0 Introduction

This technical report supports the '*Preparing for re-use: a roadmap for a paradigm shift in Wales*' document (referred to as *The Roadmap*). It provides technical information regarding:

- details of the scope of the research and how the aims and objectives of the research shaped the research methodology;
- details of literature and data sources used;
- commentary around the various interventions included under each scenario in the roadmap report, including case study examples;
- details of the modelling approach, its outputs, interpretation of its outputs and its limitations;
- recommendations for further research.

The Roadmap is available here: http://www.wrapcymru.org.uk/preparation-reuse

1.1 Project objectives

The aim of the project was to research the potential for increasing the amount of material that is managed through preparation for re-use focused on local authority (LA) collected municipal waste (LACMW). The objective was to research good practice examples to present interventions that could be taken to achieve increased re-use. A model was designed that estimates the potential impacts across agreed factors associated with preparation for re-use activities and interventions. A series of four scenarios are outlined, along with a series of interventions that would help realise those scenarios.

1.2 Project scope

The Waste Hierarchy is the guiding approach behind managing waste more sustainably and its application is established in law through the Revised Waste Framework Directive 2008/98/EC. At the top of the hierarchy waste prevention is preferred where practicable and this includes direct re-use of items that, legally, are not defined as waste. This is followed by preparation for re-use, which is defined in the Framework Directive as activity in which goods that have become waste are rendered suitable for re-use. For example, inspecting and then selecting an item from the waste stream as suitable for re-use is defined as a preparation for re-use activity within the Framework definition. In contrast, repair and refurbishment activities conducted on items that have not entered the waste stream do not fall under the interpretation of preparation for re-use.

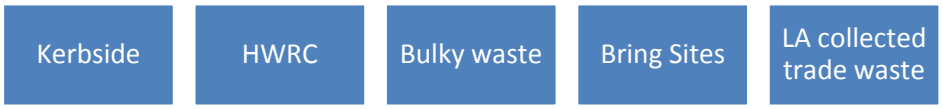
1.2.1 Waste management activities in scope

Activities that are defined as 'direct re-use' are out of scope. These include: informal direct re-use between family and friends, online auction sites, donations to charity retail stores, community-based re-use initiatives and car boot sales. Preparation for re-use involves re-using items that have entered the municipal waste stream.

1.2.2 LA municipal waste material streams in scope

The project scope was focused on preparation for re-use in LACMW which includes local authority trade waste collection services as well as collections from households and other municipal streams – see Figure 1.

Figure 1: LACMW waste streams in the scope of the Roadmap



1.2.3 Items in scope

Not all items in the LACMW waste stream are currently suitable for re-use. For the purposes of the research, the project focused on 7 main types of items. These items are referred to as *in-scope re-usable items* (IRIs) in the remainder of this report. Each Scenario had different intensities of re-use of the IRIs associated with it. The IRIs are detailed in Figure 2 below.

Figure 2: In-scope re-useable items (IRIs)

*Books, gardening tools, toys, bicycles & baby equipment

1.3 Overview of Scenarios

The Roadmap sets out actions and interventions that could be implemented to support increased preparation for re-use and the impact that these could have on the national re-use, recycling and composting rate, and other agreed metrics, for four different Scenarios:

- Scenario A: Welsh good practice;
- Scenario B: International good practice;
- Scenario B+: Maximum potential technically feasible; and,
- Scenario C: Paradigm shift.

There were no pre-determined criteria for what should or should not be included under each scenario. Decisions were guided solely by the scenario titles and information acquired through progressing through the various elements of the project methodology.

2.0 Literature and data review

A literature review was completed to develop well-informed views on what aspects of preparation for re-use each of the four scenarios would comprise.

In Wales and indeed the whole of the UK there is a well-developed re-use sector, but it is not fully coordinated, measured and reported. For example, except for WDF, there are

few, if any, comprehensive data sources to interrogate to derive tonnages of re-use activity of LACMW within the project scope.

A wide range of literature was studied and included:

- Waste composition studies and metrics;
- Welsh Government policy documents;
- Defra research;
- WRAP reports;
- Zero Waste Scotland research;
- Reports published on the Charity Commission website;
- Various re-use organisations' websites; and,
- Various re-use umbrella / campaign organisations' websites.

The literature review sought the most up-to-date information and examples of re-use regarding:

- Current practice in Wales;
- Current practice internationally;
- Commercial collaboration on take back;
- Extended producer responsibility;
- Cross-sector collaboration;
- Re-use hubs;
- Centrally coordinated (and funded) support;
- International and national statistics and targets;
- Re-use standards;
- Financial services and products supporting re-use;
- Training schemes;
- Communication of re-use to re-use organisations and the public;
- Examples of roadmap presentation;
- How re-use is marketed; and,
- Upcycling.

The literature revealed a great deal of information fragmented across many individual re-use practitioners' websites, plus several comprehensive reviews from research.

A recent comprehensive overview of the re-use sector in the UK was published by CIWM in late 2016.[2] It provided a point for explaining the baseline, informing Scenarios A and B and a starting point for which Scenario C could look forward.

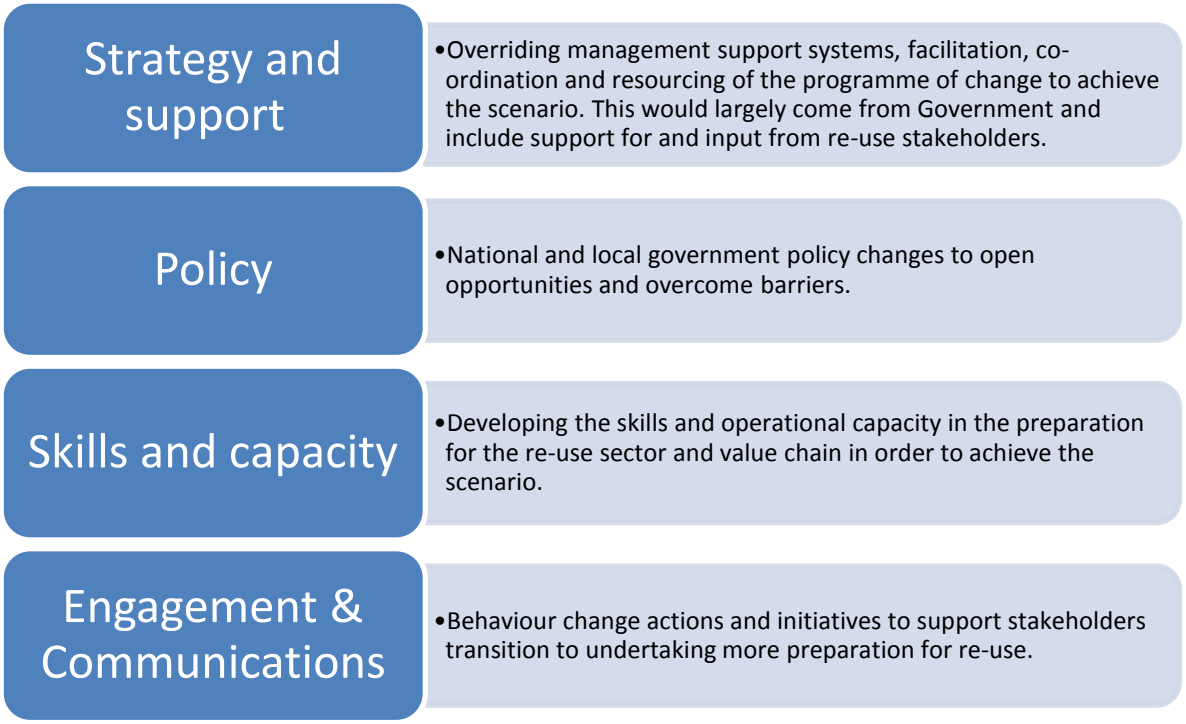
No survey was built into the project, though it was considered prudent to speak with a small number of re-use practitioners and local authority waste managers (described in section 3.0).

[2] *Beasley J, Georgeson R (2016) Reuse in the UK and Ireland – a 'State of the Nations' report for the Chartered Institution of Wastes Management*

The process for developing the scenarios was as follows:

1. A matrix was developed of salient ideas from the literature and interviews with re-use practitioners for increasing re-use tonnages of the IRIs in Wales and techniques for achieving that ("interventions"[3]) that would facilitate each scenario being realised;
2. The interventions were individually reviewed by the project team and an initial sort against each scenario heading completed;
3. The changes under each scenario were placed into the categories presented in Figure 3; and,
4. Further iterations of review, refinement, deletions, insertions and reordering of the changes to produce the final tables for The Roadmap.

Figure 3: Roadmap scenario presentation themes



The tables presented in The Roadmap are intended to give the reader a broad range of high-level examples of changes that would occur under each scenario for them to be realised. They are not exhaustive lists and do not provide a detailed plan. This Technical Report provides additional commentary, along with case studies, for each of the scenarios.

A bibliography is provided in Appendix 5.

2.1 Overview of data for modelling

The model baseline uses data from WasteDataFlow and composition studies to estimate the quantity of each IRI in the LACMW and how much is currently re-used, recycled, sent to EfW or landfilled.

[3] *For the purposes of this report 'interventions' are actions and changes that re-use stakeholders would take to achieve the scenario.*

Impact factors were established to convert the waste treatment tonnage for each IRI into impact results, and the values were sourced as part of the literature review. The data sources were selected by an assessment of relevance to the project, for example based on geography with first preference for data relating to Wales if available and secondly the UK. An assessment of quality was made, for example with preference for data from widely recognised sources such as Office for National Statistics (ONS), UK Department for Environment, Food and Rural Affairs (Defra) and WRAP.

The scenarios' assumptions were derived from WasteDataFlow to establish 'Welsh good practice' in preparation for re-use for Scenario A and an assessment of the condition of IRIs in the current waste stream was used to determine the technically feasible maximum level of re-use for Scenario B+. Scenario B is modelled as achieving a level of preparation for re-use half way between Scenario A and Scenario B+. The impacts of the paradigm shift in Scenario C carry a level of uncertainty that doesn't lend itself to numerical modelling in the manner undertaken for the other scenarios. Instead, the impacts of achieving zero waste by 2050 are explored, as the measures in Scenario C may form an important part of the programme to achieve this target.

Further detail on the model methodology and data is given in Section 5.0.

3.0 Stakeholder consultation

A number of stakeholders were contacted during the course of the project to sense check data and qualitative information, plus provide ideas for the scenarios. Requests for interview were made and the project team was successful in completing interviews with:

- A selection of the top-performing and lowest-performing local authorities in Wales with regards to preparation for re-use rate of the project items against overall LACMW;
- Representatives of charity retailers who are involved in preparation for re-use;
- An advocacy organisation representing social enterprises across Europe active in re-use, repair and recycling;
- A large charity organisation from North America involved in re-use to support funding its charitable activities;
- A leading waste management company; and,
- An online white goods retailer.

4.0 Scenarios

4.1 Introduction

The level of preparation for re-use increases in each scenario from Scenario A to B+. The scenarios are characterised in the model as follows:

- In Scenario A - Welsh good practice, preparation for re-use of IRIs accounts for 1.5% of all municipal waste generation by weight, reflecting the average performance of top five Welsh local authorities;
- In Scenario B – international good practice, preparation for re-use levels are half way between the performance of Scenario A and Scenario B+;

- In Scenario B+ - technically feasible maximum, preparation for re-use reaches the maximum feasible level estimated for each IRI, based on the condition of items currently found in the waste stream.

Further detail on the modelling approach is given in Section 5.0, and the method used to model the scenarios is detailed in Section 5.4.

Of course, increasing preparation for re-use will impact on demand for other forms of waste treatment. In the baseline, the IRIs undergo a range of waste treatment methods: preparation for re-use, recycling, EfW and landfill. The total tonnage of material does not change in each scenario, the model simply alters the balance of waste treatment methods used. The level of recycling, EfW and landfill of IRIs therefore is reduced (relative to the baseline) as material is diverted to preparation for re-use.

The increase in preparation for re-use activities has various environmental, social and economic impacts, such as avoiding greenhouse gas emissions and creating jobs in the re-use sector. Two sets of results are presented for each scenario:

1. Re-use in isolation, looking just at preparation for re-use activities, and
2. The scenario as a whole, considering the net impact of both the increase in preparation for re-use and the corresponding reduction in recycling, EfW and landfill.

The first set of results (re-use in isolation) represents growth in re-use from an increased quantity of material undergoing preparation for re-use. The results show that processing more material for re-use will create jobs, generate GVA, and save GHG emissions.

The second set of results (scenario as a whole) presents the net impact after the effects of lower levels of recycling, EfW and landfill (relative to the baseline) are included. In these results, for example, the number of jobs gained in the re-use sector is offset to some degree by reduced employment needs for the other waste treatment methods. Similarly, GVA gained from increased preparation for re-use is balanced against a lower level of GVA generation in recycling, EfW and landfill.

The model only calculates impacts relating to waste management of the IRIs and does not include impacts of treating or re-using other items and materials, such as rubble and soil.

The impacts of GVA, employment and salaries from jobs on the wider economy are calculated using 'multipliers' that estimate how growth in one sector will have a ripple effect that benefits supporting industries and the impact of increased spending created by growth. This is referred to in the results tables as '*including multiplier effects*'. Further detail is given in Section 5.2.8.

Impacts that have a monetary value in future years are 'discounted' in accordance with HM Treasury guidance to account for the time preference for money. This reflects the

inherent preference for monetary benefits in the near future rather than the distant future. Further detail is given in Section 5.2.9.

4.2 Baseline

4.2.1 Baseline overview and modelling

The baseline represents the 'do nothing' case in terms of preparation for re-use. The arisings and treatment of IRIs are based on the most recently published waste data and remain constant in the model baseline from 2019 to 2050. The impacts associated with preparation for re-use, recycling, EfW and landfill are calculated and presented below, first viewing preparation for re-use in isolation and then looking at the net impact of IRIs across all waste treatment.

Re-use in isolation

Table 1 and Table 2 show the impacts associated with preparation for re-use of IRIs. These results do not include the impact of any recycling, EfW and landfill of IRIs.

Table 1: Impacts from preparation for re-use activities for IRIs in baseline, cumulative values from 2019 to 2050

	Re-use in isolation
Re-use tonnage	389,000
Sale value of re-used items †	£239 m
GVA, inc. multiplier effects †	£134 m
GHG savings (tonnes CO_2e)	1,390,000
Value of GHG savings †	£91 m

† Discounted at HM Treasury discount rate

Table 2: Impacts from preparation for re-use activities for IRIs in baseline in year 2050 Baseline scenario as a whole

	Re-use in isolation
Jobs (FTEs), inc. multiplier effects	264
Salaries from jobs, inc. multiplier effects	£5.2 m
Volunteers (FTEs)	38

Table 3 and Table 4 show the net impacts associated with preparation for re-use, recycling, EfW and landfill.

Table 3: Baseline Scenario net impacts from all waste treatment of IRIs, cumulative values from 2019 to 2050

	Scenario as a whole
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	£171 m
GVA, inc. multiplier effects †	£1,450 m
GHG savings (tonnes CO_2e)	3,940,000
Value of GHG savings †	£233 m

† Discounted at HM Treasury discount rate

Table 4: Baseline Scenario net impacts from all waste treatment of IRIs in year 2050

	Scenario as a whole
Jobs (FTEs), inc. multiplier effects	1,430
Salaries from jobs, inc. multiplier effects	£25.7 m

4.3 Scenario A – Welsh good practice

4.3.1 Overview

Scenario A represents Welsh current good practice. In this scenario, preparation for re-use of IRIs accounts for 1.5% of all municipal waste generation by weight, reflecting the average performance of top five Welsh local authorities.

As the leading UK nation in re-use and recycling rates, it is unsurprising that there are examples of good practice in preparation for re-use taking place in Wales. However, this good practice is not systematically replicated across the UK, Wales included. There is significant potential to improve that by supporting and replicating key elements.

Scenario A assumes that a great deal more preparation for re-use can be achieved through introducing re-use focused services through the HWRC network and bulky waste collections, as is currently done by a handful of authorities across the country.

4.3.2 Achieving Scenario A – Welsh Good Practice

There are numerous examples of good re-use practice in Wales but there is little evidence of a coordinated programme or strategy, led by government, to increase re-use rates in a joined-up way and towards a common target or goal.

Achieving Scenario A will primarily be driven by working in partnerships with existing and new Third Sector Re-use Organisations (TSROs) to introduce preparation for re-use through the HWRC and bulky collection services. Critical to achieving success will be the involvement and a modest amount of additional effort, from each of the 22 local authorities and their waste contractors to facilitate and support the replication of good practice throughout Wales. This will require strategic support and direction from Welsh Government. The following sub-sections provide substantiation for the content of the Scenario A summary tables included in The Roadmap.

Strategy and support

It is recommended that a **Welsh Re-use Strategy Board is established with a remit to set a national re-use strategy**, coordinate efforts and support stakeholders. The board would lead and facilitate the development and implementation of a detailed implementation strategy plan, secure funding and work with local authorities, their waste contractors and re-use organisations. The Board's ongoing work would be key for achieving each of the scenarios (not limited to Scenario A). As the Welsh economy moves towards being more 'circular' (Scenario C paradigm shift) its remit will widen as will the number and variety of stakeholders it will interact with (including those acting outside of Wales).

For active engagement with re-use practitioners (and facilitators) it is recommended that a separate **Welsh Re-use Practitioners Working Group** is established. The Working Group would comprise representatives from all elements of the preparing for re-use value chain. As with the Welsh Re-use Strategy Board recommendation, its remit would likely widen as the re-use agenda moves ever-closer to achieving a paradigm shift of Wales fully transitioning its economy to a 'circular' one.

The development of a **local authority re-use toolkit** is recommended. The toolkit would build on WRAP's Household Waste Prevention Hub[4]. It would provide resources such as bilingual Welsh/English draft service contracts (between, for example, local authorities and re-use organisations, and re-use organisations and housing associations).

As highlighted in *Beasley and Georgeson*[5], the reuse sector at present is made of, "disparate stakeholders", and that there is a, "lack of any standardised data collection protocols, and challenges around developing robust methodologies to measure wider social value of reuse activities". To replicate good Welsh re-use practice and magnify the effect of working towards a common-goal (see later commentary on targets in Scenario B) better and more consistent quality data is recommended. The approach for Scenario A is two-pronged:

1) Establishment of a **directory of re-use organisations** activity and capacity including a monitoring and evaluation plan to capture operating scale and opportunity for expansion and collaboration;
2) Design and implement a common system, e.g. an online tool, to **more accurately and consistently measure preparation for re-use of LACMW**. The advantage for the participating re-use practitioners would be that the tool will calculate metrics for the wider benefits of re-use (as used in this report), including tonnes of waste diverted from landfill, tonnes of greenhouse gas avoided, jobs and volunteer placements created, and gross value added to the economy of Wales. Calculated metrics would aid re-use organisations in evidencing the wider added value impacts of delivering waste management contracts (with a high re-use element) for clients with a social remit (e.g. local authorities, housing association).

Under the Environmental Protection (Waste Recycling Payments) Regulations 2006 Waste Collection Authorities, and Waste Disposal Authorities (including Unitary Authorities) already have the power (but not legal obligation) to pay recycling credits to community groups, business or other who collect household waste for recycling, thus reducing the amount of waste they have to collect and dispose of. Local authorities in

[4] http://www.wrap.org.uk/content/household-waste-prevention-hub

[5] *Beasley J, Georgeson R (2016) Reuse in the UK and Ireland – a 'State of the Nations' report for the Chartered Institution of Wastes Management*

Wales, which are not already doing so, would likely increase preparation for re-use by promoting and **making recycling credits available to re-use organisations**[6].

As discussed in Section 5.5, the environmental and social impacts of the clothing sector are known to be high and re-use forms one of the five main elements of the WRAP Sustainable Clothing Action Plan (SCAP)[7]. It is recommended that **actions to increase preparation for re-use of clothing currently in the waste stream are co-ordinated with SCAP and its stakeholders across Wales**.

Policy

Cosmetic damage to bulky LACMW, e.g. refrigerators, often makes preparation for re-use uneconomic due the high cost of repairing such damage and the significant devaluation of items in the eye of potential purchasers (even though the item may be in perfect working order). It is recommended that each local authority is encouraged to establish **bulky waste collections which are geared towards protecting the outer surface of bulky items**, including but not limited to, training of operatives and equipment to cushion and hold the items in lifting and in transit.

Contracts may become more attractive to prospective bulky uplift contractors if they are long-term and multi-authority (making it worthwhile investing in efficient collection systems and to realise economies of scale).

'Re-use shops' feature on at least some local authority HWRCs (see the case study on the following page).

[6] *Eligibility criteria include: goods must be household waste (excludes donations to charity shops because such material is not classed as waste); waste must originate from the same LA area for which the claim is being made; cannot claim in addition to fees, if already contracted to a local authority; it is the collector (or 're claimer') not the 'recycler' (usually a merchant) who is eligible for recycling credits; the merchant must be registered with the local authority; there are currently differences across the UK schemes for what materials and sources can and cannot be claimed for, e.g. textiles, books, WEEE, door-to-door and the rates paid for each.*

[7] http://www.wrap.org.uk/sustainable-textiles/scap

Case study: Swansea's Tip Treasures

Tip Treasures is located at the Llansamlet HWRC, Swansea. Residents are requested to donate household items which "are too good to tip" directly to the shop or at any of Swansea's other HWRCs.

Items that Tip Treasures accepts include WEEE, furniture, homeware and audio/visual media, bicycles, clothing, tools, sports equipment and musical instruments.

Source: https://www.swansea.gov.uk/reuseshop

Re-use shops are places for the public to donate and purchase items that would have previously been placed in the HWRC skips and sent to recycling, EfW or landfill. Other examples of re-use shops in Wales include re-use shops run in Newport and Rhondda Cynon Taff by Wastesavers and the Recycling Centre, Wrexham, which is run by FCC Environment. It is recommended that **each of the local authorities in Wales provide re-use shops, or as a minimum, suitable donation points for preparation for re-use on all HWRCs** to boost collection and sale of re-useable items.

Skills and operational capacity

There are several examples of Wales-based re-use organisations which run online re-use shops[8,9,10] and an increasing trend to online shopping overall in the UK[11]. These online re-use shops are a useful way to increase the sales of items sourced through either HWRC or kerbside bulky collections rather than relying of physical retail premises alone. To enable re-use organisations to fully embrace the opportunity of online marketing and sales it would be prudent for **training in technical aspects of webpage design, legal**

[8] *http://nulifefurniture.co.uk/shop; http://www.pembrokeshire-frame.org.uk/product-category/furniture*

[9] *http://www.pembrokeshire-frame.org.uk/product-category/furniture/*

[10] *http://craftrecycling.org.uk/shop/*

[11] *https://www.ons.gov.uk/businessindustryandtrade/retailindustry/bulletins/retailsales/november2017#whats-the-story-in-online-sales*

obligations of distance-selling and effective online marketing strategies. Training providers could include the previously recommended Welsh Re-use Practitioners Working Group, WRAP Cymru or existing re-use networks such as the Furniture Reuse Network.

Preparation for re-use adds value to items by, sorting and grading, repairing broken items and making them cosmetically more attractive by removing dirt and grime. 'Upcycling' goes a step further by enhancing the value of a reusable item above what the original would fetch, even if in perfect original condition. Recovering a chair with a more modern fabric, painting an old wardrobe to an in-trend colour, adding some sparkle to already worn clothes, or turning a games console into a wall clock are all examples of upcycling. In Merthyr Tydfil, for example, Furniture Reborn[12,13] is a commercial enterprise providing customers with an upcycling services as well as retailing its own upcycled stock. It is recommended that a strategy in **training in upcycling techniques and promotion of upcycling** is developed and implemented across Wales. The training strategy would draw from experience gained through training providers such as Make it in Wales[14] and learning materials in WRAP's Resource Library[15]. The promotion strategy could be based on the #upcyclingrevolution bus which toured through Cardiff in June 2016[16], and the Cardiff Fashion Week / Love Your Clothes event during October 2016[17].

Niche material re-use projects already exist in Wales. For example, Community RePaint[18] is a proven model for collecting unwanted paint and getting it redistributed to help community projects and individuals on low incomes decorate property at much lower cost than purchasing new tins of paint. Coordination across Wales, assisted by the recommended national re-use strategy, would **help existing niche material re-use organisations explore and develop partnership opportunities**.

Engagement and communications

Consistent well designed multi-channel communications will play a vital role in promoting and supporting the required behaviour change of all stakeholders. There are various examples across Wales of local authorities promoting re-use services on their websites. Powys County Council, for instance, promotes Phoenix Furniture's re-use collection service on its 'What can I do with large items' page (see Powys County Council case study on the following page).

[12] http://www.furniturebywendy.co.uk/

[13] http://www.walesonline.co.uk/whats-on/shopping/reworked-vintage-items-available-new-11792151

[14] http://www.makeitinwales.co.uk/upcycling-course-details/

[15] https://partners.wrap.org.uk/search/?text=upcycle

[16] http://www.walesonline.co.uk/lifestyle/welsh-homes/upcycled-double-decker-bus-turned-11530678

[17] http://www.jomec.co.uk/altcardiff/no-logo/get-upcycling-and-save-the-environment

[18] https://communityrepaint.org.uk/?s=wales

Case study: Powys County Council

Powys Council's website directs residents with bulky waste to two re-use schemes (as well as its HWRCs), emphasising that collection is free.

Powys cleaning service are working alongside the **Homelessness Prevention and alleviation team** within Powys and are looking for unwanted recyclable household items (in good clean order) to be able to donate to people in Powys who are vulnerable or less privileged.

Collection is free of charge.

For more information please ring 01597 827500 or email cleaning@powys.gov.uk

Phoenix Furniture Collection Scheme

Phoenix is a registered non-profit making charity. They collect donated furniture, household goods and electrical items from the public. These are then cleaned and sorted before being passed on to Powys residents in need of low-cost furniture.

Phoenix will collect for free, contact Phoenix on 01686 623336 for more information.

Screenshot from: *http://www.powys.gov.uk/en/bins-rubbish-recycling/what-can-i-do-with-large-items*)

It is recommended that **all local authorities in Wales provide information on local re-use organisations on their 'bins and recycling' (or equivalent) webpages**. Such information should be 'first on the list' options for dealing with unwanted items, and not restricted to bulky waste. Recently, CIWM Cymru has written to every local authority in Wales asking them to put re-use options at the top of their bulky waste webpage – 19 of the 22 have agreed to this.

Gaining access to good quality, undamaged items suitable for re-use is in the interest of re-use organisations because it is a key route to maximising income from re-use. Re-use organisations could place themselves as stronger contenders for specific waste management contracts with, for example, local authorities. However, efficiently communicating the positive impacts re-use organisations have on society is not straightforward, though there are examples of good practice in Wales (see the Pembrokeshire FRAME case study on the following page).

Case study: Pembrokeshire FRAME

Pembrokeshire FRAME was originally known as 'Furniture Recycled and Managed Effectively'. 'FRAME provides opportunities through the operation of a community re-use projects and a horticultural project.'

FRAME regularly publishes its detailed social accounts on its website so the value it adds to its stakeholders and the wider community is clear:

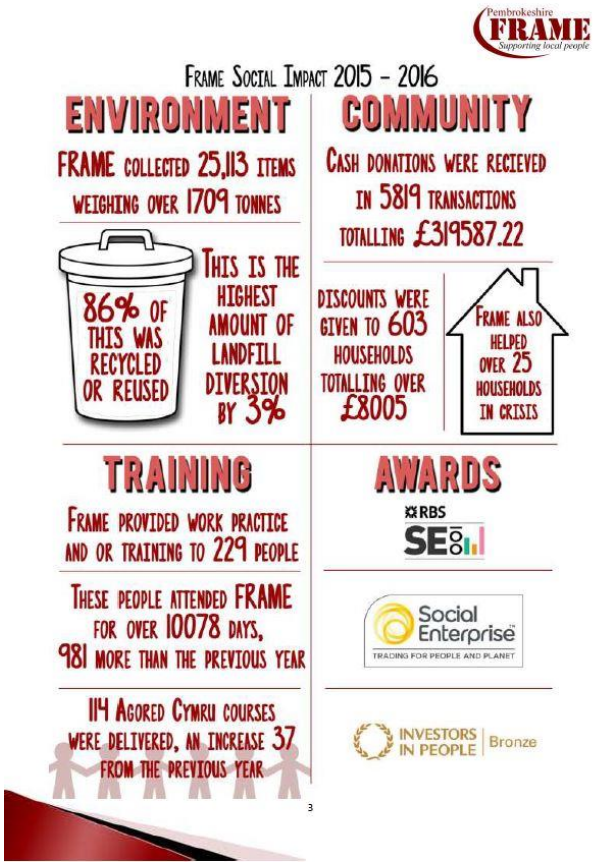


Image from: Pembrokeshire FRAME Limited (2016), Social Accounts Measuring Our Impact 1st April 2015–31st March 2016

It is recommended that **re-use organisations communicate the wider positive aspects of re-use on the community** in discussions with LAs and waste management companies around working in partnership on delivering services such as kerbside bulky waste collections and re-use shop concessions on HWRC sites.

The overriding theme of Scenario A is support of the replication of good practice in re-use of LACMW that already occurs in Wales. Knowledge of good re-use practice can be found on re-use practitioner's websites, on local authority web pages and on WRAP's Cymru's web page[19]. But, at present, there is no one recognised co-coordinated portal dedicated to re-use in Wales for which individual re-use practitioners can upload their own case studies. It is therefore recommended that **re-use practitioners (including local authorities) regularly share good re-use practice** between them and so build a

[19] http://www.wrapcymru.org.uk/node/34969

constantly updated re-use practice reference library. One existing on-line platform which could be utilised and promoted amongst practitioner is the Good Practice Wales website[20].

A summary roadmap for Scenario A is provided in Appendix 4.

4.3.3 Stakeholders

The main types of stakeholders for Scenario A are referred to throughout Section 4.3.2 but can be summarised as:

- Welsh Government, and any national re-use bodies it supports;
- TSROs;
- SME re-use organisations;
- Niche product re-use organisations;
- Local authorities;
- Commercial waste management companies; and,
- Information-sharing platforms.

4.3.4 Scenario modelling

Scenario A is modelled to reflect the average performance of top five Welsh local authorities. The defining characteristic of Scenario A is that the preparation for re-use of IRIs accounts for 1.5% of all municipal waste generation nationally, as this is the average performance currently achieved by the top five authorities. Preparation for re-use tonnage is increased steadily from current values to achieve the target rate in 2025 and then the tonnage remains constant to 2050.

Re-use in isolation

Table 5 and Table 6 show the impacts associated with preparation for re-use activities. These results do not take account of any reduction in recycling, EfW and landfill caused by increased re-use activity. The tables show the scenario impacts presented as absolute figures and relative to the baseline, for example +87% shows an 87% increase over the baseline performance. Results for other scenarios, presented in later sections of this report, are shown in comparison to the same baseline. The results for the baseline are presented in
Table 1 to Table 4 in Section 4.2, as referenced in the results below.

Table 5: Impacts from preparation for re-use activities on IRIs in Scenario A, cumulative values from 2019 to 2050

	Re-use in isolation	**% change against baseline (see Table 1)**
Re-use tonnage	727,000	+87%
Sale value of re-used items †	£560 m	+134%
GVA, inc. multiplier effects †	£234 m	+75%

[20] http://www.goodpractice.wales

	Re-use in isolation	% change against baseline (see Table 1)
GHG savings (tonnes CO_2e)	1,720,000	+24%
Value of GHG savings †	£111 m	+23%

† Discounted at HM Treasury discount rate

Table 6: Impacts from preparation for re-use activities on IRIs in Scenario A in year 2050

	Re-use in isolation	% change against baseline (see Table 2)
Jobs (FTEs), inc. multiplier effects	451	+71%
Salaries from jobs, inc. multiplier effects	£9.0 m	+71%
Volunteers (FTEs)	108	+182%

Scenario as a whole

The increase in preparation for re-use is shown in Figure 4. The height of each column shows the additional tonnage of material that undergoes preparation for re-use in the model scenario. The bars are subdivided to show how this material would have been treated in the baseline, i.e. whether the items are diverted from recycling, EfW or landfill.

Figure 4: Increase in LACMW re-use in Scenario A in 2050, showing how increasing re-use in the scenario effectively diverts waste away from other waste management routes used in the baseline

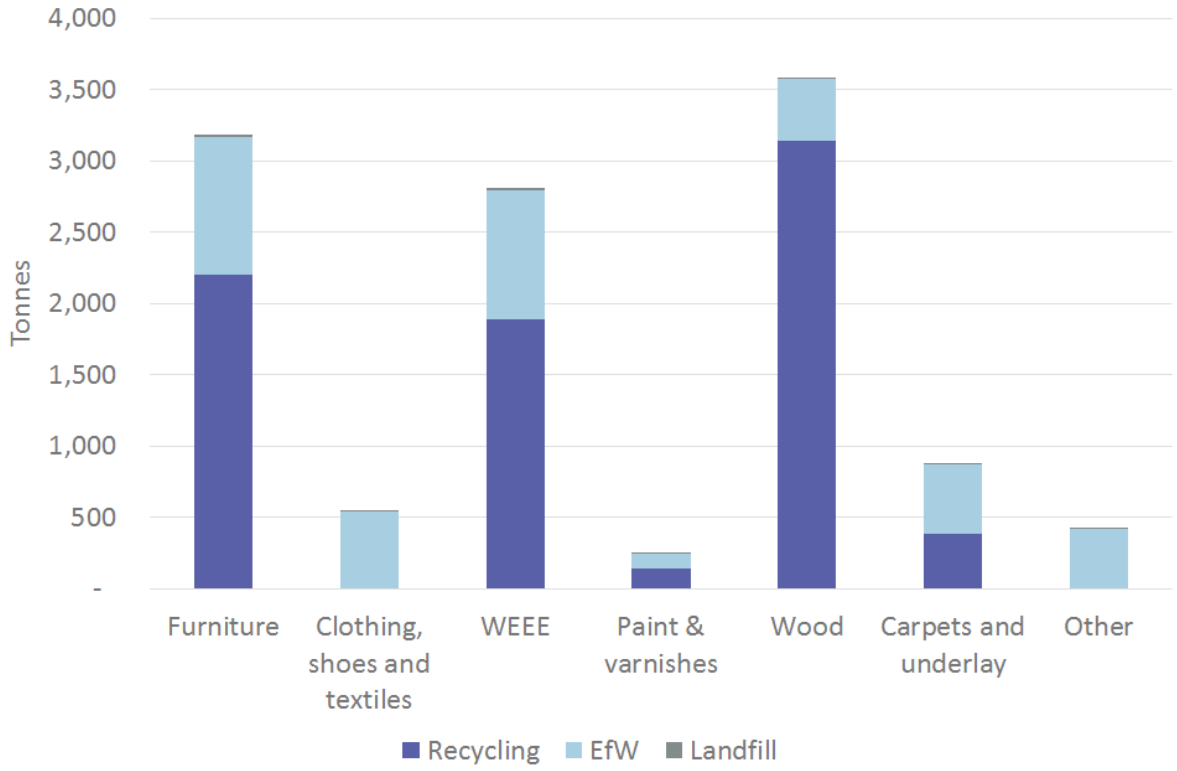


Table 7 and Table 8 show the impacts associated with preparation for re-use, recycling, EfW and landfill. The results differ from those presented for re-use in isolation because they reflect the wider impacts of the scenario and incorporate any negative impacts

caused by reduced demand for other waste treatment methods. The negative sign for the change in LA waste treatment costs indicates that these costs have reduced, relative to the baseline, as a result of diverting material to preparation for re-use away from other waste treatment methods.

Table 7: Impacts from waste treatment of IRIs in Scenario A, cumulative values from 2019 to 2050

	Scenario as a whole	**% change against baseline (see** Table 3**)**
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	£163 m	- 5%
GVA, inc. multiplier effects †	£1,460 m	+1%
GHG savings (tonnes CO_2e)	4,080,000	+4%
Value of GHG savings †	£242 m	+4%

† Discounted at HM Treasury discount rate

Table 8: Impacts from waste treatment of IRIs in Scenario A in year 2050

	Scenario as a whole	**% change against baseline (see Table 4)**
Jobs (FTEs), inc. multiplier effects	1,520	+6%
Salaries from jobs, inc. multiplier effects	£27.8 m	+8%

4.4 Scenario B – international good practice

4.4.1 Overview

Scenario B represents international good practice. In this scenario, preparation for re-use levels are modelled as half way between the performance of Scenario A and Scenario B+.

Scenario B broadly assumes that current examples of good practice from outside Wales can be replicated. This includes scale of operations, cooperation with government and commercial organisations. The changes assume that Scenario A has occurred, i.e. current examples of good re-use practice in Wales have been replicated and achieved across the country, and it is still focused on LACMW.

In Scenario B, behaviour and perceptions of re-use of LACMW are changing and effort continues to make it more acceptable and therefore mainstream, but there is still some way to go to reach the 'paradigm shift' outlined in Scenario C.

Scenario B increases the capture of IRIs through incorporating local on the ground solutions for engaging with communities to deliver preparation for re-use activities e.g. repair cafés and tool libraries. Government intervenes more through setting of preparation for re-use targets and providing incentives to drive activity up the waste hierarchy. The establishment of a re-use standard covering all points in the value chain

is established to support the required perception and behavioural change of consumers and manufacturers in engaging with the re-use sector.

4.4.2 Achieving Scenario B – international good practice

Strategy and support

It is recommended under Scenario A that a Welsh Re-use Strategy Board be set up to lead and implement a strategy to replicate Welsh good practice in re-use across the country. When looking beyond Scenario A and replicating international good practice across Wales it would be prudent for the **Board to evaluate the achievements and challenges from Scenario A (at a mid-point) to inform the detailed planning for Scenario B**.

A **strategy for developing Wales as an academic centre of excellence for re-use,** monitoring and evaluation of re-use and re-use partnership design across its universities would boost the country's chances of becoming the global leader in re-use rates. Research themes should include, but not be limited to, measuring re-use, social metrics, detailed models for greenhouse gas impacts, how to collaborate and deliver locally on national re-use plans and targets.

October 2017 saw the setup of the Benthyg[21] 'library of things' in Cardiff where members of the public are, "able to borrow essential but little-used items". Other, more-established, examples from outside of Wales include Leila[22] in Berlin, Germany; SHARE[23] in Frome, England; and the Library of Things, London, England. In Canada, the Toronto Tool Library operates out of four locations in the city of its namesake[24]. It is recommended that **a national network of libraries of things, swap shops and repair cafés is established, supported and promoted**.

At present Wales has preparing for re-use targets set out in the country's municipal sector plan[25] (see Table 9).

Table 9 - preparation for reuse target is set in the Municipal Sector Plan

Municipal Waste collected by local authorities (year)	2009/10	2012/13	2015/16	2019/20	2024/25
Minimum levels of preparing for re-use (excluding WEEE).	-	0.4%	0.6%	0.8%	1.0%

[21] https://www.facebook.com/Benthyg

[22] http://leila-berlin.de

[23] https://sharefrome.org/

[24] https://torontotoollibrary.com/about-2/locationsandhours/

[25] *Welsh Assembly Government (2011), Municipal Sector Plan, Part 1; Towards Zero Waste One Wales: One Planet*

The Welsh re-use targets are, however, non-statutory and so receive less focus than other targets. Other countries have set minimum targets for re-use. Spain has been the first European country to require a proportion of some types of waste electrical and electronic items (WEEE) to be prepared for re-use. The mandatory target requires 2% of large household appliances and 3% of small devices such as IT and telecoms equipment. In Flanders, Belgium, the re-use target (not restricted to preparing for re-use) is set on an annual weight per capita of 5 kg reused material by 2015, combined with an employment target of 3,000 FTE in re-use activity to be prepared for re-use from 2017; then 3% and 4% respectively from 2018[26]. The French target for re-use of furniture is based on increasing re-use from a baseline (see furniture re-use target case study).

Case study: furniture re-use target, France

France's re-use target, within the requirements of the country's Extended Producer Responsibility Scheme, has focused on supporting the wider social value that social enterprises provide through provision of job and training opportunities.

The target is to increase the amount of used furniture put back on the market by social enterprises by 50% over a 4-year period in comparison to a baseline situation.

Source RREUSE (2016), RREUSE response to the European Commission's Circular Economy Package Proposals

In light of the above case studies combined with the complexity of the subject area it is recommended that **the proposed Re-use Strategy Board research the cross-government implications of setting targets associated with job creation and/or greenhouse gas reduction in relation to setting future re-use preparation targets**.

There are examples in Wales of local authorities working in partnership with re-use organisations (see Phoenix Furniture case study on the following page).

[26] Boletín Oficial del Estado (2015), 1762 Real Decreto 110/2015, de 20 de febrero, sobre residuos de aparatos eléctricos y electrónicos.

Case study: Phoenix Furniture

The majority of furniture items received by Phoenix Furniture are donated to individuals and families who have been newly rehoused by Powys Council and housing associations through the organisation's Peace of Mind project. Peace of Mind also supplies bedding, curtains and clothes where possible. The project received interim funding from Powys County Council.

Phoenix's last annual accounts show less reliance on grant funding due to additional income streams from diversified activity. To further the income diversity, the organisation is collaborating with Powys County Council and the local housing associations to undertake house clearances for properties that have been vacated.

Source: Phoenix Community Furniture Scheme Ltd, Unaudited Trustees' Report and Financial Statements for the year ended 31 March 2017

It is recommended that the proposed Welsh Re-use Strategy Board **develops a programme to establish working arrangements to link re-use organisations with social housing landlords, so they can collect, prepare for re-use and redistribute those same items to social housing tenants**. An extension to the programme could also involve the collection of unwanted stock (e.g. customer returns) from retail partners that would be prepared for-re-use (St Vincent de Paul, Oregon, USA, is one example of an organisation that works closely with commercial retail organisations to re-use returned items, there are also examples in the England through the FRN).

Policy

Much has been written on the potential wider direct and in-direct impacts of re-use. The Well-being of Future Generations (Wales) Act 2015 is about improving the economic, social, environmental and cultural well-being of Wales and includes four key themes: i) prosperous and secure; ii) healthy and active; iii) ambitious and learning; and, iv) united and connected. In September 2017 Welsh Government published Prosperity for All: the national strategy[27]. The strategy sets out a vision and action for each of the four key themes, including 12 well-being objectives. Driving sustainable growth and combating climate change are key elements of the Prosperity for All strategy. This includes building on Wales' success in increasing recycling and working to reduce the impacts of production and consumption to develop a more resource efficient, resilient and vibrant economy. It is recommended that **re-use is recognised and supported as being a contributor to achieving the aims and objectives of the Well-being of Future Generations (Wales) Act 2015** in detailed policy and programme development.

[27] *Welsh Government (2017), Prosperity for All: the national strategy*

Local authorities should lead by example and demonstrate to all economic sectors and the public that re-use is credible as a routine practice. To create working sustainable re-use activity across local government, a **statutory obligation for local authorities to meet minimum re-use targets [3%] could be set.** The target could be across all material types or target specific items, e.g. furniture.

There is global precedence on prohibiting the deposition of certain materials and items in landfill facilities. Out of the 50 US states, 18 have landfill bans on white goods and four have mandatory recycling of white goods,[28] A joint report[29] by waste management firm Suez and charity think tank the Royal Society of the Encouragement of Arts, Manufactures and Commerce (RSA) as part of the Great Recovery Project recommended the UK should, "introduce a future ban on landfill for bulky waste items". It is recommended that Wales develop a policy to **ban the disposal of bulky items to landfill and energy from waste treatment in order to stimulate innovation on preparation for re-use, e.g. white goods.**

Revolve[30] is a Zero Waste Scotland re-use quality standard for shops who sell second hand goods in Scotland. The aim of the standard is to assure quality, reliability and professionalism in the re-use sector. To achieve certification a shop must commit to continuously meet the scheme's standards. Revolve offers training and checks to make sure the required standards are being met, e.g. shops are tested on customer care, shop layout, how they prepare goods for re-use, testing of goods and health and safety. Environmental Protection Agency Ireland awarded funding to Community Reuse Network Ireland to explore the concept of a quality mark for reuse between December 2016 and February 2018[31] (the results of which are pending). Using knowledge from the implementation of Revolve and research outcomes of the research in the Republic of Ireland, it is recommended that Wales develops an **accredited Welsh re-use standard and code of practice (with potential to sponsor a BSI Publicly Available Specification (PAS) for a fast track option). The standard could go beyond other existing standards to cover whole value chain: from collection and treatment, to retail, customer care and after-sales**.

Skills and operational capacity

In Scenario B, re-use organisations in Wales will be expanding their operations. To do so and remain efficient, different operating models will need to be developed to:

- Tap into new supplies of stock;
- Distribute stock to geographical areas where there is demand to match;
- Be able to repair a wider range of items and items in poorer condition when they are acquired; and,
- Be able to provide sufficient warehousing and retail space.

[28] *Northeast Recycling Council (2017), Disposal Bans & Mandatory Recycling in the United Sates, Revised May 2017*

[29] *RSA and Suez Recycling and Recovery UK (2015),*

[30] *http://www.revolvereuse.com*

[31] *http://www.crni.ie/news/quality-mark-project-kicks-off*

Interviews completed with a large re-use practitioner in the United States indicated that scaling-up would be key and that operations of re-use organisations could and should become more like regular chain stores (as landmark destinations for shoppers; not just incidental to a larger shopping trip), with retail unit size and logistics operations to match. Recommendations to support the scaling-up of re-use across Wales include:

- **Development of a shared online stock-sharing and transportation platform for re-use organisations** so that wholesale stock can be efficiently traded and transported between areas of high supply and high demand;
- **Support to transition micro local retail re-use stores to 'super-size retail warehouses'** where market conditions are suitable;
- **Establishment of regional re-use and repair hubs combined with a national (or several regional) network(s) of donation points in addition to the HWRC network** (repair of some items, or types of malfunction, will require more specialist skills and tools and a suitable volume of stock coming through to be economically viable – hubs would overcome the economies of scale require).

Engagement and communications

Fully achieving Scenario B envisages that re-use has become as mainstream as recycling is today. The public, re-use practitioners, public bodies and business are commonly familiar with the term, its meaning and its advantages over recycling.

It is recommended that a re-use helpline (and online help platform) for Wales is established, which provides efficient and consistent advice to householders. Scotland has a track record in providing such a service through the Re-use Line[32] (see case study below).

Case study: Re-use Line

Zero Waste Scotland's Re-use Line arranges collections of bed frames, mattresses, chests of drawers, bookcases, wardrobes, dressing tables, tables, chairs, sofas, armchairs, washing machines, electric cookers, fridge freezers and bikes.

Items donated via the Re-use Line are collected by local re-use organisations. These are usually social enterprises and charities which sell furniture in their re-use stores to raise money for their charity work, or to help people on low incomes to set up home.

In July 2017 the Re-use Line recorded its highest ever number of donations in a single month. The phone and online service achieved a record high of 928 items – or 30 tonnes of household goods – referred.

Source: http://www.zerowastescotland.org.uk/content/scotland%E2%80%99s-circular-economy-reaches-re-use-milestone

[32] *https://www.recycleforscotland.com/re-use/national-re-use-phone-line*

To gain traction in making re-use mainstream and building skills across Wales it is recommended that **Welsh Government should look to embed the principles and benefits of re-use through the Welsh education system**. That may include re-use as part of school lesson plans, specialist university degree modules and sponsorship of research degrees. In time it is envisioned that Wales will be a centre of academic leadership on the subject of re-use.

The proposed Welsh Re-use Strategy Board would have oversight for implementation but it very likely that **regional re-use coordinators** would benefit the transition (see the Devon County Council Re-use Coordinator case study below).

Case study: Devon County Council Re-use Coordinator

Devon County Council has procured the services of 're-use coordinators' to encourage re-use and repair. The coordinators developed a re-use forum, ran a series of skills-based re-use/repair workshops, developed community re-use kits for community led events and developed an on-line resource to identify re-use opportunities.

Achievements included:

- 1.82 tonnes of furniture and textiles collected for reuse;
- 21 free workshops with 160 attendees;
- 2 events kits published online and 1 Re-use it directory launched;
- 2 forum meetings with 25 different organisations;
- £24,427 income generated; and,
- £28,044 match funded.

Source: WRAP (2016), Innovation in Waste Prevention Fund – Review

To influence an increase in re-use rates it may be an advantage that **re-use, as a term becomes the 'new normal' when discussing waste.** Simple and subtle intervention measures can be influential in making changes to human behaviour and which do not require new rules, obligations, or restrictions – sometimes referred to as 'nudge theory'. 'Nudging' "proposes a set of seemingly simple, low cost solutions that do not require legislation and can be applied to a wide array of problems arising from our behaviour".[33] A theoretical example put forward by one of the stakeholders interviewed for this research was to **change the name of Household Waste Recycling Centres (HWRCs) to 'Household Waste Re-use and Recycling Centres' (HWRRCs); or, 'Household Re-use and Recycling Centres' (HRRCs)**.

[33] *Marteau, T. et al (2011) 'Judging Nudging: Can Nudging Improve Population Health?', British Medical Journal, 342: d228.*

A push on **awareness-raising of re-use through direct publicity campaigns** would also be applicable as it has been with recycling.[34] For example, a nationally recognised re-use campaign that is fronted by Welsh celebrities (e.g. rugby players) may be appropriate.

As re-use becomes more mainstream and moves beyond LACMW systems it will become ever more important to integrate Welsh re-use systems and efforts with wider stakeholders across the UK and beyond. Depending on the outcome of the UK's exit from the European Union, if appropriate, Welsh Government could add value to and benefit from **participating in the European Circular Economy Stakeholder Platform** – an EU-funded online portal advancing the circular economy concept and strengthening collaboration across the EU.

A summary roadmap for Scenario B is provided in Appendix 4.

4.4.3 Stakeholders

To achieve Scenario B, the number and diversity of people and organisations involved will increase as current system boundaries of collection of LACMW and its treatment blur with those of non-LACMW. The main types of stakeholders for Scenario B are the same as for Scenario A with the addition of:

- Schools and higher-education organisations;
- Social housing providers;
- Retailers;
- Landfill operators; and,
- UK and wider global re-use partners.

4.4.4 Scenario modelling

In Scenario B preparation for re-use levels reach halfway between those achieved in Scenario A and Scenario B+. Preparation for re-use tonnage is increased steadily from current values to achieve the target rate in 2030 and then the tonnage remains constant to 2050.

Re-use in isolation

Table 10 and Table 11 show the impacts associated with preparation for re-use activities. These results do not take account of any reduction in recycling, EfW and landfill caused by increased re-use activity.

Table 10: Impacts from preparation for re-use activities on IRIs in Scenario B, cumulative values from 2019 to 2050

	Re-use in isolation	**% change against baseline (see Table 1)**
Re-use tonnage	1,300,000	+234%
Sale value of re-used items †	£1,070 m	+348%
GVA, inc. multiplier effects †	£395 m	+195%

[34] *See: https://partners.wrap.org.uk/campaigns/recycle-for-wales/*

	Re-use in isolation	% change against baseline (see Table 1)
GHG savings (tonnes CO_2e)	2,320,000	+67%
Value of GHG savings †	£150 m	+66%

† Discounted at HM Treasury discount rate

Table 11: Impacts from preparation for re-use activities on IRIs in Scenario B in year 2050

	Re-use in isolation	% change against baseline (see Table 2)
Jobs (FTEs), inc. multiplier effects	823	+212%
Salaries from jobs, inc. multiplier effects	£16.3 m	+211%
Volunteers (FTEs)	243	+534%

Scenario as a whole

Increases in preparation for re-use in the scenario are balanced by reduced demand for recycling, EfW and landfill compared with the baseline. Figure 5 shows the reduction in these methods of waste treatment, relative to the baseline, that results from increasing preparation for re-use.

Figure 5: LACMW diverted to re-use in Scenario B in 2050, showing how increasing re-use in the scenario effectively diverts waste away from other waste management routes used in the baseline

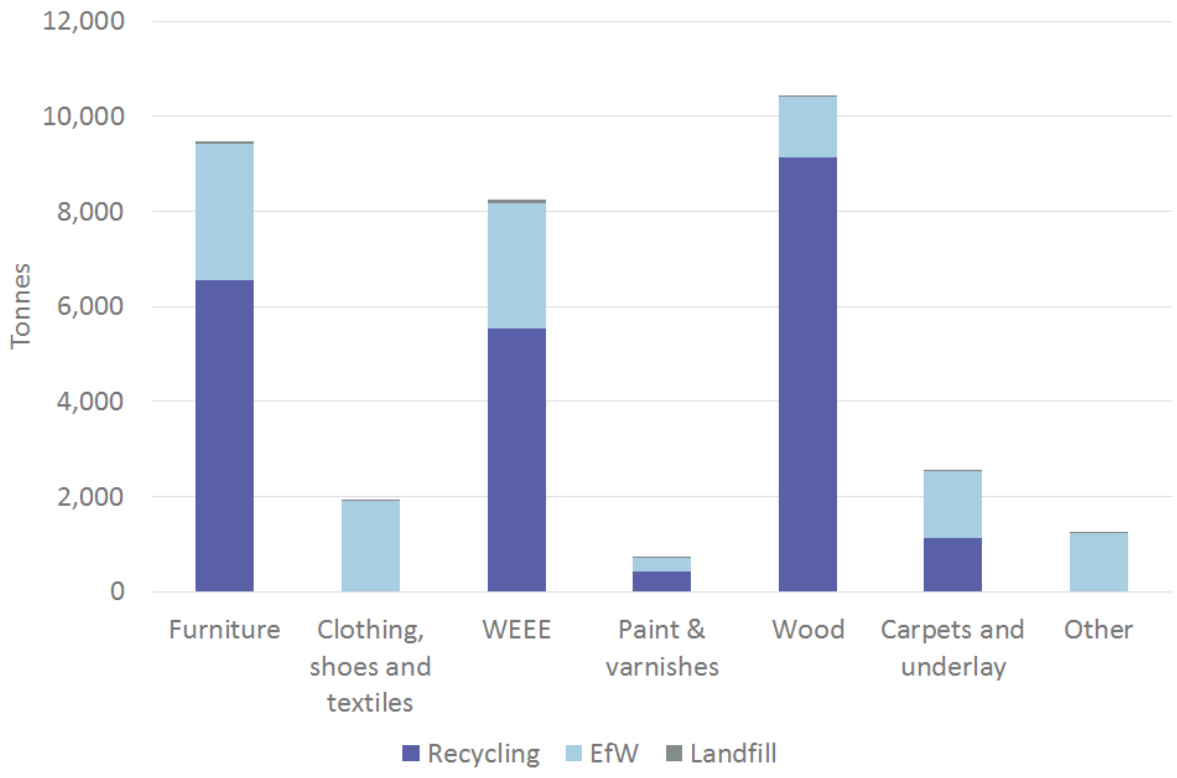


Table 12 and Table 13 show the impacts associated with preparation for re-use, recycling, EfW and landfill for IRIs. The results differ from those presented for re-use in

isolation because they reflect the wider impacts of the scenario and incorporate any negative impacts caused by reduced demand for other waste treatment methods.

Table 12: Impacts from waste treatment of IRIs in Scenario B, cumulative values from 2019 to 2050

	Scenario as a whole	**% change against baseline (see Table 3)**
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	£149 m	- 13%
GVA, inc. multiplier effects †	£1,470 m	+1%
GHG savings (tonnes CO_2e)	4,380,000	+11%
Value of GHG savings †	£262 m	+12%

† Discounted at HM Treasury discount rate

Table 13: Impacts from waste treatment of IRIs in Scenario B in year 2050

	Scenario as a whole	**% change against baseline (see Table 4)**
Jobs (FTEs), inc. multiplier effects	1,700	+19%
Salaries from jobs, inc. multiplier effects	£31.8 m	+24%

4.5 Scenario B+ – technically feasible maximum

4.5.1 Overview

Scenario B+ represents the technically feasible maximum, based on the condition of IRIs currently found in LACMW. Scenario B+ is presented as a theoretical maximum for preparation for re-use of LACMW with no system losses, but it is not a re-use rate ceiling for Wales because under Scenario C, the paradigm shift, re-useable materials would be diverted to enhanced direct re-use and preparation for re-use systems, before becoming LACMW. However, it is very likely that if the resources allocated to Scenario B interventions were increased, then it would be reasonable to expect the amount of material diverted through preparation for re-use activities to increase.

Scenario B+ looks at what is technically feasible rather than attempting to define a future route for preparation for re-use. It would not be wise to attempt to achieve Scenario B+ by focusing on re-use alone. Diminishing returns on investment would mean poor value for money. To increase re-use to its maximum potential it will be imperative to widen efforts to develop a circular economy approach (discussed under Scenario C). There is, therefore, no Roadmap presented for Scenario B+.

4.5.2 Scenario modelling

Scenario B+ is modelled to reflect the technically feasible maximum level of re-use. The maximum level of re-use is based on an assessment of the condition of items currently found in the waste stream.[35] Preparation for re-use tonnage is increased steadily from

[35] *See Section 5.4 for further details.*

current values to achieve the target rate in 2035 and then the tonnage remains constant to 2050.

Re-use in isolation

Table 14 and Table 15 show the impacts associated with preparation for re-use activities. These results do not take account of any reduction in recycling, EfW and landfill caused by increased re-use activity.

Table 14: Impacts from preparation for re-use activities on IRIs in Scenario B+, cumulative values from 2019 to 2050

	Re-use in isolation	% change against baseline (see Table 1)
Re-use tonnage	1,770,000	+355%
Sale value of re-used items †	£1,440 m	+503%
GVA, inc. multiplier effects †	£513 m	+283%
GHG savings (tonnes CO_2e)	2,810,000	+102%
Value of GHG savings †	£184 m	+103%

† Discounted at HM Treasury discount rate

Table 15: Impacts from preparation for re-use activities on IRIs in Scenario B+ in year 2050

	Re-use in isolation	% change against baseline (see Table 2)
Jobs (FTEs), inc. multiplier effects	1,190	+351%
Salaries from jobs, inc. multiplier effects	£23.7 m	+352%
Volunteers (FTEs)	379	+890%

Scenario as a whole

Increases in preparation for re-use in the scenario are balanced by reduced demand for recycling, EfW and landfill compared with the baseline. Figure 6 shows the reduction in these methods of waste treatment, relative to the baseline, that results from increasing preparation for re-use.

Figure 6: LACMW diverted to re-use in Scenario B+ in 2050, showing how increasing re-use in the scenario effectively diverts waste away from other waste management routes used in the baseline

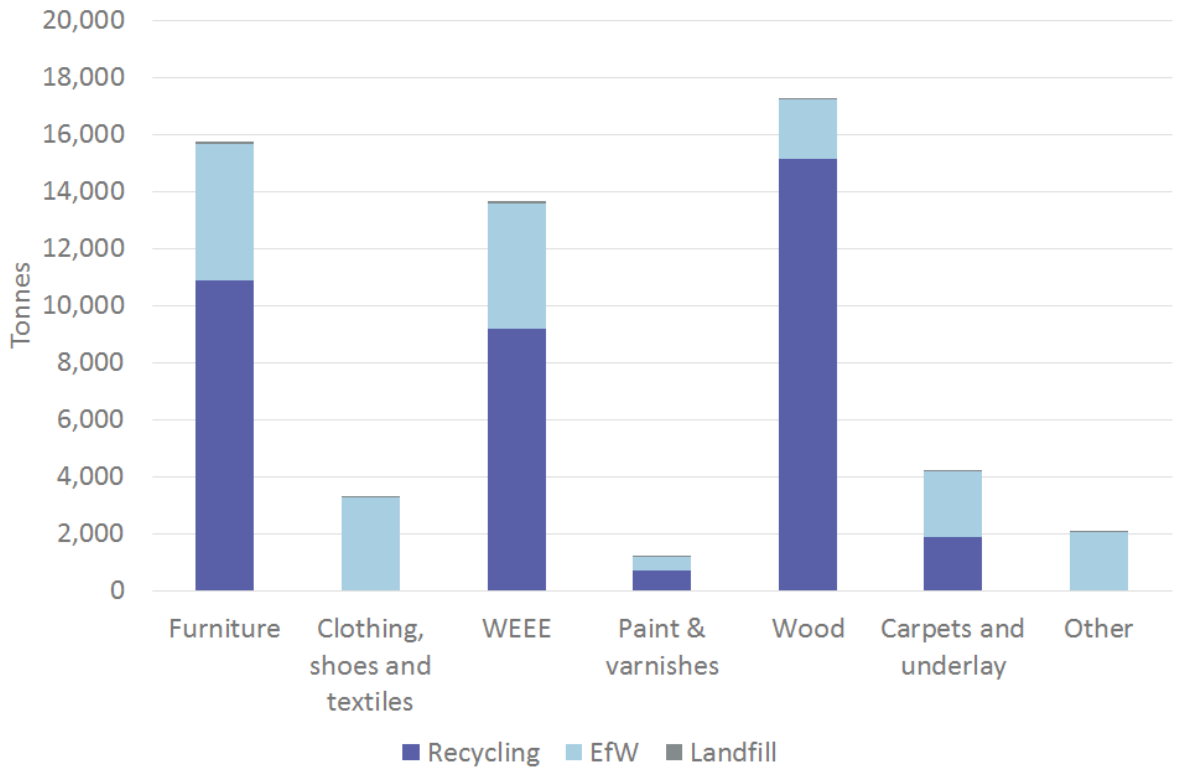


Table 16 and Table 17 show the impacts associated with preparation for re-use, recycling, EfW and landfill. The results differ from those presented for re-use in isolation because they reflect the wider impacts of the scenario and incorporate any negative impacts caused by reduced demand for other waste treatment methods.

Table 16: Impacts from waste treatment of IRIs in Scenario B+, cumulative values from 2019 to 2050

	Scenario as a whole	**% change against baseline (see Table 3)**
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	£139 m	- 19%
GVA, inc. multiplier effects †	£1,480 m	+2%
GHG savings (tonnes CO_2e)	4,620,000	+17%
Value of GHG savings †	£278 m	+19%

† Discounted at HM Treasury discount rate

Table 17: Impacts from waste treatment of IRIs in Scenario B+ in year 2050

	Scenario as a whole	**% change against baseline (see Table 4)**
Jobs (FTEs), inc. multiplier effects	1,880	+31%
Salaries from jobs, inc. multiplier effects	£35.8 m	+39%

4.6 Scenario C – a paradigm shift

4.6.1 Overview

Scenario C encompasses preparation for re-use within a paradigm shift of how goods are designed, produced, used and discarded in the wider economy. Scenario C addresses the role of preparation for re-use as part of a circular Welsh economy.

At a fundamental level, preparing for re-use in a circular economy should not be viewed as a waste management activity. Preparing for re-use does not "deal" in tonnes of material, but with valuable, socially useful items that have a positive sale value. If re-use is considered primarily as a waste management activity, rather than a means to extract the maximum possible value from items it is likely to remain in a subordinate position to landfill, energy recovery and recycling.

In Scenario C re-use in the Welsh circular economy will be embedded into the whole economy, including certain aspects of the taxation system which will be in line with the waste hierarchy.

It is not within the scope of this project to present a detailed Roadmap or a technical analysis of how the Welsh economy can develop a more circular economy or indeed the scale of opportunities that might arise in following such a move. However, this section in The Roadmap does present a range of actions and outcomes that would be anticipated to feature in a Welsh circular economy in relation to preparation for re-use only. The recommendations are bold and ambitious. They should be challenging, though not unrealistic, aspirations. They will require scrutiny and further development by a wide range of academics, officials, businesses and third sector organisations and other stakeholders. Scenario C is forward-looking beyond present-day systems and so there are fewer references and case studies to draw on.

4.6.2 Achieving Scenario C – a paradigm shift

Strategy and support

Developing the Welsh economy to a circular one and keeping it in line with the Well-being of Future Generations (Wales) Act 2015 will be complex and therefore extensive cross-sector research and planning will be necessary. **Use of the recently published British Standard, *BS 8001:2017 Framework for implementing the principles of the circular economy in organisations*** is one method that could be used to assess the relevance and opportunities of supporting the circular economy in Wales. The assessment should be framed around how a circular economy would support and very likely increase the impact of achieving the goals of the Well-being of Future Generations (Wales) Act 2015. An important element of the assessment and viable starting point would be to assess the impact of re-use as part of a circular economy for public sector services and procurement. The Welsh public sector touches many parts of the economy. A *systems thinking* assessment would be one possible method of initially understanding the scale, complexity and range of stakeholders involved along with the multitude of impacts that would result. This understanding of the interconnectedness is needed to

develop a viable plan for addressing the plethora of elements and stakeholders in the correct order.[36]

As the Welsh economy transforms to a circular one, the remits of the previously proposed Welsh Re-use Strategy Board and Welsh Re-use Practitioners Working Group (see Scenario A) will need to expand and evolve as re-use becomes a larger part of the economy. It is recommended that a **multi-disciplinary cross-sector circular economy delivery committee incorporating the Wales National Re-use Strategy Board and Forum is established** with the objective of developing and delivering transition plans on the circular economy.

Scenario C will be the achievement of a 'paradigm shift' in the Welsh economy, which will require complex planning and consensus on various matters across the UK and beyond. It would therefore be prudent for planning detailed policy **research is conducted between 2025 and 2035 into the mechanisms that would likely feature in a circular economy**, e.g. VAT rates in line with the waste hierarchy, Extended Producer Responsibility schemes and greater understanding and use of social return on investment metrics

It is recognised that there is social value in preparation for re-use from skill-building, social interaction, and to bringing access to goods that to some would otherwise find unaffordable. Investment by government (central and local) in improving LACMW practices and in developing the wider circular economy should, therefore, be recognised across a wider range of organisational departments than environmental and waste departments. In other words, there should be recognition, in terms of department budgets, that investment in re-use aids the achieving of other departments' objectives. Cross-sector collaboration needs to be established to ensure holistic sustainable actions are developed and implemented. To reach full development it is recommended that **a strategy is set for researching all public sector procurement assessed on sustainable circular economy criteria against positive impact on holistic long-term aims**, e.g. social inclusion, material stewardship, long-term prosperity, and economic resilience.

Building from the earlier recommendation in Scenario B to establish Wales as a global centre of excellence for re-us, it is recommended that a **strategy is set for Wales to become a global leader in supporting and implementing circular economy business practices** including re-use. This would include academic research on circular design and manufacturing practices, how financial institutions can and should support the transition from linear to circular business models and circularity metrics for governments and businesses.

Hand in hand with efforts by academia and other research organisations, it is recommended that Wales **set-up an innovation fund for new 'designed for the circular economy' products, initiatives, and business models**, with project and pilot studies to be led by private sector innovators. It should build on the success of cross-

[36] *See 'BS 8001:2017: Framework for implementing the principles of the circular economy in organizations – guide' for further guidance and possible methods of assessment.*

sector collaborations based on re-use (see Scenario B) to evolve into sustainable circular economy good practice.

Financial practices and services are at the heart of all economies and it is no different for the circular economy. Understanding how money flows through a circular economy and what the transition means for the finance sector is critical e.g. reframing expectations on aspects such as return on investment periods. It is recommended that **Welsh Government work with the finance sector to develop financial products and services that support the transition from the linear to circular business models.** Understanding the financial implications of transitioning and need to support the long-term objectives of business through developing, establishing and growing circular practices will be key.

Policy

A sustainable circular economy is well aligned with the goals of the Well-being of Future Generations (Wales) Act 2015. Following the various assessments detailed in this Section 4.6.2, it is recommended that **Welsh Government look to incorporate the aims of achieving a circular economy with future revisions and updates to the Well-being of Future Generations (Wales) Act 2015**.

Whilst it can be politically sensitive and highly complex, a long-term research programme is needed to provide a robust evidence-base for policy change to incentivise circular-thinking in the economy. It is recommended that research is conducted to **evaluate economic instruments, e.g. tax single use items more than reusable items, the role of extended producer responsibility schemes, incentivisation of action up the whole of the waste hierarchy, tax breaks for TSROs**. This sounds radical but, in many ways, it is not. In the UK there are already taxes on disposing of waste to landfill[37] and an emissions-based duty on vehicle emissions.[38] Research by RREUSE has identified several EU countries which have preferential value added tax (VAT) rates for repair and for the sale of used goods, and that in New York State, in the United States, tax deductions are used to incentivise donations of used items to social enterprises.[39]

Maximising product design for durability, repair, refurbishment and remanufacture is a key aspect of increasing the re-use potential of goods. Planned obsolescence has been defined as an, "assortment of techniques used to artificially limit the durability of a manufactured good to stimulate repetitive consumption".[40] As a variation, Apple's products, for example, are durable but it has been alleged the company has made it deliberately difficult for its customers to replace basic components in them.[41] Whilst

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[37] *Landfill Tax primary legislation is contained in the Finance Act 1996*

[38] *Vehicle Excise Duty (VED) was reformed in 2001 when a carbon dioxide emissions-based system was introduced for cars registered from 1st March 2001 onwards. This was part of the then Government's policy to use transport taxes to create incentives for the reduction of emissions. Source: https://www.legislation.gov.uk/ukpga/2009/10/notes/division/1/13*

[39] *RREUSE (2017) Reduced taxation to support reuse and repair*

[40] *Slade G, (2006) Made To Break: Technology and Obsolescence in America*

[41] *Reuters (2011) Apple tightens the screws on iPhone 4: sources*

those techniques may be true for some manufacturers, others will simply design their products to have certain functions, look a certain way and meet a certain price point – reparability, certainly DIY repair, can be low-down on the list of design criteria. Theoretically, if consumers knew about these aspects of the product, availability of spares along with a stated anticipated lifetime, they would be able to make informed choices at the time of purchase. It is recommended that **targeted, product-specific reparability standards and repair documentation transparency are supported through eco-labelling on reparability and expected product lifetime.**

There has been much in the press at the end of 2017 and early 2018 regarding a deposit return scheme (DRS) for plastic bottles in the UK.[42,43,44] It would also be possible to apply DRSs to other goods to encourage their re-use through specialist systems. An example from California, USA is provided in the case study below.

Case study: Used Mattress Recovery and Recycling Act, State of California

In California, USA, the Used Mattress Recovery and Recycling Act (as amended) requires mattress manufacturers to create a state-wide recycling program for mattresses and bed bases discarded in the state.

The California Department of Resources Recycling and Recovery (CalRecycle) has certified the Mattress Recycling Council (MRC) to develop and administer a programme known as Bye Mattress.

MRC funds its California activities through a $10.50 per unit recycling fee collected from consumers when they buy a mattress or bed base. Residents of California may drop off discarded mattresses and box springs at a recycling facility, collection point or collection event. They will receive a $3 incentive for each unit they drop off (up to five units per day).

Sources: http://www.mattressrecyclingcouncil.org; https://byebyemattress.com/

Other mattress DRSs are in place in Connecticut and Rhode Island. It is recommended that **DRSs in Wales are considered for goods such as large electrical goods and mattresses**.

[42] *BBC News (2 October 2017) Michael Gove suggests plastic bottle deposit scheme*

[43] *The Telegraph (21 December 2017) Bottle deposit scheme must be introduced to 'turn back the plastic tide' warn MPs*

[44] *letsrecycle.com (22 January 2018) Coffey inspects European bottle deposit schemes*

Skills and operational capacity

In Scenario C - the paradigm shift, Wales will have benefitted from the push in research for re-use and circular economic practice through the education system, to become the **global leader on educational support on sustainable circular economic theory and practice.** Sustainable circular business training programmes will be mainstream e.g. Master of Circular Business Administration (MCBA, the new MBA) qualifications will be delivered by Welsh academic institutions and supported and sought after by employers**.**

TSROs will be operating at scale and delivering cross sector partnership collaborations across Wales on re-use. In Scenario C extended producer responsibility schemes are likely to play a vital role in the transition to and in maintaining a circular economy. It is important that the transition considers how to equitably and legally support the development and growth of TSROs as critical stakeholders in delivery of re-use within a circular economy. This means ensuring they can bid and engage on a level playing field in how the DRSs are delivered to capture the wider positive social impact as well as being economically sustainable.

As a result of the paradigm shift to the Welsh economy becoming circular, **global cloud-based technology platforms are likely to increasingly link businesses and consumers with efficient services delivered locally and there will be less reliance on owning goods** (which under more linear economic systems were potentially not utilised to their full capacity and discarded when malfunctions occurred).

Case study: Hello Tractor

Based in Nigeria, Hello Tractor allows over quarter of a million small-hold farmers to obtain tractor services on demand, improving their food and income security.

The technology is based on mobile and machine to machine (M2M) technology. It allows sharing of information on the vehicle and its efficiency. This maximises the work the tractor can achieve over its lifecycle.

Source: Greenbiz (23 October 2017) 5 disruptive technologies driving the circular economy

Engagement and communications

Under the paradigm shift, public awareness of basic circular economy concepts will be as high as awareness of recycling is today. Some of that awareness will come from the experience of interaction with goods and service providers using circular business models, but more active efforts will still need to be made to achieve acceptance of the circular economy as a positive change and the 'new normal'. For example, it is recommended that **national sustainable circular economy campaigns are delivered, reinforcing the message that re-use should be the default behaviour**.

As the Welsh circular economy develops and is better understood, practical advice and case-studies should be disseminated to the public and private sectors so that the provision of goods and of re-use centric procurement advice is embedded across the

public and private sector. It is relatively straightforward to find small numbers of high-profile exemplar projects for case studies where a unique set of circumstances has come together to demonstrate that re-use or circular economy actions are feasible. However, **development of a shareable knowledge base of mainstream, everyday, and incremental examples of change would likely be a useful aid** to demonstrate that re-use and circular business and public sector models can and should be normal and routine.

Through partnering with local service providers (government and non-governmental organisations) it is recommended that **Wales works towards providing local services aimed at servicing, re-use and repair activities**. Libraries are a well-established example of a sharing service (of books), but they could be publicly recognised as the focal point of all community re-use activities, including a repair manual library, specialist tool rental and drop-in repair advisors. Funding for such services should be based on the detailed knowledge of the value of re-use built up from the previously-recommended programme of research and it is anticipated that the added economic and community value that re-use brings will be understood in detail. It would likely be helpful for that body of knowledge to be used in assessments for **value for money investment across departmental budgets in facilities such as swap shops, repair cafés and libraries of things, and to incorporate regional and national networks**.

A summary roadmap for Scenario B is provided in Appendix 4.

4.6.3 Stakeholders

In a paradigm shift to a fully circular economy where everything that is re-useable is re-used, the stakeholders that will be engaged and involved will simply be everyone. That is:

- Central government and its departments;
- Local government;
- Institutions;
- Business;
- NGOs;
- International partners; and,
- The public.

4.6.4 Scenario modelling

Scenario C represents a paradigm shift in re-use and will affect not only attitudes towards re-use but also the way in which items are designed and manufactured to facilitate greater levels of re-use. In Scenario C items are maintained and upgraded to prolong item lifetimes and create a mature and well-functioning market in re-use of items that would currently be discarded as waste.

This paradigm shift will fundamentally alter the LACMW stream, delivering considerable levels of waste reduction per capita and altering the nature, scale, and condition of items that do enter the waste stream. Furthermore, the impacts and benefits of re-use under the paradigm shift are likely to be radically different from those created in today's preparation for re-use industry (which could be considered to be in its infancy).

Efficiencies will be gained from economies of scale, partnerships and government support and greater competition in the market will lead to innovation and streamlining of services. These developments will not only improve economic performance but, given the right support, will also improve the delivery of social and environmental benefits.

In the context of modelling impacts, the conditions of the paradigm shift present a large unknown in terms of the waste stream and the impact factors. As such, the impacts for Scenario C have not been calculated in the same way as the other scenarios. An attempt to do so would be largely speculative and results would be more indicative of uncertain assumptions than the scale of likely impacts.

Wales's Zero Waste Strategy sets out an ambition to achieve zero waste by 2050, and IRIs must be reduced to zero in the residual waste stream to meet this target. In Scenario B+ a significant quantity of IRIs is still treated within residual waste. The measures outlined in Scenario C could form part of the programme to achieve zero waste. The model can calculate the impact of going beyond Scenario B+ to achieve zero waste in 2050. Whilst these impacts are less broad than those presented for other scenarios and only include the impact of avoiding residual waste, these results give an indication of some of the impact that could be delivered in Scenario C. These results are presented in Table 18.

Table 18: Impacts of achieving zero waste by 2050, cumulative values from 2019 to 2050

Metric	Additional impact beyond Scenario B+
Avoided waste disposal tonnage	493,754
Avoided LA waste treatment costs †	£17.5 m
GHG savings from avoided disposal (tonnes CO_2e)	72,576
Value of GHG savings from avoided disposal †	£5.4 m

† Discounted at HM Treasury discount rate

5.0 Modelling approach

5.1 Aims and overview of the model

A Microsoft Excel model was developed to indicate the scale of environmental, social and economic impacts associated with increasing preparation for re-use. The model focusses on in-scope re-usable items (IRIs) in the Welsh LACMW stream, and is based on available data at the time of the work. The outputs are indicative estimates to provide a framework for comparison and are not a statement of accuracy to predicting the future.

There is a high degree of uncertainty in forecasting waste arisings and waste treatment for over thirty years. It was therefore necessary to make assumptions to manage data gaps and uncertainty. These assumptions are explored in more detail in the sections below. The aim of the model is to indicate the scale of impact that might be achieved from increasing preparation for re-use. The model scenarios are constructed as 'what if' explorations of the impact of achieving a certain level of re-use. It does not attempt to predict exactly how measures to increase re-use might be undertaken and estimate the

combined effect of these measures. A relatively simple methodology is followed, as appropriate for the aim of indicating the scale of the impact rather than providing detailed analysis, which may be undertaken in later work.

The scope of the modelling is limited to items categorised in Table 19, referred to in this technical report as IRIs, as these are deemed to currently have the greatest potential for re-use.

Table 19: IRIs – items modelled for impacts of preparation for re-use

Category	IRI
Furniture	Hard furniture
	Soft furniture
	Office furniture
Clothing, shoes and textiles	Clothing, shoes and textiles
WEEE	TVs & monitors
	Fridges & freezers
	Large domestic app
	Small domestic app
	Electrical & electronic toys
	Automotive batteries
	Post-consumer, non-automotive batteries
Paint & varnishes	Paint & varnishes
Wood	Wood
Carpets and underlay	Carpets and underlay
Other	Books
	Mattresses
	Gardening tools
	Toys
	Bicycles
	Baby equipment

A baseline is created in the model using WasteDataFlow data from the financial year 2016/17 and scenarios are created to test the impact of different levels of preparation for re-use from 2019 to 2050. The model calculates net impacts – estimating both the positive impacts that could be achieved as well as highlighting potential negative impacts or unintended consequences of increasing preparation for re-use activity.

The impacts calculated in the model are listed below:

- Re-use tonnage (tonnes);
- LA waste treatment costs: EfW & landfill gate fee minus recycling revenue (£);
- Sale value of re-used items (£);
- GVA (£), including direct, indirect and induced effects;
- GHG savings (tonnes-CO_2e);

- Value of GHG savings (£);
- Jobs (FTEs), including direct, indirect and induced effects;
- Salaries from jobs (£), including direct, indirect and induced effects; and,
- Volunteers (FTEs).

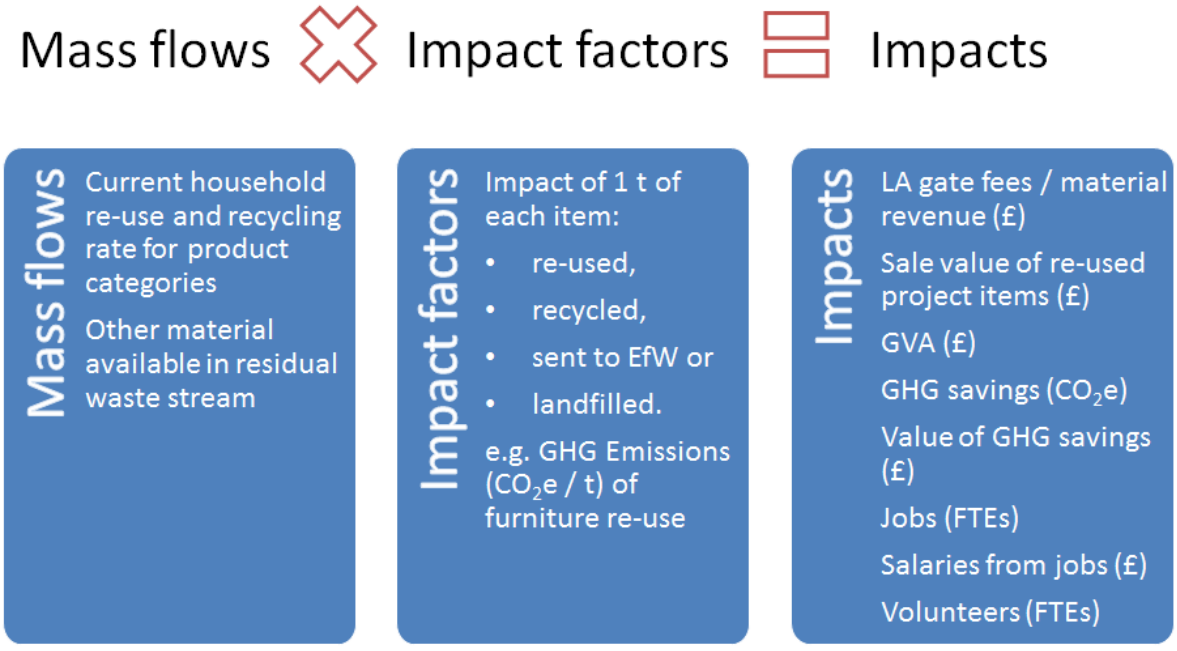
All financial impacts are presented in today's prices. Direct effects refer to the activity within the waste sector. Indirect and induced effects refer to the impact on the wider economy. This is also referred to as the 'multiplier effects' and is explained in more detail in Section 5.2.8. The impacts relate only to IRIs, not the wider waste stream.

The baseline in the model maintains the current level of preparation for re-use and recycling of IRIs up to 2050.[45] For scenarios A–C in the model, an increase in preparation for re-use takes place relative to baseline levels. As a result, the preparation for re-use activities divert material from other waste treatment methods, causing a reduction in recycling, EfW and landfill relative to the baseline, and the model calculates the effects and impacts of this.

The amount of waste treated through preparation for re-use, recycling, EfW or landfill drives the impact calculations.

Figure 7 summarises how per tonne impact factors are used to calculate impacts based on the modelled mass flows. The impact factors were sourced as part of the literature review. The data sources used were selected by an assessment of relevance to the project, for example based on geography with first preference for data relating to Wales if available and secondly the UK. An assessment of quality was made, for example with preference for data from widely recognised sources such as the ONS, DEFRA and WRAP.

Figure 7: Calculation method of impact metrics



[45] *Past trends in the waste stream were analysed for the previous 10 years to understand changes in re-use and recycling tonnage of each item. These trends were projected forwards from 2016 but curtailed over the following years as it is unlikely that changes in re-use and recycling are likely to continue in the baseline without any additional action. From 2019 the waste stream stays constant for these items.*

5.2 Data sources, cleansing, manipulation and adjustments

WasteDataFlow data and the recent national waste composition study[46] are used to determine current levels of recycling and re-use and how much more material is potentially suitable for re-use in the remaining residual waste stream.

Some of the IRIs are not separately recorded in these datasets and are typically not included in other published composition studies. Survey data from previous composition work is used to estimate the quantities of these items. The sources available are limited and so some data from outside of Wales is used[47] and these estimates are generally considered to have greater uncertainty than the national composition study as the datasets from which they are drawn are smaller in size.

5.2.1 WasteDataFlow

Waste tonnages for the baseline are based on data from WasteDataFlow 2016/17. The current end destination tonnages for re-use and recycling are taken from WasteDataFlow question 100. This is deemed to be more accurate than the collection tonnage data as it also accounts for contamination, rejects and other process losses. The furniture category is further split into hard furniture, soft furniture and office furniture based on kerbside and HWRC bulky waste composition studies.[48] Residual waste tonnage for household kerbside, HWRC, C&I and bulky waste streams is taken from waste collection data in WasteDataFlow.[49] Composition data is used to estimate the tonnage of each item in these residual streams.

5.2.2 Waste composition data

The recent national waste composition study[50] is used to understand the composition of the residual waste streams. Furniture in the residual waste stream is split into hard furniture, soft furniture and office furniture based on HWRC composition studies,[51] in the same way as for the furniture re-use and recycling tonnage. Composition of the waste streams 'electrical & electronic toys', 'gardening tools', 'toys', and 'baby equipment' are not recorded in the national composition study and are difficult to estimate with accuracy as they are rarely recorded in other composition studies. The most relevant data source available is from a HWRC composition study and user survey in a county council in England.[52]

5.2.3 Overview of impact metrics

The impact metrics calculated in the model are presented in Table 20 and Table 21. In the research, the impacts are calculated annually. The results are summed over the

[46] *WRAP (2016), Wales Municipal Compositional Analysis*

[47] *See Section 5.3 for further details.*

[48] *Analysis of WRAP (2012), Composition of kerbside and HWRC bulky waste.*

[49] *Referred to as NotQ100 in the WasteDataFlow data downloads.*

[50] *WRAP (2016), National municipal waste compositional analysis in Wales*

[51] *Analysis of WRAP (2012), Composition of kerbside and HWRC bulky waste.*

[52] *Analysis of Resource Futures (2014), Residual Waste Compositional Analysis and Onsite Customer Re-use Survey at [a single county council's] Household Waste Recycling Centres*

period from year 2019 to 2050 to show the full impact of each scenario and account for timing of delivery and impacts. Employment impacts are presented for 2050 only, as employment levels vary year-on-year and results from 2050 reflect the impacts to their fullest extent. Values are calculated in today's prices.

Table 20: Impact metrics used in the model

Metric	Calculation type
Re-use tonnage	Cumulative tonnage from FY 2019 to 2050.
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue	Fees paid for energy recovery and waste disposal minus revenue gained from recycling material.
Sale value of re-used items	Estimated resale value of items after preparation for re-use. Relates to items sold, does not include LA waste treatment costs.
GVA, inc. multiplier effects	GVA associated with waste treatment, including preparation for re-use activities.
GHG savings (tonnes CO_2e)	Re-use displaces a proportion of new items thereby saving GHG emissions associated with a proportion of the primary materials and manufacturing burdens associated with production of new item. Recycling saves GHG emissions by displacing the burdens associated with production of primary materials. Energy from Waste (EfW) displaces energy production but creates direct combustion emissions and landfill creates net GHG emissions.
Value of GHG savings	Monetisation of the GHG savings. Cumulative net value from FY 2019 to 2050

Table 21: Metrics used in the model, for a single year at 2050

Metric	Calculation type
Jobs (FTEs), inc. multiplier effects	Paid jobs created by waste treatment (preparation for re-use, recycling, EfW and Landfill).
Salaries from jobs, inc. multiplier effects	Salaries of all jobs calculated above, using current average salary for waste industry.
Volunteers (FTEs)	Volunteer posts associated with preparation for re-use.

The main data sources used in calculating the impacts and the scope of the calculations are outlined in Table 22. The scope of the metrics focussed on impacts in Wales, and aimed, as far as possible, for a comparable scope amongst different metrics. The impact factor values used in the model are presented in Appendix 1.

Table 22: Main data sources used for the impact metrics and the scope of calculations

Metric	Main data sources	Scope
Re-use tonnage	WasteDataFlow. National municipal waste compositional analysis in Wales.[53]	Preparation for re-use only, does not include direct re-use (charity shops, eBay, Gumtree etc.).
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue	Let's Recycle Material Prices.[54] WRAP Gate fees report.[55] Previous work with Welsh local authorities.	The gate fees paid by local authorities for waste treatment minus income gained from recyclate. Does not include waste collection costs. These are assumed to be approximately constant.
Sale value of re-used items	Resale values from: Resource Futures (2015, Unpublished) *Re-use at Household Waste Recycling Centres in Bristol: A feasibility study for the European Green Capital*.	The sale value of items put back into the economy through preparation for re-use activities.
GVA, inc. multiplier effects	ONS labour productivity measures.[56] Jobs impact.	GVA associated with preparation for re-use activities, recycling, EfW and landfill. Covers direct, indirect and induced multiplier effects. Does not include impacts of displaced items, the majority of which will occur outside of Wales.

[53] *WRAP (2016), National municipal waste compositional analysis in Wales*

[54] *Let's Recycle Material Prices, mid-point values for 16-17, https://www.letsrecycle.com/prices/*

[55] *WRAP (2017), Gate Fees Report 2017: comparing the costs of waste treatment options, Median value for Post-2000 facilities 16-17, http://www.wrap.org.uk/gatefees2017*

[56] *ONS, Labour Productivity Measures from the ABS: 2008–2012, GVA per hour of waste management sector*

Metric	Main data sources	Scope
GHG savings (tonnes CO_2e)	ZWS Scottish Carbon Metric.[57] WRAP study into consumer second-hand shopping behaviour to identify the re-use displacement effect.[58]	Greenhouse gas emissions associated with waste treatment and the emissions avoided by recycling and re-use activities. Scope does not include waste collection. Preparation for re-use burdens are excluded as insignificant. Impact of re-use is calculated based on the amount of new item displaced, with displacement factors of between 24% and 34%, based on a study into second-hand shopping behaviour.[59] Whilst these items may not be manufactured locally, and the materials may not be extracted or produced locally, any emissions from these processes will have a global impact and so are included for comparable scope. EfW avoids GHG emissions as it offsets electricity generation by other means, but also emits GHGs in the incineration process. EfW values are based on the current energy mix rather than factoring in future decarbonisation of the grid, which is a simplification of the model discussed in more detail in Section 5.2.7.
Value of GHG savings	BEIS Carbon Values.[60] BEIS publishes projected values for each year up to 2050, which have been inflated to today's prices. Values assigned on basis of material production sector in the EU emissions trading system (EU ETS).[61]	Same scope as GHG savings metric.

[57] ZWS (2017) The Carbon Footprint of Scotland's Waste 2014 and 2015 Carbon Metric: Annual Report and Biennial Technical Update, http://www.zerowastescotland.org.uk/sites/default/files/The%20Carbon%20Footprint%20of%20Scotland%27s%20Waste%20-%202014%20and%202015%20Carbon%20Metric%20Annual%20Report%20and%20Biennial%20Technical%20Update.pdf

[58] WRAP (2013) Study into consumer second-hand shopping behaviour to identify the re-use displacement effect, http://www.wrap.org.uk/sustainable-electricals/esap/consumer-behaviour/reports/study-consumer-second-hand-shopping-identify-re-use-behaviour

[59] WRAP (2013) Study into consumer second-hand shopping behaviour to identify the re-use displacement effect, http://www.wrap.org.uk/sustainable-electricals/esap/consumer-behaviour/reports/study-consumer-second-hand-shopping-identify-re-use-behaviour

[60] BEIS Carbon valuation, https://www.gov.uk/government/collections/carbon-valuation--2

[61] European Commission, ETS handbook, https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf

Metric	Main data sources	Scope
Jobs (FTEs), inc. multiplier effects	WRAP (2015) Benefits of Re-use tool.	Jobs associated with preparation for re-use activities, recycling, EfW and landfill. Covers direct, indirect and induced multiplier effects. Does not include impacts of displaced items, the majority of which will occur outside of Wales.
Salaries from jobs, inc. multiplier effects	ONS UK average salary for 'recovery of sorted materials' in 2014 – Direct wage effects only.[62] Jobs (FTEs) impact.	Paid jobs (FTEs) multiplied by average salary for re-use and recycling sector. Same scope as jobs metric.
Volunteers (FTEs)	WRAP (2015) Benefits of Re-use tool.	Volunteers directly engaged in preparation for re-use activities. No multiplier effects calculated as these are expected to be minimal for volunteer posts.

The impact factors used represent 'indicative', 'central' values, as appropriate for a high-level modelling exercise of this nature. The values and data sources are discussed in more detail below.

[62] *Officer for National Statistics (2016) Industry (4 digit SIC) - ASHE: Table 16, Date Accessed: 22 July 2016, Available at: www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/industry4digitsic2007ashetable16*

5.2.4 LA waste treatment costs: EfW & landfill gate fee minus recycling revenue

This metric captures the majority of the costs of waste treatment of the IRIs and is calculated using gate fees for EfW and landfill minus the revenue gained from recycling material. The actual costs to local authorities will be affected, for example, by contractual issues, and the costs presented are only intended as an indicative calculation. It does not include the cost of waste collection as these are assumed to remain broadly constant whether the waste is collected for re-use or other waste treatment. When interpreting the model results it should also be noted that not all items generate revenue from recycling, and some may be a cost to the authority.

5.2.5 Resale values of items after preparation for re-use

No empirical sales data was available to determine the resale values of products taken out of the LACMW stream. Instead, the resale value estimates are derived from an assessment of the types of items diverted to re-use from HWRC sites in England and an estimate of their resale value range, as shown in Table 23. The average item weights were calculated using a weighted average of item-weight data from the Furniture Re-use Network[63] and survey data of the number of these re-usable items diverted from the HWRC sites.

Table 23: Resale values of preparation for re-use products

Item	Resale value per item (£)		Average item weight (kg)	Mean resale value per tonne (£), and maximum range
	Min	Max		
Hard furniture	£10	£70	29.9	£1,340 ±75%
Soft furniture	£20	£120	29.2	£2,395 ±71%
Office furniture	£5	£15	11.5	£869 ±50%
TVs & Monitors	£10	£60	15.0	£2,338 ±71%
Fridges & Freezers	£20	£70	37.2	£1,209 ±56%
Large Domestic App	£20	£80	22.8	£2,197 ±60%
Small Domestic App	£2	£20	6.6	£1,667 ±82%
Electrical & Electronic Toys	£2	£70	6.2	£5,802 ±94%
Paint & varnishes	£1	£50	16.0	£1,592 ±96%
Wood	£1	£50	16.0	£1,592 ±96%
Gardening tools	£1	£40	9.4	£2,176 ±95%
Toys	£1	£50	8.0	£3,206 ±96%
Bicycles	£1	£50	8.0	£3,206 ±96%
Baby equipment	£1	£50	8.0	£3,206 ±96%

Some of the IRIs categories were not recorded separately in the survey data used in Table 23. Resale values for these IRIs are derived from other sources. The value of £460 per tonne of 'Clothing, shoes and textiles' is the mid-point value for textile material in bulk (clothing, textiles and rags) as delivered to a sorting plant for 2016–17 published on

[63] *FRN Average Weights (2009), http://www.frn.org.uk/documents/FRN%202009%20Final%20average%20weights%20list.pdf*

LetsRecycle.com.[64] Batteries are assumed not to be suitable for resale under current conditions. A resale value of £2,400 per tonne of 'Carpets and underlay' and £3,500 per tonne of books is derived from proprietary data from previous work.

Resale values of items from preparation for re-use vary greatly depending on the age, condition and original sale value of the item. Some re-use organisations are also focussed on fast throughput of stock or creating social benefits rather than maximising revenue from product sales and this can be reflected in the sale price. There is a large range between the minimum and maximum resale value assigned to each product in Table 23. The mean resale value from Table 23 is used in the model calculations, although it must be highlighted that there is a great deal of uncertainty in these figures. The calculated resale value metrics should be interpreted with this in mind.

Many of the measures outlined in The Roadmap are likely to intercept items in the waste stream before their condition deteriorates, and so this may lead the resale value to increase in future years. However, the model does not attempt to increase resale values in future years as quantifying such a change would be highly speculative.

The resale value does not take into account any costs of preparing the items for re-use. These costs vary greatly across different re-use organisations and are often related to other outcomes such as providing training and employability skills for volunteers or delivering other social benefits.

5.2.6 Gross value added

The ONS calculates GVA of a sector as turnover minus intermediate consumption (goods and services consumed as inputs by a process of production). The published GVA per hour measure is calculated by dividing GVA by the hours worked in each sector. The model uses this measure to calculate GVA impacts by combining with the hours worked associated with the paid FTEs calculated in the jobs impacts.

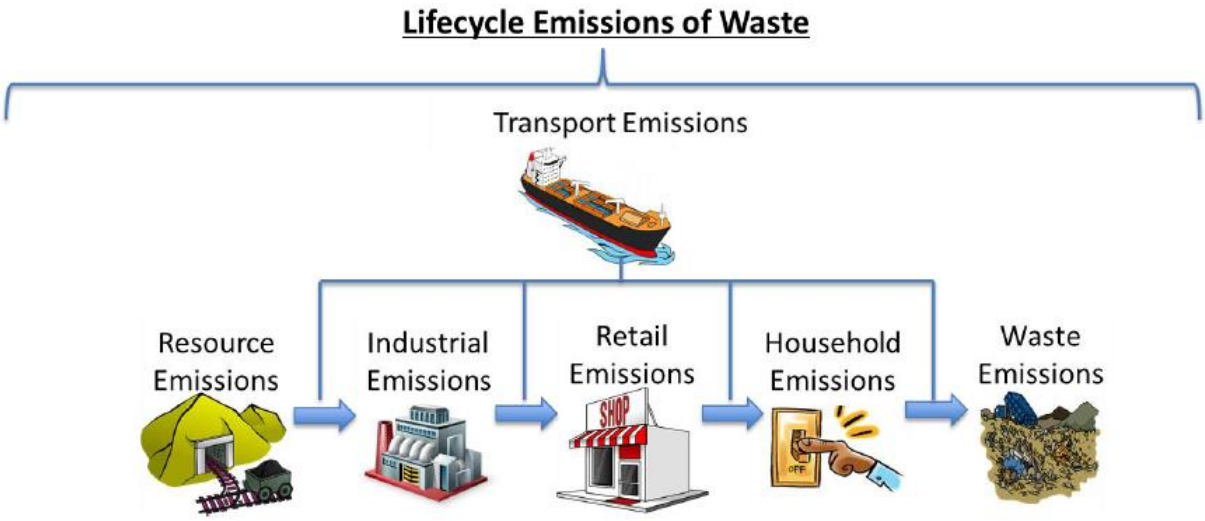
5.2.7 Greenhouse gas emissions

The GHG emissions are calculated using the Scottish Carbon Metric,[65] which includes the carbon impacts across the whole life cycle of an item regardless of where in the world those emissions occur. Whilst some of the gasses might be emitted abroad, the impact will be felt globally and so are included in the metrics. The scope of the Scottish Carbon Metric is illustrated in Figure 8.

[64] *LetsRecycle.com, Textiles, https://www.letsrecycle.com/prices/textiles/*

[65] *ZWS (2017) The Carbon Footprint of Scotland's Waste 2014 and 2015 Carbon Metric: Annual Report and Biennial Technical Update, http://www.zerowastescotland.org.uk/sites/default/files/The%20Carbon%20Footprint%20of%20Scotland%27s%20Waste%20-%202014%20and%202015%20Carbon%20Metric%20Annual%20Report%20and%20Biennial%20Technical%20Update.pdf*

Figure 8: Scope of greenhouse gas emissions captured in the Scottish Carbon Metric[66]



The greenhouse gas benefit of re-use is derived from the re-used item being used in the place of a new item, effectively displacing the need to manufacture a new item. For example, a toaster is repaired and resold and if the purchaser had not bought the repaired toaster then they would have bought a newly manufactured one. However, there may not always be a one-to-one displacement of new items. The model conservatively applied displacement factors of between 24% and 34%, based on a study into second-hand shopping behaviour,[67] in order to not overestimate the greenhouse gas benefits.

The carbon burden of re-use and repair activities is largely uncaptured in the Carbon Metric dataset. The carbon emissions from these activities vary depending on the nature of the re-use activity – location, scale, etc. These are likely to be small compared to other emissions captured in the Carbon Metric and so their omission is considered not to have a large impact on the overall result.

EfW avoids GHG emissions as it offsets electricity generation by other means, but also emits GHGs in the incineration process. Currently a significant portion of the national energy mix comes from fossil fuels. However, the use of coal has reduced drastically and renewables are becoming increasingly prominent in energy generation. Further decarbonisation of the grid will reduce the carbon benefits of EfW, as the energy it displaces is increasingly generated from renewable sources. Using the current carbon factor for EfW is therefore likely to overestimate the carbon benefits of EfW and underestimate the relative benefit of diverting material from EfW to re-use. Future analysis may take account of the decarbonisation of the grid, whilst the model results presented here reflect a conservative view where the mix of power generation technology stays the same as today's.

[66] *ZWS, What is the carbon metric?, http://www.zerowastescotland.org.uk/content/what-carbon-metric*

[67] *WRAP (2013) Study into consumer second-hand shopping behaviour to identify the re-use displacement effect, http://www.wrap.org.uk/sustainable-electricals/esap/consumer-behaviour/reports/study-consumer-second-hand-shopping-identify-re-use-behaviour*

The monetary value of carbon emissions is calculated using values published by BEIS.[68] Values are published for 'traded carbon', for sectors which are part of the EU ETS,[69] and 'non-traded carbon' for other industrial sectors. The non-traded carbon values increase each year up to 2050 reflecting the increasing effort required, and additional cost, of mitigating emissions in future years to meet UK GHG targets. GHG emissions are monetised using the appropriate carbon value. For example, in the model GHGs emitted in 2025 are monetised using the value of carbon published by BEIS for the year 2025. GHG impacts from waste treatment are assigned a traded or non-traded value based on which sectors are covered by the EU ETS. Whilst this is straightforward for landfill, EfW and recycling, this poses a problem in assigning carbon values to preparation for re-use where the carbon is calculated for an item displaced by re-use activities. A full life cycle assessment of items displaced by re-use would ideally reveal what portion of the carbon emissions are covered by the EU ETS.

However, comparable life cycle assessments are not available for each IRI in the project, and so emissions are assigned traded or non-traded carbon values based on the materials in each item. The IRI categories 'Clothing, shoes and textiles', 'Batteries' and 'Wood' are therefore assigned the higher non-traded values as the main materials are not covered by the EU ETS. Arguably this may overestimate the value of carbon emissions as the emissions from electricity use, aviation and petrochemical used to create these items, for example, should be valued at the lower traded value. However, the impact of this is reduced going forwards as traded and non-traded carbon values are projected to converge, becoming equal in 2030 when it is assumed that there will be a functioning global carbon market.[70]

5.2.8 Multiplier effects

In addition to the direct impacts on employment and GVA from re-use interventions there are "knock on" effects, or "multipliers" also sometimes referred to as "ripple effects". There are two types of ripple effect calculated in the model. These can be described as follows, using employment impacts from increasing preparation for re-use as an example:

- **Indirect**, the organisation doing the preparation for re-use activity will need more goods and services from their supply chain. The companies in the supply chain will therefore need more staff to meet the increase in demand. The additional jobs created in the supply chain is the indirect effect.
- **Induced** or income multiplier effects arise from the additional spending by those employed directly by the organisation carrying out the preparation for re-use or by the employees of the organisations benefiting from the indirect effects.

[68] *BEIS Carbon valuation, https://www.gov.uk/government/collections/carbon-valuation--2*

[69] *European Commission, ETS handbook, https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf*

[70] *BEIS (2018), Valuation of Energy Use and Greenhouse Gas, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/671205/Valuation_of_energy_use_and_greenhouse_gas_emissions_for_appraisal_2017.pdf*

The direct effects are calculated using the datasets outlined in Table 22. Economic multipliers for the waste sector are not available for Wales or the UK as a whole. Values are instead taken from Input-Output tables published by The Scottish Government,[71] which distinguish between 'repair & maintenance' sectors and the more general 'waste, remediation & management' sector. Incorporating indirect and induced effects provides a more complete picture of the impacts across the whole economy.

5.2.9 Discounting future impacts

Monetary values are discounted in future years in accordance with the HM Treasury Green Book guidance, which describes the process as follows:[72]

Discounting is a technique used to compare costs and benefits that occur in different time periods. It is a separate concept from inflation, and is based on the principle that, generally, people prefer to receive goods and services now rather than later. This is known as 'time preference'.

It should be emphasised that discounting is entirely distinct from the concepts of inflation and depreciation. The effect of discounting is that the preference for monetary benefits in future years is reduced when viewed from the present day. This is useful when comparing two actions: for example, one which will generate £100 worth of benefit next year, and one which will generate £100 worth of benefit in ten years' time. All things being equal, most people would opt to receive £100 next year rather than £100 in ten years' time. Discounting is a means to incorporate this 'time preference of money' into decision making. A larger discount rate is applied in each year going forward. For example, the discount rates published by the Treasury mean that monetary values occurring ten years hence are reduced by one third, values occurring twenty years hence are reduced by half and values occurring thirty-two years hence are reduced by two thirds.

In the presentation of model results the salaries from jobs in the year 2050 are not discounted. This is because salaries are calculated for the same single year in each scenario and so the results are comparable without discounting. Discounting would be required to compare salaries from different years. Presenting results without discounting also makes interpretation of the results simpler as it is easy to understand X jobs with an average salary of £Y gives an overall benefit of £X*Y. Discounting the salaries of jobs that far into the future might lead one to erroneously conclude that the salaries for the jobs created is very low, if the results were misinterpreted.

5.3 Baseline

5.3.1 Modelling IRIs

The total quantity of each item currently in the LACMW and how much is re-used and recycled is calculated using 2016/17 WasteDataFlow data and composition studies, as described in Sections 5.2.1 and 5.2.2. Analysis of the data showed a greater quantity of

[71] *Scottish Government (2016) Input-Output Tables 1998-2014 - All Tables, July 2016, http://www.gov.scot/Topics/Statistics/Browse/Economy/Input-Output/Mulitipliers*

[72] *HM Treasury, THE GREEN BOOK, Appraisal and Evaluation in Central Government, ds/system/uploads/attachment_data/file/220541/green_book_complete.pdf*

books, clothing, shoes and textiles being recycled, i.e. processed into new materials, than would seem likely for these waste streams, given that their re-use value is considerably higher than the recycled material value and they are often received in a good state when separately collected. Consultation with WasteDataFlow experts at WRAP revealed that some categories may be erroneously recorded in the system as recycling instead of re-use, and so the tonnage was adjusted in the model to reassign 95% of this tonnage as re-use. The wood tonnage was also adjusted to account for furniture deposited in wood skips at HWRCs that is subsequently recorded as 'wood' in WasteDataFlow. 42% of this tonnage was reassigned to the furniture categories, based on research into the recovered wood market.[73]

IRIs are estimated to account for 12% of the LACMW by weight. The treatment of items in the waste stream is shown in Figure 9. This chart shows the current state of preparation for re-use of IRIs and the opportunity for increasing activity in this area. Interestingly, whilst preparation for re-use tonnage is low, much of the material is currently recycled. This gives an indication of how increasing preparation for re-use might impact on the rest of the LACMW stream. Whilst some material will be diverted from residual waste it is also likely that a significant proportion of material will be diverted from recycling. The model assumptions used are best demonstrated by way of example. If 10 additional tonnes are diverted to preparation for re-use in Scenario A then there will be 10 tonnes less residual waste. In the baseline, if the IRI has a 30% recycling rate then three of the 10 tonnes would have been recycled and seven of the 10 tonnes would undergo residual waste treatment. The diversion to re-use therefore reflects the recycling rate and recycling behaviour of citizens.

[73] *WRAP (2011) Realising the value of recovered wood, http://www.wrap.org.uk/sites/files/wrap/Wood%20Market%20Situation%20Report_0.pdf*

Figure 9: Current arisings of IRIs in Wales LACMW per annum, based on WasteDataFlow 2016/17 and composition studies

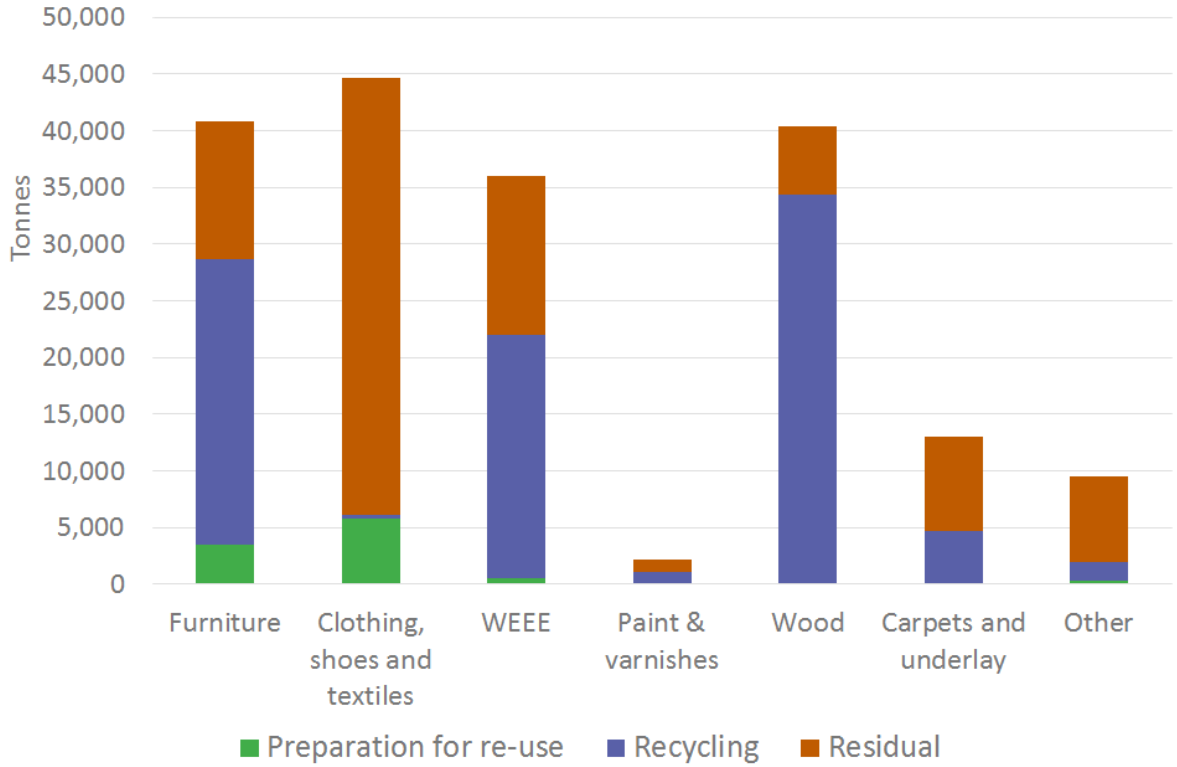
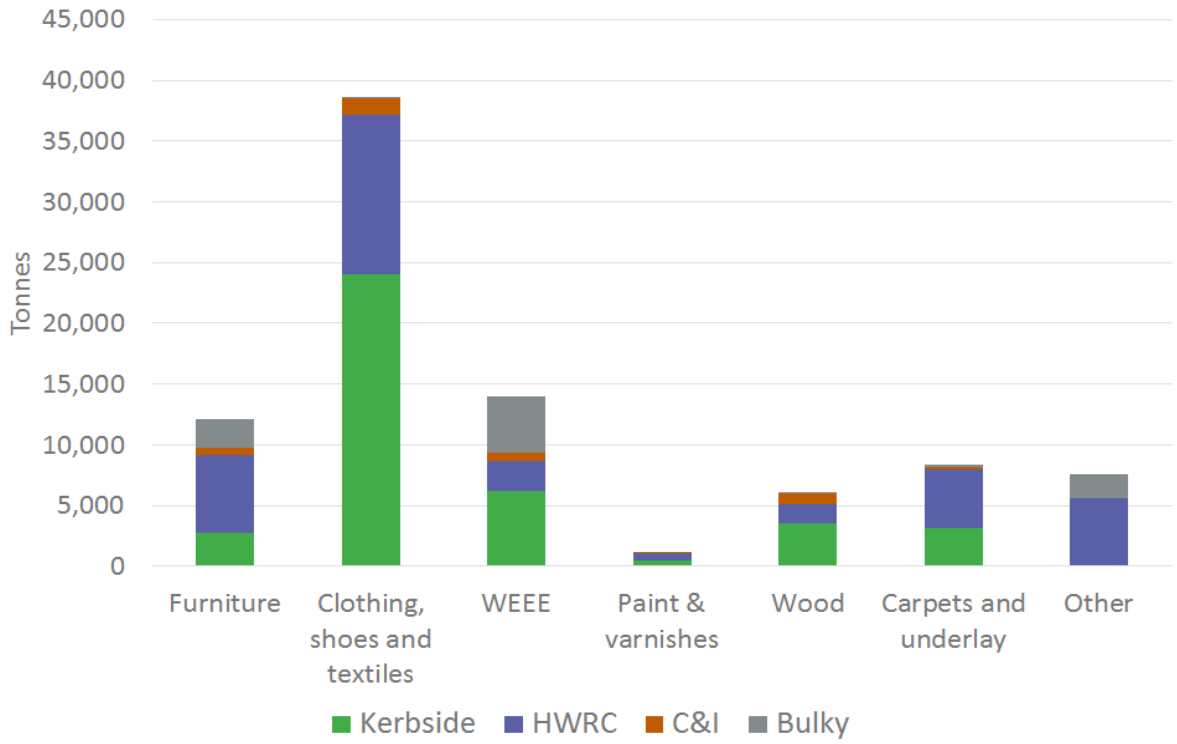


Figure 10 shows where IRIs are currently entering the residual waste stream, in terms of council waste services (i.e. kerbside, HWRC, bulky or C&I). It is based on the residual composition data. Clothing, shoes and textiles show the greatest quantity of material in residual waste, predominantly arising in kerbside collections. A significant quantity of furniture is also shown, although it must be noted that this is largely the result of reclassifying the wood tonnage from WasteDataFlow to the furniture category, and so the tonnages shown in both charts are the product of the model assumptions.

Figure 10: Current arising of IRIs in residual waste streams in Wales LACMW per annum, based on WasteDataFlow 2016/17 and composition studies



Materials not separately recorded in WasteDataFlow and the national waste composition study are determined using data from other composition work, as described in Section 5.2.[74] The data revealed the likely composition of items in residual waste at HWRCs, which is reflected in the charts above. Estimates are not obtained for the other waste streams. As these are also expected to be relatively small quantities this has little impact on the model results.

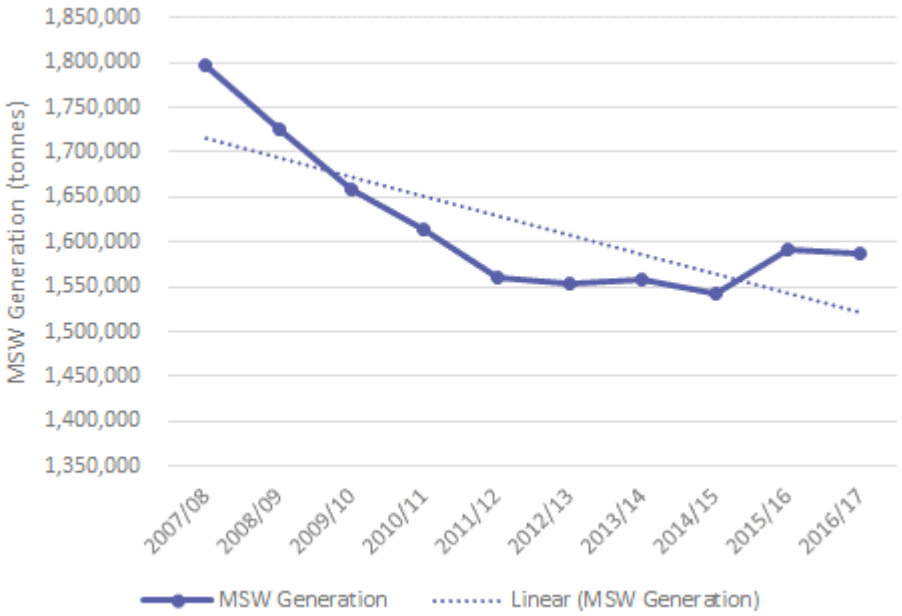
There has been a general waste reduction trend in LACMW over the past decade, with a small bounce-back in recent years as shown in Figure 11. Much of the work in recent years to affect waste arisings has focussed on measures that would primarily affect kerbside collections of household packaging and organic waste rather than IRIs considered in this project. In light of this, it was not deemed appropriate to apply strong waste reduction factors in the baseline model. The Zero Waste strategy has targets for year-on-year reductions in LACMW,[75] and reductions should be sought in the arisings of IRIs too. Some reductions may occur through changing production and consumption patterns, but the nature and extent of this is impossible to predict. The majority of waste reduction for these items, however, is likely to require interventions from Government and other stakeholders, and as such would most likely be delivered through measures such as those listed in Scenario C. In the baseline, arisings of IRIs are therefore projected forward to 2050, and the total quantity of each item entering the LACMW stream is

[74] *These categories are: 'Electrical & Electronic Toys', 'Gardening tools', 'Toys', and 'Baby equipment'.*

[75] *"{T}o reduce our waste by around 1.5% (of the 2007 baseline) each year across all sectors in order to achieve our one planet goal for 2050", Welsh Assembly Government (2009), Towards Zero Waste One Wales: One Planet, http://gov.wales/docs/desh/publications/090521susdev1wales1planeten.pdf*

assumed to remain constant, as shown in Figure 12. As the population of Wales is predicted to rise[76] this equates to a small reduction in waste per capita each year.

Figure 11: Municipal Solid Waste generation and linear regression trend line[77]

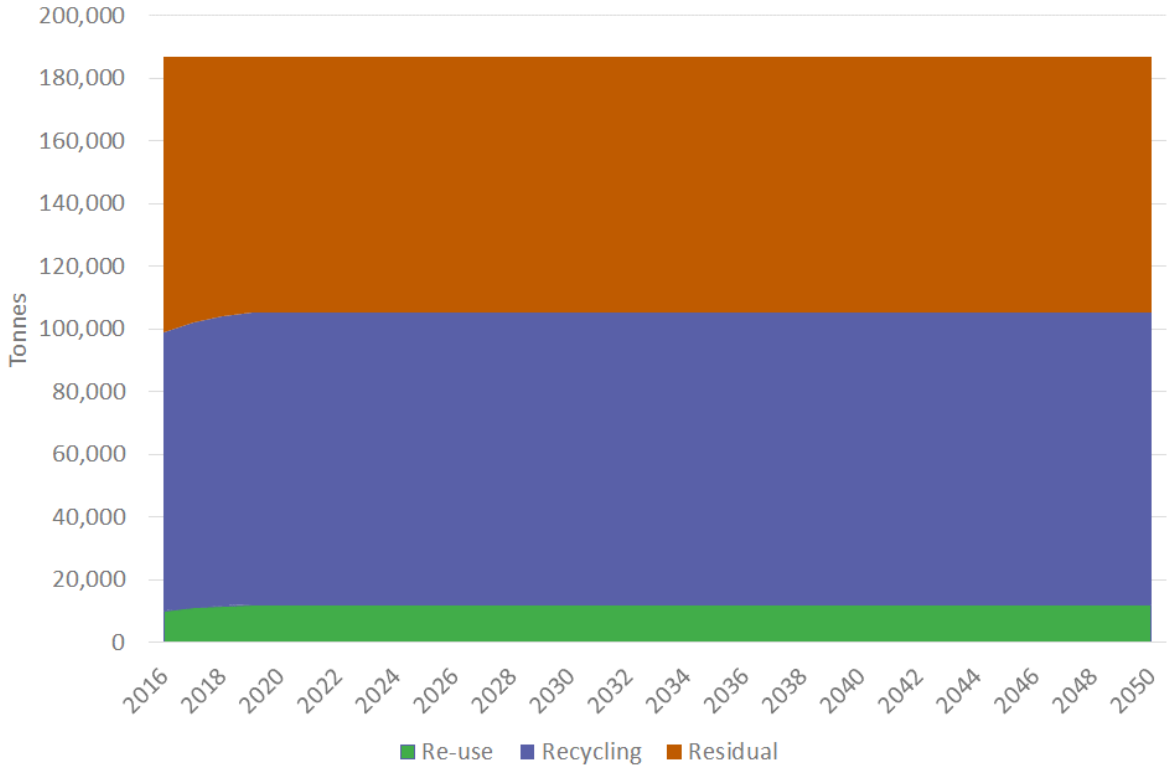


The past ten years of WasteDataFlow data were analysed to identify trends in the waste treatment of IRIs. These trends reflect changes in the public's use of recycling and re-use facilities and the waste services available. Recent activity is likely to continue to affect the waste stream for several years and so the trends are projected forwards, curtailing any impact by 2019 to create a static baseline from that point onwards. This reflects the fact that there is assumed to be little or no additional effort or growth in preparation for re-use activities in the model baseline. Figure 12 charts how IRIs are modelled in the baseline, reflecting the curtailing of current trends by 2019 and static baseline tonnages past that point.

[76] *The population of Wales is projected to increase by 3.1 per cent to 3.21 million by 2026 and by 4.6 per cent to 3.26 million by 2041. National Statistics, Welsh Government, accessed 30/01/18, http://gov.wales/statistics-and-research/national-population-projections/?lang=en*

[77] *Stats Wales, Local authority municipal waste, https://statswales.gov.wales/Catalogue/Environment-and-Countryside/Waste-Management/Local-Authority-Municipal-Waste*

Figure 12: Arisings and treatment of IRIs in the model baseline

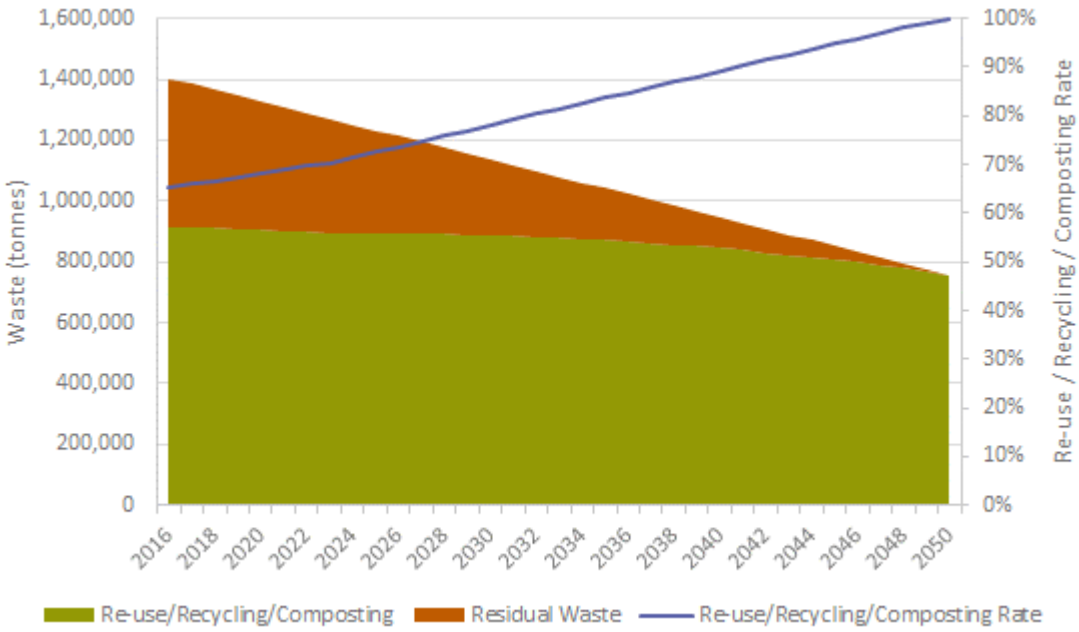


5.3.2 Calculating the national recycling rate

The entire LACMW stream must be considered in order to calculate the national re-use and recycling rate. Whilst arisings and treatment IRIs are considered to remain largely the same in each year in the baseline scenario, it is assumed that the rest of the waste stream continues to develop. A linear waste reduction assumption is applied each year based on the linear regression trend from the previous decade of waste data, shown in Figure 11. It is also assumed that the rest of the LACMW meets recycling rate targets set in the Zero Waste strategy:[78] 70% by 2024 and zero waste by 2050, interpreted as 100% re-use, recycling and composting. The net effect of annual waste reduction and increasing recycling rates is to reduce residual waste to zero by 2050 whilst the total tonnage of re-use, recycling and composting remains largely constant, as shown in Figure 13.

[78] *Welsh Assembly Government (2009), Towards Zero Waste One Wales: One Planet, http://gov.wales/docs/desh/publications/090521susdev1wales1planeten.pdf*

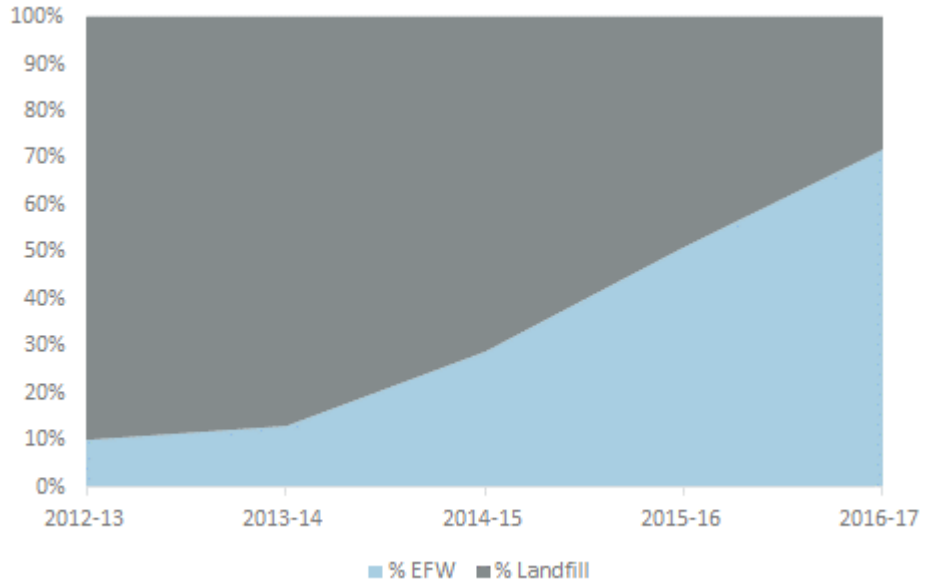
Figure 13: Arisings and treatment of the rest of the LACMW stream in the model baseline (waste items not included in the list of IRIs)



Note that the data in Figure 13 does not include the IRI tonnage.

The EfW industry has grown dramatically in recent years, with a subsequent reduction in the use of landfill, as demonstrated in Figure 14. The Cardiff Energy Recovery Facility (ERF), for example, has a capacity of 350,000 tonnes per annum, has been operational since 2014, and the plant's operating company, Viridor, claims the facility treats at least 95% of South Wales' residual waste,[79] referring to waste received from a partnership of five Councils: Cardiff, Newport, Monmouthshire, Vale of Glamorgan and Caerphilly.

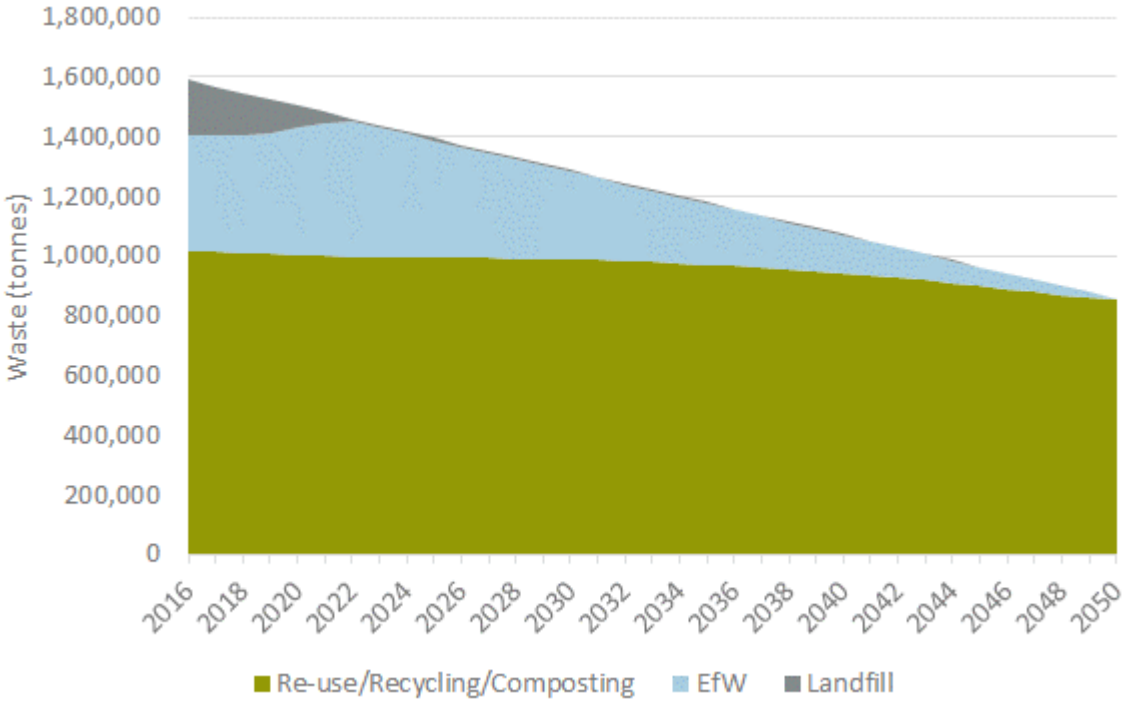
Figure 14: Treatment of residual municipal waste in Wales



[79] *Viridor, CARDIFF ERF, accessed 15/1/2018, https://www.viridor.co.uk/our-operations/energy/energy-recovery-facilities/cardiff-erf/*

Further growth is expected in the Welsh Government strategy Towards Zero Waste[80] which sets out the aspiration that by 2025 "residual waste [will be] phased out of landfill sites [and sent instead] to high efficiency Energy from Waste plants". Much of the additional EfW capacity will be provided by the Wheelabrator Parc Adfer Project EfW[81] in North Wales, which will have a capacity of 200,000 tonnes per annum and will be operational in 2019. Figure 15 shows how waste treatment is modelled in the baseline, incorporating the capacity of the Wheelabrator Parc Adfer Project. It is assumed this plant will reach near full capacity three years after coming online. The effect is that by 2022 there is enough EfW capacity (if reduction and recycling assumptions are correct) to treat all LACMW residual waste, although the model assumes that 2% of residual waste is still sent to landfill for technical reasons. Interestingly, the reducing quantity of residual waste means that the demand for EfW will start to decrease sharply after 2022.

Figure 15: Treatment of LACMW



5.4 Scenario functionality for model outputs

The model scenarios explore the question: what is the impact of increasing the level of preparation for re-use?

A metric was invented to measure the current level of preparation for re-use, as calculated below:

Calculation (%) = re-use of IRIs (t) / municipal waste generation (t)

[80] *Welsh Assembly Government (2009), Towards Zero Waste One Wales: One Planet, http://gov.wales/docs/desh/publications/090521susdev1wales1planeten.pdf*

[81] *Wheelabrator Parc Adfer Project , accessed 15/1/2018, http://wtiparcadfer.co.uk/*

This metric calculates what proportion of the LACMW stream is treated with preparation for re-use activities. The metric was calculated for each local authority using WasteDataFlow data to reveal the top five performing authorities, shown in Figure 16. The average value of the re-use metric for these authorities is 1.5%. This is taken as a conservative estimate for current Welsh good practice. Powys shows a much higher level of preparation for re-use than other local authorities in Wales. These values were verified with Powys County Council. The activities behind this re-use tonnage were explored in a telephone interview, which revealed a multi-pronged approach with a long-term and strong working relationships with third sector partners.[82, 83]

Figure 16: Re-use of IRIs as a percentage of municipal waste generation[84]

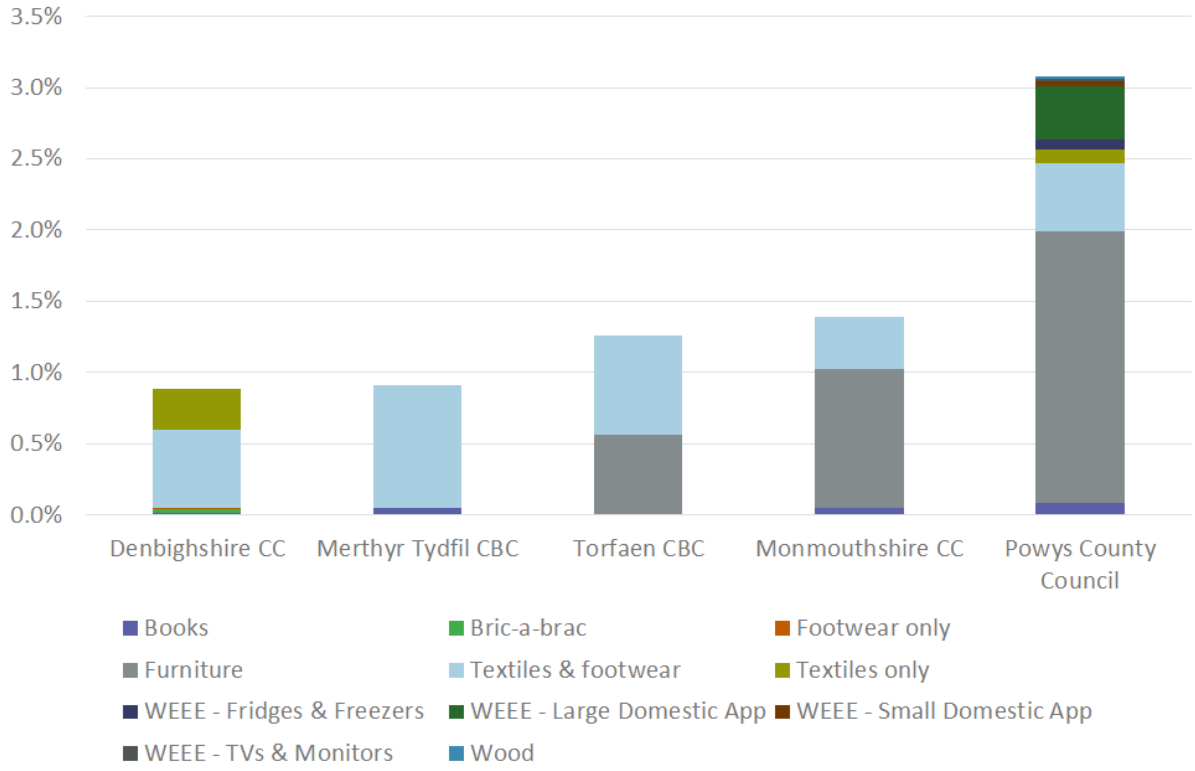


Table 24 summarises the way in which each scenario is represented in the model. Scenario B+ reflects the maximum potential level of re-use determined by an assessment of re-usability in the national waste composition study,[85] with a few data gaps filled by another composition study.[86]

[82] *Powys County Council (2014), Powys County Council Waste Strategy 2014/15*

[83] *Interview with Powys County Council's Information Officer, 9 October 2017*

[84] *Note that the model uses more categories of waste than are separately recorded in WasteDataFlow and so the 'bric-a-brac' category was included in the analysis to capture some of the tonnage from categories: 'Electrical & Electronic Toys', 'Gardening tools', 'Toys', and 'Baby equipment'. The chart only shows waste categories for which a tonnage was reported in the local authorities shown.*

[85] *WRAP (2016), Wales Municipal Compositional Analysis*

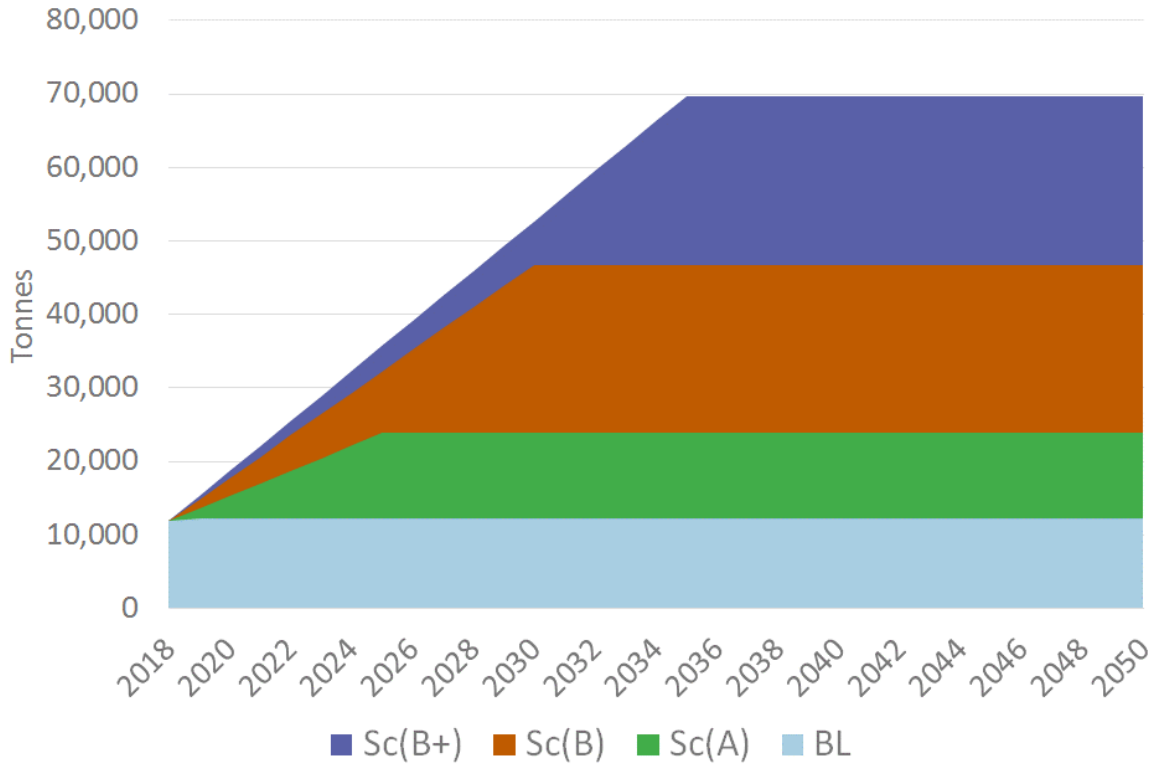
[86] *New analysis of data collected for WRAP (2012), Composition of kerbside and HWRC bulky waste.*

Table 24: Scenario modelling methods

Scenario	Performance	Timing
Scenario A Welsh good practice	A national average 1.5% in the preparation for re-use metric, [87], reflecting the average of the current five top performing authorities.	This performance is achieved in 2025, rising from current values, and maintained until 2050.
Scenario B International good practice	Modelled as the mid-point between Scenario A and B+.	This performance is achieved in 2030, rising from current values, and maintained until 2050.
Scenario B+ Maximum potential technical feasibility	Each item reaches the maximum level of re-use, based on the current condition of items assessed in the national waste composition study.	This performance is achieved in 2035, rising from current values, and maintained until 2050.

The effect of the scenarios on the total tonnage is shown in Figure 17.

Figure 17: Re-use of IRIs



Each item reaches its maximum re-use rate in 2035 in Scenario B+, and the years between 2019 and 2035 are modelled as a linear increase in re-use from current levels. Scenarios A and B are modelled in a similar way, except with different levels of re-use and different years in which they reach a 'peak' of re-use. For example, Scenario A reflects current Welsh good practice, the re-use tonnage is calculated as 1.5% of LACMW

[87] *Relative to 2016/17 tonnage of LACMW.*

in 2016/17, which is achieved in 2025. Scenario A is modelled as a point between current re-use levels and the maximum re-use rate for each item, where the total re-use tonnage is equal to 1.5% of LACMW in 2016/17, as described above. Scenario B is simply the mid-point between Scenario A and B+, achieving 'peak' re-use rates in 2030.

Table 25 shows the re-use metric calculated for the preparation for re-use levels shown in Figure 17.

Figure 13shows the waste reduction in the rest of the LACMW stream, which is the denominator in the re-use metric. Scenario A 2025 preparation for re-use tonnage is calculated as 1.5% of 2016/17 LACMW. However, by 2025 the municipal waste stream has reduced and so this tonnage now accounts for 1.7%. The falling municipal waste generation tonnage causes the re-use metric to rise even in the baseline and after the re-use tonnage peaks in the other scenarios.

Table 25: National re-use metric (%) = re-use of IRIs (T) / municipal waste generation (T)

	2019	2020	2025	2030	2035	2040	2045	2050
Baseline	0.6%	0.8%	0.9%	0.9%	1.0%	1.1%	1.2%	1.3%
Scenario A - Welsh Good Practice	0.6%	1.0%	1.7%	1.8%	1.9%	2.1%	2.3%	2.5%
Scenario B - international best practice	0.6%	1.2%	2.3%	3.5%	3.8%	4.1%	4.5%	5.0%
Scenario B+ - Maximum technical feasibility	0.6%	1.2%	2.5%	4.0%	5.7%	6.2%	6.7%	7.4%

5.5 Model outputs

The model results are discussed for each scenario in Section 4.0. Comparison and analysis of the scenario results reveals further insight into the model and the potential effect of increasing preparation for re-use, as explored in the section below.

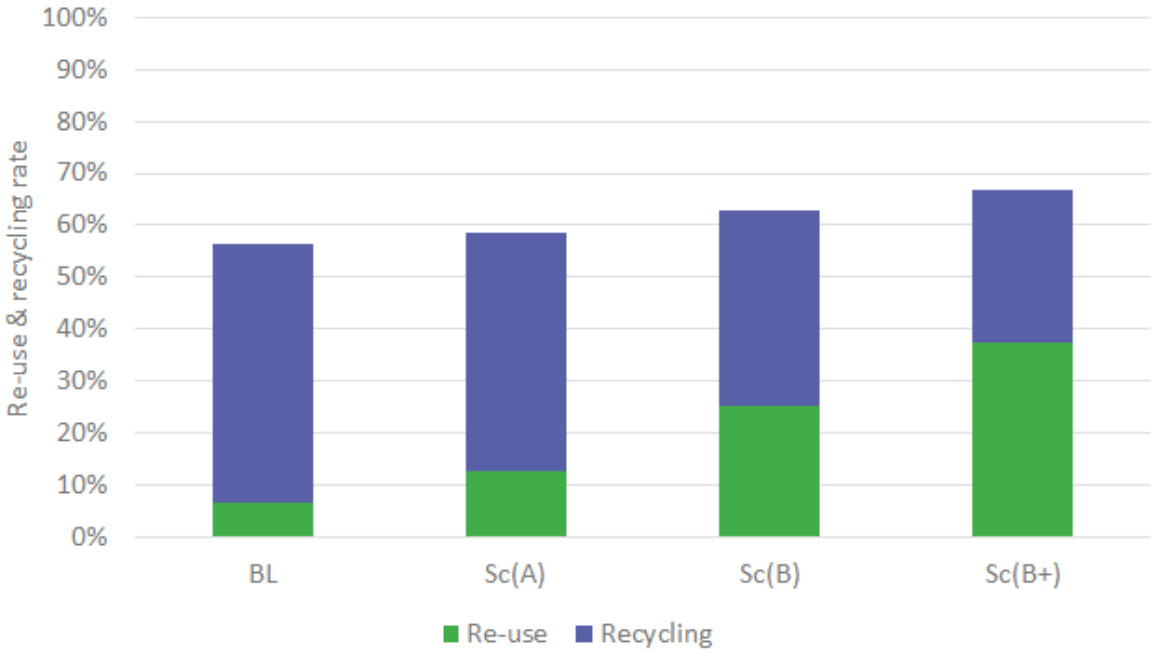
Table 26 shows that increasing preparation for re-use has a relatively small impact on the national recycling rate. The impact is limited for several reasons. Firstly, the IRIs only account for 12% of the total LACMW stream. Secondly, a significant portion of the material diverted to re-use comes from the current recycling stream as well as the residual waste stream. This means that increasing preparation for re-use will decrease recycling to some extent. Thirdly, re-use of each item is limited to a maximum feasible re-use rate based on the condition of items currently found in the waste stream.

Table 26: Estimated impact on the national recycling rate by 2050

	Baseline	Scenario A	Scenario B	Scenario B+
National recycling rate	91.4%	91.8%	92.67%	93.5%

Figure 18 highlights how re-use increases across scenarios but the net impact on the re-use and recycling rate is less pronounced. The re-use and recycling rate shown is calculated as 're-use and recycling of IRIs' (T) / 'total arisings of IRIs' (T).

Figure 18: Re-use and recycling rate of IRIs



A comparison of impact metrics for each scenario is shown in Table 27. The re-use tonnage relates to the coloured area under each line in Figure 17.

Table 27: Summary table of the estimated impact from waste treatment of IRIs, cumulative values from 2019 to 2050

Metric	Baseline	Scenario A	Scenario B	Scenario B+
Re-use tonnage	389,000	727,000	1,300,000	1,770,000
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	- £171 m	- £163 m	- £149 m	- £139 m
Sale value of re-used items †	£239 m	£560 m	£1,070 m	£1,440 m
GVA, including multiplier effects †	£1,450 m	£1,460 m	£1,470 m	£1,480 m
GHG savings (tonnes CO2e)	3,940,000	4,080,000	4,380,000	4,620,000
Value of GHG savings †	£233 m	£242 m	£262 m	£278 m

† Discounted at HM Treasury discount rate

As shown in Figure 6, the waste categories contributing the greatest increase in re-use tonnage are wood, furniture and WEEE. As each IRI has different impact factors in the model, these are not necessarily the IRIs driving the results across all metrics. For example, 'clothing, shoes and textiles' and 'carpets and underlay' contribute most of the greenhouse gas savings. Job creation is largely associated with 'clothing, shoes and textiles', 'small domestic appliances' in the WEEE category, and 'wood'. GVA meanwhile

has large contributions from 'wood', 'clothing, shoes and textiles' and the white goods and appliances WEEE categories.

The environmental and social impacts of the clothing sector are known to be particularly high[88,89,90] and these model results support the case for increasing re-use activity, particularly on the grounds of the GHG benefits. It has been previously recommended in Section 4.3.1 how re-use of clothing could be boosted.

The jobs and GVA assumptions in the model are to some extent limited by using today's relatively small preparation for re-use sector to model what will become a large and complicated industry as it matures. For example, recycling furniture requires a lot of labour to disassemble furniture items and so the employment impacts compare favourably to re-use where a lot of work is undertaken by volunteers. The re-use industry will naturally seek to work with the items found in the best condition available, taking the cream of the stock out of the waste stream. However, as the amount of re-use material increases organisations will work with items in poorer condition requiring more work. A mature re-use industry requiring more specialist repair skills is likely to have a greater employment intensity. It is entirely possible, therefore, that the number of jobs and GVA created per tonne could increase. The model impact factors have not been altered to reflect such changes as there are no suitable data available to inform these assumptions. Employment and GVA impacts of re-use may, therefore, be underestimated in future years.

Similarly, the GHG impacts of re-use relate to reduced consumption of newly manufactured products, which are displaced by re-used goods. The model assumes different displacement factors for IRIs based on research into second-hand shopping behaviour. Re-used goods are typically much more affordable and therefore more accessible to people and groups with lower disposable incomes. The availability of affordable goods has great social and economic importance. In these circumstances the consumer may not purchase as many products if the cheap second-hand goods are not available, i.e. the displacement rate is low. However, attitudes towards re-use and second-hand goods are changing. Under a paradigm-shift scenario there will be a much greater supply of re-used goods and demand will increase from all sections of society. Re-use will, therefore, displace more primary consumption than is seen today. The current displacement rate limits the GHG benefits of re-use calculated in the model. A lack of category detail in some data sources mean that some IRIs are mapped to generic waste categories, which may not accurately reflect the GHG impacts of that specific product. The shortcomings in the detail of source data and the low displacement rates result in relatively low GHG impacts for some IRIs, most notably the furniture categories. This is a limitation of the data and future research could provide more accurate results. However, it does highlight the importance of the displacement factor on the GHG

[88] *WRAP (2017), Valuing Our Clothes: the cost of UK fashion, http://www.wrap.org.uk/sustainable-textiles/valuing-our-clothes%20*

[89] *WRAP (2013), Economic Impacts of Resource Efficient Business Models in Textiles, http://www.wrap.org.uk/sustainable-textiles/scap/resource-efficient-business-models/reports/economic-impacts-of-rebms*

[90] *World Resources Institute (2017), The Apparel Industry's Environmental Impact in 6 Graphics, http://www.wri.org/blog/2017/07/apparel-industrys-environmental-impact-6-graphics*

impacts and the benefit of promoting re-use as an alternative to buying newly manufactured goods as well as a valuable market for less affluent sectors of society.

There is also a danger in seeking to maximise an impact in a single area at the cost of all others, and it is for this reason that a broad range of impacts are presented in this study. GVA is an imperfect measure of economic contribution, and economic growth is not an end in itself as it is the benefit to society, progress and well-being created by economic growth that is also of importance. Recycling may generate a lot of jobs and GVA per tonne of material handled but a broad range of impacts should be weighed before deciding the best fate for waste materials. It is recommended that there be a focus of further work in this area. The waste hierarchy provides a good reference for priorities of waste management in the absence of detailed item-specific life cycle assessment.

5.5.1 Limitations

As a high-level exercise, the model fulfils its purpose to indicate the scale of impact that might be achievable by implementing different scenarios of increasing preparation for re-use. However, the model has constraints that should be understood when interpreting the results.

The calculated impacts are driven by the mass flows in the model. Sensitivity analysis has not been carried out to reflect uncertainty in the baseline or the future scenarios' preparation for re-use tonnage as this is essentially what the scenarios do. If a level of re-use is achieved somewhere between the values modelled in two scenarios then the impacts will similarly fall in the range presented for the two scenarios. The baseline data is assumed to be representative.

Re-use of items is limited in all scenarios to a maximum feasible re-use rate based on an assessment of items currently found in the waste stream. The method is based on a fairly rudimentary visual assessment but gives an idea of what proportion of these items may be suitable for re-use and what proportion are too badly damaged or soiled. The assessment attempts to distinguish between damage and soiling that occurred as they entered the waste stream as a result of discarding the objects, for example stains from being mixed with food waste, and damage that occurred before the object was discarded. Some of the interventions in The Roadmap are likely to intercept objects before they enter the waste stream, limiting the damage caused by careless transport and mixing of waste. Some of the more progressive measures are also likely to alter the way in which householders care, maintain and repair their possessions. For these reasons, the current maximum feasible re-use rate would not apply in future years under the paradigm shift in Scenario C. Indeed, The Roadmap contains measures that will fundamentally change not only consumption, item maintenance and waste treatment patterns but also affect item design and manufacturing to the extent that by 2050 the waste stream may be unrecognisable from that seen in Wales today. Due to the uncertainty of predicting and quantifying such changes, the impacts of the paradigm shift in Scenario C are not modelled as fully as the other scenarios.

The impact calculations for the paradigm shift in Scenario C are limited to those associated with avoiding residual waste, rather than the full range of impacts calculated

for other scenarios in this project. To understand the full impact in the same terms presented for the other scenarios it must first be understood how the actions described in The Roadmap will affect the waste stream, specifically in terms of waste prevention, preparation for re-use and recycling activities, and reduction in waste treated with EfW and landfill. The impact factors should also be reviewed to understand employment, GVA and greenhouse gas emissions associated with the paradigm shift, as this could be radically different to the current activities upon which the metrics are based for Scenarios A, B and B+. Further research is required and may draw upon previous work, such as a 2011 study to understand the environmental impact of extending item lifetimes.[91]

All calculations are limited to the extent that the metrics are based on the impacts of current activities. It is impossible to predict how the impact factors, per tonne of waste, may change in the future, particularly where impacts rely on technology such as carbon emissions from production and waste management, or market values such as gate fees and item resale values. Modelling impacts to 2050 is therefore an inherently speculative exercise. It is for this reason that the model aim is to provide an indicative scale of the impact of increasing preparation for re-use.

6.0 Recommendations on further research

During this research, several issues have arisen that would warrant further research to support the successful maximisation of the positive impacts of re-use:

1. Detailed composition of separately collected material streams at HWRCs including an assessment potential for re-use.
2. Audit of the current re-use operators in Wales, the scope, scale and potential for growth.
3. Research into the social return on investment of preparation for re-use activities. There is a growing theoretical literature on Social Return on Investment (SROI). In particular, the "avoided costs" are of interest regarding evidencing the positive impact re-use has on individuals and communities.
4. To aid understanding for a paradigm shift in re-use, better data on re-useable items outside of LACMW systems is required. To achieve a paradigm shift LACMW systems will blend with other material systems. Therefore, an assessment of the number and the quality of items going through direct re-use channels e.g. online sales, charity retail, car boot sales, and small-scale community initiatives such as tool libraries, and swap shops. would assist in building the bigger picture.
5. Research into the attitudinal barriers to re-use for specific items and interventions that would overcome those barriers.
6. Circular Economy scoping study and the role re-use could play in the short to medium term.

[91] *DEFRA (2011), Longer Product Lifetimes - EV0445, http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17047*

7. Detailed analysis of the key items and waste diversions driving the results and sensitivity analysis over the assumptions of tonnage and impact factors. This could inform different stakeholders to focus on particular items or waste streams depending on their individual priorities (e.g. gate fee savings, carbon, jobs.).
8. Research into how individual measures might affect preparing for re-use levels of different items and recalculate using bottom-up approach – apply each intervention in turn, increasing re-use of each item accordingly, and apply several interventions that make up a scenario. This may be some way in the future as the evidence base is currently lacking.
9. Undertake new research and augment existing data sets on the environmental, economic and social impacts of producing goods and managing waste. For example, the Scottish Carbon Metric could provide greater detail on household waste material types and common product categories such as the IRIs used in this study.

Appendix 1 Impact factors

The model calculates the impact of different waste treatment methods by multiplying the tonnage data by 'impact factors'. Each impact factor gives the impact per tonne of waste, for example the jobs created for each tonne of waste recycled. Impact factors were gathered for each item and each waste treatment method: preparation for re-use, recycling, EfW and landfill, as described in Section 5.2.3. The values used in the model are shown in Table 28 to Table 31 below, including intermediary values used in calculating GVA and greenhouse gas emission factors. Some values are included for mattresses so that they can be included in the residual waste diversion calculations in Scenario C.

Table 28: Preparation for re-use impact factors

In-scope re-useable items / Impact factor	Resale value (+ve is revenue) (£ / T)	GVA (£ / hr)	GVA (£ / T)	Paid jobs (FTEs / T)	Volunteers (FTEs / T)	Jobs income (£ / T)	GHG emissions (tCO_2e / T)	GHG value 2017 (£ / T)
Hard furniture	£1,340.00	£17.25	£217.91	0.0074	0.0058	£168.26	-0.513	-£2.22
Soft furniture	£2,395.00	£17.25	£217.91	0.0074	0.0058	£168.26	-0.456	-£1.97
Office furniture	£869.00	£17.25	£112.19	0.0038	0.0029	£86.62	-0.475	-£2.05
Clothing, shoes and textiles	£460.00	£17.25	£493.38	0.0168	0.0007	£380.96	-5.929	-£397.91
TVs & monitors	£2,338.00	£33.42	£671.43	0.0118	0.0096	£267.58	-0.474	-£2.05
Fridges & freezers	£1,210.00	£33.42	£779.54	0.0137	0.0113	£310.67	-0.474	-£2.05
Large domestic app.	£2,197.00	£33.42	£779.54	0.0137	0.0113	£310.67	-0.474	-£2.05
Small domestic app.	£1,667.00	£33.42	£779.54	0.0137	0.0113	£310.67	-0.597	-£2.58
Electrical & electronic toys	£5,800.00	£33.42	£779.54	0.0137	0.0113	£310.67	-0.439	-£1.90
Automotive batteries	N/A	£17.25	£282.23	0.0096	0.0046	£217.92	-2.906	-£195.03
Post-consumer, non-automotive batteries	N/A	£17.25	£282.23	0.0096	0.0046	£217.92	-2.906	-£195.03
Paint & varnishes	£1,592.00	£17.25	£282.23	0.0096	0.0046	£217.92	-0.336	-£1.45
Wood	£1,590.00	£17.25	£282.23	0.0096	0.0046	£217.92	-0.124	-£8.35
Carpets and underlay	£2,400.00	£17.25	£80.76	0.0028	0.0008	£62.36	-4.907	-£21.22
Books	£3,500.00	£17.25	£282.23	0.0096	0.0046	£217.92	-0.212	-£0.92
Gardening tools	£2,180.00	£17.25	£282.23	0.0096	0.0046	£217.92	-0.421	-£1.82
Toys	£3,210.00	£17.25	£282.23	0.0096	0.0046	£217.92	-0.765	-£3.31
Bicycles	£3,210.00	£17.25	£282.23	0.0096	0.0046	£217.92	-0.935	-£4.04
Baby equipment	£3,210.00	£17.25	£282.23	0.0096	0.0046	£217.92	-0.765	-£3.31

Table 29: Recycling impact factors

In-scope re-useable items / Impact factor	Gate fees (+ve is cost) (£ / T)	GVA (£ / hr)	GVA (£ / T)	Paid jobs (FTEs / T)	Volunteers (FTEs / T)	Jobs income (£ / T)	GHG emissions (tCO_2e / T)	GHG value 2017 (£ / T)
Hard furniture	£50.00	£42.05	£973.55	0.0136		£308.40	-1.216	-£5.26
Soft furniture	£50.00	£42.05	£973.55	0.0136		£308.40	-1.216	-£5.26
Office furniture	£50.00	£42.05	£973.55	0.0136		£308.40	-1.216	-£5.26
Clothing, shoes and textiles	-£230.00	£42.05	£357.92	0.0050		£113.38	-5.828	-£391.15
TVs & Monitors	-£60.00	£42.05	£386.56	0.0054		£122.45	-0.181	-£0.78
Fridges & freezers	-£116.70	£42.05	£386.56	0.0054		£122.45	-0.181	-£0.78
Large domestic app.	-£116.70	£42.05	£386.56	0.0054		£122.45	-0.181	-£0.78
Small domestic app.	£0.00	£42.05	£386.56	0.0054		£122.45	-0.181	-£0.78
Electrical & electronic toys	£0.00	£42.05	£386.56	0.0054		£122.45	-0.181	-£0.78
Automotive batteries	-£463.00	£42.05	£787.43	0.0110		£249.44	-0.579	-£38.83
Post-consumer, non-automotive batteries	£0.00	£42.05	£787.43	0.0110		£249.44	-0.579	-£38.83
Paint & varnishes	£300.00	£42.05	£200.44	0.0028		£63.49	-0.725	-£3.14
Wood	£20.00	£42.05	£53.69	0.0008		£17.01	-0.289	-£19.40
Carpets and underlay	£65.00	£42.05	£200.44	0.0028		£63.49	-5.828	-£25.20
Books	-£78.00	£42.05	£143.17	0.0020		£45.35	-0.547	-£2.36
Gardening tools	-£49.00	£42.05	£386.56	0.0054		£122.45	-0.181	-£0.78
Toys	£117.00	£42.05	£737.32	0.0103		£233.57	-0.539	-£2.33
Bicycles	-£49.00	£42.05	£386.56	0.0054		£122.45	-2.543	-£11.00
Baby equipment	£117.00	£42.05	£737.32	0.0103		£233.57	-0.539	-£2.33

Table 30: Energy from waste impact factors

In-scope re-useable items / Impact factor	Gate fees (+ve is cost) (£ / T)	GVA (£ / hr)	GVA (£ / T)	Paid jobs (FTEs / T)	Volunteers (FTEs / T)	Jobs income (£ / T)	GHG emissions (tCO_2e / T)	GHG value 2017 (£ / T)
Hard furniture	£91.00	£29.11	£8.42	0.0002		£3.86	-0.201	-£0.87
Soft furniture	£91.00	£29.11	£8.42	0.0002		£3.86	-0.201	-£0.87
Office furniture	£91.00	£29.11	£8.42	0.0002		£3.86	-0.201	-£0.87
Clothing, shoes and textiles	£91.00	£29.11	£8.42	0.0002		£3.86	0.216	£0.93
TVs & monitors	£91.00	£29.11	£8.42	0.0002		£3.86	0.062	£0.27
Fridges & freezers	£91.00	£29.11	£8.42	0.0002		£3.86	0.062	£0.27
Large domestic app.	£91.00	£29.11	£8.42	0.0002		£3.86	0.062	£0.27
Small domestic app.	£91.00	£29.11	£8.42	0.0002		£3.86	0.062	£0.27
Electrical & electronic toys	£91.00	£29.11	£8.42	0.0002		£3.86	0.062	£0.27
Automotive batteries	£91.00	£29.11	£8.42	0.0002		£3.86	0.403	£1.74
Post-consumer, non-automotive batteries	£91.00	£29.11	£8.42	0.0002		£3.86	0.403	£1.74
Paint & varnishes	£375.00	£29.11	£8.42	0.0002		£3.86	-1.195	-£5.17
Wood	£91.00	£29.11	£8.42	0.0002		£3.86	-0.271	-£1.17
Carpets and underlay	£91.00	£29.11	£8.42	0.0002		£3.86	0.216	£0.93
Books	£91.00	£29.11	£8.42	0.0002		£3.86	-0.180	-£0.78
Mattresses	£91.00						0.139	£0.60
Gardening tools	£91.00	£29.11	£8.42	0.0002		£3.86	0.062	£0.27
Toys	£91.00	£29.11	£8.42	0.0002		£3.86	1.665	£7.20
Bicycles	£91.00	£29.11	£8.42	0.0002		£3.86	0.062	£0.27
Baby equipment	£91.00	£29.11	£8.42	0.0002		£3.86	1.665	£7.20

Table 31: Landfill impact factors

In-scope re-useable items / Impact factor	Gate fees (+ve is cost) (£ / T)	GVA (£ / hr)	GVA (£ / T)	Paid jobs (FTEs / T)	Volunteers (FTEs / T)	Jobs income (£ / T)	GHG emissions (tCO_2e / T)	GHG value 2017 (£ / T)
Hard furniture	£107.00	£29.11	£3.47	0.0001		£1.59	0.108	£7.22
Soft furniture	£107.00	£29.11	£3.47	0.0001		£1.59	0.108	£7.22
Office furniture	£107.00	£29.11	£3.47	0.0001		£1.59	0.108	£7.22
Clothing, shoes and textiles	£107.00	£29.11	£3.47	0.0001		£1.59	0.599	£40.20
TVs & monitors	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31
Fridges & Freezers	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31
Large domestic app.	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31
Small domestic app.	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31
Electrical & electronic toys	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31
Automotive batteries	£107.00	£29.11	£3.47	0.0001		£1.59	0.091	£6.11
Post-consumer, non-automotive batteries	£107.00	£29.11	£3.47	0.0001		£1.59	0.091	£6.11
Paint & varnishes	£107.00	£29.11	£3.47	0.0001		£1.59	0.000	£0.00
Wood	£107.00	£29.11	£3.47	0.0001		£1.59	0.925	£62.07
Carpets and underlay	£107.00	£29.11	£3.47	0.0001		£1.59	0.599	£40.20
Books	£107.00	£29.11	£3.47	0.0001		£1.59	0.498	£33.44
Mattresses	£107.00						0.302	£20.25
Gardening tools	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31
Toys	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31
Bicycles	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31
Baby equipment	£107.00	£29.11	£3.47	0.0001		£1.59	0.005	£0.31

Appendix 2 Re-usability assessment

Table 32 shows the maximum level of re-use as assessed in the national waste composition study, with a few data gaps filled by data from composition of kerbside and HWRC bulky waste. [92] [93] In the national composition study, items deemed re-usable were weighed separately to gauge an accurate record of the re-usability percentage by weight.

Table 32: Percentage of each waste item deemed re-usable

In-scope re-useable items	Maximum re-usability, by weight	Item	Maximum re-usability, by weight
Hard furniture	47%	**Post-consumer, non-automotive batteries**	0%
Soft furniture	51%	**Paint & varnishes**	60%
Office furniture	53%	**Wood**	43%
Clothing, shoes and textiles	23%	**Carpets and underlay**	33%
TVs & monitors	63%	**Books**	98%
Fridges & freezers	32%	**Mattresses**	0%
Large domestic app	52%	**Gardening tools**	35%
Small domestic app	38%	**Toys**	23%
Electrical & electronic toys	89%	**Bicycles**	69%
Automotive batteries	0%	**Baby equipment**	90%

[92] *WRAP (2016), Wales Municipal Compositional Analysis*

[93] *New analysis of data collected for WRAP (2012), Composition of kerbside and HWRC bulky waste.*

Appendix 3 Yearly impacts

Table 33 to Table 36 show the impacts calculated for each year in the model.

Table 33: Baseline impacts calculated for each year, including multiplier effects and discounting, results at five year intervals

Impact / year	2019	2025	2030	2035	2040	2045	2050
Re-use tonnage	12,165	12,165	12,165	12,165	12,165	12,165	12,165
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	-£8,824,522	-£7,017,987	-£5,908,957	-£4,975,183	-£4,188,971	-£3,527,001	-£3,013,098
Sale value of re-used items †	£12,079,800	£9,826,925	£8,274,007	£6,966,492	£5,865,599	£4,938,677	£4,219,085
GVA, including multiplier effects †	£73,415,200	£59,837,888	£50,381,896	£42,420,205	£35,716,674	£30,072,481	£25,690,756
GHG savings (tonnes CO_2e)	118,173	123,309	123,309	123,309	123,309	123,309	123,309
Value of GHG savings †	£3,227,237	£5,292,498	£6,355,190	£8,051,106	£8,884,855	£9,309,451	£9,467,873
Jobs (FTEs), inc. multiplier effects	1,424	1,427	1,427	1,427	1,427	1,427	1,427
Salaries from jobs, including multiplier effects	£25,681,152	£25,743,135	£25,743,135	£25,743,135	£25,743,135	£25,743,135	£25,743,135
Volunteers (FTEs)	38	38	38	38	38	38	38

† Discounted at HM Treasury discount rate

Table 34: Scenario A impacts calculated for each year, including multiplier effects and discounting, results at five year intervals

Impact / year	2019	2025	2030	2035	2040	2045	2050
Re-use tonnage	13,565	23,847	23,847	23,847	23,847	23,847	23,847
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	-£8,771,189	-£6,620,896	-£5,574,617	-£4,693,678	-£3,951,951	-£3,327,437	-£2,842,611
Sale value of re-used items †	£14,528,632	£25,328,431	£21,325,859	£17,955,801	£15,118,303	£12,729,205	£10,874,491
GVA, including multiplier effects †	£73,439,434	£60,173,513	£50,664,483	£42,658,135	£35,917,005	£30,241,155	£25,834,853
GHG savings (tonnes CO_2e)	118,047	128,464	128,464	128,464	128,464	128,464	128,464
Value of GHG savings †	£3,198,667	£5,530,837	£6,622,184	£8,387,694	£9,256,299	£9,698,647	£9,863,692
Jobs (FTEs), inc. multiplier effects	1,433	1,518	1,518	1,518	1,518	1,518	1,518
Salaries from jobs, including multiplier effects	£25,889,806	£27,759,351	£27,759,351	£27,759,351	£27,759,351	£27,759,351	£27,759,351
Volunteers (FTEs)	47	108	108	108	108	108	108

† Discounted at HM Treasury discount rate

Table 35: Scenario B impacts calculated for each year, including multiplier effects and discounting, results at five year intervals

Impact / year	2019	2025	2030	2035	2040	2045	2050
Re-use tonnage	14,763	32,229	46,784	46,784	46,784	46,784	46,784
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	-£8,719,827	-£6,332,295	-£4,909,662	-£4,133,804	-£3,480,552	-£2,930,531	-£2,503,537
Sale value of re-used items †	£16,462,638	£36,341,638	£46,700,910	£39,320,913	£33,107,154	£27,875,335	£23,813,746
GVA, including multiplier effects †	£73,485,449	£60,431,481	£51,258,857	£43,158,582	£36,338,368	£30,595,931	£26,137,936
GHG savings (tonnes CO_2e)	118,691	132,786	140,291	140,291	140,291	140,291	140,291
Value of GHG savings †	£3,226,215	£5,739,148	£7,236,522	£9,159,923	£10,108,498	£10,591,571	£10,771,811
Jobs (FTEs), inc. multiplier effects	1,442	1,585	1,701	1,701	1,701	1,701	1,701
Salaries from jobs, including multiplier effects	£26,100,664	£29,233,155	£31,792,411	£31,792,411	£31,792,411	£31,792,411	£31,792,411
Volunteers (FTEs)	54	158	243	243	243	243	243

† Discounted at HM Treasury discount rate

Table 36: Scenario B+ impacts calculated for each year, including multiplier effects and discounting, results at five year intervals

Impact / year	2019	2025	2030	2035	2040	2045	2050
Re-use tonnage	15,256	35,680	52,701	69,721	69,721	69,721	69,721
LA waste treatment costs: EfW & landfill gate fee minus recycling revenue †	-£8,698,678	-£6,213,457	-£4,738,134	-£3,573,927	-£3,009,150	-£2,533,624	-£2,164,461
Sale value of re-used items †	£17,259,005	£40,876,555	£53,246,529	£60,686,139	£51,096,101	£43,021,546	£36,753,071
GVA, including multiplier effects †	£73,504,396	£60,537,705	£51,412,179	£43,659,032	£36,759,733	£30,950,709	£26,441,021
GHG savings (tonnes CO_2e)	118,956	134,565	143,342	152,118	152,118	152,118	152,118
Value of GHG savings †	£3,237,558	£5,824,925	£7,394,993	£9,932,156	£10,960,701	£11,484,500	£11,679,935
Jobs (FTEs), inc. multiplier effects	1,446	1,612	1,748	1,884	1,884	1,884	1,884
Salaries from jobs, including multiplier effects	£26,187,489	£29,840,024	£32,832,758	£35,825,493	£35,825,493	£35,825,493	£35,825,493
Volunteers (FTEs)	57	178	278	379	379	379	379

† Discounted at HM Treasury discount rate

Appendix 4 Roadmap scenario summaries

	2019	Scenario A: Welsh good practice	2025	2035	2050
Strategy & support		Establish a Welsh Re-use Strategy Board with a remit to set a strategy, coordinate efforts and support stakeholders. The board should facilitate the development and implementation of a detailed implementation plan, secure funding and work with local authorities and re-use organisations.			
		Re-establish a Welsh Re-use Practitioners Working Group consisting of elected representatives from all elements of the value chain e.g. central and local government, third sector re-use organisations, charity retailers, waste management companies, educational establishments, social services and regeneration departments.			
		Develop a local authority re-use toolkit, which would build on WRAP's Household Waste Prevention Hub . It would provide resources such as bilingual Welsh/ English draft service contracts (between, for example, local authorities and re-use organisations, and re-use organisations and housing associations).			
		Establish a directory of re-use organisations' activity and capacity including a monitoring and evaluation plan to capture the operating scale and opportunity for expansion and collaboration.			
		Design and implement a common system, e.g. an online tool, to more accurately and consistently measure preparation for re-use of LACMW. The advantage for the participating re-use practitioners would be that the tool would calculate metrics for the wider benefits of re-use which would aid re-use organisations in evidencing the wider added-value impacts that they provide to society.			
		Local authorities in Wales, which are not already doing so, should promote and make recycling credits available to re-use organisations.			
		Actions to increase preparation for re-use of clothing currently in the waste stream should be co-ordinated with SCAP and its stakeholders across Wales.			
Policy		Each local authority should be encouraged to establish bulky waste collections which are geared towards protecting the outer surface of bulky items, including but not limited to, training of operatives and equipment to cushion and hold the items in lifting and in transit.			
		Each of the local authorities in Wales should provide re-use shops, or as a minimum, donation points for preparation for re-use on all HWRCs to boost collection and sale of re-useable items.			
Skills & operational capacity		Provide training to enable re-use organisations to maximise sales of goods through online sales portals, including technical aspects of webpage design, legal obligations of distance-selling and effective online marketing strategies.			
		A strategy in training in upcycling techniques and promotion of upcycling should be developed and implemented across Wales. This work to include skill-sharing between re-use organisations.			
		Coordination across Wales, assisted by the recommended national re-use strategy, to help existing niche material re-use organisations (e.g., paint re-use) explore and develop partnership opportunities.			
Engagement & communications		All local authorities in Wales should provide information to the public on local re-use organisations on their 'bins and recycling' (or equivalent) webpages.			
		Re-use organisations should focus their communications on the positive aspects of re-use in the competitive market for waste management contracts and it is Recommended that they are supported in doing so.			
		Re-use practitioners (including local authorities) should regularly share good re-use practice between them and so build a constantly updated re-use practice reference library, e.g. by use of the Good Practice Wales website.			

	2019	2025	Scenario B: international good practice	2035	2050
Strategy & support			Welsh Re-use Strategy Board evaluation of mid-term progress of Scenario A to inform detailed planning for Scenario B.		
			A strategy for developing Wales as an academic centre of excellence for re-use, monitoring and evaluation of re-use and re-use partnership design across its universities would boost the country's chances of becoming the global leader in re-use rates.		
			Support and promotion of a national network of 'library of things', swap shops and repair cafés.		
			The proposed Re-use Strategy Board should research the cross-government implications of setting targets associated with job creation and/or greenhouse gas reduction in relation to setting future re-use preparation targets.		
			Develop a programme to establish working arrangements to link re-use organisations with social housing landlords so they can collect, prepare for re-use and redistribute those same items to social housing tenants.		
Policy			Re-use is recognised and supported as being a contributor to achieving the aims and objectives of the Well-being of Future Generations (Wales) Act 2015.		
			Create a statutory obligation for local authorities to meet minimum re-use targets [3%]. The target could be across all material types or target specific items, e.g. furniture.		
			Ban of items to landfill and energy from waste treatment in order to stimulate innovation on preparation for re-use e.g. white goods.		
			Develop an accredited Welsh re-use standard and code of practice. The standard should go beyond other existing standards to cover whole value chain: from collection and treatment, to retail, customer care and after-sales.		
Skills & operational capacity			Develop a shared online stock-sharing and transportation platform for re-use organisations so that wholesale stock can be efficiently traded and transported between areas of high supply and high demand.		
			Support transition of micro local retail re-use stores to 'super-size retail warehouses' where market conditions are suitable.		
			Establish regional re-use and repair hubs combined with a national (or several regional) network(s) of donation points in addition to the HWRC network.		
Engagement & communications			Establish a 're-use helpline' (and online help platform) for Wales which provides an efficient and consistent advice to householders.		
			Welsh Government should look to embed the principles and benefits of re-use through the Welsh education system.		
			Use regional re-use coordinators would benefit the transition to an economy in which greater rates of re-use are realised.		
			Re-use, as a term should become the 'new normal' when discussing waste. The application of 'nudge theory' may be beneficial, e.g. changing the name of Household Waste Recycling Centres to 'Household Waste Re-use and Recycling Centres' or 'Household Re-use and Recycling Centres'.		
			Raise levels of awareness of re-use through direct publicity campaigns, as has been done with recycling previously.		
			Depending on the outcome of the UK's exit from the European Union (and if appropriate), Welsh Government could add value to, and benefit from, participating in the European Circular Economy Stakeholder Platform.		

	2019	2025	2035	Scenario C: paradigm shift	2050
Strategy & Support	Use *BS 8001:2017 Framework for implementing the principles of the circular economy in organisations* to assess the relevance and opportunities of supporting the circular economy in Wales to achieve the goals of the *Well-being of Future Generations (Wales) Act 2015*.				
	Establish a multi-disciplinary cross-sector circular economy delivery committee incorporating the proposed Wales National Re-use Strategy Board and Forum.				
		Conduct policy research between 2025 and 2035 into the mechanisms that would likely feature in a circular economy.			
			All public sector procurement assessed on sustainable circular economy criteria against positive impact on holistic long-term aims, e.g. social inclusion, material stewardship, long-term prosperity, economic resilience etc.		
			Set a strategy for Wales to become a global leader in supporting and implementing circular economy business practices.		
			Set-up an innovation fund for new 'designed for the circular economy' products, initiatives, and business models, with project and pilot studies to be led by private sector innovators. It should build on the success of cross-sector collaborations based on re-use (see Scenario B) to evolve into sustainable circular economy good practice.		
			Work with the finance sector to develop financial products and services that support the transition from the linear to circular business models. Understanding the financial implications of transitioning and need to support the long-term objectives of business through developing, establishing and growing circular practices.		
Policy				Welsh Government should look to incorporate the aims of achieving a circular economy with future revisions and updates to the Well-being of Future Generations Act.	
				Research should evaluate economic instruments, e.g. tax single-use items more than re-useable items, the role of extended producer responsibility schemes, incentivisation of action up the whole of the waste hierarchy, and tax breaks for TSROs.	
				Introduce targeted product-specific reparability standards and repair documentation transparency are supported through eco-labelling on reparability and expected product lifetime.	
				Deposit Return Schemes in Wales should be considered for goods such as large electrical goods and mattresses.	
Skills and operational capacity				Wales develops into the global leader for educational support in sustainable circular economy theory and practice.	
				TSROs in Wales operate at scale and deliver cross-sector partnership collaborations across the country on re-use, extended producer responsibility and material stewardship programmes.	
				Global cloud-based technology platforms should increasingly link businesses and consumers with efficient services delivered locally, and there should be less reliance on owning goods.	
Engagement & Communications				National sustainable circular economy campaigns incorporating re-use as the default behaviour.	
				Beyond exemplar case studies, a shareable knowledge base of mainstream, every-day, and incremental examples of change should also be developed to demonstrate that re-use and circular business and public sector models can and should be normal and routine.	
				Wales should work towards providing local services aimed at servicing, re-use and repair activities. Investment decisions should incorporate a deep understanding of the social benefits of re-use and should also cross departmental budgets.	

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