Re-use of WEEE from Household Waste Recycling Centres (HWRCs)

Trials

Valpak Consulting

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Glossary

AATF	Approved Authorised Treatment Facility
DCF	Designated Collection Facility: a registered and approved site which is dedicated to the collection of WEEE from private households for onward clearance by, or on behalf of, producers or compliance schemes. DCFs may be established at local authority civic amenity sites or waste transfer stations, or by distributors, producers, third parties or charitable and social enterprise organisations engaged in the re-use of EEE.
EEE	Electrical and Electronic Equipment
HWRC	Household Waste Recycling Centres
KPI	Key Performance Indicator
LA	Local Authority
LDAs	Large Domestic Appliances
NPV	Net Present Value
PAT	Portable Appliance Testing
WEEE	Waste Electrical and Electronic Equipment

Zero Waste Scotland works with businesses, individuals, communities and local authorities to help them reduce waste, recycle more and use resources sustainably.

Find out more at www.zerowastescotland.org.uk

Executive Summary

This report provides a summary of the opportunities to maximise the re-use of waste electrical and electronic equipment (WEEE) products disposed at HWRC sites. The project used four trials to identify the key issues, potential solutions to barriers and provide an economic analysis to identify the most cost effective options. The trials have resulted in commitments by the participating councils to continue the trials and expand them into permanent activity. In real terms, this means that 770,000 people, almost 15% of Scotland's population, now have the option to re-use their unwanted electrical items.

Background

Research indicates that only 7% of Waste Electrical and Electronic Equipment (WEEE) collected at Household Waste Recycling Centres (HWRCs) is currently re-used. However, it is estimated that approximately 23% could be re-used with only a small degree of refurbishment and repair[1]. However it should be noted that achieving this level of re-use will be dependent on the condition of items presented at site, site conditions, protection during transportation and technical ability of the re-use organisation. This presents a significant opportunity to increase the benefits of re-use to local communities at a time when the re-use sector is seeing a significant increase in demand for such items; particularly large domestic appliances.

Scope of Trials

- Trial I – Items collected from designated bays at HWRCs;
- Trial II – Items collected from lockable containers at HWRCs;
- Trial III – Re-use organisation set-up as a Designated Collection Facility (DCF); and
- Trial IV – Bulky uplifts intervention.

Key Findings

The report proves that re-use can be viable; however, a complex set of elements needs to be put in place and co-ordinated if the system is to succeed. The findings also show that no stakeholder can work in isolation; success is gained by partnership, and by a designated party taking "ownership" of the project. The findings are covered in more detail later in the report, but they can be summarised in the following key points:

Public Awareness is Important to Optimise Re-use

The public should be aware that re-use is available, and where they can access a site or location with the facilities to accept the item on a re-use basis. Knowledge can be provided in several ways with advertising, local marketing and use of a national re-use hotline available to local authorities at little cost. Installing a "Re-use First" approach means that the public may be more mindful of how they transport or arrange to have the items disposed. In addition, the awareness can also be replicated at the HWRCs, with the operational staff being conscious that the item they handle is not at the end of its useful life; someone in the local community may actually benefit from their actions.

Use of Containers at HWRCs Increases the Amount of Products that can Successfully be Re-used

The trials showed that the best value option for re-use was achieved by using dedicated containers at HWRCs. Having the right facilities at HWRCs meant that the second element of the operation (handling & storage) had a different focus, and became an independent service in its own right; re-

[1] http://www.wrap.org.uk/sites/files/wrap/WRAP%20WEEE%20HWRC%20summary%20report.pdf

use gained its place in the waste hierarchy by being ahead of recycling. Segregated WEEE, securely stored in watertight locking containers, had a significantly higher ratio of items repaired than when the WEEE was left in the open. These results can be improved via a combination of training, improving site signage and further support for HWRC operatives. During Trial I, 22% of LDAs and cooling equipment that were uplifted from the HWRCs were successfully re-used; however, during Trial II, 68% of items uplifted were re-used.

Co-ordination of Stakeholders is Important

A successful re-use process is a collaborative exercise, and needs co-ordination of all stakeholders. The trials showed that the re-use organisation should focus on the collection logistics of the items, planning the routes in line with the main reprocessing collections. This should be done in order to avoid the crew arriving on site after the recycling organisations. Co-ordination with other service providers (again with the compliance scheme facilitating the communication) meant that this situation was avoided.

Each partner retaining control of their element of the service whilst working to an overall operational plan controlled by the compliance scheme is one that can be replicated throughout the UK, both in the third sector and in private re-use organisations.

Repair Expertise Required to Maximise Re-use

Once the WEEE is in the system, the re-use organisations need a qualified domestic appliance technician to maximise the number of units being repaired; however, most cannot fund that expertise until they have enough items in the system. One organisation in particular employed a full time technician due to the trials and commitment of the Council, but not all re-use organisations may have the space or capacity to follow this route. Therefore, there may be an argument to establish central repair hubs to provide a steady stream of warrantied electrical goods. Taking an alternative perspective, it could be possible to have a pool of trained domestic engineers who could work for the smaller organisations on allocated days. This idea may prove attractive as it leaves control of sourcing the goods with the re-use organisation.

Cost Benefit Analysis Results

The summary of the analysis is shown in the figure below. It provides the marginal revenue and cost per item for Trials I, II and IV (in comparison to no trial taking place, i.e., all recycled) and the net benefit per unit of each trial over the six month trial period.

Cost Benefit Analysis (Re-use Trials vs 'No Trial / All Recycled')

	Trial I	Trial I (All recycled)	Trial II	Trial II (All Recycled)	Trial IV	Trial IV (All Recycled)
Total Revenue	£9,935	£6,458	£21,320	£7,872	£3,830	£440
Total Cost	£3,826	£0	£14,865	£0	£561	£0
Total Benefit	£6,110	£6,458	£6,456	£7,872	£3,269	£440
Revenue / Unit	£0.60	£0.39	£1.65	£0.61	£10.13	£1.16
Cost / Unit	£0.23	£0.00	£1.15	£0.00	£1.48	£0.00
Benefit / Unit	**£0.37**	**£0.39**	**£0.50**	**£0.61**	**£8.65**	**£1.16**

The results showed that trials I and II yield a lower benefit (total and per item) than simply recycling all the items. However, containers and marketing costs are 'sunk' costs so only needed to be accounted for at the start of the trial. This means that in the following months Trial I and II are preferable options to 100% recycling in terms of cost benefits.

In addition, the results would suggest that Trial II is preferable to Trial I; this is despite a lower cost related to Trial I due to no containers being required. This is due to the higher proportion of items being re-used in Trial II in comparison to Trial I.

Trial IV had a significantly high net benefit (per item), although with a lower overall benefit, which was due to the lower volume of items. The larger benefit per item was due to having a higher proportion of items being re-used; however, this consequently resulted in a lower volume of items, impacting on the total revenue.

Conclusion

Re-use systems work; however, not in isolation and not without pro-active support from all parties involved. The majority of obstacles in the trial were overcome, and the consistent reason behind these successes was pro-active participation from all parties:

- The **councils** (and their on-site staff) actively sought out goods for re-use, and embraced the concept of using set-aside areas and containers to overcome the first hurdle, making material available for the re-use organisations;
- The **re-use organisations** in turn worked closely with the councils to build relationships at site level, and to work around established collection patterns to maximise the yield from HWRCs; and
- The **compliance scheme**, perhaps inevitably due to the nature of WEEE contracts, took the role of Account Manager. This involved a degree of management in co-ordinating re-use organisations, councils, and re-processors to ensure services were interlinked. The compliance scheme effectively became the facilities manager for each trial, taking an overview of where changes needed to be made and amending services as and when required.

The barriers to re-use remain; nevertheless, the solutions to overcoming them are much clearer than before. The final analysis, that re-use is now available to 15% of Scotland, highlights that partnership combined with project ownership is a powerful demonstration of how re-use potential can be harnessed.

1 Introduction

Research indicates that Household Waste Recycling Centres (HWRCs) represent an important source of waste electrical and electronic equipment (WEEE) for re-use. Currently only 7% of WEEE separately collected at HWRCs is re-used[2]. However, it is estimated that approximately 23% could be re-used with only a small amount of repair. This proportion represents a large resale value for the re-use sector of approximately £200M, highlighting the opportunity and benefits of capturing WEEE for re-use from HWRCs[3].

It is generally accepted that re-use contributes to resource efficiency by extending the life of a product, and thereby decreasing primary resource consumption. This results in a reduced demand for the manufacture of new products, and, as such, reduces the burden on raw material extraction for all the constituent materials, such as metal, glass and plastic that makes up electrical and electronic equipment (EEE)[4].

The benefits of WEEE re-use are not restricted to environmental and resource efficiency. Since April 2013, the third sector has seen an increase in demand for various re-used items by 40-100%[5]. Even though the UK has over 1,100 HWRCs with DCF status, each one of which has electrical items deposited every single day, the third sector struggles to source items for repair and onward sale.

However, re-use should not be viewed solely in terms of the third sector. There can be potential for private companies to provide re-used electrical goods, and the barriers identified during the trial apply equally to both private and third sector organisations. The re-use organisations in the trials were from the third sector as it was difficult to find private companies who operated in this market (in the trial areas). Further research may prove invaluable in finding ways to make re-use more attractive to the private sector.

This study covered different methods of collecting WEEE for re-use from HWRCs in order to identify the best method for optimising WEEE for re-use. It also included a cost benefit analysis and comparison of all trials. Barriers and benefits were also identified.

Although the focus of the study was on collections from HWRCs, a trial was included in this work which involved the collection of WEEE for re-use from bulky uplift collections. It was identified that bulky uplift collections can affect the items collected at HWRCs, and, as such, this activity was included for completeness. The aim of the bulky waste project was to assess the levels of WEEE collected by the Council's bulky waste collection service and analyse the levels of re-use that can be obtained by direct deposit into a re-use centre.

The trials were conducted in four Scottish local authority areas:

- Dundee City Council;
- Fife Council;
- Renfrewshire Council; and
- West Dunbartonshire Council.

These trials have helped provide data to support what may have previously been considered anecdotal assumptions, and have highlighted several main barriers to effective re-use at HWRCs. However, more importantly, it has been able to identify methods to overcome those barriers, and to provide guidance

[2] Or approximately 40,650 tonnes: data accessed from the Environment Agency website on October 2013.
[3] WRAP: http://www.wrap.org.uk/content/value-re-using-household-waste-electrical-and-electronic-equipment
[4] Re-using WEEE products provides a greater benefit than recycling WEEE because most of the upstream activities required to manufacture a WEEE product are avoided. The only upstream activities that might be required are those associated with repair and parts that may be needed to refurbish a re-usable WEEE product.
[5] http://www.frn.org.uk/frn-news/306-could-the-waste-sector-help-reduce-poverty-for-millions-of-uk-households.html

that can be used to introduce WEEE re-use systems at other HWRCs in the UK. This was achieved by pro-actively involving all stakeholders (the WEEE Compliance Scheme, the relevant local authority and third sector re-use organisations).

All the sites that participated in the trials have either maintained a full re-use system, or now have one which will be re-activated in the near future. One local authority has also expanded the re-use service to all of its sites, and others have indicated that they would wish to roll out the service in 2014. All of this means that the trials have provided, and will continue to provide, re-use facilities to approximately 770,000 people, which is just under 15% of Scotland's population; further increases are expected in the future.

This report provides the findings of the study, and is divided into the following key sections:

- Methodology;
- Scope of Trials;
- Trial Results;
- Cost Benefit Analysis;
- Re-use Trials Benefits;
- Conclusions; and
- Opportunities.

2 Methodology

The project was undertaken in four key phases, illustrated in the diagram below.

Figure 1 Methodology

Phase 1 involved meeting and engaging local authorities and re-use organisations that were willing to participate in the trials. It also involved liaising with recycling organisations to ensure that any items which could not be re-used would be recycled appropriately.

Phase 2 was used to define the scope of the four trials. This involved identifying which HWRCs would be included, what categories of WEEE the trials would cover, and setting up a collection schedule.

Phase 3 involved designing the marketing plan for each trial. This was done at the same time as Phase 2. At this stage, WRAP and ZWS communication staff were engaged to help develop a design that would be consistent with WRAP's national re-use programme. A total of 8,000 leaflets were printed and distributed door-to-door in the catchment area of the participating local authorities, via a private company. Nine posters were printed and fixed at each HWRC site, together with large stickers on specific containers, identifying items suitable for re-use. Text highlighting the aims of each trial and how it would work was also uploaded onto the participating LA websites.

Phase 4 covered the actual trials and involved initiation and monitoring. It covered the duration of the trials and included addressing any operational issues, data gathering (and cleansing) and reporting.

3 Scope of Trials

This section of the report provides a summary of each trial including its scope and collection method. It also includes a summary of each re-use organisation participating in this project and details of their re-use process. The marketing plan for each trial is also outlined.

3.1 Summary of Trials

Figures 2 and 3 below outline the scope of each trial. They include details on the relevant partners, an overview of the trials and their purpose.

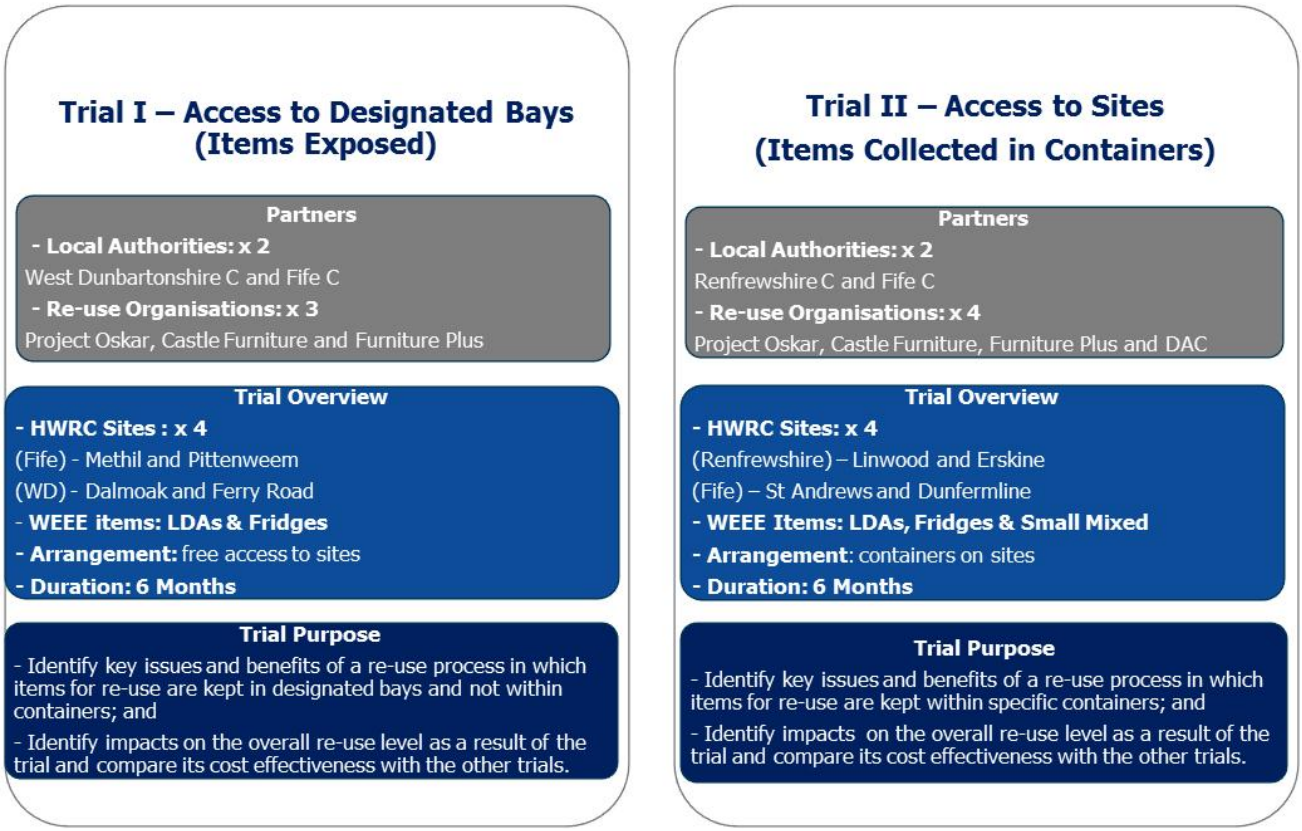

Figure 2 Scope of Trials I and II

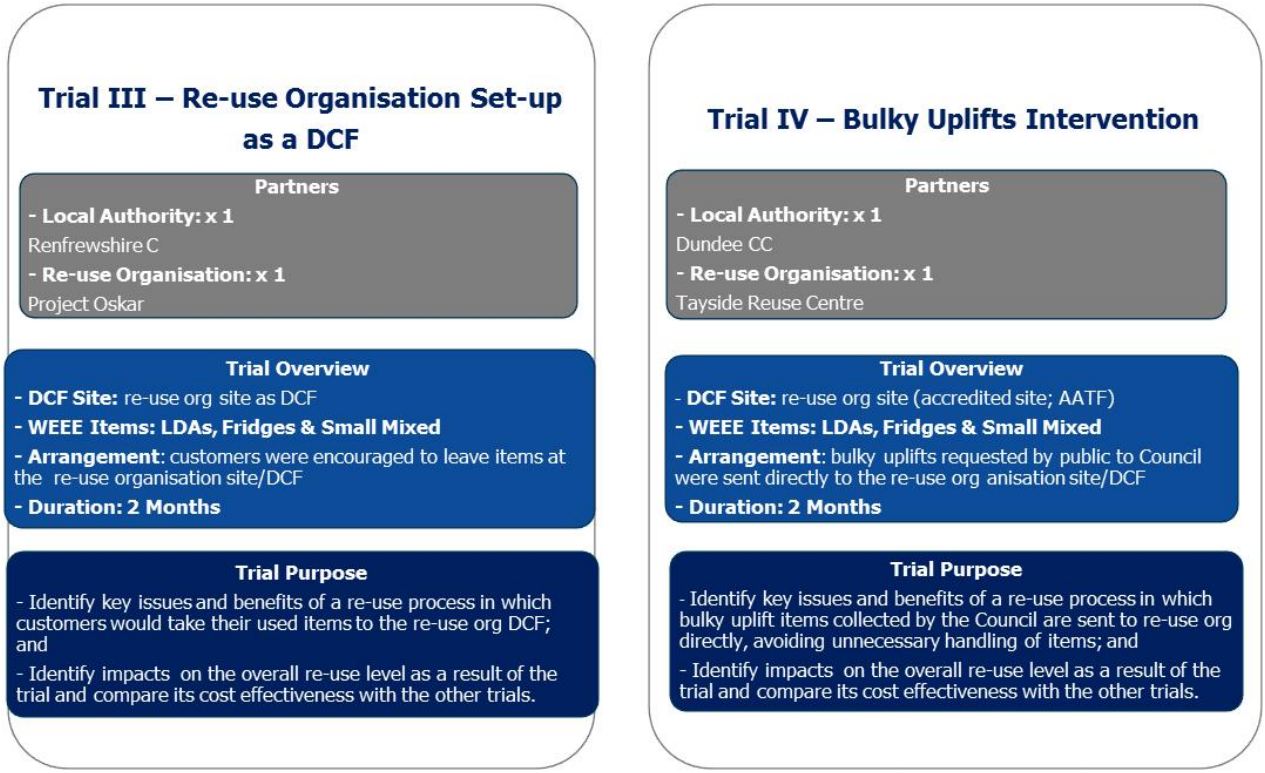

Figure 3 Scope of Trials III and IV

3.2 Collection Methods

This section provides an overview of the collection methods used for each trial.

3.2.1 Trial I – Access to Designated Bays (Items Exposed)

Trial I was designed to establish the percentage of items that could be re-used where the WEEE is stored in designated bay areas, and consequently exposed to the elements. This would determine the impact of storage and weather on re-use performance, whilst also gathering information on any issues and benefits of setting up and implementing such trials.

Within the scope of Trial I, three re-use organisations were given access to the HWRCs to collect large domestic appliances (LDAs) and cooling items for re-use. This included four sites and two different councils, as shown in the figure below.

Council	HWRCs	Re-use Organisation
Fife Council	Methil Recycling Centre Pittenweem Recycling Centre	Castle Furniture Furniture Plus
West Dunbartonshire Council	Dalmoak Recycling Site Ferry Road Recycling Site	Project Oskar

Figure 4 Trial I Partners (LDAs & Cooling)

The items were collected from the HWRCs by the re-use organisations following a visual inspection on site (as the initial point of the re-use assessment process). Those items considered unsuitable for re-use were left at the site to be collected by the designated recycling company. Those items identified

as suitable for re-use were taken back to the organisation's facility for further assessment of their working condition and potential for repair.

Once at the re-use organisation's repair facility, the items passing the re-use process were repaired and sold to end markets, whilst those failing were collected for recycling by the designated recycling company, as illustrated in the figure below. The re-use process used in Trial I is described in more detail in Appendix VI.

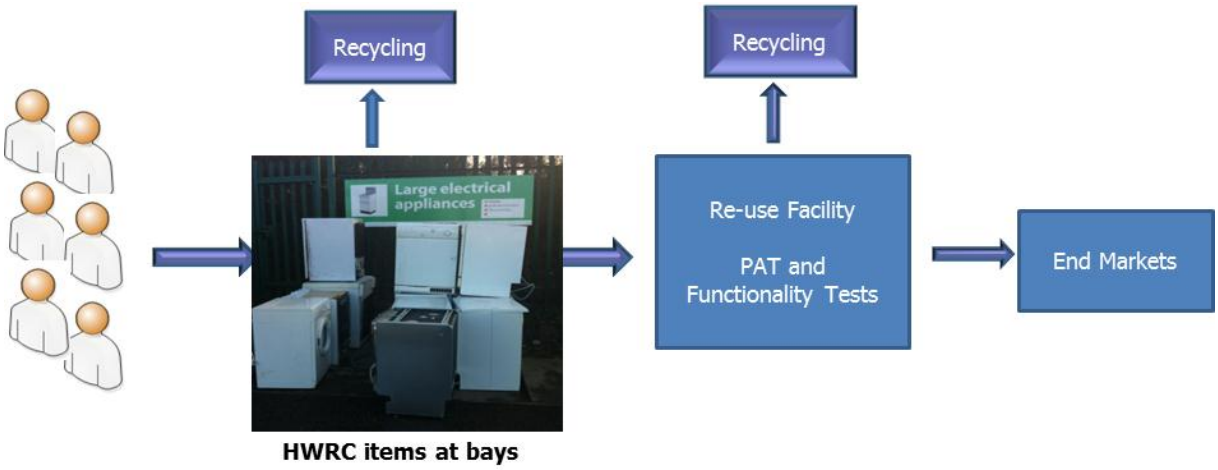

Figure 5 Trial I – Access to Designated Bays (Items Exposed)

3.2.2 Trial II – Access to Sites (Items Collected in Containers)

Trial II was set up to identify the number of items that could potentially be recovered for re-use from an HWRC where the items were kept under cover in containers. The key issues and benefits of collecting WEEE for re-use in this way were documented during this trial.

The trial method included providing access for four re-use organisations to collect LDAs, fridges and small WEEE from four HWRCs in two council areas, as shown in the figure below.

Council	HWRCs	Re-use Organisation
Renfrewshire Council	Linwood Recycling Centre Erskine Recycling Centre	Project Oskar
Fife Council	St Andrews Recycling Centre Dunferlime Recycling Centre	Castle Furniture Furniture Plus DAC

Figure 6 Trial II Partners (LDAs, Cooling & Small WEEE)

Similar to Trial I, the first stage of the process was the visual inspection, with approved items being taken for re-use. Items that failed this inspection were removed from the container by the re-use partner and relocated to the appropriate recycling bay at the HWRC. Once back in the bay, the items entered the standard WEEE recycling process and were collected by the designated recycler. Once at the re-use organisation's repair facility, the items passing the re-use process were repaired and sold to end markets. Those items failing the re-use process were collected for recycling by the designated

recycling company, as illustrated in the figure below. The re-use process used in Trial II is described in more detail in Appendix VI.

Figure 7 Trial II – Access to Sites (Items Collected in Containers)

3.2.3 Trial III – Re-use Organisation Set-up as a DCF

Trial III was set up to identify the number of items that could be recovered by the public taking items directly to a re-use organisation instead of an HWRC. Project Oskar, was set-up as a designated collection facility (DCF) and hence acted as a dedicated HWRC. The marketing campaign attached to this section of the trial (see section 3.4 for more details) advised the public to take their WEEE directly to Project Oskar.

The aim of this trial was also to determine the improvement in cost effectiveness of avoiding collection costs (in contrast with Trials I and II) and the effects on the quality of items from reduced handling (ie householders taking items directly to site rather than involving a collection body), as shown in Figure 8.

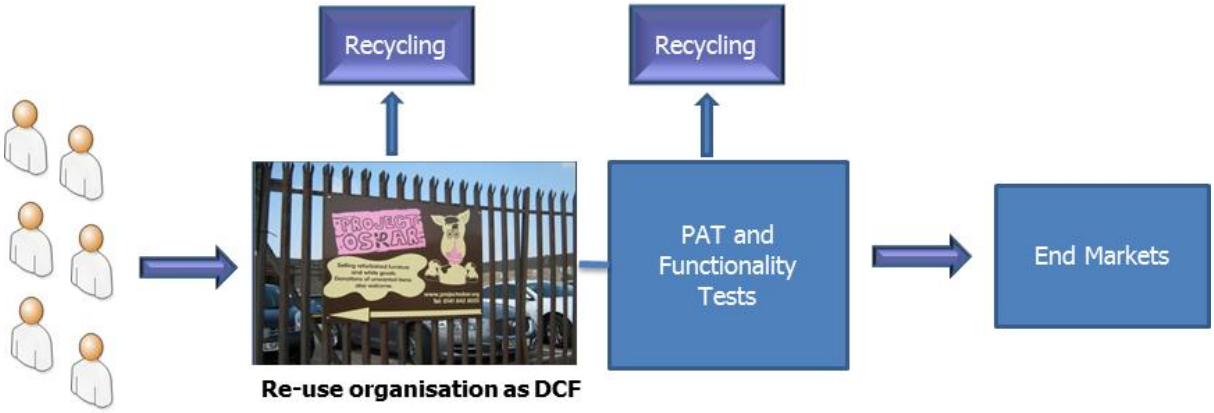

Figure 8 Trial III – Re-use Organisation Set-up as a DCF

3.2.4 Trial IV – Bulky Uplifts Intervention

Trial IV was set up to identify the number of items that could be recovered directly from bulky uplift collections performed by Dundee City Council. The trial worked by Dundee City Council collecting bulky uplift items from households on demand, as per their normal collection service. However, rather

than take the items back to their depot, they diverted the WEEE items directly to the Tayside Re-use Centre.

Items were visually inspected at the Tayside Re-use Centre to determine their suitability for re-use. Those considered not suitable for re-use were put into a quarantine area and designated for recycling; items identified as suitable for re-use were diverted to Tayside Re-use Centre's re-use assessment process.

The items that passed the re-use process were sold at Tayside Re-use Centre's showroom, whereas those items that failed the process were collected for recycling by a designated recycling company, as illustrated in the figure below. The re-use process used in Trial IV is described in more detail in Appendix VI.

The aim of the trial was to identify if the quality and quantity of items collected for re-use could be improved by collecting the WEEE items from the public and taking them directly to the re-use organisation. This process eliminated the need to handle and store items at HWRCs, consequently cutting out the impact of handling and storage at the HWRC, and also reducing transport damage.

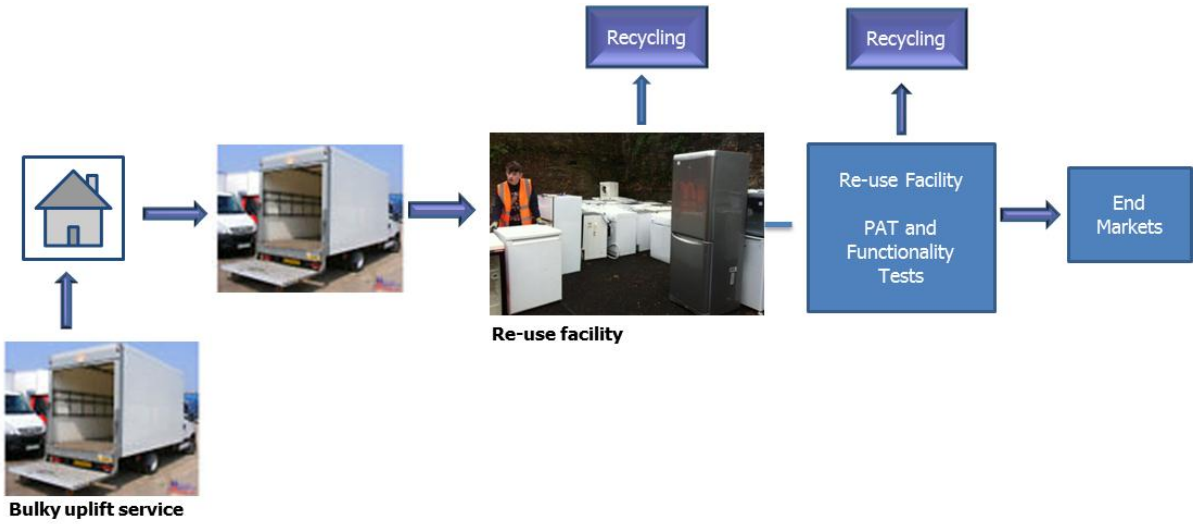

Figure 9 Trial IV – Bulky Uplifts Intervention

3.3 Re-use Organisations

Details of the five re-use organisations engaged in the trials, and their re-use processes, are described in this section. The re-use partners were:

- Castle Furniture;
- Furniture Plus;
- Project Oskar;
- Burnhouse Discount Appliances Company (DAC); and
- Tayside Re-use Centre.

All items rejected at any stage of the re-use process were collected for recycling by approved authorised treatment facilities (AATFs). These companies provided Valpak with collection schedules for each site, which allowed the re-use partners to dovetail their collection patterns to achieve optimum yields.

The co-ordination of collection schedules for each site was considered critical to ensure that:

- The re-use partner had access to the optimum number of items;
- The AATFs were only taking items deemed as unsuitable for re-use;
- Bays did not overflow (a major concern of site supervisors); and
- The site received frequent re-use and recycling services.

Further details regarding each re-use organisation and the processes they used for assessing, testing, repairing and refurbishing WEEE for re-use can be found in Appendix VI.

3.4 Promotion of Trials

Discussions with local authorities indicated that using consistent marketing tools, messages and imagery would help engage the largest proportion of the region's population, thereby achieving the best results from the trials. The key aims of the communication strategy were to:

- Engage and educate site staff of the benefits of re-use;
- Inform staff of how the re-use system used in the trial should operate and what their role would be; and
- Encourage the public to increase the number and frequency of items they bring to the site for re-use.

Based on the above and in conjunction with the WRAP and ZWS communications teams, Valpak used the following communications tools for Trials I, II and III, using the WRAP Re-use National Campaign template:

- **Signage (banners and stickers)**[6] – was used to reinforce the re-use message as the public arrived at the site (see figure 10 for examples), and also to help HWRC staff divert items for re-use. Large signage in the form of decals was also added later in the trial as a direct result of feedback from the HWRC staff relating to public perceptions;
- **A5 Leaflets**[7] – these were printed and distributed door-to-door in the HWRC catchment area by a specialist fulfilment company. The leaflets informed the public of the service and its benefits, and highlighted the Council's engagement with community projects. The leaflets encouraged the public to bring working or repairable items to the HWRC for re-use (see Appendix VII for an example); and
- **Advertisements on Council Websites**[8] – Details of the trials were posted on each Council's website. The message was consistent for Trials I & II; however, for Trial III, the text encouraged the public to take their working items (or items only needing minor repair) directly to the DCF (Project Oskar).

Figure 10 shows examples of communication materials used on site to promote the re-use service.

[6] Each of the nine sites (including trial III with Project Oskar as a DCF) was given a banner and stickers for the containers (trial II only).
[7] A total of 8,000 A5 leaflets were printed and distributed for all trials.
[8] As an example, within its bulky uplift webpage, Renfrewshire Council reminds the public of the possibility of those items being re-used, and provides the contact details for Project Oskar. It can be accessed here: http://www.renfrewshire.gov.uk/webcontent/home/services/environment/recycling+and+waste/special+uplifts/es-ss-special-uplift-household

Figure 10 Examples of Sticker & Banner (On-site)

Marketing templates used (and shown above on site) can be found in Appendix VII.

4 Trial Results

The results gathered from the six month trial period are detailed in this section. The analysis includes quantities re-used and recycled per category, percentage of items rejected for re-use at each stage within the re-use process and key issues/benefits identified. The full data set for each trial is provided in Appendices I to IV.

4.1 Trial I – Access to Designated Bays (Items Exposed)

Trial I involved **collections from the designated bays at HWRCs.** There was little or no segregation between items deemed suitable for re-use and those only suitable for recycling; the trial focussed on LDAs and Cooling Equipment. Although microwave ovens are technically classified as LDAs, it is common practice at HWRCs to place the units within the mixed WEEE stream, and the re-use organisations tended to report them in the manner they were stored. The results sections show the journey of WEEE from deposit at the HWRC through to the end markets, and the pass/fail ratio of items from HWRCs (by units & weight) going through the re-use process.

4.1.1 Trial I Results

4.1.1.1 Quantities Received on Sites, Collected for Re-use, Recycled and Re-used

The figure below shows the number of items (by category) that passed through the HWRCs during the trial period, the number that passed the visual inspection stage (deemed to have the potential for repair) and the number re-used[9]. A more detailed table of results is included in the appendices section.

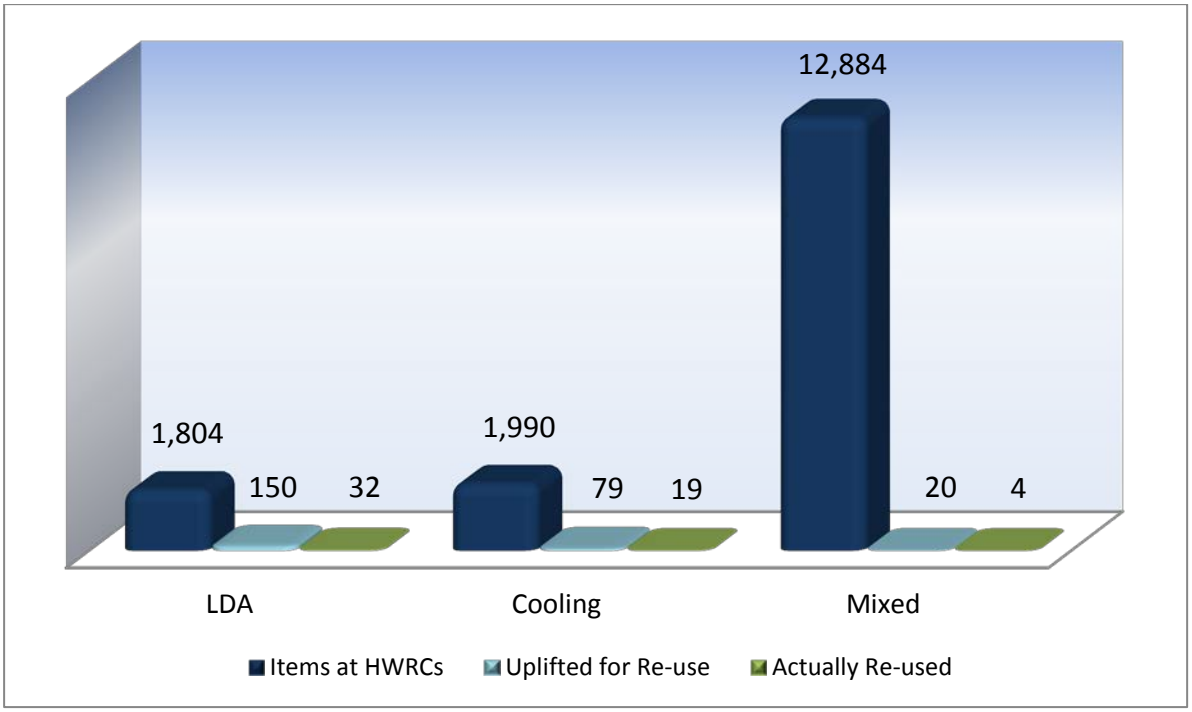

Figure 11 Trial I Results

The total number of items received on all four sites operating this trial was 16,678, with 3,794 of them being white goods (LDAs and Cooling Equipment). Of these white goods, 229 items that passed the

[9] Total re-used includes items already sold plus proportion of items nearing the end of the test process, of which 40% are expected to be repaired.

initial visual inspection stage at the HWRCs were collected for re-use (6% of the white goods) by the re-use organisation.

The graph below shows the percentage of items (split by category) that passed the visual inspection phase. The disparity between the quantities of LDA items taken for further repair against the number of cooling should be considered by taking into account the level of fridge compressors missing from units at HWRCs.

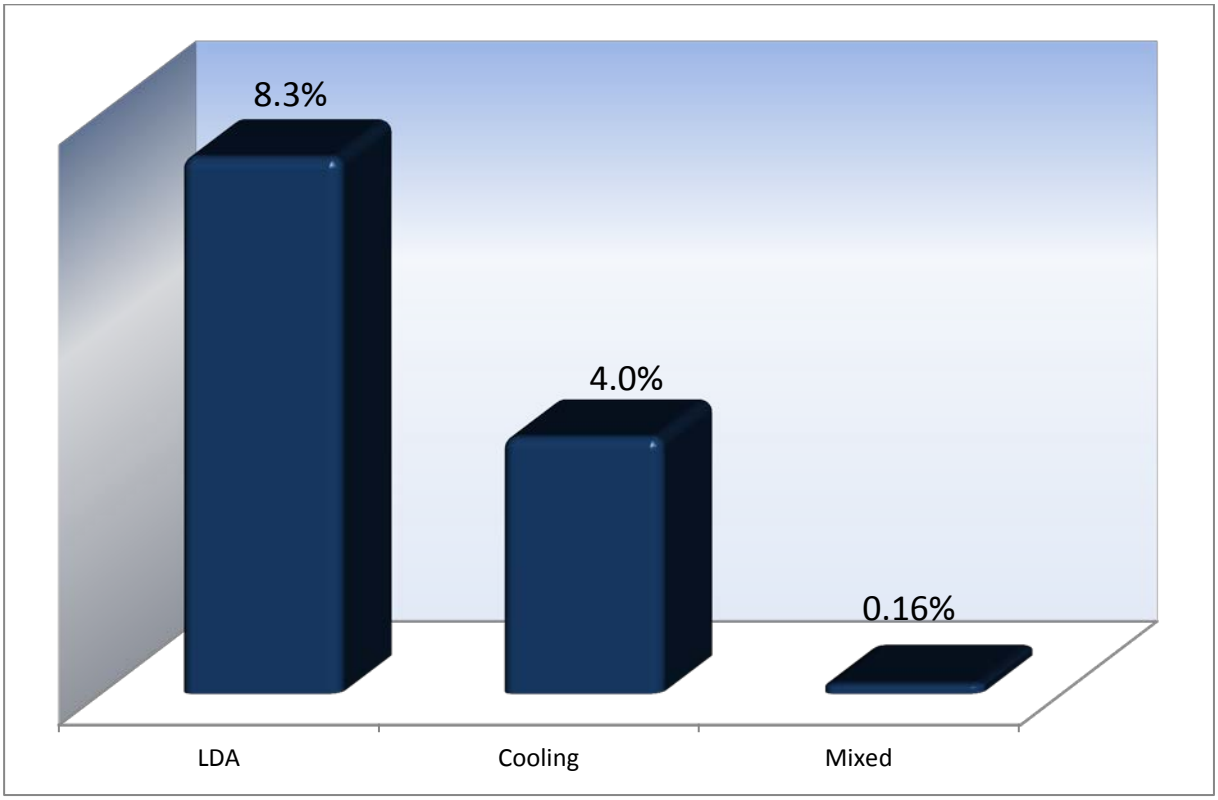

Figure 12 Trial I Items Passing Visual Inspection

Just under 99% of the total items received at HWRC sites were deemed to be beyond economic repair, and remained in the recycling process. The key reasons identified for the rejection levels relating to the condition of items, included:

- Badly damaged due to weather exposure (e.g. rusting);
- Missing parts (e.g. doors, control knobs, wires, shelves, compressors etc.);
- Item considered too old; and
- Item unlikely to be re-sold.

The re-use organisations involved in this trial revealed that the number of items actually removed from the sites for re-use 'was not surprising', and this was mainly due to their cosmetic condition. Often, the manual handling process is still geared towards recycling, which is inadequate for re-use.

Many items on sites were found to be in a 'badly damaged' condition. Although part of the communication plan was to make the public aware of the trials and to minimise damage during transportation from home to the site, some items did arrive on site in poor condition. However, there are strong indications that subsequent damage also occurs once the items are on the site; with rough stacking, water ingress and metal theft being three of the main factors.

The results showed that some mixed WEEE items were collected for re-use, even though that particular stream was not within the scope of the Trial. The reason for this was the site operatives' enthusiasm to try and assist in meeting the aim of the trials. Therefore, the decision was taken to accept these items in the re-use collections as it was felt that a refusal may affect the motivation of the HWRC staff. This is an ideal demonstration of the complexities of providing re-use services at HWRCs, the willingness of HWRC staff to support projects and the importance of communication.

All items collected from the HWRCs were then taken to the premises of the re-use operators to undergo Portable Appliance Testing (PAT) and functionality tests. The proportion of items failing PAT and functionality tests was 78% of the amount collected; therefore, 22% (55 items) remained in the re-use process[10].

The main reasons cited for tests failure included the following:

- Multiple elements faulty (e.g. cracked parts, leaks, gas flow blocked, motor faulty etc.);
- Failed functionality test;
- PAT fail;
- Faulty bearings;
- Compressor motor damaged;
- Special thermostat required;
- Multiple components melted and damaged; and
- Door brackets beyond repair.

The most common repairs undertaken (most of the items collected needed some degree of repair) involved fixing and replacing parts. The degree of difficulty in replacing and sourcing components varies greatly between manufacturers. Some parts may be generic and can be used across a range of units, whereas others may have a component as part of the integral design of the item, making the repair cost prohibitively expensive. Many technicians admit to having favourite units to repair, simply due to the ease by which they can obtain and swap parts. Components required are generally:

- Plugs, bulbs, component plates, printed circuit boards, heater elements;
- New cables; and
- Draining pumps, hoses and covers.

The end market phase was dependent on the re-use partners' own established markets. In this case, they were sold in the organisation's own showrooms in Cupar and Perth. All items rejected at any stage of the re-use process were collected (on request) by the relevant compliance scheme and returned to the recycling stream.

It is important also to point out that, for the first weeks of the trials, there was a period of "maturation" which included the co-ordination of collections between re-use organisations, other collection partners and communication with site supervisors and staff. This maturation period almost certainly impacted on the number of re-use collections carried out during the initial stages; however, at the same time, it did provide some valuable lessons in communications and logistical support.

[10] The timeframe of the trial placed limitations on more detailed repair analysis, but all re-use organisations felt that it would be possible to increase the percentage of repairs if they had the workload to employ a full time domestic engineer, and, if through time, the organisation built up a stock of refurbished parts to reduce the cost of the repairs.

4.1.2 Key Issues

The key issues identified in relation to Trial I during the six month trial period were:

- Items were subject to damage once on the site. This included water damage to electrical circuits and cosmetic damage to cases;
- Extra traffic on sites to collect items for re-use separated at designated bays. This added extra management time for site supervisors: extra vehicles in and out of sites meant re-designing a plan for the co-ordination of vehicle movements. A minority of supervisors were sceptical regarding the trials, and gaining staff "buy-in" should be a feature of pre-service training;
- Many items that could have been considered for re-use were incomplete when inspected by the re-use partner. The most common example of this was missing copper wire; however, fridge compressors and filters were also regularly missing from otherwise salvageable units. The level of missing components increased during the second phase of the project; and
- The organisations involved in Trial I all had established retail showrooms and had constant demand for white goods. The end market in this instance was 100% retail; however, alternatives such as Social Services and Landlords would readily fit into the template should the retail model reach surplus.

4.2 Trial II – Access to Sites (Items Collected in Containers)

Trial II involved **access to sites with items placed in containers** for the collection of LDAs, fridges and mixed WEEE. This section shows the key findings including total amount received on all sites, collected for re-use, re-used and recycled per category (by units). It also shows the re-use process (from collection to end market) and the hotspots where most items were rejected from the re-use flow and recycled. The key issues identified during this trial are also presented in this section.

4.2.1 Trial II Results

4.2.1.1 Quantities Received, Collected for Re-use, Recycled and Re-used

Figure 13 shows the number of items (by category) that passed through the HWRCs during the trial period, the number that passed the visual inspection stage (deemed to have the potential for repair) and the number re-used[11]. A more detailed table of results is included in the appendices section.

[11] Total re-used includes items already sold plus proportion of items nearing the end of the test process, of which 40% are expected to be repaired.

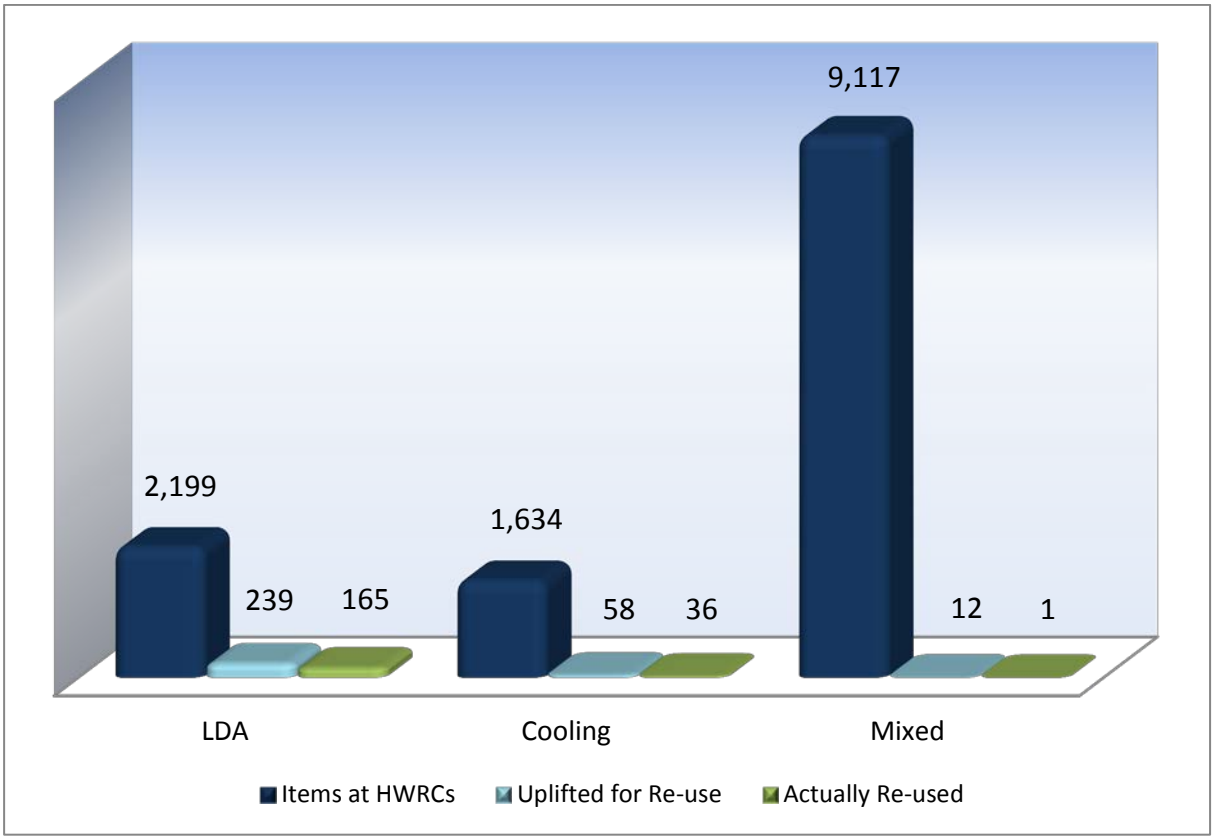

Figure 13 Trial II Results

The total number of items received on all four sites was 12,950, with 3,833 (or 30%) of them being white goods (cooling and LDAs). Of these, 297 items (8%) passed the visual inspection phase and were collected for re-use by the re-use organisation.

The figure below shows the percentage of items (by category) in Trial II that passed the visual inspection phase.

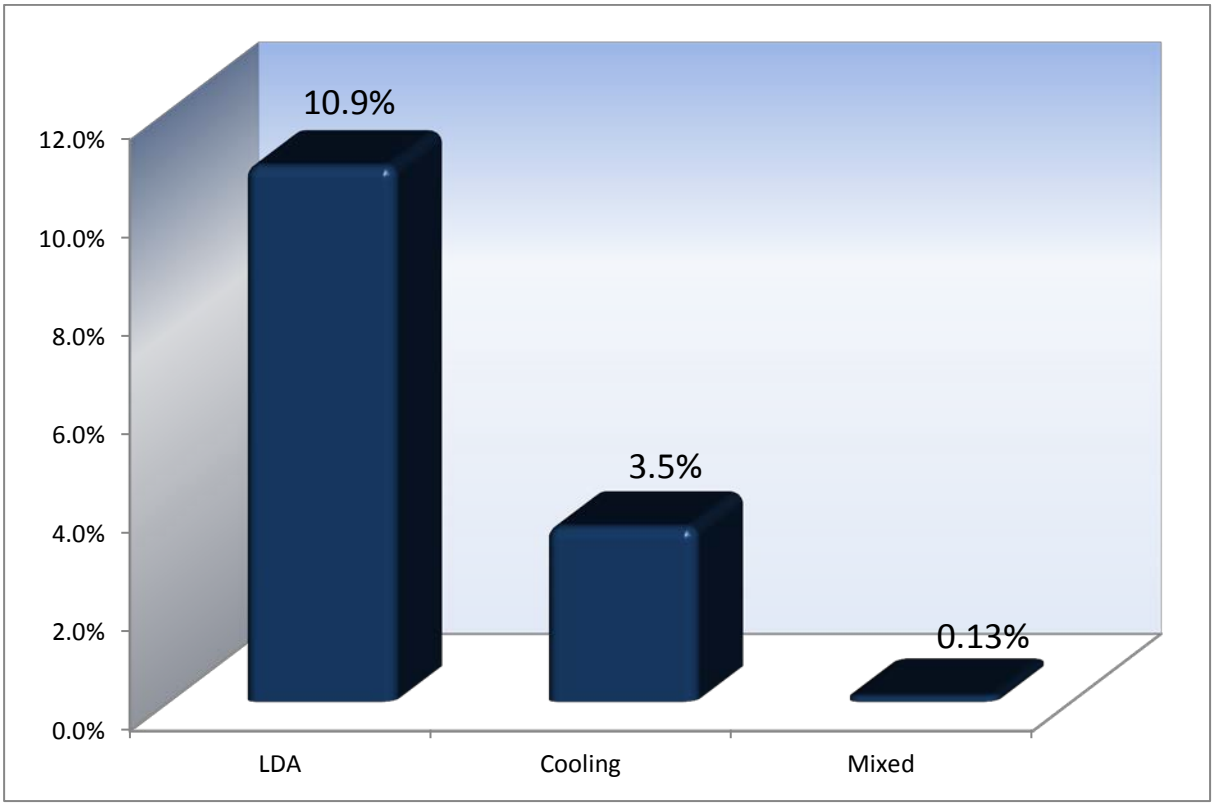

Figure 14 Trial II Items Passing Visual Inspection

During Trial II, there were fewer examples of items damaged by exposure to the elements compared to Trial I, indicating that the use of containers improves the potential for items to be suitable for repair[12]. However, it is important to note that there remained a relatively high proportion of damaged items.

The question of missing fridge compressors should again be taken into account when assessing the figures. There was, for a short period of time during the trial, a period where confusion between the re-use organisations resulted in fridges being stored outside the re-use container. This could have been another factor contributing to the lower figure for cooling units[13].

All items collected from the HWRCs went through PAT and functionality tests. The proportion of collected items failing tests at this stage was 35%; therefore, 65% (202 items) remained in the re-use process[14]. The main reasons cited for the failure of items at this stage was similar to Trial I:

- Multiple elements faulty (e.g. cracked parts, leaks, gas flow blocked, faulty motors);
- Some faults considered too costly to repair (e.g. faulty hobs; faulty door brackets);
- Seized compressor motor;
- Special thermostat required;
- Multiple components melted and damaged;
- Faulty printed circuit board;

[12] The containers also seemed to promote a re-use first mentality at the site, which made it easier for the public to elect to place items where they could be used by local third sector organisations. Anecdotal evidence from the sites also suggested that the proportion of people using the container could be increased if the signage was in a more prominent position.

[13] The impact of re-use containers is also shown in Section 5, Cost Benefit Analysis.

[14] As previously mentioned, 40% of items that were still being tested, were assumed to pass the test, which is a fair proportion suggested by the re-use organisations.

- Faulty heating element; and
- Electrically unsafe.

Most of the items collected needed some degree of repair, with the key repair activities being around:

- Plugs, bulbs, and component plates;
- Cables and printed circuit boards;
- Heater elements and oven neon lights; and
- Draining pumps.

The end market for the number of items sold is shown in the figure below, by units per category.

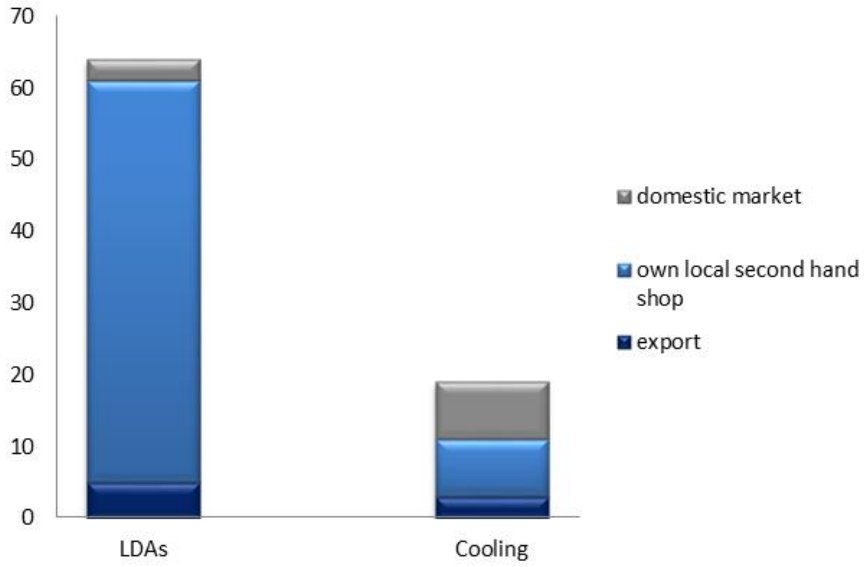

Figure 15 Trial I I End Market Split in Units

Of those items already sold, the majority were LDAs (78%) sold at an average price of £75, with cooling equipment comprising 22% of the total sold for an average price of £69. The end markets are dependent on each re-use organisation's established target market; however, there seems to be a need for specialist support to allow third sector and other re-use partners to find alternative outlets. Although the markets are there, some of the smaller local organisations lack expertise and support to be able to effectively market themselves.

'Domestic market' represents those items sold within the UK to many second hand shops, 'own local second hand shop' represents those items sold at the re-use organisations' own showrooms and 'export' represents those items sold for export to Ghana by Burnhouse DAC (re-use organisation). During the trial period, Burnhouse DAC exported 73% of items sold for re-use overseas via an Approved Exporter, with the rest sold to the domestic market.

According to the re-use organisations, all items repaired were eventually sold within a period ranging from one day to three months. This demonstrates there can be a high demand for such items. All items rejected for re-use at all stages were collected for recycling by the compliance scheme.

4.2.2 Key Issues

The key issues identified in relation to the operational aspects of Trial II (collected in containers) during the trial period were similar to Trial I, as follows:

- Space constraint proved to be an issue on some sites where extra containers were required;
- The introduction of the re-use collections meant more site traffic, which, in the mobilisation phase of the trial, required review and amendment of site operating procedures. Once the service is operational, the site supervisors will also have additional collections and vehicle movements to oversee; however, the number of movements will be relative to the amount of weekly collections required, and will have a minimal impact on standard operating procedures;
- Risk assessments relating to the ingress and egress of materials from the re-use container needs to be completed prior to the commencement of the service; and
- It was found that there was a high degree of difficulty in re-using mixed WEEE collected from HWRCs, which is an issue experienced at many sites (and is not specific to these trials). The key reasons are:
    - The vast majority of HWRCs use open skips to store mixed WEEE: these containers cannot be safely accessed to remove items suitable for re-use;
    - The mixed WEEE contained in open skips is often compacted or rolled for more cost-effective transportation;
    - Secondary segregation areas for re-usable mixed WEEE could increase the number of items taken for repair, but few sites have the required space to provide bays or containers for this purpose;
    - Most re-use organisations consider mixed WEEE as uneconomic to refurbish and repair; and
    - The physical characteristics of mixed WEEE, where cables readily intertwine, makes the process of selecting objects for re-use time-consuming and labour intensive.

As in trial I, it is important to note that during the first weeks, there is a period of “maturation”, which included the co-ordination of collections between re-use organisations, recycling companies and site staff. This maturation period may have affected the number of items separated at containers for collection and therefore the amount of WEEE suitable for re-use that could have been collected during that period.

4.2.3 Comparison between Trial I & II

Trial I and Trial II were operationally very similar, with the variances relating to the way items were stored on sites rather than changes to collection procedures. Even allowing for local variances in service provision and repair skills, the figure below highlights that re-use containers facilitated a dramatic increase in the ratio of items from visual inspection at the sites to full repair at the re-use organisations sites.

It may also be important to note that the trial became part of a wider learning curve, and the use of containers at the end was more effective than at the start. This was simply due to the applied learning of HWRC and re-use organisation experiences.

From the experience gained, it should be possible to increase the number of items uplifted and the ratio of items repaired by controlled use of re-use containers. More details are provided in the conclusions and opportunities sections of this report.

The figure below illustrates the difference between the number of LDAs and cooling items (excluding mixed WEEE) uplifted from HWRCs during trials, and the number subsequently repaired and re-used. Trial II proved the most successful in terms of the volume entering the re-use system and volume being re-used.

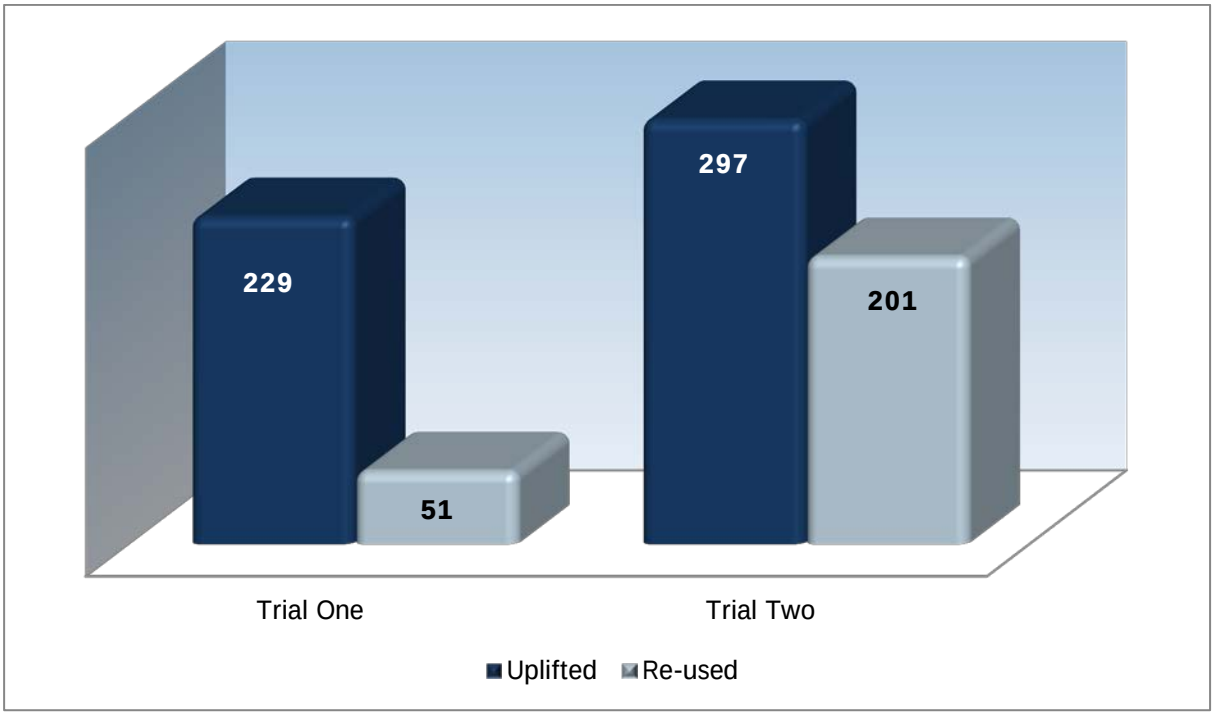

Figure 16 Number of Items Uplifted and Re-used (Trials I and II)

4.3 Trial III – Re-use Organisation Set-up as a DCF

Trial III involved the engagement of Project Oskar as a DCF (Designated Collection Facility) where householders could bring their unwanted WEEE for direct donation for re-use. However, monitoring of site activity over a two month period established that no WEEE items were taken directly to Project Oskar. Discussions with Project Oskar's staff, management and the Council established that one of the principle reasons for this lack of activity was due to the number of options currently offered to the public when disposing of working electrical items. Websites such as eBay, Gumtree, and Freecycle all offer alternative routes, either as donations or as a means of raising cash. These routes can therefore be viewed as a more convenient option when compared to transporting items to a local DCF.

Project Oskar also emphasised that they may have contributed to the situation by offering free collections, where the public could have the items uplifted directly from their own door. This meant that although the items were still being taken to the DCF site that the bulky uplift service prevented the public using the site as a HWRC/DCF.

Public awareness messages from local and national governments have been extremely effective in changing public attitudes and behaviour towards recycling.

Trial III was promoted through the marketing and communication plan, an announcement on the Council website, distribution of leaflets in the local area and the design and provision of posters at the site. Even with this high level of awareness activity, the public continued to take items to the HWRCs rather than to the Project Oskar DCF.

As the take-up of the DCF was lower than expected, being mindful of the continuing high demand for refurbished EEE, Valpak set up an alternative trial (Trial IV), in which bulky uplifts requested by householders were taken directly to a charity organisation's site for repair and re-use. This trial ran for a period of two months and the results are detailed below. The aim of trial IV was to identify whether the condition of items would be positively affected by a reduction in handling activities and therefore whether there would be a difference in the number of items that could ultimately be re-used.

4.4 Trial IV – Bulky Uplifts Intervention

4.4.1 Trial IV Results

The bulky uplift service in the local authority area offers a specific collection vehicle for the "on demand" uplift of electrical items from households. The theory behind the collection service is to allow items to be collected from the householder and taken directly to the re-use organisation. This avoids the need for double handling and storage, resulting in a higher ratio of repaired items.

However, in practice, items from the bulky uplift service have not significantly increased the supply of re-use to the third sector partner, and overall, only 8% of items delivered to the re-use organisation were actually repaired.

The graph below shows the number of items collected, the number of items that passed the visual inspection stage at the re-use organisation site (upon receipt of the items), the number that passed the PAT and functionality tests and the quantity re-used.

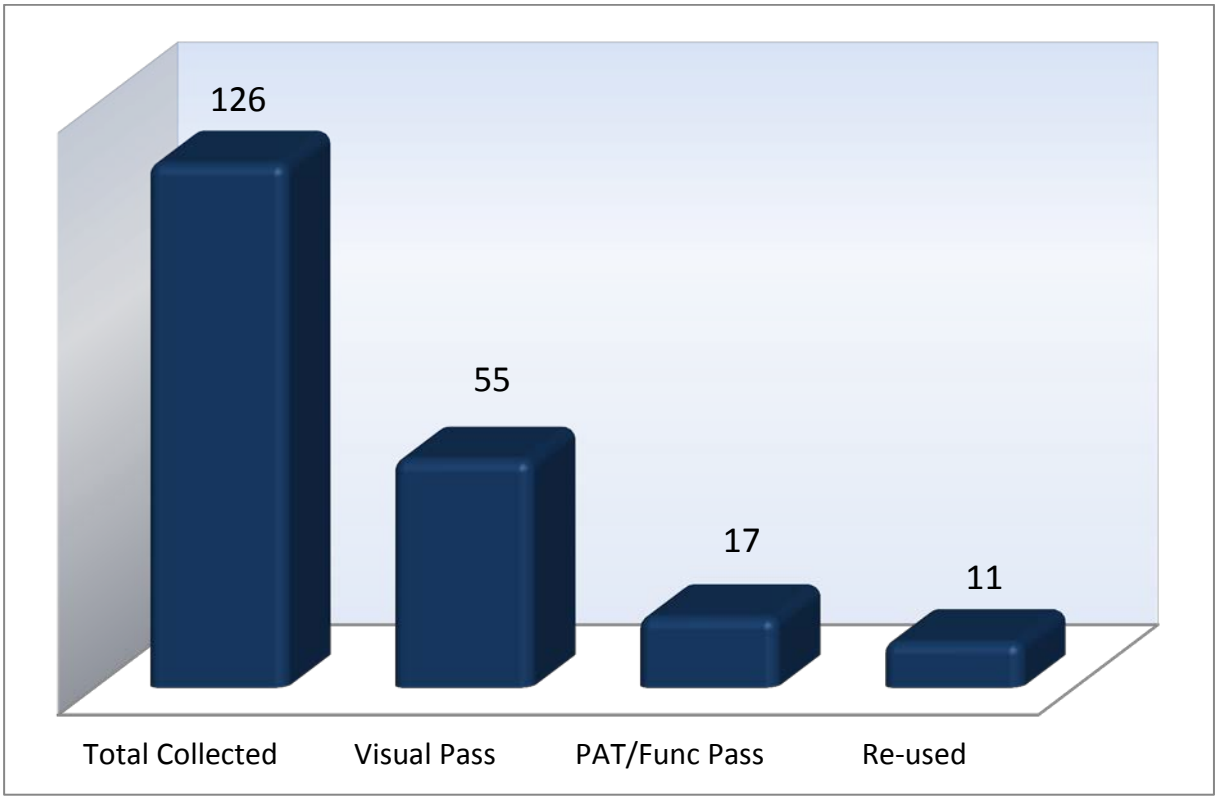

Figure 17 Re-use Flow - Items Passing Each Stage

The difference in number of units seen between the first stage (collection) and the visual inspection was significant. As bulky uplift items are collected from kerbside, some do show signs of prolonged exposure to the elements. This renders them damaged beyond that which could be considered as normal household use. The figure below shows an item collected from a bulky uplift, which has a missing door and broken shelves.

Figure 18 Fridge Collected Through Bulky Uplift

Approximately 44% of items delivered to the re-use centre passed the initial visual inspection, which is similar to that seen during the HWRC trials. This means that if items can be collected in the bulky uplift service before any damage by weather, vandalism, or theft occurs then the volume of items that are suitable for re-use could increase significantly.

4.4.2 Key Issues

- The time gap between the items being put out for collection and when they are uplifted may be a significant factor in WEEE being unsuitable or even unavailable for re-use. Traditionally, bulky uplifts are carried out at kerbside, with a wide window of opportunity for collection (from time placed outside to collection). The only responsibility the householder has is to place the item at the collection point; they have no responsibility, and usually no control over who actually collects the item;
- The number of items being delivered to the re-use organisation was fairly consistent, but the condition varied greatly. The reasons for the variation in the condition of the items were because items left at the kerbside were frequently found to be vandalised or had parts and valuable metals removed. Audits showed that the majority of items put out for collection reached the re-use organisation; however, it should be acknowledged that leaving items on the kerbside poses a risk of theft[15]. The scale of the problem is difficult to fully assess and would require careful cross-checking of client orders against uplifted totals to ascertain the full effect of shrinkage to the re-use sector; and
- Many items delivered to the re-use organisation were badly damaged. This was principally due to weather (items being left out for some time before the collections were ordered) and suspected vandalism. Other rejections included the insulation having been eaten by mice.

Figure 19 shows the mix of goods being collected by the bulky uplift scheme, with a much higher percentage of cooling units entering the system than LDAs. This is at odds with the ratios collected from HWRCs and may point to items being left out and stolen from the kerbside before the

[15] This scenario is not limited to a single local authority; discussions relating to Bulky Uplift services with other authorities are similar, with crews arriving at the collection address and finding that the item has already been removed.

householder phones the bulky uplift service (LDAs are much easier to dispose of than fridges, which are a hazardous waste).

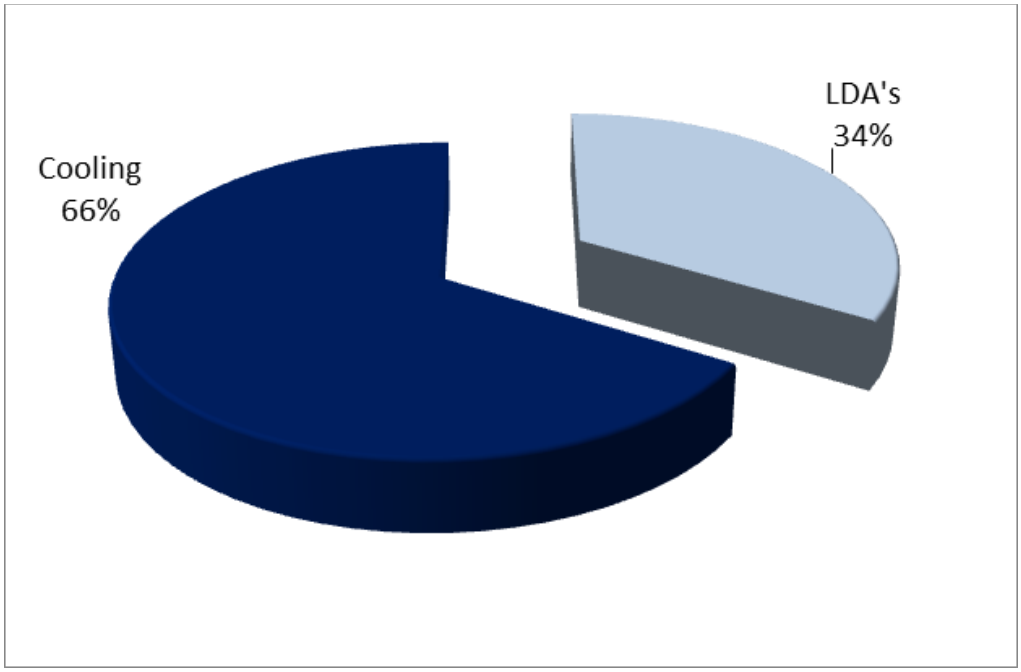

Figure 19 Ratio of Items Collected During Trial IV

5 Cost Benefit Analysis

This section of the report details a financial analysis and a snapshot comparison of Trial I, Trial II and Trial IV[16]. This includes an evaluation against an equivalent baseline scenario of 100% recycling from the HWRC sites. It also presents a net analysis (which is the total benefit of the trial), a marginal analysis (which is the benefit or cost per item), an assessment of the impacts of extending the trials and changes to the initial visual inspection rejection rate. A detailed breakdown of the associated costs and benefits are provided in Appendix V.

5.1 Results

The total results are shown in the figure below, which provides the marginal revenue and cost per item for Trials I, II and IV (in comparison to no trial taking place, i.e., all recycled) and the net benefit per unit of each trial over the initial six month trial period[17]. A full breakdown of the revenues and costs are provided in Appendix V.

	Trial I	Trial I (All recycled)	Trial II	Trial II (All Recycled)	Trial IV	Trial IV (All Recycled)
Total Revenue	£9,935	£6,458	£21,320	£7,872	£3,830	£440
Total Cost	£3,826	£0	£14,865	£0	£561	£0
Total Benefit	£6,110	£6,458	£6,456	£7,872	£3,269	£440
Revenue / Unit	£0.60	£0.39	£1.65	£0.61	£10.13	£1.16
Cost / Unit	£0.23	£0.00	£1.15	£0.00	£1.48	£0.00
Benefit / Unit	**£0.37**	**£0.39**	**£0.50**	**£0.61**	**£8.65**	**£1.16**

Figure 20 Cost Benefit Analysis (Re-use Trials v 'No Trial/All Recycled')

The results show that trials I and II yield a lower benefit (total and per item) than simply recycling all the items. However, it should be noted that the containers and marketing costs are 'sunk' costs so only needed to be accounted for at the start of the trial. This means that in the following months Trial I and II are preferable options to 100% recycling, in terms of cost benefits.

In addition, the results would suggest that Trial II is preferable to Trial I; this is despite a lower cost related to Trial I due to no containers being required. This is due to the higher proportion of items being re-used in Trial II in comparison to Trial I.

Trial IV had a significantly high net benefit (per item), although, with a lower overall benefit due to the lower volume of items. The larger benefit per item was due to having a higher proportion of items being re-used; however, this consequently resulted in a lower volume of items, impacting on the total revenue.

The trials showed that re-use was more beneficial than recycling; however, the service needs to be operational for several months before this is the case due to the initial costs of marketing and containers.

[16] Trial III was not included as it was terminated.

[17] It should be noted that the results for Trial IV have been scaled up to represent six months' worth of results as this trial only ran for two months.

5.2 Scenarios

The following scenarios were developed in order to allow for a more detailed analysis. These were as follows:

- Trial I, II and IV running for a longer period;
- Trial II extension; and
- Trials assuming reduced visual inspection rejection levels.

Trials I, II and IV Running for a Longer Period

This analysis considers a four year period and gives a cumulative net present value (NPV) for each trial option at the end of each year[18]. It is shown that over the first full year, Trial II and Trial IV are preferable to full recycling based on the number of items that arise (for Trial II this is due to the one off sunk costs such as marketing and container costs only being picked up once). However, for Trial I, this only occurs at the end of the second year[19]. This is summarised in the figure below.

	Year 0	Year 1	Year 2	Year 3
Discount Factor	1.00	0.97	0.93	0.90
Trial I	£12,744	£13,269	£13,269	£13,269
Trial I (Recycling)	£12,916	£12,916	£12,916	£12,916
Net Present Value of Trial I	**£12,744**	**£25,565**	**£37,951**	**£49,918**
Net Present Value of Trial I (Recycling)	**£12,916**	**£25,395**	**£37,453**	**£49,101**
Trial II	£21,406	£29,901	£29,901	£29,901
Trial II (Recycling)	£15,744	£15,744	£15,744	£15,744
Net Present Value of Trial II	**£21,406**	**£50,296**	**£78,209**	**£105,177**
Net Present Value of Trial II (Recycling)	**£15,744**	**£15,744**	**£15,744**	**£15,744**
Trial IV	£6,538	£6,538	£6,538	£6,538
Trial IV (Recycling)	£881	£881	£881	£881
Net Present Value of Trial IV	**£6,538**	**£12,856**	**£18,959**	**£24,856**
Net Present Value of Trial IV (Recycling)	**£881**	**£1,732**	**£2,554**	**£3,348**

Figure 21 Projected Trials Results Over Four Years

This indicated that Trial I would need to run for at least two years before it is preferable to 100% recycling. However, Trial II and Trial IV equivalent would be preferable to 100% recycling after just one year in operation.

[18] These costs are discounted in line with the discount factors as provided in the Defra Green Book on economic evaluation which can be found here: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

[19] It should be noted that what has been included in the revenues and costs in this table is detailed in Appendix V, i.e., this is a direct financial comparison and does not include a wider external analysis such as the impact upon the incumbent compliance scheme.

Trial II Extension

This scenario looks at the impact through an extension of Trial II only, due to the higher re-use level, assuming five times Trial II services were in operation. The analysis is based on one year and includes the total quantity of material successfully re-used and the total NPV (net present value).

	Trial II	Trial II x 2	Trial II x 3	Trial II x 4	Trial II x 5
Tonnes Re-Used	20.7	41.4	62.11	82.81	103.51
Items Re-Used	404	808	2,424	9,696	48,480
Year 1 Net Present Value	£21,406	£42,812	£64,218	£85,624	£107,030

Figure 22 Trial II Extension

The results show that with only five Trial IIs in operation across the UK (based on a 12 month period), approximately 2,000 items could be re-used each year, which equates to 104 tonnes. There would also be a positive NPV of just over £107,000 over the first year.

Reduced Visual Inspection Rejection Levels

The final analysis carried out was on the visual inspection rejection levels that occur at this processing stage at the HWRCs. Of the total items received on site, 99% and 98% were rejected from collection for re-use for Trial I and Trial II respectively[20].

A further scenario was designed in order to identify the impact on the re-use levels just by improving the conditions of items on site; i.e., by reducing the current levels of rejection at visual inspection stage. The figure below presents the findings of this scenario including impacts of assumed reduced rates and on the number and weight of items that could be re-used if such levels were reduced.

	Reduced Visual Inspection Rejection Rate															
	Current (99% & 98%)		95%		90%		85%		80%		75%		70%		65%	
Re-Used	Items	Tonnes	Items	Tonnes	Items	Tonnes	Items	Tonnes	Items	Tonnes	Items	Tonnes	Items	Tonnes	Items	Tonnes
Trial I	55	3	184	10	368	19	553	29	737	39	921	48	1,105	58	1,289	68
Trial II	202	10	423	22	847	43	1,270	65	1,693	87	2,116	108	2,540	130	2,963	152

Figure 23 Reduced Visual Inspection Rejection Rates

The figures for trial II, above, show that by reducing the visual inspection rejection rates by just 3% (from 98% to 95%), the total quantity of items re-used would more than double from 202 to 423 items: a rise of 109%. That figure should be achievable if opportunities provided in this report are adopted, including:

- Manual handling needs to change its focus from recycling to re-use;
- Improved communication and co-operation with site supervisors at HWRCs;
- Establish a national and local public awareness on potential for re-use of items left at HWRCs; and
- Use of containers at HWRCs to increase the re-use potential of items.

Conclusion

The results from the cost benefit analysis show that, over a period of at least two years, all the re-use trials are more cost effective than a recycling only option. This highlights that re-use is not only a

[20] This was not completed for Trial IV due to the different nature of the trial.

more environmentally preferable option, but it is also more economically advantageous once the initial set up costs are paid back.

When comparing each trial, the results show that Trial II delivers the best economic results because it combines the most advantageous features of Trial I and IV. It has a high throughput of items in comparison to Trial IV, meaning the overall benefit is greater due to a higher number of items being re-used and returned to market. It also sees a higher re-use rate in comparison to Trial I due to the use of containers, which protects the equipment from the elements. This combination of a high number of items and high re-use rate results in Trial II being the most cost effective process for re-use.

6 Re-use Trials Benefits

This section presents the key benefits that were recognised by the trial participants.

The overall benefits of the project were identified throughout the duration of the trials and also through interviews with the trial partners. These are summarised below.

Supports the local community – re-use organisations are often involved in providing jobs and training opportunities for the local community, and, as such, being able to secure a consistent feedstock of items from HWRCs (and bulky uplift collections) allows them to continue and even expand these opportunities. Examples of this include:

- Furniture Plus employs socially excluded people: the long term unemployed, people with learning difficulties and people undertaking community service roles. This employment provides them with the opportunity to develop skills and build a career. With the organisation's participation in the trials, a higher number of WEEE items were accessible to them, thereby improving their capability to provide more jobs and training opportunities;
- Castle Furniture has a similar approach, providing volunteering opportunities and training for people who are removed from labour markets, such as unemployed young people, long term unemployed adults, adults with disabilities or learning difficulties and anyone who needs support to improve their levels of employability. Through the trials and access to the HWRCs, Castle Furniture was able to secure a larger number of WEEE items, which meant they were able to provide an increased number of jobs and training opportunities; and
- For the first time, Project Oskar was able to secure a high demand for WEEE from local residents. As a direct consequence of their engagement in Trial 1, they were able to provide more training opportunities and jobs.

Supports the growth of re-use organisations – Castle Furniture has indicated that participation in the trials and the resultant engagement with Fife Council and its WEEE Producer Compliance Scheme has enabled them to invest in their business, safe in the knowledge that they have regular access to a secured supply of items.

Supports the development of skills within re-use organisations – the secured supply of items has enabled Castle Furniture to employ a full time engineer whose role is to increase the knowledge and skills of employees, enabling them to repair a greater amount of WEEE collected from HWRCs. Trainees receive support to improve their knowledge and skills to progress in their career, whilst the company ensures that the maximum quantity of WEEE is repaired and placed back into circulation within the community.

Potential to extend support to other local authorities and charities – Castle Furniture now has access to approximately three times more WEEE items than prior to the trials. This increase has allowed Castle Furniture to continue to sell refurbished items through its outlets in Cupar, Perth and Glenrothes, as well as supply items to charitable organisations such as the Bethany Christian Trust in Edinburgh[21]. This demonstrates that the benefits of the re-use trials can extend beyond the trial catchment area, by providing basic electrical appliances to an increased number of communities that require this support/service.

Managing WEEE further up the waste hierarchy – by diverting more WEEE to re-use rather than other waste management options such as recycling or disposal, the local authorities are able to demonstrate improved management of WEEE further up the waste hierarchy.

[21] Bethany specialises in the support of vulnerable people moving from homelessness into new tenancies, and consequently requires a high number of white goods.

Positive Public Relations (PR) – as a result of local authorities' participation in the trials they are able to demonstrate their willingness to support the local community as well as the environment.

Supports circular economy approach – an increasing rate of WEEE re-use demonstrates improved resource efficiency through product life extension.

7 Conclusions

This section presents the conclusions from each of the trials and includes the feedback from the re-use organisations and councils involved. Several conclusions ran as common threads throughout all the trials, in particular, the benefits gained by having a pro-active partnership approach from all stakeholders.

7.1 Trial I – Access to Designated Bays (Items Exposed)

The main conclusions from trial I are provided below.

Communication and Co-operation with Site Supervisors at HWRCs is Critical

The trials have shown that in order to implement a successful re-use process at an HWRC, site supervisors and all relevant staff[22] must be briefed on the objectives and benefits of a re-use process and agree in advance to co-operate on allowing the necessary arrangements to take place on the site, such as:

- Organising designated areas to keep items suitable for re-use ready for collection;
- Supporting re-use organisations' staff on the selection of items suitable for re-use and the segregation of those items in the designated area;
- Organising the movement of extra vehicles from re-use organisations on site. This proved to be a difficult, but not impossible barrier at some small sites; and
- Reporting any theft occurring on site immediately and working towards the prevention of further incidents.

Public Awareness is Important to the Success of Trials

- Marketing activities raised public awareness of the re-use opportunities at the sites and reminded the public to handle items carefully when transporting potentially suitable items to the site. This public engagement is of importance to the success of any re-use service at HWRCs; and
- It is important that site staff build on any marketing initiatives by promoting the occurrence of a re-use service (or trial) to the public to help ensure items are presented in a good condition to optimise their potential for re-use.

Incomplete Items at HWRCs Reduces the Quantity of Items Available for Re-use

During the trials, many items of equipment at the HWRCs were found to be incomplete, with cables and fridge compressors frequently missing. Too often the theft of a component (worth relatively little in terms of scrap value) put a valuable piece of equipment beyond economic repair, meaning the potential financial loss to the third sector of hundreds of pounds; significantly greater in value than the value of the component which had been removed.

[22] Most sites operate in a shift arrangement, where three or more staff may be responsible for the same site on an alternating basis. It is therefore important that all staff are made aware of the changes occurring on site due to the introduction of any re-use process.

Weather and Poor Handling Reduces Quality of Items Available for Re-use

The condition of items collected from Trial I sites was often considered poor and not suitable for repair. As well as the missing parts outlined above, site audits also noted a high level of cosmetic damage, which may have been caused by rough stacking and dragging the items into position.

7.2 Trial II – Access to Sites (Items Collected in Containers)

The main conclusions from trial II are provided below.

Communication and Co-operation with Site Supervisors at HWRCs is Important

The trials have shown that in order to implement a successful re-use process at an HWRC, site supervisors and all relevant staff[23] should be trained and briefed on the objectives of the re-use process. The re-use element of the WEEE compliance service should form part of the standard daily operational procedures, and re-use specific procedures at the HWRCs should include:

- Clear signage and guidance on how to use the containers, as unless advised otherwise, the public will by-pass the re-use container and take the items to the recycling bays;
- Training for HWRC staff on good practice for re-use, both handling and initial assessment;
- Mechanisms for ensuring both the public and HWRC site staff are aware of how to handle re-usable WEEE with care, stacking it safely in the re-use container;
- Equal responsibility put on HWRC and re-use organisation personnel around the housekeeping of the container: the former to ensure items are assessed and stored in a safe manner and the latter to ensure that rejected items are returned to the correct recycling bays, and that the container is empty after collection;
- Identification of re-use vehicles in the standard weekly collection planners to ensure that only authorised personnel are allowed on the site;
- Noting the condition of re-use items as they arrive and reporting any deterioration in condition, for example, cables or compressors missing; and
- Being part of the HWRC's staff job description or Key Performance Indicators (KPIs) to help increase staff engagement in the re-use process.

Public Awareness is Important to the Success of Trials

- Marketing activities raised public awareness of the re-use opportunities at the site and reminded them to handle items potentially suitable for re-use carefully when transporting them to the site;
- Council websites are a useful tool for advising the public of the trials (or re-use service) and should carry clear advice for the public on how to identify items for re-use and what to do with them. Options such as the National Re-use Hotline (Scotland only) can also be utilised to divert materials for re-use;
- HWRC staff are a key element in promoting the re-use option to the public whilst on site. Training on how to approach the public will improve site usage and participation in re-use;
- Containers used for re-use should be clearly visible to the public when they arrive on the site, both by signage and instructions from HWRC staff; and

[23] Most sites operate in a shift arrangement, where three or more staff may be responsible for the same site on an alternating basis. It is therefore important that all staff are made aware of the changes occurring on site due to the introduction of any re-use process.

- The public must be made aware that re-use is available on the site, and they must be aware why the site operative is asking about the condition of the item. In one documented incident, a member of the public accused the site operative of keeping the item for himself. Using signage on the container to promote the re-use process proved effective in preventing this type of accusation from recurring.

The Set-up and Delivery of the Service is Important to the Success of the Trials

Trial II highlighted the importance of the re-use organisation in engaging HWRC staff and ensuring the re-use service runs smoothly on site. Therefore, in order to ensure the service is operating effectively, the re-use organisations should take responsibility for certain aspects of the service such as:

- The day to day relationship with the HWRC staff;
- 'Ownership' of the re-use container: Trial II highlighted that whilst site staff may be prepared to divert materials into a container, they may be less willing to empty the items rejected by the re-use organisation. The re-use organisation, as the main stakeholder, should assume the responsibility for the 'housekeeping' element of the service at the HWRCs;
- Providing initial and on-going staff training. The turnover of staff and shift patterns at sites can quickly degrade the knowledge base of the staff. The re-use organisation needs to maintain a constant dialogue with on-site operatives to keep the re-use process flowing and within the standards agreed; and
- Training programmes for HWRC operatives: although these are available via Non-Governmental Organisations (NGOs), these programmes contain no references to re-use, and, as such, re-use organisations must engage site staff to teach them how to identify, handle and store items potentially suitable for re-use.

Use of containers at HWRCs increases the amount of products that can successfully be re-used

The comparison between Trials I & II clearly demonstrates that the use of containers protects the items from weather, which can prevent both cosmetic damage (from rust) and mechanical damage (from water damage to internal circuits). It also helps create a 're-use first' mentality on site, which can have indirect benefits such as the items being handled more carefully. This helps generate a significantly higher number of items being potentially suitable for re-use, passing the PAT/functionality tests and ultimately being re-used.

Partnership Working and Pro-active Account Management can Increase Re-use

By working with the compliance scheme, Castle Furniture moved to a structured logistical system that took into account the main recycling collections and when they were conducted. The optimisation of their route planning has seen a significant increase in the quantity of items being collected for re-use, which has had the knock-on effect of a 300% increase in the quantity of electrical items being sold by them. This has enabled Castle Furniture to grow the business and employ a full time technician who can undertake more difficult repairs and increase the level of staff training.

7.3 Trial III – Re-use Organisation Set-up as a DCF

Trial III involved Project Oskar setting up their premises as a DCF, allowing residents to take their items directly to the site for re-use. Following a trial period of two months, no items had been presented by the public for re-use at the site and therefore the trial was suspended.

The lack of items presented for re-use during Trial III was investigated, and the main conclusions are provided below.

Location of the Site may have Negatively Affected Public Participation

During the review of the site it was also identified that the site was located in an industrial area, and, as such, the public may not have been be fully aware of it. Although the trial benefited from marketing activities, the lack of visits to the site by the public demonstrated that in order for it to be a success, a facility located in this type of environment may need a more sustained marketing campaign.

DCF Re-use Drop-off Service Conflicted with Other Services Offered

During the period of the trial, Project Oskar continued to operate its bulky uplift service for local residents. This could have substantially reduced the local community's motivation to take their items to the site when they could access a free bulky uplift service by Project Oskar. If the site is to be made into a DCF site in the future, they should evaluate the most effective service method for recovering items for re-use. For example, if the bulky uplift service is the most effective option, then this could be continued and perhaps complemented by a DCF service in order to offer a more complete service to the public.

Economic Climate Reduced Items Available for Re-use

Discussions with Project Oskar identified that, due to the economic environment, the public were more inclined to hold on to their items for longer rather than replacing them as quickly as they may have done prior to the economic downturn. This has reduced the quantity of items being presented by the public for re-use/recycling.

Also, in some cases it is believed that rather than putting items out for re-use/recycling the public are trying to gain value from them by selling them to online retailers of second-hand equipment. This means that re-use organisations, such as Project Oskar, are facing competition from organisations such as Ebay and Gumtree (amongst others). This is similar to donating directly to re-use end markets.

7.4 Trial IV – Bulky Uplifts Intervention

The key conclusions in relation to trial IV are provided below.

Support from Councils is Important

The trials have shown that, in order to implement a re-use process through a bulky uplift service, it is important to have the full support of the Councils. This is important to ensure:

- Collection staff are aware of the re-use service and that items are collected and stored in the vehicle with care and are taken from households directly to the re-use organisation; and

- Collections are done as quickly as possible to reduce any potential damage from the elements or from vandalism. This may also help reduce or prevent the items being taken by unauthorised collectors.

The Quality of Items Collected Prevented Greater Re-use Levels

One of the main issues experienced during this trial was the number of items that (depite being uplifted from households) were in too poor a condition to be re-used. It was identified this could be due to:

- Weather exposure due to items being left outside for prolonged periods of time prior to collection;
- Vandalism, either at the kerbside or if items were left in gardens;
- Poor handling, transportation and storage; and
- The potential for unauthorised collectors cherry-picking the best items (or taking them all), leaving the poor quality items for the local authority collections.

Impact of the Trial was Reduced by Lack of Continuous Service and Limited Duration

It was also identified that:

- A lack of continuous service over the festive period (when the Council stopped the bulky uplift collections) prevented items from being taken for potential re-use during this period. This meant that the public may have still placed items on the street until the Council could collect them or (without their knowledge) they were being uplifted by unauthorised collectors; and
- The limited duration of the trial prevented further work being undertaken to investigate the lack of good quality items being collected by the Council and to trial adjustments to the service that may have been able to overcome any issues.

8 Opportunities

This section provides opportunities to increase re-use from HWRCs based on the key findings and conclusions from the trials. These opportunities are also based on feedback from the project partners.

Increase Public Awareness of Re-use Services and Benefits

Previous studies have found that the public believes 56% of the WEEE that they take to HWRCs is re-usable, either in its present condition or with repair. However, the trials indicated that the public can also be sceptical about re-use and what happens to items on site. Therefore, re-use should be widely promoted on-site to ensure the public is aware of the service being provided by the local authority and its partners. The benefits of re-use should also be promoted. Consideration should be given to informing the public about re-use before they get to site to ensure they handle and transport the items to site in a manner that optimises the potential for re-use.

Improved Training and Support for HWRC Operatives

HWRC staff have a demanding client facing role. However, the trials showed that there is limited or no formal training in place regarding methods of engagement with the general public in terms of re-use. This means that WEEE often arrives at HWRCs in a reasonable condition, but is then either put directly into the recycling area without being considered for re-use, or unsuitable handling procedures put the unit beyond economic repair. HWRC staff are a key factor in any successful re-use operation, but there is limited research into their attitudes and views on improving re-use processes, for example, by approaching the general public, assessing goods, potential double handling of materials on the site and so on. All HWRC staff that received training during the trials responded in a positive manner, but the impact of training (delivered by a service supplier rather than in a formal module) was time bound, and, as such, should be a continuous process with key messages reinforced.

Prioritise Re-use at HWRCs

Household Waste Recycling Centres have been designed to assist the public in diverting items from landfill via recycling. However, re-use is often absent from the site design or operational procedures. The use of bays containing hook lift compactors is a good example of how repairable items, by being thrown over the bay wall into the container, are instantly beyond re-use. Set-aside re-use areas should be included at all HWRCs to capture re-usable WEEE before it enters the recycling stream.

Use of Containers at HWRCs Increases the Amount of Products that can Successfully be Re-used

The variance in re-use levels for Trials I & II highlights the effectiveness of using containers for increasing re-use. The main advantage of using containers is to keep the items under cover to prevent weather damage; the container also helps reinforce a ‘re-use first’ message on site, giving a physical presence to the re-use element of the site. The container can, in effect, be used as a public awareness portal, helping to direct people to the re-use service.

Increase Repair Skills of Re-use Organisation Staff

As the trials matured, it was identified that improved recovery of items for re-use at HWRCs would not on its own optimise the number of items ultimately re-used from this source. The trial showed a clear correlation between the number of items repaired, the skill-set of the technician employed by the re-

use organisation and the repair facilities available. Therefore, improving the skill set of the repair staff would increase the quantity of items being repaired and ultimately re-used.

Consideration should be given for supporting re-use organisations to improve the knowledge and repair capabilities they can offer, allowing them to realise the full potential of WEEE for re-use. This would include the recruitment of staff with the specialist skills required to repair WEEE, and the ability to transfer that knowledge to other members of the organisation. This training would ideally be delivered via a structured training programme leading to externally recognised qualifications.

Leakage Must be Prevented to Increase Re-use

The unauthorised removal of items including fridge compressors, cables and even complete units such as TVs, has a greater impact on re-use than any other segment of the WEEE system. As an example, a collection at one site during the trial revealed that over 30 fridge compressors were missing. A further inspection showed that around 10-12 of these units would have been taken back to the re-use organisation for repair. Using the ratios and information from similar sites, it could be estimated that, from that single site on a single day, the third sector organisation lost between £800 and £1,000 in retail value. This is in addition to the lost training/job opportunities and the cost of the failed visit.

This was also a key issue for the HWRC trials and the bulky uplift trial, and, as such, work should be undertaken to prevent this happening. Initiatives that could help reduce or prevent leakage and increase the potential pool of items available for re-use include use of onsite CCTV, spot site visits, item tracking and comparing bulky item requests against items collected.

EEE Should be Designed for Easy Repair

The lack of standardisation of parts and accessories used in items, even within the same brand, can make the repair of items more expensive. This is because the re-use organisation often has to buy specific parts direct from manufacturers, which can mean that the item is too expensive to repair and is sent for recycling instead. Producers should be encouraged to design items for easy disassembly and repair, using standardised parts that would enable items to be easily and cost effectively repaired.

Scottish Welfare Fund Should Include Re-use Items

A factor which has reduced the end market demand for re-use items in Scotland is the introduction of the Scottish Welfare Fund. The fund is intended to offer grants or in-kind support for two purposes[24]:

- Provide a safety net in a disaster or emergency, when there is an immediate threat to health or safety – Crisis Grants; and
- Enable independent living or continued independent living, preventing the need for institutional care – Community Care Grants.

The grants are available to people who do not have alternative means of paying for what they need. The grants are intended to meet one-off needs rather than on-going expenses. Although the fund provides a valuable lifeline to people in severe hardship, the fund only applies to new items. This means that, people who may have had their needs met by re-used EEE are now able to apply through the fund to purchase new items, thereby reducing end market demand for re-use. In addition, the cost of the grant system would be increased as there is a clear cost differential between new and re-used items. Consideration should be given to determine if the scope of the fund can be broadened to include re-used EEE.

[24] http://www.scotland.gov.uk/Resource/0041/00415780.doc

Increase Stakeholder Engagement

Housing Associations and Social Services have a constant and increasing need for quality, refurbished white goods and electrical items, and both sectors could be significant benefactors from an increased number of refurbished items being put back into use by re-use organisations. Moreover, for the re-use sector, having a steady marketplace for their goods could open up new opportunities for growth, leading to an increase in training and job opportunities.

More research needs to be done to establish a comprehensive national picture, but from those organisations involved in the trials, the initial assessment would be that communication between these stakeholders is unstructured and relies heavily on local contacts rather than any formal arrangement.

This situation could present an excellent opportunity to increase re-use levels because it could match organisations that desperately need goods (and are forced to buy new at much higher costs) with organisations that may be struggling to find volume outlets for quality repaired items. A mechanism for bringing these stakeholders together should be investigated.

The Benefits of Re-use Organisations Providing Bulky Uplifts Services Should be Investigated

During the trials, re-use organisations indicated that they would be interested in providing bulky uplift collections on behalf of local authorities. This should be investigated further to determine if this could reduce or prevent leakage of items as well as improve the quality of items collected directly from the householder.

Further Research

These trials have highlighted the advantages and disadvantages of different methods of collections from HWRCs as well as bulky uplifts; however, they have also shown that introducing a re-use service can be both challenging and time consuming and often reliant upon the engagement of local key stakeholders. Although the trials have provided an insight into each method used, they have also identified areas where further work would complement and support the aim of this study. This includes the following:

- **Increase Length of Trials**: although these trials provided valuable information about each collection method for re-use, in some cases, it took several weeks to get the trials operational due to snagging issues. This means that it was difficult to determine if the service was fully mature by the end of the project. If undertaking further trials, it is recommended that they be conducted over a longer period, incorporating different seasons, which may cause an increase or decrease in the quantity/quality of items collected;
- **Trials to Measure and Prevent Leakage**: the leakage of items was one of the biggest issues faced during the trials and had a significant impact on the quantity of items available for re-use. Further work to encourage the re-use of WEEE should include provisions for measuring the impact of leakage from a financial perspective as well as examining the impact on local training and job opportunities. This work should also include trials for assessing the impact of differing methods for the prevention of leakage. The trials have indicated that leakage will be an issue experienced by many local authorities, and, as such, if it can be prevented would significantly increase re-use rates in the UK;
- **Review of Bulky Uplift Services**: it could be beneficial to conduct such trials to identify the best way to conduct the service in order to optimise the potential for re-use; i.e. does a free bulky uplift encourage greater participation than one that is charged, or does a bulky uplift service operated by a re-use organisation recover the items in a better condition, due to their priority for

re-use and consequently their care when handling and transporting the items back to the re-use organisation; and

- **Roll-out of Re-use Services:** these trials have identified factors to consider when implementing a new re-use service in HWRCs. The mix of trials also demonstrated that re-use as a concept is viable, and that some systems deliver a higher percentage of goods back to the market than others. Despite the comprehensive assortment of the trials (in terms of population alone covering 15% of Scottish Local Authorities), it is likely there will be other factors that did not appear during the programme. As such, consideration should be given to rolling out more trials and permanent programmes. However, additional trials should be based on the templates shown and monitored centrally in order to constrictively add to the existing knowledge base.

Appendix I

Quantity Received, Recycled, Collected for Re-use and Re-used by Site and Category

(Trial I)

HWRCs	LDA's		Cooling		Mixed		Total Units	Total Tonnes
Methil Recycling Centre	**Units**	**Tonnes**	**Units**	**Tonnes**	**Units**	**Tonnes**		
Total Received**	483	25.1	685	27.8	4797	57.6	5964.4	110.5
Collected for re-use	85	4.7	34	1.4	8	0.1	127.0	6.2
Recycled	398	20.4	651	26.4	4789	57.5	5837.4	104.3
Re-used*	16	0.9	5	0.2	1	0.0	22.0	1.2
Pittenweem Recycling Centre								
Total Received**	286	14.9	242	10.0	1363	16.4	1891.5	41.4
Collected for re-use	38	2.2	30	1.3	11	0.2	79.0	3.7
Recycled	248	12.7	212	8.8	1352	16.2	1812.5	37.7
Re-used*	8	0.5	8	0.4	3	0.1	19.0	0.9
Dalmoak Recycling Centre								
Total Received**	534	27.5	754	30.0	3768	45.2	5055.2	102.7
Collected for re-use	16	0.9	8	0.4	1	0.0	25.0	1.3
Recycled	518	26.6	746	29.6	3767	45.2	5030.2	101.4
Re-used*	5	0.3	3	0.2	0	0.0	8.0	0.5
Old Kilpatrick Recycling Centre								
Total Received**	501	25.8	309	12.4	2957	35.5	3766.8	73.6
Collected for re-use	11	0.6	7	0.3	0	0.0	18.0	1.0
Recycled	490	25.1	302	12.0	2957	35.5	3748.8	72.7
Re-used*	3	0.2	3	0.2	0	0.0	6.0	0.3
Total Received (all HWRC)	**1804**	**93.3**	**1990**	**80.2**	**12884**	**155**	**16678**	**328.2**
Total Collected for Re-use Trial 1	**150**	**8.4**	**79**	**3.4**	**20**	**0**	**249**	**12.1**
Total Recycled Trial I	**1654**	**84.8**	**1911**	**76.8**	**12864**	**154.4**	**16429.0**	**316.0**
Total Re-used Trail I	**32**	**1.9**	**19**	**0.9**	**4**	**0.1**	**55**	**2.9**

**total re-used includes items already sold as well as a proportion of items being tested at the time of writing (40% of those are expected to pass the test, estimated by the re-use organisation)*

*** total received is a sum of total recycled and total collected for re-use*

Figure 24 Quantity Received, Recycled, Collected for Re-use and Re-used by Site and Category (Trial I)

Appendix II

% Received, Recycled, Collected for Re-use and Re-used by Site and Category (Trial I)

HWRCs	LDA's		Cooling		Mixed		Total Units %	Total Tonnes %
Methil Recycling Centre	**Units**	**Tonnes**	**Units**	**Tonnes**	**Units**	**Tonnes**		
Collected for re-use	18%	19%	5%	5%	0%	0%	2%	6%
Recycled	82%	81%	95%	95%	100%	100%	98%	94%
Re-used	3%	4%	1%	1%	0%	0%	0%	1%
Pittenweem Recycling Centre								
Collected for re-use	13%	15%	12%	13%	1%	1%	4%	9%
Recycled	87%	85%	88%	87%	99%	99%	96%	91%
Re-used	3%	3%	3%	4%	0%	0%	1%	2%
Dalmoak Recycling Centre								
Collected for re-use	3%	3%	1%	1%	0%	0%	0%	1%
Recycled	97%	97%	99%	99%	100%	100%	100%	99%
Re-used	1%	1%	0%	1%	0%	0%	0%	0%
Old Kilpatrick Recycling Centre								
Collected for re-use	2%	2%	2%	3%	0%	0%	0%	1%
Recycled	98%	98%	98%	97%	100%	100%	100%	99%
Re-used	1%	1%	1%	1%	0%	0%	0%	0%
Total % Received	**11%**	**28%**	**12%**	**24%**	**77%**	**47%**	**100%**	**100%**
Total % Collected for Re-use	**8%**	**9%**	**4%**	**4%**	**0%**	**0%**	**1.5%**	**4%**
Total % Recycled	**92%**	**91%**	**96%**	**96%**	**100%**	**100%**	**98.5%**	**96%**
Total % Re-used	**2%**	**2.1%**	**1%**	**1%**	**0%**	**0%**	**0.3%**	**1%**

Figure 25 % Received, Recycled, Collected for Re-use and Re-used by Site and Category (Trial I)

Appendix III

Quantity Received, Recycled, Collected for Re-use and Re-used by Site and Category (Trial II)

HWRCs	LDAs		Cooling		Mixed		Total Units	Total Tonnes
Dunfermline Recycling Centre	**Units**	**Tonnes**	**Units**	**Tonnes**	**Units**	**Tonnes**		
Total Received**	1095	57	989	41	4426	52	**6510**	**150.5**
Collected for re-use	181	10.2	12	2.3	8	0.2	**201**	**12.7**
Recycled	914	47.1	977	38.9	4418	51.8	**6309**	**137.8**
Reused*	128	6.6	10	0.5	0	0.0	**138**	**7.1**
St. Andrews Recycling Centre								
Total Received	236	12.5	175	7.3	2497	30.0	**2908**	**49.7**
Collected for re-use	42	2.5	37	1.5	2	0.01	**81**	**4.0**
Recycled	194	10.0	138	5.8	2495	29.9	**2827**	**45.7**
Reused	27	1.4	21	1.1	0	0.0	**48**	**2.4**
Erskine Recycling Centre								
Total Received	693	35.4	395	14.5	1644	19.7	**2732**	**69.6**
Collected for re-use	7	0.2	6	0.3	1	0.01	**14**	**0.5**
Recycled	686	35.2	389	14.2	1643	**19.7**	**2718**	**69.1**
Reused	4	0.2	3	0.2	1	0.01	**8**	**0.4**
Linwood Recycling Centre								
Total Received	175	8.8	75	2.7	550	6.6	**800**	**18.1**
Collected for re-use	9	0.2	3	0.1	1	0.02	**13**	**0.3**
Recycled	166	8.6	72	2.6	549	6.59	**787**	**17.8**
Reused	6	0.3	2	0.1	0.0	0.0	**8**	**0.4**
Total Received (all HWRCs)	**2199**	**114.0**	**1634**	**65.7**	**9117**	**108.3**	**12950**	**288.0**
Total Collected for Re-use Trial II	**239**	**13.1**	**58**	**4.2**	**12**	**0.2**	**309**	**17.5**
Total Re-used Trial II	**165**	**8.5**	**36**	**1.9**	**1**	**0.0**	**202**	**10.4**
Total Recycled Trial II	**1960**	**100.9**	**1576**	**61.5**	**9105**	**108.0**	**12641**	**270.5**

** total re-used includes items already sold as well as a proportion of items being tested at the time of writing (40% of those are expected to pass the test, estimated by the re-use organisations)*

*** total received is a sum of total recycled and total collected for re-use*

Figure 26 Quantity Received, Recycled, Collected for Re-use and Re-used by Site and Category (Trial II)

Appendix IV

% Received, Recycled, Collected for Re-use and Re-used by Site and Category (Trial II)

HWRCs	LDAs		Cooling		Mixed		Total	Total
Dunfermline Recycling Centre	**Units**	**Tonnes**	**Units**	**Tonnes**	**Units**	**Tonnes**	**Units (%)**	**Tonnes (%)**
Collected for Re-use	17%	18%	1%	6%	0%	0%	**3%**	**8%**
Recycled	83%	82%	99%	94%	100%	100%	**97%**	**92%**
Reused	12%	11%	1%	1%	0%	0%	**2%**	**5%**
St. Andrews Recycling Centre								
Collected for Re-use	18%	20%	21%	21%	0%	0%	**3%**	**8%**
Recycled	82%	80%	79%	79%	100%	100%	**97%**	**92%**
Reused	11%	11%	12%	15%	0%	0%	**2%**	**5%**
Erskine Recycling Centre								
Collected for Re-use	1%	1%	2%	2%	0%	0%	**1%**	**1%**
Recycled	99%	99%	98%	98%	100%	100%	**99%**	**99%**
Reused	1%	1%	1%	1%	0%	0%	**0%**	**1%**
Linwood Recycling Centre								
Collected for Re-use	5%	2%	4%	4%	0%	0%	**2%**	**2%**
Recycled	95%	98%	96%	96%	100%	100%	**98%**	**98%**
Reused	3%	3%	3%	4%	0%	0%	**1%**	**2%**
Total % Received	**17%**	**40%**	**13%**	**23%**	**70%**	**38%**	**100%**	**100%**
Total % Collected for Re-use	**11%**	**11%**	**4%**	**6%**	**0%**	**0%**	**2.4%**	**6%**
Total % Recycled	**89%**	**89%**	**96%**	**94%**	**100%**	**100%**	**97.6%**	**94%**
Total % Re-used	**8%**	**7%**	**2%**	**3%**	**0%**	**0%**	**2%**	**4%**

Figure 27 % Received, Recycled, Collected for Re-use and Re-used by Site and Category (Trial II)

Appendix V

Cost Benefit Analysis Breakdown

This appendix provides a more detailed breakdown of the associated benefits and costs of the trials.

Benefits

Benefits are the revenues generated by each trial as well as the equivalent baseline scenario of 100% recycling, both net and marginal.

Trial I

Over the six month trial period, 16,678 items in total were received at the four trial sites (Methil, Pittenweem, Dalmoak and Old Kilpatrick). Of these, 16,429 were recycled and 249 (1.5%) collected for re-use. Of the 249, 55 (22.1%) were successfully re-used. The average revenue generated by each item successfully re-used was approximately £65 per item.

For those 16,429 items collected for recycling[25], it is assumed that LDAs have small revenues available due to the scrap metal value being higher than the collection costs for such items. The scrap value was estimated as £3.58[26] per item during the course of the trial. It is also assumed that the cooling and small mixed WEEE items are revenue-neutral. The same revenues are applied to the items that were subsequently recycled after having been collected and assessed as unsuitable for re-use by the re-use organisations.

Having considered the above assumptions, for Trial I, the marginal revenue per item was £0.60 and the total revenue was approximately £9,935. This is summarised in the figure below.

[25] They refer to items rejected at visual inspection stage on sites, so not collected by re-use organisations.

[26] Assumed scrap metal value as £144.4 per tonne, minus £25 per tonne (the Metals Bulletin 5C Old Light iron price refers to the scrap metal content only; as LDAs also contain plastic, glass, rubber and concrete, the discount takes these non- metal elements into account) and minus £30 per tonne to cover average collection costs. This was incorporated into the price received for the LDAs, and means a marginal revenue of £89.4 per tonne. Assuming the average unit is 40kgs, this equates the marginal revenue of £3.58 per unit. Please note the metals bulletin figures change monthly, so an average over the period was used.

Trial I - Revenue	
Total Number of Items Received on Sites	16,678
Number of Items Initially Recycled (rejected at visual inspection stage)	16,429
LDAs Initially Recycled	1,654
Number of Items Collected for Re-use	249
Number of Items Re-used	55
Average Revenue from Items Re-used	£65.29
Number of Items Collected for Re-Use Subsequently Recycled	194
LDAs Recycled after Collection for Re-use	118
Total LDAs Recycled	1772
Average revenue for LDAs Recycled	£3.58
Total Revenue	**£9,935**
Total Revenue / Item	**£0.60**

Figure 28 Trial I Revenue

It is important to note that this revenue includes the amount available through recycling the LDAs that are not collected for re-use as well as the revenue generated by the re-use organisations through the sale of items successfully re-used and the items recycled which failed the test stages.

Trial II

Over the six month trial period a total of 12,950 items were received at the four trial sites (Dunfermline, St. Andrews, Erskine and Linwood). Of these, 12,641 were recycled and 309 were collected for re-use, which means that 2.4% of all items received were collected for re-use. Of the 309, 202 items were successfully re-used. The average revenue generated by these items was approximately £70 per item.

The 12,641 items that were not collected for re-use were later collected for recycling. Again, it is assumed that in the case of LDAs, revenue per item of £3.58[27] is available, and that cooling and small mixed WEEE items are revenue-neutral. The same values are applied to the items that were subsequently recycled after having been assessed as unsuitable for re-use at a later stage by the re-use organisations.

Therefore, for Trial II, the marginal revenue per item was £1.65 and the total revenue was £21,320. This is shown in the figure below.

[27] Assumed scrap metal value as £144.4 per tonne, minus £25 per tonne (the Metals Bulletin 5C Old Light iron price refers to the scrap metal content only; as LDAs also contain plastic, glass, rubber and concrete, the discount takes these non- metal elements into account) and minus £30 per tonne to cover average collection costs. This was incorporated into the price received for the LDAs, and means marginal revenue of £89.4 per tonne. Assuming the average unit is 40kgs this equates the marginal revenue of £3.58 per unit. Please note the metals bulletin figures change monthly, so an average over the four months period was used.

Trial II - Revenue	
Total Number of Items Received on Sites	12,950
Number of Items Initially Recycled	12,641
LDAs Initially Recycled	1,960
Number of Items Collected for Re-use	309
Number of Items Re-used	202
Average Revenue from Items Re-used	£69.49
Number of Items Collected for Re-Use Subsequently Recycled	107
LDAs Recycled after Collection for Re-use	74
Total LDAs Recycled	2,034
Average revenue for LDAs Recycled	£3.58
Total Revenue	**£21,320**
Total Revenue / Item	**£1.65**

Figure 29 Trial II Revenue

Again, it is worth noting that this revenue includes the amount available through recycling the LDAs that are not collected for re-use as well as the revenue generated by the re-use organisations through the sale of items successfully re-used and the items recycled which failed re-use test stages.

Trial IV

Over the two month trial period, a total of 126 items were received at the Tayside Re-use Centre. Of these, 11 were successfully re-used, which means that 9% of all items received were re-used. The average revenue generated by these items was approximately £105 per item.

The 126 items that were not suitable for re-use were sent for recycling. Again, it is assumed that in the case of LDAs, revenue per item of £3.58[28] is available, and that cooling and mixed items are revenue-neutral. The same values are applied to the items that were subsequently recycled after having been assessed as unsuitable for re-use at a later stage by the re-use organisations.

Therefore, for Trial IV, the marginal revenue per item was £10.13 and the total revenue was £1,277. This is shown in the figure below.

[28] Again as above, assumed scrap metal value as £144.4 per tonne, minus £25 per tonne (the Metals Bulletin 5C Old Light iron price refers to the scrap metal content only; as LDAs also contain plastic, glass, rubber and concrete, the discount takes these non- metal elements into account) and minus £30 per tonne to cover average collection costs. This was incorporated into the price received for the LDAs, and means a marginal revenue of £89.4 per tonne. Assuming the average unit is 40kgs this equates the marginal revenue of £3.58 per unit. Please note the metals bulletin figures change monthly, so an average over the four months period was used.

Trial IV - Revenue	
Total Number of Items Collected	126
Number of Items Recycled	115
Total LDAs Recycled	34
Number of Items Re-used	11
Average Revenue from Items Re-used	£105.00
Average revenue for LDAs Recycled	£3.58
Total Revenue	**£1,277**
Total Revenue / Item	**£10.13**

Figure 30 Trial IV Revenue

Baseline 100% Recycling

The baseline is used as a comparison for each trial. The marginal revenue of the LDAs recycled is assumed to be £3.58. Assuming that all items are recycled (i.e. no items are re-used); Trial I would see total revenue of approximately **£6,500** and marginal revenue of approximately **£0.40** per unit. This is summarised below.

100% Recycling (Trial I) - Baseline	
Number of Items Recycled	16,678
LDAs Recycled	1,804
Average revenue for LDAs Recycled	£3.58
Total Revenue	**£6,458**
Total Revenue / Item	**£0.39**

Figure 31 100% Recycling (Trial I) Baseline

Assuming that all items are recycled, Trial II would see total revenue of approximately **£7,900** and marginal revenue of **£0.61** per unit. This is shown in the figure below.

100% Recycling (Trial II) - Baseline	
Number of Items Recycled	12,950
LDAs Recycled	2,199
Average revenue for LDAs Recycled	£3.58
Total Revenue	**£7,872**
Total Revenue / Item	**£0.61**

Figure 32 100% Recycling (Trial II) Baseline

Assuming that all items are recycled, Trial IV would see total revenue of approximately **£147** and marginal revenue of **£1.16** per unit. This is shown in the figure below.

100% Recycling (Trial IV) - Baseline	
Number of Items Recycled	126
LDAs Recycled	41
Average revenue for LDAs Recycled	£3.58
Total Revenue	**£147**
Total Revenue / Item	**£1.16**

Figure 33 100% Recycling (Trial IV) Baseline

Costs

This section details the costs (both total and marginal) for each trial as well as the equivalent baseline for recycling. The costs are broken down between transportation costs (collection from sites), repair costs, marketing costs and container costs (Trial II only).

Trial I

Over the six months, 249 items were collected for re-use, with 55 of these being successfully re-used. For each of the re-use organisations engaged for Trial I, cost data was collated for both transport and re-use and weighted based on the number of items they each collected and re-used, including marketing costs. The total costs for Trial I was approximately **£3,800** or a marginal cost of around **£0.20** per item.

Trial II

Over the six months, 309 items were collected for re-use, with 202 of these being successfully re-used. For each of the re-use organisations engaged for Trial II, cost data was collated for both transport and re-use and weighted based on the number of items they each collected and re-used, including marketing and container costs. This was used to calculate the total cost of Trial II as approximately **£14,400** or a marginal cost of **£1.15** per item.

Trial IV

Over the two month trial period, a total of 126 items were received at Tayside Re-use Centre. The average cost data was taken for each of the re-use organisations engaged for Trial I & II and weighted based on the number of items. The total costs were approximately **£187** or a marginal cost of around **£1.48** per item.

Baseline 100% Recycling

Within this analysis no associated costs of recycling are included.

Appendix VI

Re-use Organisations & Re-use Processes

Castle Furniture

Background

Castle Furniture[29] is a charity organisation and AATF that aims to provide free or low cost household goods to disadvantaged families and individuals to alleviate poverty and indebtedness in Fife. The organisation co-ordinates the collection of donations, including furniture and WEEE, free of charge from households throughout the North and North East of Fife.

The charity is able to offer vulnerable people the opportunity of training and employment in a safe, supportive and inclusive environment, which can often be the first step for them to lead a more structured life. The organisation has initiatives with charitable organisations such as Bethany Christian Trust in Edinburgh, where home starter packs are provided, including not only re-used EEE, such as fridges, cookers, washing machines, but also used furniture such as beds and other essential furniture.

Re-use Process

Castle Furniture was given access to four HWRCs, these were:

- Methil and Pittenweem (Fife Council) - Trial I (items at bays); and
- St Andrews and Dunfermline (Fife Council) - Trial II (items in containers).

The re-use process operated by Castle Furniture, as well as the other participating re-use organisations, is initiated by carrying out a visual inspection at the HWRCs. This includes:

- Checking seals, bearings and drums on washing machines;
- Noting any visible corrosion, dents or rust. Where this is the case the items are normally rejected and sent for recycling;
- Checking cables. The removal of mains cable (a common issue) can easily tip the scales when considering if an item is suitable for repair; and
- Making a decision on parts that may need to be repaired or replaced.

Once items are visually assessed for re-use, they are either collected from the HWRC or left on site to be collected for recycling. The items taken back to the re-use facility undergo the second phase of the assessment process, which includes the following:

1 Labelling;
2 PAT Testing;
3 Functionality Testing;
4 Repair and Refurbishment;
5 Cleaning; and
6 Sale.

Upon arrival on site, each product is allocated an individual stock number and logged onto a central computer data system. This stock number is printed and placed onto the item to ensure traceability. Once labelled, the item is put through Portable Appliance Test (PAT) and functionality tests (as shown in the figure below).

[29] http://www.cfproject.org.uk/index.php/about-us, Accessed 15/07/2013

Figure 34 Castle Furniture Testing & Repair Testing

All items are given a PAT to ensure they are safe for use; additional tests include checking insulation levels and leakages.

Once PAT tested, items are then put through a functionality test to ensure they are in working condition. Functionality tests for refrigerators and freezers, for example, include testing where items are left to stand for 24 hours to allow the coolant to diffuse evenly within the cooling circuit. After this period, they undergo a 72 hours functionality test whereby a thermometer is placed in the top and bottom of the units to confirm they are operating consistently and at the correct temperature. Washing machines are tested during several cycles/settings to ensure all of the washing machine functions are in good working order.

Once items are tested and/or repaired, they are cleaned to prepare them for re-sale. Items are sold with a warranty of one to 12 months, depending on the value of the item. Should a customer submit a claim within the warranty period, Castle Furniture will send a qualified staff member out to the customer to fix the problem, whenever possible.

End Markets

Items were sold in one of the two Castle Furniture showrooms, located in Perth and Cupar, as well as other charity organisations such as the Bethany Christian Trust in Edinburgh. Examples of warranty labels and unique number labels for traceability are provided in the figure below.

Figure 35 Castle Furniture Warranty Labels

Furniture Plus

Background

Furniture Plus is a charitable re-use organisation handling both used EEE and furniture. Their mission is to offer low cost items to the local community in Fife, while simultaneously delivering employability options through work and skills based placements and/or training. The charity also involves people who are long-term unemployed, have some degree of learning difficulties or have been undertaking community service.

The organisation was the first charity to obtain the Revolve Re-use Quality Standard accreditation[30]. Furniture Plus also provides home starter packs through a voucher scheme, where vouchers are allocated to qualifying tenants to redeem as they wish in their shops.

The organisation is not currently an AATF due to the re-use of EEE not being a core priority for them.

Re-use Process

Furniture Plus was given access to three HWRCs in Fife, and participated in Trials I and II, as follows:

- Methil and Pittenweem sites (Fife Council) – related to Trial I (items in bays); and
- St Andrews site (Fife Council) – related to Trial II (items in containers).

The re-use process operated by Furniture Plus, as well as the other re-use organisations, begins by carrying out a visual inspection at the HWRCs.

Once items are visually assessed for re-use, they are either collected from the HWRC or left on site to be collected for recycling. The items taken back to the re-use facility undergo the second phase of the assessment process, which includes the following:

1. Labelling;
2. Functionality Testing;
3. PAT Testing;
4. Repair and Refurbishment;
5. Cleaning; and
6. Sale.

When items arrive on site, they are labelled and given a unique stock code number to ensure traceability: each item is recorded using both paper and electronic formats, together with its test results, sale price and end market.

At this site, the items undergo the functionality tests first, which differs from the order used by other participating re-use organisations, and is then followed by the PAT. Labels are then placed on each item that passed the test, as shown in Figure 35.

[30] Revolve re-use accredited stores aim to provide a good quality shopping environment for the consumer. More information on Revolve can be found here: http://www.revolvereuse.com/

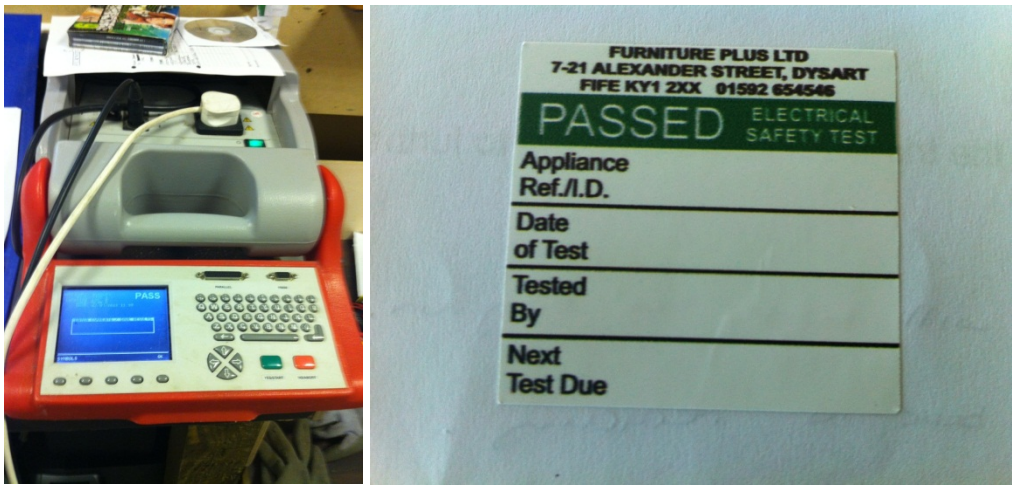

Figure 36 PAT Test & Labels

Following the PAT, the items are steam cleaned, ready for sale. Those items failing functionality tests are taken to Castle Furniture for repair.

End Markets

Furniture Plus has three outlets in which re-use items are sold. These were designed as showrooms and are open to the public. The figure below shows a showroom and a refurbished washing machine and a fridge for sale in the showroom.

Figure 37 Furniture Plus Showroom

Figure 38 Fridge with Nine Month Warranty Label – Ready for Sale

Furniture Plus operates three facilities within the Fife region:

- Dysart - Main Office and Sales Warehouse;
- Dunfermline - Furniture and Household Items Sales Warehouse; and
- Cowdenbeath - Furniture Sales Shop.

Project Oskar

Background

Project Oskar[31] is a charity organisation, an AATF and a private DCF, with its own showroom. Aware of the local demand for used LDAs and cooling equipment, it initiated a partnership with Renfrewshire Council that involves the provision of starter packs to new tenants in partnership[32] with four local Housing Associations: Linstone, Williamsburgh, Paisley South and Ferguslie Park.

In partnership with the local council and with support from INCREASE funding[33], Project Oskar aims to:

- Reduce the quantity of waste going to landfill in Renfrewshire;
- Offer employment, training and stability to young people in Renfrewshire, particularly those furthest from the job market; and
- Supply good quality re-use household items for sale to members of the public, particularly low income families or housing association tenants.

[31] http://www.oskars.org.uk/, Accessed 15/07/2013

[32] This partnership takes the form of vouchers distributed to new tenants; who can redeem them at Project Oskar's showroom. The tenants choose whatever they feel they require, rather than be given a prescriptive list of what they can obtain. In the majority of cases, tenants exchange their vouchers for re-used EEE, with cookers, washing machines, fridges and microwaves being the most popular items.

[33] The Scottish Government's £7.5 million INCREASE fund was launched in 2009 and targeted Scottish-based community projects which re-use household items, such as furniture, LDAs, and carpets. The investment programme was managed by WRAP Scotland (Waste & Resources Action Programme) and supported by the Community Recycling Network for Scotland (CRNS).

Re-use Process

Project Oskar was given access to four HWRCs, related to Trials I and II, these were:

- Dalmoak and Ferry Road sites (West Dunbartonshire Council) - Trial I (items at bays); and
- Linwood and Erskine sites (Renfrewshire Council) - Trial II (items contained).

The re-use process operated by Project Oskar after carrying out the visual inspection and collecting items suitable for re-use, was as follows:

1 PAT Testing;
2 Functionality Testing;
3 Repair and Refurbishment;
4 Cleaning; and
5 Sale.

Due to the volume of WEEE presently available, Project Oskar has limited resource in terms of qualified test and repair staff. Consequently, the organisation needs to be particularly vigilant in selecting items to remove from the HWRCs.

Each item chosen and collected at Council sites goes through PAT and functionality tests. For those items failing the tests; repair is carried out if cost-effective.

Items which fail the PAT and Functionality tests, or, where repair proves uneconomic, are collected by the WEEE compliance scheme and passed for recycling. Handling rejected material in this manner ensures that the WEEE remains within the producer responsibility system and all units, repaired or rejected, are recorded in the final reports to the council.

End Markets

Most repaired items are sold in their showroom (see figure below); however, Project Oskar works closely with the council to help meet the social needs of the area, and items can also be diverted to disadvantaged people via the home starter-pack programme, a scheme run in partnership with the Council.

Figure 39 Project Oskar Showroom

Burnhouse DAC

Background

Burnhouse Discount Appliance Company (DAC) is a well-established family run re-use organisation based in Kilmarnock. It provides WEEE re-use services throughout central Scotland.

Re-use Process

Burnhouse DAC was already engaged in re-use work at selected HWRCs in Fife, albeit without access to any re-use containers. The Dunfermline re-use container was specifically installed for the trial. The re-use process operated by this organisation, after carrying out the visual inspection and collecting items for re-use, was as follows:

1 Labelling;
2 Functionality Testing;
3 PAT Testing;
4 Repair and Refurbishment; and
5 Sale.

When items arrive on site, they are labelled and given a stock code number to ensure all items are traceable and that there is a record of all tests/results at each stage of the re-use assessment process. Items which are then considered economical to repair[34], are put through a functionality test and PAT to ensure they are in good working order (see figure below).

Figure 40 Burnhouse DAC Functionality Test

Following the functionality test, items are PAT tested to ensure they are safe for use. Once each item passes the PAT test, a label is placed on each, documenting the details of the test. Following the PAT, the items are then repaired if necessary.

[34] Re-use organisations consider an item to be economic to repair when the cost of refurbishment is less than the sale value of the item, which will vary depending on the type, brand and quality of the item. In these cases, items that are not repaired may be used for sourcing spare parts prior to being sent for recycling, whenever possible.

End Markets

A large proportion of repaired WEEE from Burnhouse DAC was, until recently, exported to Ghana via long standing arrangements with intermediaries. As a result of changes to Ghanaian legislation, this export has stopped and Burnhouse DAC now distributes their re-use items to four second hand shops in the UK. The items sold in the UK carry a six month warranty.

Tayside Re-use Centre

Background

Tayside Re-use Centre has been a recycling organisation since 1992. Since 2003 it started focussing on the re-use of furniture and WEEE[35]; recently it was granted DCF status by the Scottish Environment Protection Agency (SEPA). They achieved the Revolve standard, becoming a member of the scheme in 2012. Administrative improvements will be made during 2014 when their paper work data system will be replaced by an electronic database with bar codes, to help manage the traceability of items.

Tayside currently employs 13 full-time staff, including a qualified electrical engineer who oversees and provides training to volunteers (approximately ten volunteers at a time, each with a six month period for training) and approximately five young people who are looking to gain experience and skills to enter the job market.

Re-use Process

The Tayside Re-use Centre was engaged to receive items directly from Dundee City Council's (DCC) bulky uplift service. The bulky uplift service process occurs as follows:

Order Process (Public)

Residents of Dundee can arrange an uplift of bulky items via the Dundee City Council call centre, charging from £12.60 (for an uplift of up to six items) to £44 (for a larger clearance). Collections are scheduled within two working days of the order being placed, and the client is responsible for leaving the items at the kerbside on the allocated day.

Currently, the council does not use the National Re-use Hotline; however, at the time of writing, discussions were being held about joining the service[36].

Order Process (DCC Internal)

Dundee City Council call centre staff send a daily list of uplifts to the operations teams. Between November 12th and December 12th 2013, these amounted to 392 bulky uplifts (of all types), and an estimated 6,000 uplifts (of all types) for the whole of 2013.

Staff Instructions

The daily list is converted into a route sheet which shows the householder's name, address and details of items to be collected. The route sheet also includes job lines that the crew needs to sign when collecting the item, or sign and note if the item is not set-out for them.

Delivery to Tayside

For the period of the trial, staff were instructed to deposit LDAs and Cooling at Tayside Re-use Centre (previous to this trial, items were deposited at one of Dundee's HWRCs). Staff then return the completed job lines to the DCC office so that uplifts can be removed from the system.

[35] Website available at: http://taysidereusers.co.uk/

[36] Dundee City Council website, bulky uplift webpage can be found here: http://www.dundeecity.gov.uk/environment/specialcollections

When items are unloaded at the Tayside Re-use Centre, the re-use assessment process includes:

1 Logging of items;
2 Visual inspection on site;
3 PAT Testing;
4 Functionality Testing;
5 Second PAT Testing;
6 Repair and Refurbishment;
7 Cleaning; and
8 Sale.

Each item delivered by the Council is recorded on a hard copy spreadsheet. The organisation is developing an internal computer system for the logging in of items, which is due to be installed in January 2014. A visual inspection occurs on site, where items suitable for re-use are separated from those deemed not suitable.

Items identified as suitable for re-use then undergo PAT and functionality tests. Fridges will be turned on for four days and washing machines are tested in all the available cycles, monitoring for leakages and the overall functioning of the item. For those items passing the tests, repair, if necessary, is carried out when cost-effective. Following this stage, a second PAT is undertaken and finally, items are cleaned in preparation for sale. Items are sold with a three to nine month warranty, or longer, depending on the value of the item.

Items failing the re-use assessment tests are disassembled for parts and components that can be re-used to repair other items, as equivalent new parts can be expensive (a new washing machine door could cost £80[37]). The pictures below show the storage of parts.

Figure 41 Storage of Fridges Trays and Washing Machines Doors

End Markets

All repaired items are sold in Tayside Re-use Centre's showroom (see figure below).

[37] Price provided by a representative of the Tayside Re-use Centre.

Figure 42 Fridges and Cookers for Sale at the Tayside Showroom

Appendix VII

Marketing Templates

Figure 43 Banner Template (placed on all HWRCs for public visibility)

Figure 44 Poster / Sticker Template (placed on containers)

Figure 45 A5 Leaflets Template