

Research of Upcycling Supports to Increase Re-use, with a Focus on Waste Electrical and Electronic Equipment (UpWEEE)

Authors: Michael Johnson, Kathleen McMahon and Colin Fitzpatrick



ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency (EPA) is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

The work of the EPA can be divided into three main areas:

Regulation: *We implement effective regulation and environmental compliance systems to deliver good environmental outcomes and target those who don't comply.*

Knowledge: *We provide high quality, targeted and timely environmental data, information and assessment to inform decision making at all levels.*

Advocacy: *We work with others to advocate for a clean, productive and well protected environment and for sustainable environmental behaviour.*

Our Responsibilities

Licensing

We regulate the following activities so that they do not endanger human health or harm the environment:

- waste facilities (*e.g. landfills, incinerators, waste transfer stations*);
- large scale industrial activities (*e.g. pharmaceutical, cement manufacturing, power plants*);
- intensive agriculture (*e.g. pigs, poultry*);
- the contained use and controlled release of Genetically Modified Organisms (*GMOs*);
- sources of ionising radiation (*e.g. x-ray and radiotherapy equipment, industrial sources*);
- large petrol storage facilities;
- waste water discharges;
- dumping at sea activities.

National Environmental Enforcement

- Conducting an annual programme of audits and inspections of EPA licensed facilities.
- Overseeing local authorities' environmental protection responsibilities.
- Supervising the supply of drinking water by public water suppliers.
- Working with local authorities and other agencies to tackle environmental crime by co-ordinating a national enforcement network, targeting offenders and overseeing remediation.
- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE), Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Prosecuting those who flout environmental law and damage the environment.

Water Management

- Monitoring and reporting on the quality of rivers, lakes, transitional and coastal waters of Ireland and groundwaters; measuring water levels and river flows.
- National coordination and oversight of the Water Framework Directive.
- Monitoring and reporting on Bathing Water Quality.

Monitoring, Analysing and Reporting on the Environment

- Monitoring air quality and implementing the EU Clean Air for Europe (CAFÉ) Directive.
- Independent reporting to inform decision making by national and local government (*e.g. periodic reporting on the State of Ireland's Environment and Indicator Reports*).

Regulating Ireland's Greenhouse Gas Emissions

- Preparing Ireland's greenhouse gas inventories and projections.
- Implementing the Emissions Trading Directive, for over 100 of the largest producers of carbon dioxide in Ireland.

Environmental Research and Development

- Funding environmental research to identify pressures, inform policy and provide solutions in the areas of climate, water and sustainability.

Strategic Environmental Assessment

- Assessing the impact of proposed plans and programmes on the Irish environment (*e.g. major development plans*).

Radiological Protection

- Monitoring radiation levels, assessing exposure of people in Ireland to ionising radiation.
- Assisting in developing national plans for emergencies arising from nuclear accidents.
- Monitoring developments abroad relating to nuclear installations and radiological safety.
- Providing, or overseeing the provision of, specialist radiation protection services.

Guidance, Accessible Information and Education

- Providing advice and guidance to industry and the public on environmental and radiological protection topics.
- Providing timely and easily accessible environmental information to encourage public participation in environmental decision-making (*e.g. My Local Environment, Radon Maps*).
- Advising Government on matters relating to radiological safety and emergency response.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

Awareness Raising and Behavioural Change

- Generating greater environmental awareness and influencing positive behavioural change by supporting businesses, communities and householders to become more resource efficient.
- Promoting radon testing in homes and workplaces and encouraging remediation where necessary.

Management and structure of the EPA

The EPA is managed by a full time Board, consisting of a Director General and five Directors. The work is carried out across five Offices:

- Office of Environmental Sustainability
- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet regularly to discuss issues of concern and provide advice to the Board.

EPA RESEARCH PROGRAMME 2014–2020

**Research of Upcycling Supports to Increase
Re-use, with a Focus on Waste Electrical and
Electronic Equipment (UpWEEE)**

(2015-SE-DS-5)

EPA Research Report

Prepared for the Environmental Protection Agency

by

Department of Electronic and Computer Engineering, University of Limerick

Authors:

Michael Johnson, Kathleen McMahon and Colin Fitzpatrick

ENVIRONMENTAL PROTECTION AGENCY

An Ghníomhaireacht um Chaomhnú Comhshaoil
PO Box 3000, Johnstown Castle, Co. Wexford, Ireland

Telephone: +353 53 916 0600 Fax: +353 53 916 0699

Email: info@epa.ie Website: www.epa.ie

ACKNOWLEDGEMENTS

This report is published as part of the EPA Research Programme 2014–2020. The programme is financed by the Irish Government. It is administered on behalf of the Department of Communications, Climate Action and Environment by the EPA, which has the statutory function of co-ordinating and promoting environmental research.

The authors would like to acknowledge the members of the project steering committee, namely Karen Roche (Project Manager on behalf of EPA Research), Michael Owens (EPA), Dominic Henry (Producer Register Ltd) and Darren Byrne (Department of Communications, Climate Action and Environment), and thank them for their time, effort and guidance towards the successful completion of the project.

In addition, the authors would like to thank the following personnel and organisations for their assistance in conducting this project: Arantxa Ramos (Aeress), Marleen Vos (Komosie), Markus Spitzbart [Demontage- und Recycling Zentrum (DRZ)], Astrid Lebrun-Frisdal (Eco-systèmes), Lionel Weidmann (Envie), Ian Story (Refresh Appliances), Alan McDowell (Refresh Appliances), Stewart Hickey (Rehab Recycle), Martin Reddy (Phoenix Recycling), Yvonne Holmes (European Recycling Platform), Martin Tobin (European Recycling Platform), Elizabeth O'Reilly (WEEE Ireland), Leo Donovan (WEEE Ireland), David Fitzsimmons (Retail Excellence Ireland), Terence Ryan (Indaver/Mungret Recycling Center), Maeve Thornberry (Community Re-use Network Ireland) and Claire Downey (Community Re-use Network Ireland).

Cover images: © Shutterstock. Reproduced under licence no. SSTK-018CE-7849.

DISCLAIMER

Although every effort has been made to ensure the accuracy of the material contained in this publication, complete accuracy cannot be guaranteed. The Environmental Protection Agency, the authors and the steering committee members do not accept any responsibility whatsoever for loss or damage occasioned, or claimed to have been occasioned, in part or in full, as a consequence of any person acting, or refraining from acting, as a result of a matter contained in this publication. All or part of this publication may be reproduced without further permission, provided the source is acknowledged.

The EPA Research Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

EPA RESEARCH PROGRAMME 2014–2020

Published by the Environmental Protection Agency, Ireland

ISBN:978-1-84095-763-1

March 2018

Price: Free

Online version

Project Partners

Michael Johnson

Department of Electronic & Computer
Engineering
University of Limerick
Plassey Technological Park
Castletroy
Limerick
Ireland
Tel.: +353 (0)61 202 700
Email: michael.johnson@ul.ie

Colin Fitzpatrick

Department of Electronic & Computer
Engineering
University of Limerick
Plassey Technological Park
Castletroy
Limerick
Ireland
Tel.: +353 (0)61 213 561
Email: colin.fitzpatrick@ul.ie

Kathleen McMahon

Department of Electronic & Computer
Engineering
University of Limerick
Plassey Technological Park
Castletroy
Limerick
Ireland
Tel.: +353 (0)61 202 700
Email: kathleen.mcmahon@ul.ie

Contents

Acknowledgements	ii
Disclaimer	ii
Project Partners	iii
List of Figures	vii
List of Tables	viii
Executive Summary	ix
1 Introduction	1
2 Literature Review	3
2.1 Introduction	3
2.2 Re-use and Preparation for Re-use	3
2.3 The Rationale for Re-use	5
2.4 Re-use Policy and Legislation	8
2.5 Operational Aspects of Re-use	14
2.6 Irish Waste Management Policy and Preparation for Re-use	24
2.7 UpWEEE Literature – In Review	27
3 Analysis of Preparation for Re-use in EU Member States	28
3.1 Introduction and Methods	28
3.2 Identified Themes	29
3.3 UpWEEE EU Analysis – In Review	32
4 Irish Stakeholder Analysis	34
4.1 Introduction and Methods	34
4.2 Interviews	34
4.3 UpWEEE Irish Stakeholder Analysis – In Review	37
5 Product Review	39
5.1 Introduction	39
5.2 Eco-design Directive and Energy Labelling Directives	39
5.3 Energy-related Products and Washing Machines/Dishwashers	41
5.4 ErP and ICT	43

5.5	Product Design – Washing Machines	43
5.6	Product Design – ICT	48
6	Conclusions and Recommendations	51
6.1	Conclusions – Summary of Findings from European Case Studies	51
6.2	Discussion of Findings in an Irish Context	52
6.3	System-related Recommendations	54
6.4	Product Design Recommendations	56
	References	58
	Glossary	62
	Abbreviations	63
Appendix 1	Interview Questionnaire EU and Irish Stakeholders	64

List of Figures

Figure 2.1.	Re-use and preparation for re-use flow diagram	4
Figure 2.2.	Flows of the re-use and preparation for re-use sector	5
Figure 2.3.	Waste hierarchy	6
Figure 2.4.	PAS 141 preparing for re-use process flow	23
Figure 2.5.	The EU ecolabel, “flower”	23
Figure 2.6.	Irish timeline for re-use/preparation for re-use activities	24
Figure 3.1.	Eurostat LHA re-use figures	28
Figure 3.2.	Eurostat IT and telecoms re-use figures	29
Figure 3.3.	Storage of equipment outdoors, depending on equipment type and space available	31
Figure 3.4.	Storage of equipment indoors, depending on equipment type and space available	31
Figure 3.5.	Damaged WEEE suitable for spare parts removal or repair	31
Figure 3.6.	Damaged WEEE suitable for spare parts removal or repair	31
Figure 5.1.	Ballymount preparation for re-use trial methodology	44
Figure 5.2.	Ballymount preparation for re-use trial process flow diagram	44
Figure 5.3.	Ratio of appliances inspected versus appliances selected for testing during the Ballymount preparation for re-use trial	45
Figure 5.4.	Ratio of appliances tested versus appliances successfully re-used during Ballymount preparation for re-use trial	46
Figure 5.5.	Repairs and refurbishments on washing machines during the Ballymount preparation for re-use trial	47
Figure 5.6.	All ICT repairs in a 12-month period at Pair Mobile repair shops	49
Figure 5.7.	Pair Mobile repair shop repairs in a 12-month period by category (%) – Dublin	49
Figure 5.8.	Pair Mobile repair shop repairs in a 12-month period by category (%) – Limerick	50

List of Tables

Table 2.1.	Recovery and recycling/preparing for re-use targets applicable from 15 August 2018 in accordance with Directive 2012/19/EC	9
Table 2.2.	Opportunities versus threats for specific targets on preparation for re-use	11
Table 2.3.	Obstacles and drivers for re-use/preparing for re-use	19
Table 3.1.	Interview preparation for re-use organisations per chosen country	30
Table 3.2.	Funding awarded to organisations as social enterprises	30
Table 3.3.	Preparation for re-use standards adhered to by interviewed organisations	30
Table 3.4.	Sourcing of WEEE by interviewed organisations	30
Table 5.1.	Summary of all refurbishments completed during the Ballymount preparation for re-use trial	46
Table 5.2.	Breakdown of all ICT repairs in a 12-month period at Pair Mobile repair shops	48
Table 5.3.	Percentage of ICT repairs in a 12-month period at Pair Mobile repair shops	48

Executive Summary

This report provides a range of recommendations aimed at supporting preparation for re-use of waste electrical and electronic equipment (WEEE) that will support the extension and development of this activity in Ireland. These recommendations are based on an analysis of preparation for re-use activities in a number of EU Member States where it has been operating successfully over a number of years. The report also examines what product design features should be implemented to support preparation for re-use.

While examining successful case studies of preparation for re-use of WEEE in Belgium, France, Austria, the UK and Spain, key stakeholders in “preparation for re-use organisations” were interviewed and the findings were analysed to form a series of recommendations as described in Chapters 3 and 4. These observations are summarised here and discussed in detail in Chapter 6:

- The overarching theme and a recognised contributing factor for success of all preparation for re-use organisations interviewed in the chosen EU Member States is the high level of involvement of social enterprises.
- Access to suitable material for re-use is a highly reported barrier across EU Member States and associated preparation for re-use organisations.
- Successful re-use of equipment is heavily dependent on a positive relationship with the compliance scheme responsible for making material suitable for preparation for re-use accessible. Successful organisations that reported access to material to be acceptable note that the most important relationship is their own relationship with the compliance scheme. This relationship is essential for the successful operation of their businesses.
- The greatest barrier to the continued success of establishing a preparation for re-use system for WEEE in Ireland is access to sufficient volumes of good-quality material, and it is apparent that this is the block that hinders the success of the Irish system.

- Both European and Irish data gathered in this report support the encouragement of a positive working relationship and alignment of interests between preparation for re-use organisations and the compliance schemes through which they gain access to materials.

The corresponding recommendations resulting from this analysis are described in detail in Chapter 6 and are summarised here:

- Introduce preparation for re-use targets for producers and producer responsibility organisations to stimulate change in the current system.
- To support the achievement of these targets it is recommended:
 - to retain required criteria for approval of preparation for re-use organisations, specifically internationally recognised standards such as publicly available specification (PAS) 141 or the soon-to-be-released EN 50614;
 - to support collection points for WEEE (civic amenity sites, retailers, special collection days, etc.) in the separation of material suitable for preparation for re-use at the source;
 - to open the opportunity for access to material at civic amenity sites and retailers by approved preparation for re-use operators in agreement with compliance schemes;
 - to integrate social enterprise in cooperation with the Department of Employment Affairs and Social Protection by supporting the establishment and approval of preparation for re-use organisations, particularly outside large population centres;
 - to enable interested charity shops to become approved collection points for information technology (IT) WEEE suitable for preparation for re-use;
 - to encourage the involvement of organisations currently involved in WEEE logistics to

become involved in preparation for re-use of electrical and electronic equipment (EEE).

Complementing this policy analysis, a product design analysis examines how product policy can be used to support preparation for re-use. Significant appliances such as large household appliances (LHAs) and small information and communications technology (ICT) equipment (smartphones, computer tablets and other ICT equipment) were selected for the analysis, given their importance in preparation for re-use organisations across Europe. Based on the analysis, described in detail in Chapter 5, the following recommendations are presented for adoption in the product life cycle of more environmentally sustainable and re-usable products:

- Washing machine manufacturers should ensure that all washing machine motors and drain pumps are modular and easily replaceable. Access to the motors and drain pumps should be easily attained by repair/refurbishment personnel and replacement of these elements should be achievable with the minimum number of specialised tools.
- All motors installed on washing machines should have modular and replaceable brushes that can be easily accessed and swapped out with the minimum amount of time and effort on the part of the repair engineer.
- All power/mains leads on washing machines should not be fused to the washing machine body. Instead, the mains cable for the washing machine should be modular and should fit into an alternating current (AC) cable socket at the point of contact with the case of the washing machine. In that way, cables that are damaged or in need of repair can be replaced with a new cable immediately.
- Doors and door seals are identified as another common point of failure in washing machine appliances; therefore, doors and door seals should be standardised and easily replaceable on all washing machine models.
- As the single largest point of failure on ICT equipment, all ICT device screens should be designed so that they are easy to remove and replace on all machines. Screen and digitiser connectors and cabling should use standardised connectors and cables.
- Batteries for all ICT devices should be modular and replaceable; the user should be able to replace the battery in the mobile phone or computer tablet device quickly, easily and with the minimum amount of time and effort.
- Chargers and charging connectors used for the ICT devices should, again, be standardised and use industry recognisable formats, which are readily available on the market and allow cabling and connector interchange.

1 Introduction

The current pace of consumption is increasing our demand for finite raw materials and creating an enormous waste problem in all fields, including in the area of electrical and electronic equipment (EEE). Factors contributing to this overconsumption include the latest fashion trends, styles and public perception, in addition to the increasing difficulties encountered in maintaining or repairing such products. Accelerated by these technological advancements and growing economic prosperity, consumption of EEE has experienced an unprecedented growth at a global level, with evidence of negative side effects, including resource depletion and environmental pollution. EEE re-use is seen as a positive progressive response to the shortening of product life spans, which is one of the leading factors contributing to this greater pressure on resources and manufacturing burdens. Re-use attempts to optimise the use phase of a product in order to achieve greater resource efficiency.

To help achieve this in Europe, the European Union (EU) has introduced the waste hierarchy as part of the Waste Framework Directive (WFD), citing waste prevention (direct re-use) as the ideal waste management strategy, followed by preparation for re-use, recycling, recovery and, finally, disposal. Preparation for re-use is obviously the most desirable option, as it ensures that maximum product potential is recovered while utilising the minimum amount of resources. A vote on 24 January 2017 within the European Parliament Committee on the Environment, Public Health and Food Safety (ENVI) (discussed further in section 2.4.4) moved to increase proposed 2030 recycling targets and called for a separate preparation for re-use target. Spain has already acted in this regard and has introduced 2017 targets of 2% for preparation for re-use of large household appliances (LHAs) and 3% for information technology (IT) equipment, rising to 3% and 4%, respectively, in 2018. On 14 March 2017, the European Parliament's plenary session first debated and then voted on the four proposals for directives on waste that together

form the Circular Economy Package. Having endorsed the vast majority of the amendments tabled by the ENVI Committee, the plenary voted (at the request of the rapporteur for all four dossiers) to refer all four proposals back to the ENVI Committee to allow inter-institutional negotiations for first reading agreements later in 2017.

Across the EU, the current state of knowledge and practice in the area of waste EEE (WEEE) re-use is fragmented and difficult to translate across national borders. With only a few notable exceptions, re-use of WEEE across Europe is very low. It is only in regions where (through unusual circumstances or enlightened policies) the skills, technology, business framework and local authority support exist that re-use has been successfully implemented on a scale commensurate with this commitment.

One of the leading examples of re-use and preparation for re-use in Europe is in the Flemish region of Belgium. Here, a specific set of policy measures has enabled re-use to grow consistently over the past 10 years and re-use figures now stand at 4.52 kg/capita, employing 5045 people and serving over 4.6 million clients.¹ France is also placing an emphasis on re-use in its WEEE management systems and has established a national partnership for re-use with the social economy, which now employs 2300 people and sees 2% of WEEE collected being prepared for re-use, with LHAs dominating these figures.²

Ireland's National Waste Policy identifies re-use (and preparation for re-use) of EEE as an important measure towards achieving resource efficiency at a national level and commits to supporting further progress in this area. In particular, a public sector re-use policy is identified as being a key measure for the successful development of this undertaking.

An important first step in the implementation of this policy has been achieved with the approval of the first "preparing for re-use of WEEE organisations" by the Producer Register Limited (PRL). While this is an

1 <http://www.rreuse.org/wp-content/uploads/Komosie-Flanders.pdf> (accessed 10 January 2018).

2 <http://www.rreuse.org/wp-content/uploads/Eco-systemes.pdf> (accessed 10 January 2018).

important step in implementing such a re-use scheme, organisations hoping to operate in this sector will need the guidance and assistance of further definitive measures to unlock their true potential and to enable the preparation for re-use industry to flourish.

To that end, this UpWEEE project aims to create recommendations that, if implemented, will support those organisations that have achieved preparation for re-use approval status.

This report presents the research, findings and recommendations of the UpWEEE project team.

Chapter 2 of the report presents a literature review, considering the rationale for re-use, re-use policies and legislation within the EU, the operational aspects of re-use and, finally, Ireland's progression towards preparation for re-use thus far. Chapter 3 presents an analysis of re-use and preparation for re-use activities within a cross-section of the EU, focusing on the most important countries, products and case studies of successful WEEE re-use in Europe for detailed analysis. Chapter 4 considers the re-use and

preparation for the re-use arena in Ireland at present and presents feedback and opinions from interviews with the key organisations and personnel involved.

While the WEEE Directive mentions that product designs should not deliberately hinder re-use or recycling, it does not provide any concrete insight into what such design features might be. Chapter 5 of this report considers some of these design features, specifically focusing on LHAs and information and communications technology (ICT)/smartphone technologies as key representative product categories of interest. The chapter presents a scientific analysis of the impact of specific design features on products at the refurbishment stage to inform the implementing measures for relevant products that would support re-use.

Chapter 6 of the report presents the conclusions and recommendations of this body of study, presenting the findings of this research as they apply to policy, organisation and product design for re-use and preparation for re-use.

2 Literature Review

2.1 Introduction

In light of the growing quantities of WEEE, resource scarcity, efforts to increase access to WEEE and the desire to generate employment opportunities, more and more attention is being given to re-use activities in the academic literature. A significant body of research has emerged over recent years exploring this topic from a number of different perspectives. In this chapter, some of the relevant re-use research and literature is presented.

Section 2.2 introduces re-use and preparation for re-use and provides an overview and description of the associated activities. Section 2.3 presents the rationale for re-use, considering some of the social, economic and environmental justifications for re-use. Section 2.4 considers the re-use policies and legislation presently in place, ranging from the WFD and the WEEE Recast Directive to the Eco-design Directive (which is also known as the Energy-related Products Directive). Section 2.5 highlights the operational aspects and considerations for prospective re-use organisations. Finally, section 2.6 presents the current preparation for re-use situation in Ireland and considers the Irish Waste Management Strategy and associated framework for re-use currently in development.

2.2 Re-use and Preparation for Re-use

“Re-use” and “preparing for re-use” activities are separate, individual operations and should not be confused with each other and they thus require some detailed explanation and discussion. To this end, the terms “re-use” and “preparation for re-use” are discussed in detail here.

Re-use may be defined as any operation by which products or components that are not waste are used again for the same purpose for which they were conceived. Re-use occurs before the item(s) become waste, i.e. before EEE becomes WEEE. Re-use is carried out by the consumer market through

activities such as passing on products to family and friends, classified ads and other such mechanisms. The second-hand market, in all likelihood, makes up the largest proportion of this re-use. The size of this market is vast and extremely difficult to estimate or measure and is most likely impossible to regulate or control.

Preparing for re-use occurs after items of EEE become WEEE. According to the WFD, Article 3.16, “preparing for re-use” means “checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing”.

Re-use and preparation for re-use can thus be distinguished by the status of the product: non-waste for re-use or waste for preparation for re-use. Re-use occurs during the initial lifetime of the product and is not officially regarded as a waste activity. Preparation for re-use, on the other hand, occurs once the product has entered the waste stream (as shown in Figure 2.1) and, as such, is a waste activity. Preparation for re-use therefore requires a company/individual to obtain all of the appropriate authorisations, permits, etc. for waste activities.³ This distinction is very important, as products not considered as waste are not covered under the WEEE Directive. As a consequence, the Directive only speaks about preparation for re-use. The main differences or distinctions between re-use and preparation for re-use can be summarised as follows:

- Re-use occurs at the user level, whereas preparation for re-use occurs at the waste level, after the EEE has been returned (via the appropriate channels).
- Re-use is a largely unregulated, non-reported activity, whereas preparation for re-use is a regulated and controlled process flow in the WEEE return stream.

3 <http://www.epa.ie/licensing/waste/> (accessed 10 January 2018).

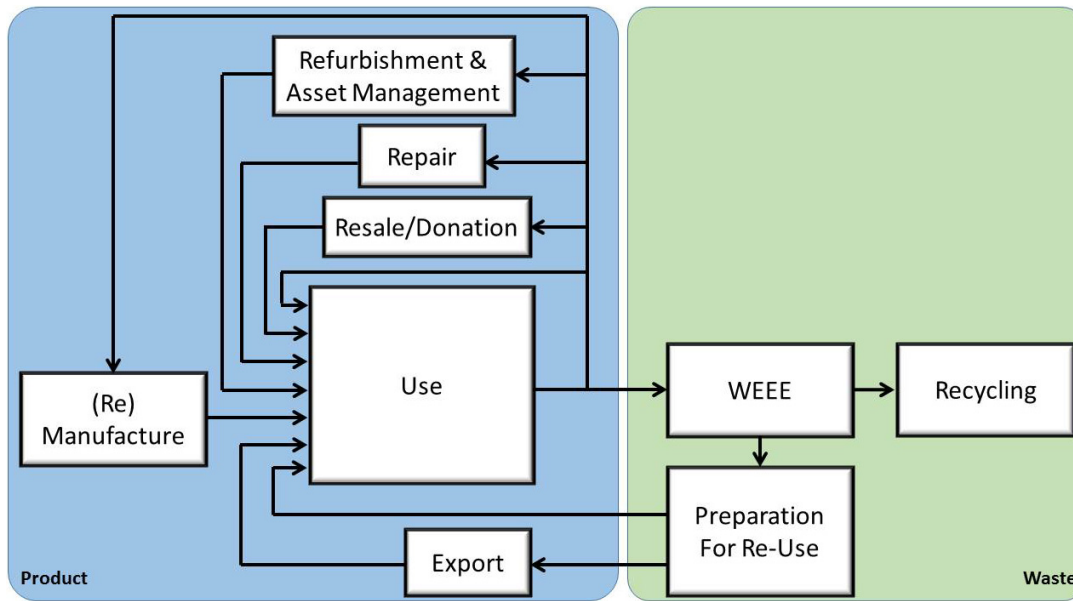


Figure 2.1. Re-use and preparation for re-use flow diagram.

- Re-use occurs at an individual or item-by-item level, but preparation for re-use is implemented at a regional, national or international level to facilitate the re-use of large quantities of EEE.

Therefore, re-use occurs before items become waste; preparation for re-use occurs after items become waste. This concept is expressed graphically in Figure 2.1. In this figure, re-use occurs in the “Product” space, shown here on the left of the figure. Preparation for re-use occurs when EEE moves from the “Product” space to the “Waste” space and must again undergo some form of processing in order to re-enter the product market as an EEE appliance capable of being re-used.

Figure 2.2 expands on this distinction to show some of the many activities that can be related to re-use. In this figure, the “Product” and “Waste” spaces afford an expanded view of the types and forms of EEE, WEEE and re-use EEE (REEE) in the arena of EEE. The progression from EEE through the use phase(s) of the product to re-use, waste and optionally preparation for re-use are shown in Figure 2.2. Products are re-used as long as they are suitable for re-use and there is a demand for them. Products deemed to be unsuitable for re-use are ultimately directed to the recycling and recovery stream, where precious materials, elements and resources are recovered from them.

Figure 2.2 shows that there are many stakeholders involved in re-use and preparation for re-use and that many activities leading to re-use are not covered by the WEEE Directive. The scope of preparation for re-use can be seen as very limited in comparison with re-use; only when used EEE (UEEE) is discarded and considered waste will any refurbishing treatment be considered for preparation for re-use. Preparation for re-use should also be carried out only by facilities authorised for the management of waste.

Re-use has become one of the “3 Rs” (reduce, re-use, recycle) promoted by environmental agencies such as the US Environmental Protection Agency (Kahhat *et al.*, 2008) and the UK Waste and Resources Action Programme (WRAP) (Phillips *et al.*, 2011) and is expressed as part of China’s circular economy (Zheng *et al.*, 2015). In particular, EEE re-use has been prioritised by a wide range of global policies and regulations as a prudent approach for conserving resources and reducing environmental pollution. The majority of laws that regulate movement and disposal of equipment containing potentially hazardous materials urge re-using used equipment, e.g. the EU WEEE Directive (EU, 2002), EU Eco-design Directive (Bertoldi and Atanasiu, 2007), EU WFD (Kallis and Butler, 2001), China Decree 551 (Lin *et al.*, 2001) and the Illinois Electronic Products Recycling and Re-use Act (Kang and Schoenung, 2005).

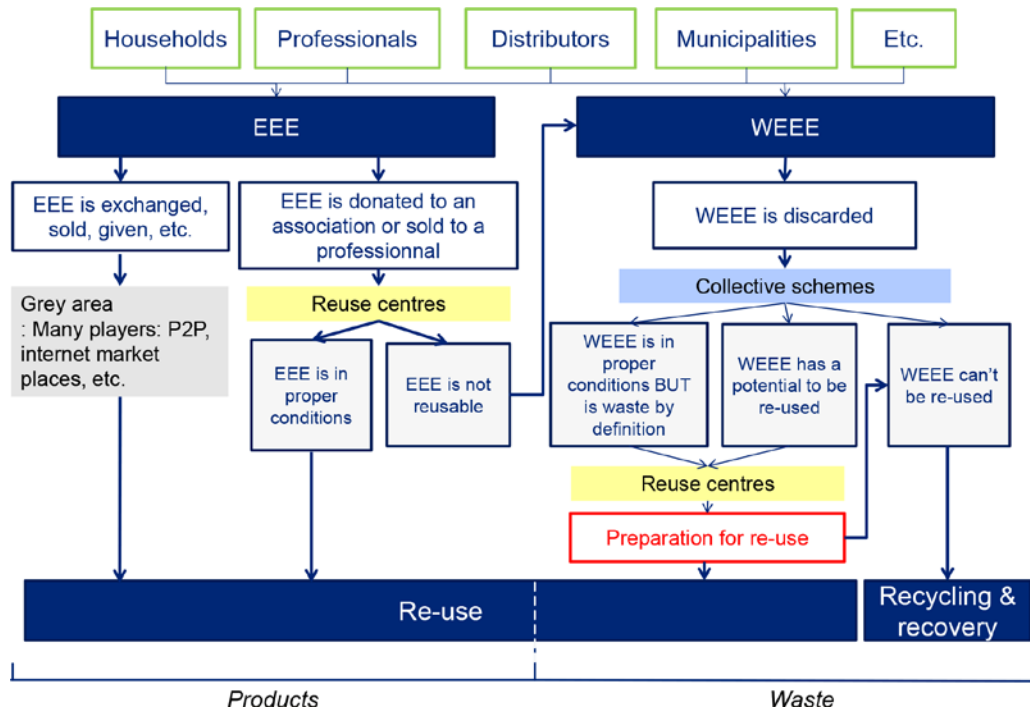


Figure 2.2. Flows of the re-use and preparation for re-use sector. P2P, peer to peer. Image from Seyring et al. (2015).

Preparing for re-use may be viewed, *inter alia*, as a means of diverting waste material from disposal options (e.g. landfill) and is therefore considered preferable to recycling and other recovery methods in the waste hierarchy, shown in Figure 2.3. EEE that falls under the scope of WEEE and is not regarded as being of sufficiently high quality or standard for preparation for re-use activities will be re-entered into the prior waste stream and treated accordingly under waste legislation. Only when such WEEE, after preparation for re-use, meets the criteria for re-used products can it achieve “end-of-waste” status through being prepared for re-use and be regarded as a (second-hand) product. Re-use should never be considered as a complete solution for WEEE management; instead, products should ultimately feed into efficient recycling systems when their (eventual) use phase is complete (Truttmann and Rechberger, 2006).

2.3 The Rationale for Re-use

This section of the literature review considers some of the factors, benefits and advantages of the re-use model, especially as they apply to the environmental, social, economic and socioeconomic rationale of re-use.

The overwhelming majority of the academic literature in the area of re-use is focused on the environmental questions associated with re-use. Several authors (Kimura *et al.*, 1998; Jofre and Morioka, 2005; Guide and Van Wassenhove, 2009) have noted that re-use and remanufacturing play a significant part in the end-of-life management of WEEE.

The case for maximising re-use focuses on a number of key benefits:

- Re-use (under the correct/appropriate circumstances) can conserve embodied energy and water (Williams, 2004); it is the most efficient use of scarce materials, which are often lost in recycling (Hagelüken and Meskers, 2008; Chancerel *et al.*, 2009; Sepúlveda *et al.*, 2010).
- It reduces the amount of transport required to put the product back on the market (Achillas *et al.*, 2011).
- It provides a social dividend by creating employment through refurbishing commerce and providing access to lower cost equipment (Williams *et al.*, 2008; Sepúlveda *et al.*, 2010; O’Connell *et al.*, 2013).
- It reduces the amount of pressure on underdeveloped recycling infrastructures (Lau, 2008).

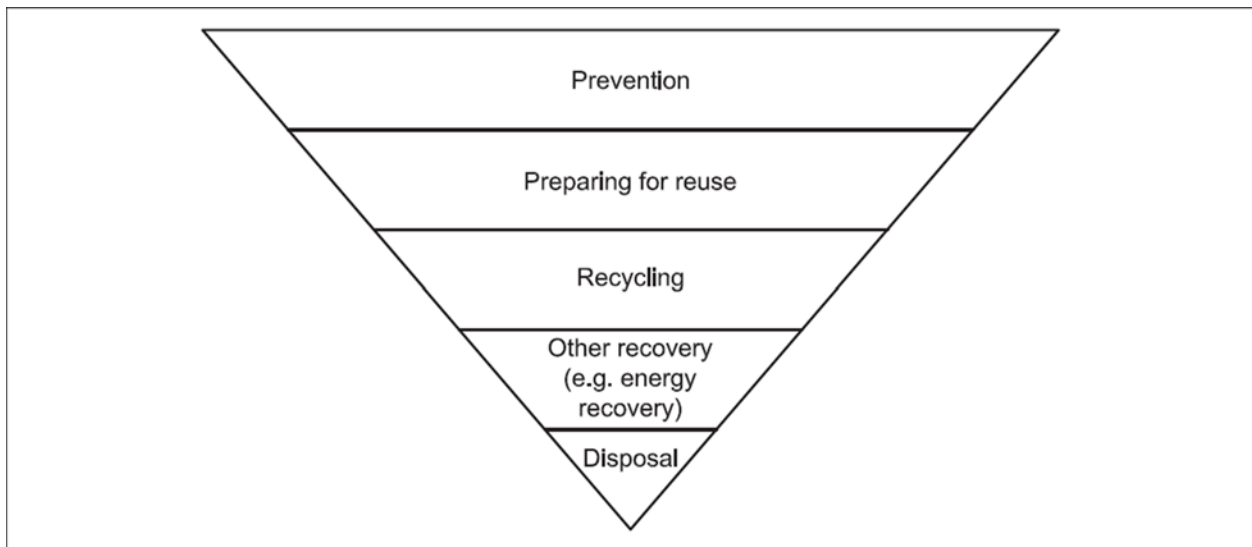


Figure 2.3. Waste hierarchy. Permission to reproduce this figure from British Standards is granted by BSI. British Standards can be obtained in PDF or hard copy formats from the BSI online shop – www.bsigroup.com/Shop – or by contacting BSI Customer Services for hard copies only – Tel: +44 (0)20 8996 9001, email: cservices@bsigroup.com.

However, the question of sustainability and the perceived environmental and socioeconomic benefits of extending the lifespan of an EEE appliance (vs purchasing a newer, more energy-efficient appliance) is one that is constantly considered when the question of the benefits of re-use is raised. Recycling potentially enables more energy-efficient appliances to replace existing ones. But at what point do the potential benefits of recycling the old appliance and purchasing a more energy-efficient device actually outweigh the benefits of re-use?

Of related interest in Ireland, O’Connell *et al.* (2010) consider the re-use potential for LHAs. The authors have developed a quantitative model to measure the “reusability” of an appliance on the Irish market as opposed to the purchasing of a new appliance. This model takes into account factors such as the energy rating of the appliance, its original usage intensity, secondary usage intensity, the electricity generation portfolio and the efficiency of the Irish electricity supply. As can be seen in their research, energy consumption in the use phase is one of the key factors in deciding if product re-use is preferable. This is particularly important in an Irish and EU context, given the ambitious renewable energy targets that many EU Member States are pursuing at present.

The model employs a streamlined analysis of the cumulative energy demand (CED) indicator from non-renewable fossil sources, focusing on the two most significant phases of the life cycle: the manufacture and usage phases. The CED indicator has a close correlation with other indicators, such as Eco-indicator 99, Ecological Footprint, Eco Scarcity and cumulative energy extraction and is recommended by authors, such as Huijbregts *et al.* (2010), for use as a screening indicator for environmental performance (e.g. using linear regression analysis; the Eco-indicator 99 correlation with CED is $R^2=0.81$). Furthermore, the model allows the examination of multiple consumer-profile scenarios with different energy-rated appliances to determine whether or not a suitable amortisation period is achieved to merit the purchase of a second-hand appliance compared with the purchase of a new appliance. It concludes that in the Irish context, re-use of LHAs one energy rating below the cheapest available products on the market is environmentally beneficial.

The Re-Evaluate report⁴ argues that the decision on whether or not to re-use or purchase a new appliance should consider environmental factors in addition to the more traditionally considered energy usage indicators (O’Connell and Fitzpatrick, 2013). The

⁴ <http://www.epa.ie/pubs/reports/research/waste/strive110-re-evaluate-re-useofelectricalandelectronicsequipment.html> (accessed 10 January 2018).

authors state that evaluations of timely replacements with more environmentally comprehensive indicators, such as the ecological scarcity method of Eco-indicators 97 and 99, tend to result in a lower importance of the use phase of white goods compared with CED. As a consequence, a timely replacement becomes less beneficial or even disadvantageous. An evaluation based on energy or energy-related data can, therefore, lead to wrong conclusions from an environmental point of view. This becomes particularly true for highly efficient appliances such as modern LHA energy-efficient devices. The outcome also depends on the use pattern (i.e. how often or intensively an appliance is used) and the electricity mix (i.e. the location of use). The first aspect largely determines how much electricity is consumed, while the latter one determines how strongly it is counted in the evaluation.

From an environmental standpoint, the Intergovernmental Panel on Climate Change has recommended a 40% to 70% cut in global carbon dioxide (CO₂) emissions from 2010 levels by 2050 (Pachauri *et al.*, 2014) in order to avoid the potentially dangerous effects of climate change. Allwood *et al.* (2011, 2013) and Skelton and Allwood (2013) have shown that there is limited scope for future efficiency improvements in material production; therefore, an absolute reduction in material production (achievable through strategies such as EEE re-use) is likely to be required to make significant cuts to industrial emissions.

The practice of re-use manages to generate a wide range of ancillary social and economic benefits. These range from employment and training opportunities for people with disabilities (or long-term unemployed people) to providing access to suitable equipment for people on low incomes in both the developed and the developing world, thus helping to bridge the digital divide (O'Connell *et al.*, 2010). It is also a major source of IT equipment for businesses and educational establishments in the developing world, thereby helping to promote vitally needed economic development (Kahhat *et al.*, 2008; Streicher-Porte *et al.*, 2009).

Another area in which increased public awareness is crucial is that of re-use services and benefits. WEEE that has a potential for re-use should be brought back directly by the consumer to the re-use organisation (or collected by the latter at households) to ensure that the re-use potential is preserved. Repairing before the product becomes waste should also be strongly promoted and should be facilitated in the product's design phase (eco-design). A strong observation from a recent EU study on WEEE recovery targets, preparation for re-use targets and the method for calculation of the recovery targets (Seyring *et al.*, 2015) is that more actions need to be put in place to prevent waste, as the potential for re-use of WEEE once it reaches a collection site may be limited.

However, consumer goods nowadays are less durable and repairable than in the past.⁵ This means that re-use, repair and preparation for re-use activities are becoming more marginalised because they are labour-intensive activities and are subject to high labour costs. The lack of viable second-hand/re-use alternatives usually results in the consumer having to constantly upgrade or buy new products/appliances rather than repair the ones they already own.

Some of the difficulties associated with attempting to repair modern electronic equipment⁶ include:

- lack of access to and high costs of spare parts: costs of repair are higher than purchasing a new appliance;
- lack of appropriate repair information: no free access to service manuals, software and hardware of product and components for independent repair operators;
- product design and components without re-use potential: new designs make it increasingly difficult to repair a product or component without breaking them forcefully.

These factors significantly contribute to the associated costs of repair and re-use, making direct replacement of a product often the cheapest option for the consumer. A recent Eurobarometer study⁷ found that 77% of EU citizens would prefer to repair their

5 <http://www.umweltbundesamt.de/en/publikationen/einfluss-der-nutzungsdauer-von-produkten-auf-ihre> (accessed 10 January 2018).

6 <http://www.rReuse.org/improving-product-design/> (accessed 10 January 2018).

7 http://ec.europa.eu/commfrontoffice/publicopinion/flash/fl_316_en.pdf (accessed 10 January 2018).

products instead of buying new ones; however, they tend to replace or throw away their products instead of repairing and re-using them because the associated costs of repair are prohibitively high.

With regard to the question of re-use and “new product displacement”, many organisations are apprehensive about their own products being re-used for fear of displacing new product sales, often termed “demand cannibalisation”. However, Cooper and Gutowski (2017) have shown that very little research has been conducted to date to deduce the degree to which re-using a product displaces new production. The restrictions that many nations place on the import of used goods to protect native manufacturers is evidence of the belief (or fear) that re-use does displace some new product sales. Navaretti and Tarr (2000) and Guide and Li (2010) have shown that many nations have imposed bans, licensing requirements or high tariffs for this very reason.

In the main, the literature on new product displacement consists of behavioural tests and surveys on consumer willingness to purchase new and re-used products (e.g. Farrant *et al.*, 2010; Guide and Li, 2010; Ovchinnikov *et al.*, 2014). The literature also comprises analytical studies attempting to maximise utility functions based on rational consumer practices, such as those found at in Scitovsky (1994), Thomas (2003) and Yokoo (2009). From the data collected, these behavioural studies conclude that, while re-use can indeed displace new product sales, it is not on a one-to-one basis. Studies such as Saunders (1992) and Hertwich (2005), which use economic utility models to predict the displacement of new products, have often found that the sale of re-used products could be subject to a rebound effect, because when the efficiency of a technology improves (lowering the associated life-cycle cost), consumers usually respond to that saving by consuming more (as seen with energy use). This means that improving energy efficiency of appliances may save less energy than expected, on account of this rebound of energy use brought about by the improved efficiency translating into higher demand for resources. Some research on the topic of re-use (Skerlos *et al.*, 2003; Thomas, 2003) has found that re-use actually allows first-time buyers the opportunity to own products that they would otherwise have done without.

2.4 Re-use Policy and Legislation

In this section of the review, the policies and legislation governing re-use are examined and considered. A variety of environmental policies (Tojo, 2004; Atasu and Wassenhove, 2012) have addressed the question of re-use, recycling and WEEE, including the WFD, the WEEE Directive, the Eco-design Directive and the Circular Economy Package. The subsequent portions of this section examine each of these policies/pieces of legislation in more detail. The Irish Waste Management Policy is also considered in this section, presenting the current status of the re-use and preparation for re-use sector in Ireland and its operation.

The global literature on re-use includes research on various WEEE management strategies in different countries and recycling approaches for specific types of equipment, which extend beyond the scope of this research. Some noteworthy examples, however, include an assessment of take-back policies in India (Dwivedy *et al.*, 2015), an analysis of e-waste decision factors in Mexico (Estrada-Ayub and Kahhat, 2014), the design of an e-waste system in Turkey (Kilic *et al.*, 2015; Özkır *et al.*, 2015) and a Korean policy development review (Manomaivibool and Hong, 2014).

2.4.1 The (Recast) WEEE Directive

The WEEE Directive (2002/96/EC) (EU, 2002), issued in 2003, was the principal directive/law regulating the management and disposal of household and non-household WEEE within the EU. The purpose of the WEEE Directive was the prevention of WEEE and the re-use, recycling and/or other recovery (e.g. energy recovery) of EEE so as to reduce the disposal of waste. It also sought to improve the environmental performance of all entities involved in the EEE life cycle, e.g. producers, distributors and consumers, and in particular those operators directly involved in the treatment of WEEE.

Within the recast WEEE Directive (2012/19/EE) (EU, 2012), EU Member States are obliged to prioritise re-use at the earliest stages of WEEE take-back, separate WEEE for re-use and enable access by refurbishment centres. Revised collection reporting will enable preparation for re-use to count towards collection targets within both the business-to-business (B2B) and business-to-consumer (B2C) markets,

possibly enabling refurbishers to contribute to WEEE targets.

Like the WFD, the WEEE Directive includes text aimed at promoting the repair and preparation for re-use of EEE. Both activities extend the lifetime of the EEE products. Although the recast WEEE Directive has helped to reduce the general administrative burden (by harmonising national registration and reporting requirements in EU Member States), there still is no framework in place for the promotion and tracking of REEE/second-hand EEE in the current take-back systems (Streicher-Porte *et al.*, 2009), as highlighted in a recent examination of the EU WEEE Directive's implementation in Finland, for example Ylä-Mella *et al.* (2014).

The original WEEE Directive referred to recovery and recycling targets in Article 7(2), but it did not specifically request the re-use of whole appliances. However, a significant amount of products suitable for re-use enters the waste flow as a result of consumer upgrades, latest model purchases, etc. To address the issue of re-use of appliances in their entirety, the recast WEEE Directive highlights that “the information on inter alia, the rates of preparation for re-use, including as far as possible preparation for re-use of whole appliances is necessary to monitor the achievement of the Directive's objectives”. Table 2.1 gives an overview of the recovery and recycling/preparing for re-use targets under the open scope period in the recast WEEE Directive.

Within the (recast) WEEE Directive, there are some aspects that are considered crucial for the re-use and repair activities in relation to EEE. These include aspects applying to the design of the product (Article

4) and aspects dealing with the information provided by the manufacturer to WEEE treatment operators, including re-use and repair centres (Article 15).

Article 4 of the WEEE Directive aims to make sure that “producers do not prevent, through specific design features or manufacturing processes, WEEE from being re-used, unless such specific design features or manufacturing processes present overriding advantages, for example, with regard to the protection of the environment and/or safety requirements”.

According to Article 6.2 of the WEEE Directive:

Member States shall ensure that the collection and transport of separately collected WEEE is carried out in a way which allows optimal conditions for preparing for re-use, recycling and the confinement of hazardous substances. In order to maximise preparing for re-use, Member States shall promote that, prior to any further transfer, collection schemes or facilities provide, where appropriate, for the separation at the collection points of WEEE that is to be prepared for re-use from other separately collected WEEE, in particular by granting access for personnel from re-use centres.

This means that WEEE collection schemes should put in place a system to hand over WEEE deposited at collection facilities to re-use and repair centres as appropriate. The loop has not necessarily been closed on this WEEE flow, however, as there is no obligation currently in place for these organisations to return all the material that was not deemed re-usable to the originating WEEE collection/treatment facilities in order to avoid diverted and unreported WEEE flows.

Table 2.1. Recovery and recycling/preparing for re-use targets applicable from 15 August 2018 in accordance with Directive 2012/19/EC

EEE categories		Recovery (%)	Preparing for re-use and recycling (%)
1	Temperature exchange equipment	85	80
2	Screens, monitors and equipment containing screens that have a surface greater than 100 cm ²	80	70
3	Lamps	n/a	80
4	Large equipment (any external dimension more than 50 cm)	85	80
5	Small equipment (no external dimension more than 50 cm)	75	55
6	Small IT and telecommunications equipment (no external dimension more than 50 cm)	75	55

In addition, Article 8.5 of the WEEE Directive outlines the development of standards via the European Standardisation Organisations, actively participating in the European Committee for Standardization (CEN)/European Committee for Electrotechnical Standardization (CENELEC) TC111X Working Group 7. One of the standards under development will be for the preparing for re-use activity.

Article 15 of the WEEE Directive provides important guidelines concerning the information given by manufacturers to treatment facilities for re-use and repair: “Member States shall take the necessary measures to ensure that producers provide information free of charge about preparation for re-use and treatment in respect of each type of new EEE placed for the first time on the Union market within one year after the equipment is placed on the market”. This indicates that EEE manufacturers should forward relevant information about their products to re-use and repair centres. In addition, Article 15 states that the information should be forwarded to treatment operators in a timely fashion, no later than 1 year after the product enters the market.

Finally, with the prioritisation of re-use at the earliest stages of WEEE take-back, additional inspection and monitoring requirements have been introduced, such that re-use organisations meet certain requirements when transporting WEEE for re-use nationally or internationally. These requirements stipulate that the re-use organisation must:

- furnish a copy of an invoice stating that the equipment is destined for re-use;
- provide evidence of equipment testing and proof of functionality;
- make a declaration that none of the material is waste;
- use appropriate protection against damage during transport.

2.4.2 EU study on re-use targets

Article 11.6 of the recast WEEE Directive asked the European Commission to present a report on the proposed recovery targets, the potential for setting separate recovery targets for WEEE to be prepared for re-use versus WEEE for recycling and an analysis

of the calculation method(s) employed in setting these targets.

The study on preparing for re-use⁸ was published to meet these requirements (Seyring *et al.*, 2015). The study considered the re-use question across all of the EU Member States and concluded that the new recovery targets to be applied from 2018 onwards are consistent with those introduced previously under the WEEE Directive. Furthermore, the study concluded that re-use and preparation for re-use was a desirable, viable and recommended pursuit for the EU Member States.

There are many different forms of management organisations and practices for re-use and preparation for re-use currently in force across the EU. This makes evaluating the potential for re-use in the EU difficult. In general, re-use and preparation for re-use is not well developed at the EU level and, with few exceptions, it is also not well developed at the Member State level. Therefore, the implementation of separate re-use/preparation for re-use targets at a European level faced several difficulties, which have to be addressed before an EU target can be set. Finally, the specification of output-/material-based targets, as opposed to the more traditional percentage figures used thus far, is not recommended yet; this is because of the limited availability of databases for assessing the feasibility of such targets and their limited benefits compared with a further enforcement of selective treatment and increasing collection rates.

Highlighting some of the implementation issues at the European level, the report also considered implementation of the terms “re-use” and “preparation for re-use”. With the different forms of management organisations, procedures and practices currently in force across the EU, even the interpretations of these terms vary from Member State to Member State. For some, re-use is the act of putting EEE back on the market for the same purpose for which it was conceived, regardless of the origin of the EEE (waste or non-waste, whether it has been repaired or not, etc.) while others have distinguished between the two activities: one is the management of products and the other is the management of waste. France, for instance, went beyond the two original definitions by defining three types of operations:

⁸ http://ec.europa.eu/environment/waste/weee/pdf/16.%20Final%20report_approved.pdf (accessed 10 January 2018).

- *Réemploi*: any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.
- *Réutilisation*: any operation by which products or components that have become waste are used again.
- *Préparation à la réutilisation*: any operation consisting of checking, cleaning or repairing with the objective of recovery, by which products or components of products that have become waste are prepared so that they can be re-used (in the French meaning of re-utilisation) without any other pre-processing.

In other words, some Member States use the term “re-use” throughout the life of the product, while others limit it to the upstream (product) portion of the life-cycle, prior to its designation as waste. It is somewhat unclear whether or not the two concepts are “mutually exclusive”, such as in the case of France, or if preparation for re-use is just a step prior to re-use.

Further concerns identified within the report concerning the difficulties of implementing a single EU re-use target include the re-use activities and stakeholders; many activities can be related to re-use either directly or indirectly (e.g. exchange/sale/etc. of EEE via internet or peer-to-peer exchanges) and many stakeholders are involved at different stages of re-use and preparation for re-use (e.g. households, municipalities, re-use centres, charity organisations, collective schemes). This makes the identification of re-use activities and operations especially difficult, complicating efforts to agree on international re-

use targets that are distinct from national targets. In addition, many of these activities leading to re-use are not covered by the WEEE Directive, since the electronic products never reach the “waste” status within these activities. Hence, the scope of preparation for re-use can be seen as very limited in comparison with re-use in general. Another associated problem is the identification of the quantities of EEE/WEEE re-used and prepared for re-use in the EU. Because of the potential overlap in definitions between preparation for re-use and re-use, a clear distinction is not always possible.

In addition, the report identified an associated set of opportunities and threats that may arise from the implementation of a specific target for preparation for re-use within Member States. These opportunities and threats are identified and summarised in Table 2.2.

The report also presented further economic, social and environmental aspects of the re-use and preparation for re-use operations. Regarding economic impacts, the report demonstrated that the re-use of appliances could generate significant revenues and bring savings to the economy by limiting unemployment. Because of positive effects on job creation and the provision of low-cost household appliances to low-income families, the re-use of equipment has positive social impacts as well. The possible environmental impacts from re-use discussed mainly related to a decrease in the amount of new EEE manufactured.

Finally, some of the recommendations included in the report aimed at promoting re-use and preparing for

Table 2.2. Opportunities versus threats for specific targets on preparation for re-use

Opportunities	Threats
Resource savings	Risk of double counting (WEEE might be collected and prepared for re-use several times)
High potential for job creation	Difficulties to report the flows (distinguish waste/non-waste)
Consumer demand	Costs for changing the organisation of the sector (ensuring proper storage, transportation, etc.)
	Unavailability of spare parts to prepare WEEE for re-use at an affordable price
	Lack of data to estimate the real potential of re-use
	Distortions to reach the target and producers taking ownership of re-use
	Design of products improving unequally
	Requirements for re-use organisations to comply with the same obligations as producers
	Inability of some Member States to reach the target

re-use within individual EU Member States are the following:

- Compliance schemes should be approved on the condition that they demonstrate how they are promoting re-use.
- Re-use should be prioritised at household waste collection sites. Where the site has sufficient free space, dedicated containers should be used at household collection sites.
- Access to WEEE by re-use organisations needs to be granted, either by collective schemes or directly by municipalities or other operators such as retailers.
- Public awareness of re-use services and benefits should be increased. WEEE that has a potential for re-use should be brought back directly by the consumer to the re-use organisation (or collected by the latter from households) to ensure that the re-use potential is preserved. Repair, before the product becomes waste, should also be strongly promoted and needs to be facilitated in the product's design phase (eco-design).
- All re-use centres should report on what goes into the re-use centre (both UEEE destined for direct re-use and WEEE to be prepared for re-use) and what goes out based on mass. It is already an obligation stipulated in many contracts for collective schemes.
- A clear methodology to measure rates of preparation for re-use needs to be defined.

Looking forward, the report considers the situation in which a separate preparation for re-use target may be implemented in the EU. If such a target is considered in the future, the recommendations include that it should take into account the differences in development of approved re-use centres and networks in Europe and the differences in the amounts of re-usable products that are discarded in the Member States. According to RREUSE, repair-friendly criteria within the implementing measures of the Eco-design Directive and smart use of taxation [e.g. zero value-added tax (VAT) on repair activities to make the sector more competitive] are examples of measures that would be useful beyond the waste legislation and should be supported. In Sweden,⁹ for example, the government has submitted proposals to cut the VAT

rate on repairs from 25% to 12% and to allow people to claim back (from income tax) half of the labour cost on repairs to electrical appliances. An inquiry from March 2017 published recommendations to reduce the tax on these services by 50% of the labour costs, amounting to a 35% reduction in these taxes for households, which will be considered and potentially proposed by the government. Another option would be to consider that both UEEE and WEEE collected by re-use centres are waste, in order to facilitate the tracking of flows and monitor the achievement of a potential target on their output. However, this would imply a different interpretation of waste and thus consideration would need to be given to the respective legislation etc. in this regard.

2.4.3 The Eco-design Directive

The Eco-design Directive (2009/125/EC) (EU, 2009) strives to create a framework for defining requirements for the environmentally friendly design of energy-using products (EuPs) and energy-related products (ErPs) placed on the EU market. Up until now, however, the focus of these solutions has been on improving energy efficiency rather than on improving material efficiency. The updated (recast) Eco-design Directive entered into force on 20 November 2009. It provides a coherent and integrated framework that allows the setting of compulsory eco-design requirements for all ErPs. Eco-design implies taking into account all the environmental impacts of a product right from the earliest stage of design. The Directive obliges manufacturers of EuPs to reduce energy consumption and other environmental impacts at the design stage.

Even though the Directive and its implementing measures do not regulate resource efficiency and protection sufficiently now, they do possess the mandate to act within this field. In particular, the law recognises the importance of a life-cycle approach to assessing the environmental impacts of products, which should be used to help alternative design solutions.

Currently, 12 eco-design measures have been introduced for standby (the electric power consumed by electronic and electrical appliances while they are switched off), street and office lighting, simple set-top

9 <https://www.theguardian.com/world/2016/sep/19/waste-not-want-not-sweden-tax-breaks-repairs> (accessed 10 January 2018).

boxes, domestic lighting, external power supplies, electric motors, circulators, domestic refrigeration, televisions, domestic dishwashers, domestic washing machines and fans. For instance, the eco-design measure on standby requires that domestic EEE, such as washing machines, televisions or personal computers, do not consume more than 1 watt of power in “off” mode as of 2010 and not more than 0.5 watt as of 2013. However, such eco-design requirements should not lower the functionality or safety of a product, or have a negative impact on its affordability or consumers’ health. A major goal of the Directive is to improve the energy efficiency of EuPs and it thereby contributes to efforts to reach European targets for climate protection (20% energy saving target by 2020). The Directive, however, not only covers the energy use of products but it also aims to reduce the overall negative environmental impact of the products under consideration. The effectiveness of the Eco-design Directive and its implementing measures is continually being reviewed and this will be discussed in greater detail in Chapter 5, where design features that support preparation for re-use will be explored in greater detail. To ensure that products have complied with EU directives, a *Conformité Européenne*/European Conformity “CE” marking is issued to prove compliance. Products that do not comply with EU directives do not qualify for the CE marking and therefore cannot be sold in the EU.

2.4.4 The Circular Economy Package

The European Commission’s Circular Economy Package¹⁰ (published in 2015) aims to help European businesses and consumers to transition to a stronger and more circular economy in which resources are used in a more sustainable way. The proposed actions outlined in the package are designed to contribute to “closing the loop” of product life cycles through greater recycling and re-use, ultimately bringing benefits for both the environment and the economy. The package presents measures that it hopes will extract the maximum value and use from all raw materials, products and waste, fostering energy savings and reducing greenhouse gas emissions. It covers the full product life cycle, from production and consumption to waste management and the market for secondary raw

materials. A conclusions document from the European Council supports the action plan and reinforces key points.

The Circular Economy Package targets more innovative and efficient means of production and consumption through the range of incentives included in the package. The European Commission claims that the circular economy has the potential to create many jobs in Europe, while preserving precious and increasingly scarce resources, reducing the environmental impacts of resource use and injecting new value into waste products.

Aside from component actions targeted at reducing food waste and developing quality standards for re-used raw materials, the Circular Economy Package also includes measures to promote reparability, durability and recyclability of products, in addition to their energy efficiency.

The revised legislative proposal on waste outlines clear targets for the reduction of waste and claims that ambitious and credible long-term goals for waste management and recycling will be established as a result. Concrete measures are to be introduced to promote re-use and stimulate industrial symbiosis, whereby one industry’s by-products may be turned into another industry’s raw materials. Economic incentives for producers to introduce greener products on the market and support recovery and recycling schemes (e.g. for packaging, batteries, EEE, vehicles) are also proposed in the package. A simplified and improved definition and harmonised calculation method for recycling rates throughout the EU has also been promised, as have targets for municipal waste, packaging waste and landfill reduction measures.

To ensure effective implementation, the waste reduction targets in the new proposal must be accompanied by concrete measures to address obstacles on the ground and the different situations across Member States. In their statement responding to the introduction of the Circular Economy Package,¹¹ the RREUSE network’s response highlights some of these potential obstacles and potential implementation issues. These include the need to clarify the definition of “preparing for re-use” and the

10 <http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52015DC0614> (accessed 10 January 2018).

11 <http://www.rreuse.org/wp-content/uploads/RREUSE-response-to-CEP-FINAL-28.4.2016.pdf> (accessed 10 January 2018).

methodology, especially as it applies to many second-hand operators within the EU. RREUSE argues that separate quantitative targets for preparation for re-use are needed (as distinct from the recycling targets) to ensure access to re-usable products and ensure the creation of the local jobs promised in the Circular Economy Package. The role of social enterprises working in waste management needs to be explicitly supported within the waste directives. RREUSE feels that rules on the Extended Producer Responsibility (EPR) scheme in the Circular Economy Package fall short in supporting preparation for re-use and repair activities. Specific incentives and targets are also needed in the Packaging and Packaging Waste Directive (94/62/EC) to encourage more re-use of packaging and more durable design. Finally, concrete legislation is needed to improve the ease of repair of products beyond the waste directives.

Recently, support for a preparation for re-use target has been shown by the European Parliament as part of the circular economy strategy. As briefly mentioned in Chapter 1, the Environment Committee voted in January 2017 to increase recycling targets for 2030 to 70% of total municipal waste and to call for a preparation for re-use target of 3% by 2025 and 5% by 2030. The vote also includes a number of other calls relevant to this report, including a distinct definition for preparation for re-use as exclusive to products in the waste stream, a definition of recognised preparation for re-use operators and further inclusion of social enterprise, including giving social enterprises preferential access to waste streams.

2.4.5 Other/miscellaneous policies and legislation

Elsewhere in the EU, under the Consumer Rights Directive,¹² the seller is liable for a product for a period of 2 years. However, after the first 6 months, the burden of proof of there being a defect at the time the product was delivered lies with the consumer. While this aspect of the Directive has been implemented in various ways on a national level, Portugal has set a noteworthy example by extending the length of this rebuttable presumption from 6 months to 2 years.

Such a law could motivate producers to make sure that their products will not fail in a short period of time.¹³

Austria has introduced the Austrian Durability Mark for Electrical and Electronic Appliances, designed for easy repair (ONR 192102). This standard, the only one of its kind in existence, is relevant for white and brown goods and was updated in 2014.

These and other examples show that existing European legislation, such as the Seventh Environment Action Programme (2014),¹⁴ which has an objective to “turn the Union into a resource-efficient, green and competitive low-carbon economy”, as well as specifying action plans in relation to eco-design, improving waste prevention, and further support of the waste hierarchy, provides a strong basis to improve the reparability of our products and boost job creation in the sector. However, as noted by Schridde *et al.* (2013), implementation is a key issue. A number of studies (Scheuer, 2005; Dalhammar, 2014) highlight that in the existing Eco-design, WEEE and EU label directives, there are a number of provisions that clearly promote product durability and call for producers to take this into account at the design stage of a product.

2.5 Operational Aspects of Re-use

Considering the operational aspects of re-use, this section of the literature review focuses on re-use operating models, associated barriers to and success factors in the implementation of a re-use scheme and the transport and transboundary issues to be considered from an international re-use perspective.

2.5.1 Re-use operating models

Kissling *et al.* (2012, 2013) identified four key generic operating models in the EEE re-use sector. These operating models are defined as: Networking Equipment Recovery, IT Asset Management, Close the Digital Divide and Social Enterprise.

- *Networking Equipment Recovery* is a model that processes both used and excess new durable IT networking equipment (e.g. rack servers, routers and switches). Most of the input to this model

¹² EU Consumer Rights Directive (2011/83/EC).

¹³ <http://www.beuc.eu/durable-goods#ourrecommendations> (accessed 10 January 2018).

¹⁴ <http://ec.europa.eu/environment/action-programme/> (accessed 10 January 2018).

comes from end-of-life third-party service providers and corporate users. The majority of equipment is distributed for re-use in parts and components from these received products. For this model, it is common that, globally, only one or two sites are capable of preparing such specialised equipment for re-use. Consequently, this model is extremely dependent on transfrontier shipments.

- The *IT Asset Management* model deals with products such as desktop computers, notebook computers, tablets and mobile phones. The majority of input equipment to this model comes from commercial corporate users or leasing companies offering take-back service to their customers. In this model, the speed at which such products can be returned to the re-use market is paramount, as product values decline sharply over time.
- The *Close the Digital Divide* model provides used desktop and laptop computers to beneficiaries in developing countries, mostly educational and medical institutions or local non-government organisations. The majority of devices for re-use are received through corporate and public donations. In exchange, this model caters for equipment collection, data sanitisation and appropriate compliance certification.
- The *Social Enterprise* model describes organisations that acquire and prepare equipment, including computers, peripherals and LHAs for re-use and retail to individual users, usually with the objective of creating social benefits (e.g. training and job creation for disadvantaged individuals). Generally, social enterprises are focused either on desktop and notebook computers received through donations or on LHAs (fridges, washing machines, etc.) from various providers. Refurbished devices are sold to eligible recipients and social markets are often a priority.

On a financial level, one may differentiate the models based on their financial orientation; whereas the first two types are “for profit” oriented, the last two both pursue a “non-profit” purpose. They aim to provide marginalised people with access to ICT products, the internet or affordable household appliances, while helping create employment and education opportunities.

All the models also differ in terms of customer segments, products and services offered to their

respective customers. The Networking Equipment Model, for example, considers original equipment manufacturers (OEMs) as its main customers. In the IT Asset Management model, organisations specialise in refurbishment of desktop and notebook computers for resale to distributors and retailers. The Close the Digital Divide model supplies used computers to eligible recipients in developing countries and the Social Enterprise model sees companies preparing computers, peripherals or LHAs for re-use and sale to individual users through retail shops. The models identified constitute generic ways to structure re-use operations along the four dimensions of the analytical framework (i.e. “supply chain”, “offer”, “customers”, “finance”). Different entities can utilise one or multiple combinations of these models as desired.

In all of these models, re-use does not compete with recycling as an end-of-life solution, but ideally it optimises the economic and ecological efficiency of the entire product life cycle by extending the use phase of the product to its optimum duration. Therefore, it is particularly important that re-use organisations transparently manage the link to proper recycling and disposal once their products have reached the definite end of their lives.

2.5.2 *Social and community enterprise*

Social enterprise plays a significant role in the operation of preparation for re-use across Europe and should thus be an important consideration in discussion on the operational aspects of re-use and preparation for re-use. However, the definition and understanding of social enterprise is varied. This section will lay out the current literature on defining and detailing social enterprise.

What is a social enterprise?

The social enterprise sector is a relatively recent construct in the business and community sectors. A report by Forfás in 2012 defines a social enterprise as:

an enterprise that trades for a social/societal purpose, where at least part of its income is earned from its trading activity, is separate from government and where the surplus is primarily reinvested in the social objective.

However, according to a study published by the Irish Local Development Network (ILDN),¹⁵ the concept of social enterprise is not well understood, even among the various stakeholders involved in the sector. The diversity of the sector, the varying profiles of the social entrepreneur and the nature/structure of the social enterprise itself all contribute to the difficulty in clearly defining the social enterprise construct. Constituents vary from small community groups to larger commercial and profit-making entities, all with different associated definitions, values and measures of success, but all classified as social enterprises.

Their activity and scope covers a broad spectrum, operating across a wide range of business sectors, in urban and rural areas as well as in socially and economically marginalised locations. They vary in size from small-scale community-based projects (typically funded by the state in Ireland) to medium-sized businesses trading on a commercial basis, typically with a single owner or administered by a team of entrepreneurs and cooperatives. They interface on the one hand with the voluntary and community sector, providing employment opportunities, etc., while on the other hand they also deal with commercially operated businesses. These enterprises usually operate across a variety of sectors, provide a range of services, operate in all markets and tackle complex social and environmental challenges in innovative and sustainable ways.

The difficulty in arriving at a single unifying definition for social enterprise is not limited to Ireland (see Bornstein and Davis, 2010, and Vasi, 2009, for more information). Part of the problem is due to the heterogeneity of the social enterprise, part of it is due to variations in the various stages of evolution and growth within the enterprise, part is due to the nature of the product or service offered and, finally, part is due to the range of different government and business model configurations involved.

Although social enterprises are important drivers of social, economic and environmental change, demonstrating the associated benefits that they provide is usually not a clear-cut task. According to Santos (2012), some of these benefits include

bridging product and service gaps in geographical and sectoral areas neglected by government interventions or deemed financially not viable by traditional enterprises. They benefit society by smoothing out economic shortcomings through raising social awareness and the provision of solutions not otherwise available. They also provide a combination of social, economic and environmental benefits to individuals and regions in need of regeneration. The continuation of these services to marginalised communities through the social enterprise construct has an essential community value, strengthening social cohesion and helping to build sustainable communities.

Social enterprise versus community enterprise

Social enterprises are usually distinct from community enterprises, although the terms are often used interchangeably. According to the Forfás (2012) report, community enterprises are typically defined in the same way as social enterprises, even though community enterprises are usually owned and managed by individuals in the community and have evolved from community initiatives into the social enterprise role. These enterprises can develop sub-enterprises, products, services and projects to meet a range of specific social, economic and environmental problems in their community. They often provide a joined-up approach to tackling what are often deep-rooted and complex issues.

A social enterprise, on the other hand, is often seen as centred in the world of business, developing products and services that have greater potential for geographic expansion.

National policy on social enterprise

Following the 2012 Forfás report, Ireland's Minister for Regional Economic Development announced that a National Policy on Social Enterprise is in development. This policy will aim to support social enterprise and follows an EU plan to increase funds for social enterprise by an estimated five times, from around €193 million to €1 billion.

¹⁵ <https://www.pobal.ie/Publications/Documents/Social%20Enterprises%20report%20master%20doc.pdf> (accessed 10 January 2018).

2.5.3 Re-use barriers and success factors

In a recent European Commission report, *Regulatory Barriers for the Circular Economy: Lessons From Ten Case Studies*,¹⁶ the authors present the analysis of a set of circular economy business practices, identify and suggest policy and regulatory actions to help European businesses and consumers make the transition to a stronger and more circular economy, and call for the removal of regulatory barriers to the circular economy (EC, 2016). The report is part of a direct contribution package to the Action Plan on Circular Economy, which was adopted by the European Commission on 5 December 2015.

The study identified major obstacles of a regulatory nature or gaps within the existing legal framework, namely in sectors, subsectors, economic activities and value chains where significant unlocked opportunities remain. In addition, the study conducted an in-depth analysis of the identified obstacles and possible solutions, aiming to identify and analyse key regulatory obstacles that hinder the realisation of economic opportunities in a European circular economy. The analysis included a full product life-cycle review and focused on the interfaces between different steps of the value chain. The analysis identified three key areas in which these barriers were concentrated:

- Collection of waste streams: Several case studies identified that regulatory barriers often related to a lack of legislation that would have allowed the collection and pre-treatment of homogeneous waste streams. Without specific legislation, many waste streams end up as mixed waste, for which high-quality-recycling costs are higher than the income from its recycled materials.
- Uptake of secondary resources: The second type of barrier referred to legislation that hinders the use of recycled materials in production processes. The rationale behind such legislation is frequently motivated by aspects of health and consumer protection and often undermines opportunities and benefits of circular approaches. In many cases, a lack of harmonised EU legislation mandating specific quality requirements has been identified as a major obstacle to high-quality recycling.
- Design for re-use, repair or recycling: The third type of barrier identified in the report is related

to the lack of concrete and enforceable product requirements. The main example used was the problematic enforcement of the requirements of the WEEE Directive regarding the recyclability of electronic products, especially concerning the disassembly of batteries.

The analysis also highlighted a variety of different generic types of barriers: in many cases, for example, waste legislation focuses on quantities (weight-based collection or recycling targets) and not so much on the qualities of recycled materials. Inconsistencies between existing regulations have also been mentioned in a variety of case studies.

Kissling *et al.* (2013) undertook a study to identify specific and generic success factors and barriers in the re-use of EEE (predominantly ICT and LHAs) under a variety of operating models. On the one hand, the most impactful barriers identified included difficulty in accessing sufficient volumes of good-quality used equipment and the lack of legislation, which supports, incentivises and, if necessary, enforces this equipment access. On the other hand, the correspondingly important success factors for re-use organisations were the control and securing of product and process quality. Re-use organisations, by adhering to good re-use practices, were able to differentiate themselves through quality guarantee from non-compliant, informal competitors. Moreover, proven quality strengthens confidence in re-use for important stakeholders such as suppliers, customers, authorities and the general public.

The analysis revealed four distinct categories of barriers for re-use organisations:

- access to supply;
- formal and informal practice restrictions;
- legislation/eco-design; and
- cost/revenue.

The highest priority barrier to the re-use of EEE relates to the access, or lack thereof, to sufficient volumes of used equipment for the respective re-use organisations. The results confirmed that the sourcing of sufficient volumes of used good-quality equipment is a key challenge for every organisation engaged in

16 http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8986&lang=en (accessed 10 January 2018).

EEE re-use. Furthermore, the survey indicates that the legal framework conditions within the EU today do not optimally support re-use organisations in accessing sufficient volumes to satisfy preparation for re-use requirements.

Moreover, it was found that public- and industry-organised collection and recycling schemes do not consider or support re-use in their design. Instead, re-use organisations often need to directly compete with recyclers for EEE that has a potential for re-use. Some OEMs prohibit the redistribution of their products once they have taken them back from their customers; instead, they demand dismantling and recycling, even if products have a potential for re-use (Kissling *et al.*, 2013). One possible explanation is that OEMs prevent used products from re-entering the market in this fashion to protect new products against competition with lower priced used equipment.

Another barrier identified stems from informal and illegal practices, the so-called “sham re-use”, such as the illegal export of WEEE (which has been declared as functioning EEE for re-use). This WEEE most often ends up being informally recycled in developing countries, resulting in damage to the surrounding environment and the health of the individuals who process it. Such practices lead to a critical public attitude towards re-use and thereby negatively impact organisations that do adhere to socially and environmentally sound re-use practices. In addition, informal actors also distort competition in the re-use sector – they save on costs (such as implementing effective social and environmental regulations) and compete with compliant re-use organisations in both access to used equipment and redistribution of EEE prepared for re-use.

The final major barrier identified was the variance and complexity in regulations leading to administrative costs, particularly for international re-use organisations and operations. The existence of a variety of different standards and the lack of a globally recognised re-use standard makes it difficult to refer to common definitions of good re-use practices and to enhance transparency and quality control in the re-use sector.

In terms of success factors for re-use, the most important are:

- The quality and reliability of products distributed for re-use, along with the control of product and process quality during preparation for re-use.
- The access to high-quality used equipment and the secure destruction of user data.
- Stakeholder relationship management. As re-use organisations deal with “waste”, they are more exposed to public attention than other commercial enterprises or organisations. Gaining and keeping the trust of the different stakeholder groups therefore becomes a critical success factor. Careful communication and convincing action are also used to positively influence the societal discussion on the soundness of re-use and the image that consumers have of used products.
- The enhancement of transparency in the life cycle of used products. Being able to secure a proper recycling solution for the products that have been distributed for re-use is especially important, in particular when products are distributed in countries where recycling infrastructure has not yet developed to satisfactory standards.

A comparable review from the EU study on re-use targets¹⁷ also considered the relevant barriers and necessary factors for the successful implementation of re-use in an organisation. Table 2.3 summarises these factors and highlights some of the relevant barriers/obstacles to the implementation of successful preparation for re-use organisations and the reciprocal factors contributing to the successful implementation of these organisations.

2.5.4 Re-use, transport and transboundary issues

In our globalised economy, increasing volumes of used and second-hand EEE are being shipped across national borders. While global and regional regulations prioritise the re-use of electronics as a prudent approach for conserving resources and reducing environmental toxicity, their effect on cross-border shipping of re-use EEE is only now becoming known.

17 http://ec.europa.eu/environment/waste/wEEE/pdf/16.%20Final%20report_approved.pdf (accessed 10 January 2018).

Table 2.3. Obstacles and drivers for re-use/preparing for re-use

Obstacles for preparation for re-use	Drivers for preparation for re-use
Access to the waste streams by re-use facilities and quality of materials collected	Quality control for re-use
Design of the products and availability of spare parts	Security standards
Lack of appropriate logistics	Open dialogue between manufacturers and re-use organisations
Costs for municipalities	Commitment of local authorities towards re-use
Resistance from producers	Policies favouring social activities and funding
Consumer perception towards re-use	Marketing of second-hand products
Legislative framework (no separate target on preparation for re-use)	Education for people involved in re-use and refurbishment
Expertise required for preparation for re-use	
Restrictions on transboundary shipments	
Unfair competition (notably from re-use organisations that do not respect quality standards)	

In response to the expanding growth in the exporting and importing trade of both EEE and WEEE, a number of regulations at international, regional, national and local levels have been developed. All international and regional legislation becomes enforceable once it has been transposed into national laws. The Basel Convention (Krueger, 2001), the Organisation for Economic Co-operation and Development (OECD) Council Decision (2001)107/Final (Clairmont, 1996) and European Waste Shipment Regulations (Baird *et al.*, 2014) are the principal agreements regulating the cross-border movement of e-waste.

The Basel Convention (or, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal) is the most comprehensive and significant of these three agreements. It is a United Nations international treaty introduced to restrict the movement of hazardous waste between countries, specifically the transfer of hazardous waste between developed and underdeveloped countries. The convention was opened for signature on 22 March 1989 and entered into force on 5 May 1992. It has been ratified by 173 countries to date. Afghanistan, Haiti and the USA are the only countries to have signed the convention but not yet ratified it. The Basel Convention aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes. WEEE/e-waste is seen as a priority waste stream and is covered in

Annex VIII and Annex IX of the convention. Under the convention, parties are obliged to ensure that such wastes are managed and disposed of in an environmentally sound manner. The convention covers toxic, poisonous, explosive, corrosive, flammable, eco-toxic and infectious wastes. Countries are expected to minimise the quantities of these hazardous materials that are transported, to treat and dispose of wastes as close as possible to their place of generation and to prevent or minimise the generation of wastes at the source. A 2015 publication under the Basel Convention provides technical guidelines on transboundary movements of EEE and UEEE that may or may not be waste, specifically providing guidance on the distinction between waste and non-waste and between hazardous and non-hazardous waste.

The OECD introduced regulation (92)39/Final to monitor the transboundary movement of wastes destined for recovery operations between OECD member countries (OECD, 2009). In addition to the requirements set out in the Basel Convention, the OECD regulation also strives to control resources secured from wastes and minimise hazardous waste shipments. It offers more detailed guidelines, allowing countries that are not signatories to the convention to continue to trade waste with OECD member countries.

The European Waste Shipment Regulation (1013/2006) transposes the Basel Convention and OECD decision into European law, making it legally binding in all EU Member States, and is referred to

in the (recast) WEEE Directive (Article 10). In order to prove that a shipment does not contain waste, evidence must be provided that a shipment contains fully functional equipment, destined for direct re-use, that appropriate protection against damage has been implemented and, if defective, proof that the equipment is sent back for repair with the intention of re-use. Correspondents' Guidelines are being finalised on the distinction between WEEE and second-hand EEE as part of ongoing work on e-waste under the Basel Convention. Correspondents' Guidelines on the distinction between WEEE and second-hand EEE have now been completed, applicable from 3 April 2017, providing guidance on the correct interpretation of the Waste Shipment Regulation to be used by Member States.

Research has identified three broad areas in which regulations may directly influence the re-use organisations and the shipment of EEE for re-use:

1. definitions, classification, operating procedures and enforcement;
2. evaluation of shipments;
3. requirement for functionality testing.

In all of these areas, shipping regulations may be contributing to raising barriers for re-use organisations instead of their desired goal of lowering them. To help eliminate these barriers, suggested policy recommendations by Milovantseva and Fitzpatrick (2015) include appropriate legislative amendments, inclusion of issues related to re-use in the development of relevant national policies, the establishment of a comprehensive international legislative database, the creation of refurbishment operations close to installation bases, the integration of informal recyclers in the re-use sector and the introduction of a regulated green e-waste transboundary channel.

2.5.5 Re-use standards

Re-use is seen as an activity that must be regulated so that it develops in a sustainable fashion going forward. The recast WEEE Directive provides the foundation for regulation and access to WEEE for re-use. However, it is essential that standards be set that re-use organisations must achieve in order to become part of the re-use system. Only organisations operating to these sufficiently high standards should

be considered eligible to undertake refurbishment and re-use activities and be given access to WEEE for these purposes. Various national actions have already been put in place to regulate preparing for re-use activities. Examples have been seen already in the WEEE Label of Excellence (WEEELABEX), the British Standards Institution "Re-use of used and waste electrical and electronic equipment (UEEE and WEEE) process management specification", Publicly Available Specification (PAS) 141 and the development of a code of conduct for re-use activities by the waste authority, Openbare Vlaamse Afvalstoffenmaatschappij (Public Waste Agency of Flanders; OVAM, 2012). While there is no single globally recognised re-use standard at present, these different standards, guides and codes of practice for re-use and preparing for re-use at European, international and national levels are considered in this section.

Standard EN 62309

The first EU standard fully devoted to re-use was EN 62309, approved and published in 2004. The standard introduced requirements and prerequisites as a means to check the reliability and functionality of re-used parts and enable their usage within new products. This includes facets such as the characteristics of the technical documentation for the product containing re-used parts as well transparency requirements for the consumers and methods for the traceability of these products. It also provided information and criteria about the requisite tests/analyses that would be required for products containing these re-used parts. These products were distinguished with a "qualified-as-good-as-new" label relative to the designed life of the product. Standard EN 62309 also describes some of the potential technical issues when approaching "design for re-use", including modularity, upgradeability, maintainability/ accessibility, ease of disassembly, interchangeability, interoperability, testability and a robust design for damage.

Standard EN 50614 (currently under preparation)

Standard EN 50614, "Requirements for the preparation for re-use of waste electrical and electronic equipment", is currently under development within the standardisation mandate M/51832 of the European Commission to European standardisation

organisations. This standard will focus on the re-use of EEE or equipment that was previously discarded as WEEE and which has been prepared for re-use for the same purpose for which it was originally designed. EN 50614 broadly aims to encourage the re-use of WEEE, thereby reducing recycled or incinerated WEEE, provide a framework to assure consumers of the safety of the equipment and the quality of the preparation for re-use processes, and assure manufacturers that returning products to the market after preparation for re-use will not adversely affect their brands or the safety reputation of the equipment.

WEEELABEX

WEEELABEX originated as a 4-year, multi-stakeholder project proposed by the WEEE Forum. The project aimed to protect the environment by improving the WEEE collection and recycling practices in Europe. WEEELABEX aimed to lay down a set of European standards with respect to the collection, handling, storage, recycling, preparation for re-use and disposal of WEEE. Furthermore, it set out to monitor the processing companies through audits conducted by auditors trained by the WEEELABEX Office.

WEEELABEX has evolved into a voluntary industrial standard covering major parts of the WEEE treatment chain, which served as a basis for the development of official CENELEC standards (e.g. EN 50625-1 on collection, logistics and treatment requirements for WEEE). The WEEELABEX standard aims to provide a coherent, continental and comprehensive set of technical requirements with respect to WEEE operations.

Standard BS8887-211

Standard BS8887-211, "Design for manufacture, assembly, disassembly and end-of-life processing (MADE) – specification for reworking and remarketing of computing hardware", was published in 2012 and analyses some of the key processes for re-use and highlights several key benefits related to re-use, in particular from the environmental and commercial point of view. Although the standard was primarily developed with the ICT sector in mind, the recommendations provided can be extended to the wider EEE market.

PAS 141

PAS 141 was commissioned by the Department for Business Innovation and Skills and its development facilitated by the British Standards Institution (BSI) in the UK. PAS 141 was developed from the WEEE Advisory Body specification for the re-use of WEEE and UEEE and came into effect in the UK on 31 March 2011. PAS 141 aims to encourage the re-use of WEEE, as promoted by the WEEE Directive, reduce the amount of WEEE sent to landfill and incineration by diverting WEEE to be prepared for re-use, and provide a framework for assuring consumers of the quality and safety of REEE as being different from WEEE and UEEE that has not been prepared for re-use.

Specifically, the PAS 141 standard exists to cover the following seven main aims:

1. increase the re-use of WEEE in accordance with the WEEE Directive;
2. decrease the amount of waste being disposed of lower on the waste hierarchy;
3. allow customers to be assured that the quality and safety of a prepared for re-use product meets the same expectations as a new product;
4. reassure producers that their quality and safety reputation will be maintained by preparation for re-use organisations;
5. provide a means to identify and prevent illegal export of WEEE;
6. allow the identification of products that have passed through the preparing for re-use process;
7. use preparation for re-use of WEEE to encourage the creation of jobs.

In addition, it provides a framework for those involved in re-use to help minimise the impact of EEE on the environment and to assure consumers that refurbished products are fit for purpose in terms of both safety and functionality.

It is important to note that PAS 141 covers the preparation for re-use of equipment and components. It does not cover the recycling process, although it does include requirements for assigning WEEE and UEEE for recycling. Processes used by organisations involved in the re-use of WEEE and UEEE need to be

designed to identify and minimise the impact they have on the natural environment.

PAS 141 also aims to provide a framework for assuring manufacturers that the placing of products on the market for re-use will not adversely affect their brands or reputation for safety and quality, and will deter the illegal export of WEEE under the guise of sham re-use and provide a tool for identifying REEE that has been subject to the preparing for re-use process set out in PAS 141 while encouraging job creation in organisations involved in preparing WEEE and UEEE for re-use.

The aim of PAS 141 is to encourage the re-use of WEEE. It may be broken down into five sections:

1. handling;
2. preparation for re-use;
3. re-use;
4. recycling;
5. operational management.

Under handling, the segregation, storage, protection and tracking of the material with potential for re-use are outlined. Equipment and components must be segregated and stored in accordance with the documented process. Each piece of equipment processed with potential for re-use must be uniquely identified and tracked throughout the re-use process with records maintained. Figure 2.4 shows the typical preparing for re-use process flow recommended under PAS 141.

OVAM

The Code of Good Practice describes the criteria that electrical and electronic appliances should meet to be made available on the market or exported as (second-hand) products. In addition, it sets out specific guidelines to which re-use centres must adhere during the process of preparing WEEE for re-use. Goals include the improvement of the environmental score of equipment that is re-used, prevention of exports of WEEE under the guise of second-hand goods and encouraging the re-use of WEEE that meets the re-use criteria.

Under the OVAM standard, the re-use criteria include those that allow an evaluation of the condition of the appliance (fully functional, electrically safe, physically inspected), those related to the environment (absence of environmentally hazardous substances, energy labels, etc.) and those for the level of certainty that the appliance will effectively be re-used (regular market for product, product safely transported, etc.). Re-use centres, too, must meet a set of minimum requirements under the OVAM standard, including inspection by an ISO 170120-accredited inspection body, registration and licensing with OVAM and full documentation of their preparing for re-use process flow.

Currently, the Code of Good Practice has the status of a guideline. In the next review of VLAREMA (a Flemish regulation on the sustainable management of material cycles and waste materials) it is proposed that the elements of the Code of Good Practice should be transposed in a ministerial order and that VLAREMA should refer to this order. From then on, the re-use criteria would be legally enforceable within the Flemish region.

Standard VDI 2343

Standard VDI 2343, “Recycling of electrical and electronic equipment – re-use”, was published in 2014. It was developed in Germany to develop practical and legally compliant recommendations for the recycling of EEE. It also analyses some of the key/critical aspects related to re-use from a variety of viewpoints, including the provision of alternative re-use definitions. For example, the standard differentiates between “re-use I” (equivalent to the definition of re-use as in the WFD) and “re-use II” (equivalent to preparation for re-use) in the context of the document. It also discusses the potential benefits of the re-use of products and estimates the functional and economic benefits when compared with alternative treatment options, such as recycling.

2.5.6 Ecolabels

Ecolabels were identified as a way of encouraging consumers to adopt more sustainable consumption patterns through the purchase of products that are

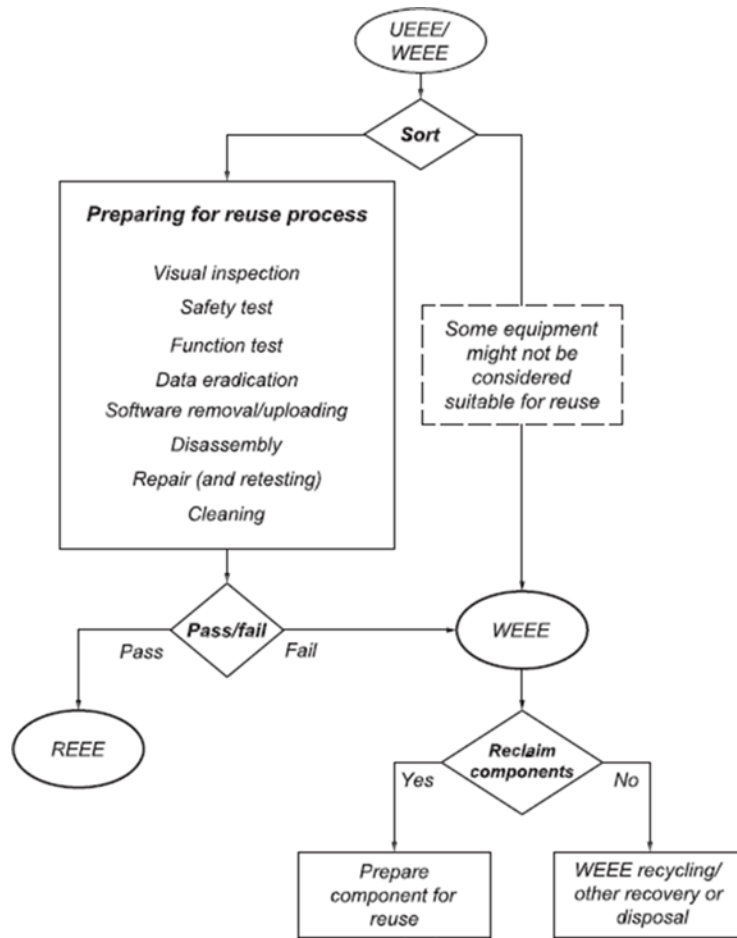


Figure 2.4. PAS 141 preparing for re-use process flow. Permission to reproduce this figure from British Standards is granted by BSI. British Standards can be obtained in PDF or hard copy formats from the BSI online shop – www.bsigroup.com/Shop – or by contacting BSI Customer Services for hard copies only – Tel: +44 (0)20 8996 9001, email: cservices@bsigroup.com.

more resource and energy efficient (Bansal *et al.*, 2001). They were adopted in the EU by means of the Household Appliances: Energy Consumption Labelling Directive (92/75/EEC), which was later extended to all ErPs (2010/30/EU), excluding transport. The Energy Labelling Directive aims to inform European users about the energy consumption of a product. Figure 2.5 shows the current implementation of the EU ecolabel “flower”.



Figure 2.5. The EU ecolabel, “flower”. Image reproduced from www.ecolabel.eu.

Because of the 2010 expansion of the label to categories other than household devices and the expansion of competence beyond the energy consumption, it is now possible – according to recital 2 of the Directive – to provide information concerning other environmental aspects. The inclusion of additional information on durability and reparability of a product on the EU Energy Label would give

consumers the possibility to choose products that are contributing, to a higher degree, to the preservation of natural resources and furthermore push manufacturers to produce more durable products.

The Electronic Product Environmental Assessment Tool, or EPEAT,¹⁸ is a global rating system used to identify “greener” electronics. Using EPEAT, potential customers in 43 countries can evaluate, compare and select electronics based on environmental attributes and considerations. EPEAT currently includes categories for mainstream electronic appliances such as computers and displays, televisions and imaging equipment.

Using EPEAT, products are rated on a life-cycle basis. The system evaluates products using criteria such as the elimination of toxic substances, the use of recycled and recyclable materials, product design for recycling, product longevity, energy efficiency, corporate performance and packaging attributes. Within the EPEAT system, products are rated Gold, Silver or Bronze depending on the number of environmental criteria they meet.

2.6 Irish Waste Management Policy and Preparation for Re-use

This section of the literature review considers Ireland’s progression towards preparation for re-use and discusses some of the key milestones in the Irish roadmap thus far. Figure 2.6 shows the timeline detailing Ireland’s progression in this regard.

While some of the components, such as the recast of the WEEE Directive, are international in nature and have previously been introduced in this chapter, the national milestones such as the Irish Waste Policy, Producer Responsibility Initiative (PRI) Review, WEEE Battery and Monitoring Group re-use report and the national requirements for re-use organisations are discussed in detail in this section.

2.6.1 The Irish Waste Management Policy

The Irish Waste Management Policy,¹⁹ published in July 2012, outlines the roadmap for Ireland’s progression from a landfill-oriented waste management system towards one in which waste reduction and resource recovery are realised through the application of appropriate technologies and procedures. These include prevention and minimisation, re-use, recycling, recovery and disposal, as predicated by the EU waste hierarchy.

The Irish Waste Management Policy formally adopted measures across all five tiers of the waste hierarchy model, including re-use and preparation for re-use. From this, the PRI Review was undertaken and tasked with assessing the nature and level of the challenges facing the existing Producer Responsibility Agreements and the forthcoming challenges that are

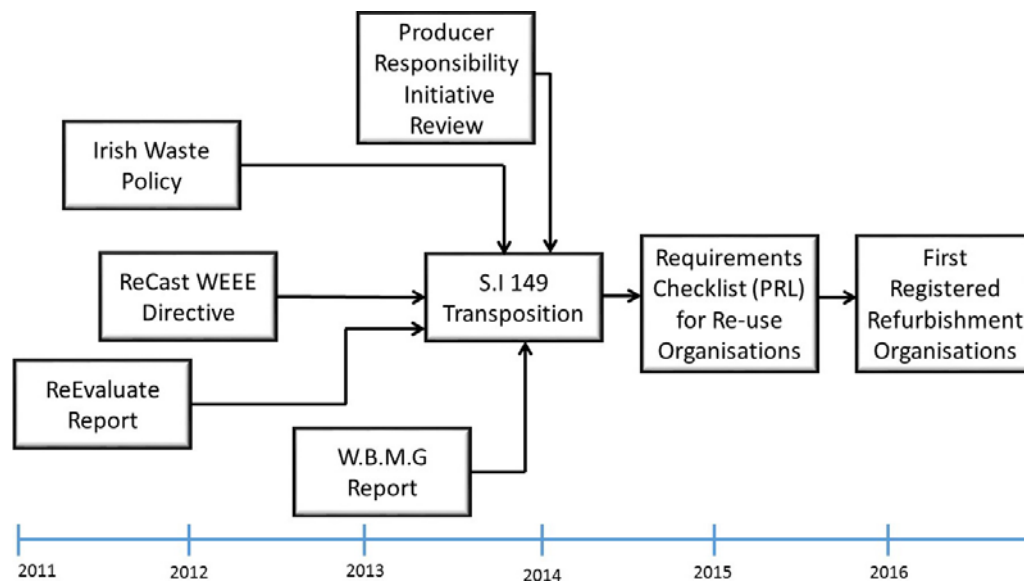


Figure 2.6. Irish timeline for re-use/preparation for re-use activities.

18 www.epeat.net (accessed 10 January 2018).

19 https://www.epa.ie/pubs/reports/waste/plans/Resource_Opportunity2012.pdf (accessed 10 January 2018).

expected to arise in the management of various waste streams in Ireland in the future.

Specifically, the areas of re-use and opportunities for preparation for re-use were to be encouraged and promoted through undertakings such as the renewed national waste prevention programme, the environmental awareness work of local authorities, the PRI compliance schemes and the enterprise support agencies. The PRI Review²⁰ was mandated to examine the issue of a re-use policy for EEE and other PRI sectors and make recommendations to inform Ireland's short-term policy development to support further progress in the WEEE waste stream.

Regional Waste Plans for the 2015–2021 period for the Southern, Eastern-Midlands and Connacht-Ulster regions include objectives relating to the prevention of waste from Irish households, by repair and re-use activities, in keeping with the waste hierarchy and contributing to the circular economy. The three plans set strategic targets of a 1% reduction in household waste and a 50% recycling (including preparation for re-use specifically in the Connacht-Ulster plan) target to be achieved by 2020.

2.6.2 The Producer Responsibility Initiative Review

The PRI Review, published in July 2014, recommended a number of different procedural changes and actions to the Irish WEEE sector in an attempt to improve the implementation of re-use/preparation for re-use in Ireland. The Review recommended that civic amenity sites and retail outlets should be upgraded to allow segregation of WEEE for re-use in order to preserve the quality of the WEEE being collected. Furthermore, the report suggested that staff at these facilities be trained in accepting and safeguarding WEEE for re-use.

From a legislative viewpoint, the review recommends that the WEEE Regulations would need to be amended to make WEEE available to re-use organisations and compliance schemes in Ireland. This access to WEEE by re-use organisations would

obviously need to be controlled and regulated. Access to this WEEE for re-use and preparation for re-use should be granted only to re-use organisations that can demonstrate environmental credentials, the ability to implement their activity to accredited standards, technical capability and organisational capacity.

On the question of standards, the review suggests that access to WEEE should be given only to authorised re-use organisations that prepare equipment for re-use to a certifiable standard. A re-use standard should be mandatory and included in legislation to assure the public that re-used items meeting this certifiable standard are fit for purpose. Existing standards such as PAS 141 or WEEELABEX were recommended. Furthermore, the standard should include the use of a standard warranty and a re-use quality label.

With regard to implementation issues, the review findings indicated that ensuring the collaboration between existing producer responsibility organisations (PROs) would probably be more effective than setting up a separate compliance scheme. To this end, and to ensure the fair allocation of WEEE to re-use organisations, clear rules should be developed for all such re-use and specific re-use targets should be included in PROs' conditions of approval. PROs should then use partnerships with re-use organisations or competitive tender for the supply of this WEEE. The process used by the PROs should be based on best procurement practice and should also be transparent and independent to prevent conflict of interest. Consideration should be given to using environmental criteria in the tendering process to ensure that the proximity principle is respected. It was also suggested that the PRL²¹ (formerly the WEEE Register Society Ltd) could act as a referee in the event of disputes regarding the allocation of WEEE.

Another requirement highlighted in the review was the need to expand information and awareness campaigns to include re-use of WEEE as well as recycling of these appliances. Finally, it was recommended that a public sector re-use policy is developed in consultation with the national procurement service and other relevant bodies, aimed at ensuring that Irish public

20 <https://www.dccae.gov.ie/en-ie/environment/publications/Documents/45/PRI%20Review%202014.compressed.pdf> (accessed 10 January 2018).

21 <https://www.weeeblackbox.ie/website/faq.html> (accessed 10 January 2018).

sector organisations give full consideration to feasible re-use options before embarking on the purchase of new goods.

This policy and associated review has led to the prioritisation of re-use and preparation for re-use being entered into Irish legislation from the (recast) WEEE Directive to its Irish transposal, S.I. 149/2014, explicitly stating that:

the preparation for re-use of WEEE and its components, sub-assemblies, and consumables must be given priority by each final user, distributor, local authority, approved body, producer, or authorised representative and authorised facility in possession of WEEE.

This is in line with the encouragement and promotion of re-use and preparation for re-use laid out in the Irish Waste Policy. Further actions in this regard require that the responsibility for prioritising preparation for re-use begins with the producer designing a product that facilitates preparation for re-use. In this regard, S.I. 149/2014 specifies that producers are:

prohibited from preventing waste electrical and electronic equipment from being prepared for re-use through specific design features or manufacturing processes, unless such specific design features or manufacturing processes present overriding advantages with sustainable environmental practices or, as appropriate, health and safety requirements.

Furthermore, the producers must

ensure that eco-design requirements facilitating the preparation for re-use are applied.

This thereby prevents producers from intentionally manufacturing products that are difficult or impractical to disassemble easily or which use an excess amount of material that may not be suitable for re-use.

Under the Irish system, once the product reaches the end of its life, it is expected that the product will be returned to a take-back system, usually through a retailer, civic amenity site or open day/special collection. Under the current structure outlined by the PRL, waste may not be transferred directly from

the retailers or local authority collection points to a preparation for re-use organisation and must pass through one of the two approved compliance schemes first.

This means that all WEEE collected in Ireland will be collected together at collection points/transfer stations before being segregated and transported to the appropriate approved preparation for re-use organisation(s) or recycling centres. Under the auspices of the compliance schemes, the responsibility for complying with the EU waste hierarchy predominantly consists of ensuring that the WEEE is properly handled and carefully transported, while maintaining the re-usability of the products/ WEEE. As members of the WEELABEX organisation, both European Recycling Platform (ERP) Ireland and WEEE Ireland are held to standards that dictate that the WEEE must be handled in a way that is conducive to preparation for re-use, both for themselves and for subsequent handlers of the WEEE.

2.6.3 WEEE battery and monitoring group re-use report

As is also shown in Figure 2.6, the report of the WEEE/Batteries Monitoring Committee Re-use Sub-Group to the Department of the Environment, Community and Local Government (February 2013), coinciding with the transposition of European Directive 2012/19/EU into Irish law, presented some of the perceived issues and challenges existing in relation to the development of re-use in Ireland. Also presented were a series of recommendations on the implementation of preparation for re-use in Ireland. These included recommendations that initial re-use efforts should focus on LHAs, cooling and freezing (fridges and freezers) and ICT equipment, and the potential implementation of an energy efficiency cut-off point for re-usable WEEE, where an energy rating applies. The regulations should ensure the absence of environmentally hazardous substances in re-usable equipment (e.g. they should exclude equipment from before Directive 2011/65/EU on the restriction of hazardous substances in EEE and similar from the scope for re-use). Producers should be required to work in collaboration with re-use organisations to ensure that they have access to technical information, where possible. All equipment recalled by

a manufacturer (e.g. as a result of epidemic failure) should be excluded from re-use. The report also called for the regulations to include a provision in relation to appropriate transport as a criterion for re-use.

2.6.4 Requirements checklist for re-use organisations

Preparation for re-use organisations that wish to engage with the compliance schemes for receipt of WEEE must now be approved by the official registration body; in Ireland, this approval comes from the PRL. This has come about as a recommendation from the PRI review, which stated that re-use organisations should register with the PRL and that the Irish Department of Housing, Planning, Community and Local Government should develop an authorisation system for these organisations. This means that there are specific requirements in place in order for an organisation to be approved as a preparation for re-use organisation by the PRL. These include:

- Organisations must obtain, or contract an organisation that has obtained, both waste collection and waste facility permits, with exemptions provided for charitable organisations and registered distributors of EEE.
- Organisations must obtain proof of coverage in the form of a letter stating that insurance is, or will be, in effect upon approval from the PRL.
- It is specified that the repair of WEEE should be completed with original or manufacturer-approved parts and should not result in important changes to the product's original function or performance; when a product has undergone significant changes or unapproved parts have been used, the product may be considered a new product and the organisation may need to register as a producer and undertake the process of having the CE mark applied, as discussed in the EU Blue Guide.
- Organisations must comply with the PAS 141 re-use standard (see section 2.5.5 of this report for more information on PAS 141). This standard originated in the UK as the first standard for proper treatment of WEEE and UEEE. PAS 141 lays out how the preparation for re-use process must be undertaken, especially ensuring that the resulting product is safe to use and retains its function.

2.7 UpWEEE Literature – In Review

This literature review has provided an overview of the academic literature and research in the field of re-use and preparation for re-use. Specifically, the chapter has reviewed the formal definitions of re-use and preparation for re-use as they apply to EEE. The rationale for re-use from the point of view of social, economic, environmental and socioeconomic factors has also been considered. Policies and legislation that directly or indirectly affect re-use and preparation for re-use in Ireland and elsewhere have been presented. Economic and business factors identified in the area of EEE re-use have been discussed and finally technical considerations for re-use and preparation for re-use were reviewed.

Some of the key points to consider from the review of this chapter include:

- The sustainability and lifetime extension of EEE and WEEE is well established in the literature in related fields of research.
- The Irish National Waste Management Policy supports re-use, recognising that it is a preferred alternative to recycling and lower tier WEEE processing strategies, allowing Ireland to minimise its reliance on finite resources, help reduce its reliance on landfill and address some of the negative impacts that such WEEE has on the environment.
- Recommendations at EU level after a review of re-use targets across Member States include the definition of a clear methodology to measure rates of preparation for re-use, the prioritisation of re-use and household waste collection sites and the granting of access to WEEE by re-use organisations (either via collective schemes or directly via municipalities or other operators such as retailers).
- Among its findings, the Irish PRI Review recommends that clear rules should be developed for all re-use activities in Ireland, clearly delineating the roles and responsibilities of all actors in the re-use field. Furthermore, the review suggests that specific re-use targets should be included in PROs' conditions of approval.
- The Irish National Preparation for Re-use of WEEE Criteria were approved in May 2015 and are now in place for all preparation for re-use organisations.

3 Analysis of Preparation for Re-use in EU Member States

3.1 Introduction and Methods

The success of preparation for re-use systems and organisations varies greatly, even where legislation regarding the process is largely identical (across the EU). The analysis within the following chapter has been conducted to identify the similarities and differences between successful preparation for re-use organisations in the countries with the highest reported yield of re-used equipment that correlate most significantly with their success. Chapter 3 outlines the rationale and methods used to select interviewees as well as the results gathered from the interview process.

3.1.1 Selection

Selection of countries and equipment of interest was conducted through analyses of Eurostat data. Country-specific data on the reported re-use rates in all European countries in recent years were gathered from nationally reported figures from Eurostat for LHA and IT; those countries with the highest reported rates were selected as countries of interest. Compiling reported national re-use data revealed five particular countries of interest: Austria, Belgium, France, Spain and the UK. These countries showed consistent and comparatively high levels of re-use within Eurostat data gathered for both LHA (Figures 3.1 and 3.2)

and IT equipment. Although the reported figures on preparation for re-use in Spain are comparable to those of several countries not chosen for analysis, they serve as an important data point for this research as Spain is the only EU country with separate targets for re-use and for recycling.

Key re-use organisations were then identified within each selected country through a mixture of professional recommendations and collection of previous online publications put forth by the organisations themselves. Using information gathered in Chapter 2, a questionnaire (Appendix 1) was developed for interviews with preparation for re-use organisations. Questions focused on the characteristics of the organisation itself, processes for the movement of WEEE in respective countries, important relationships (both positive and negative) and what serves as a barrier for facilitators to success in a preparation for re-use system.

3.1.2 Interviews

Selected contributing organisations were requested via email to participate. Participants were subsequently provided with pre-interview access to the questionnaire topics to allow for a prepared, accurate and efficient interview response to factual questions, while leaving room for open-ended answers during telephone

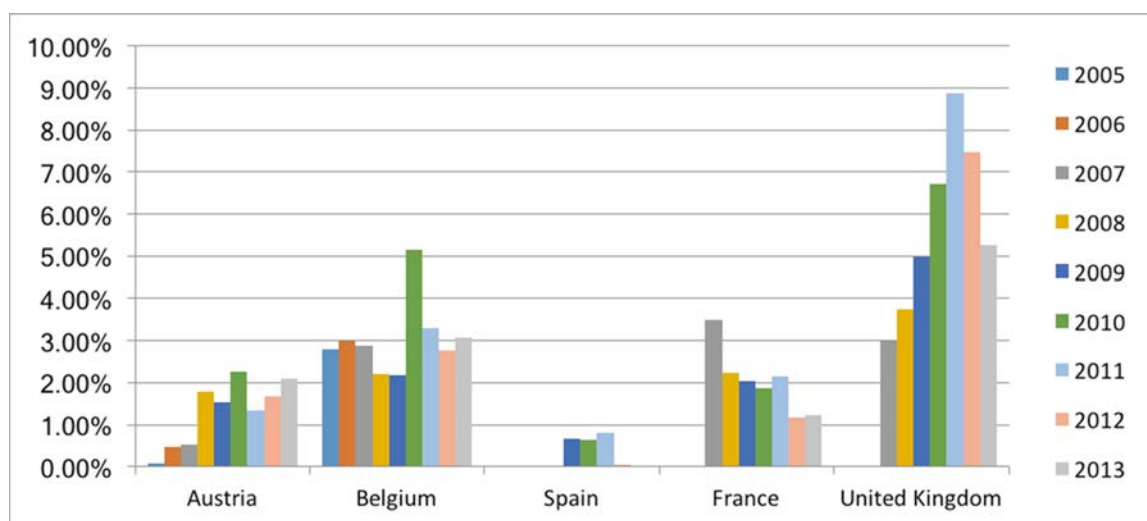


Figure 3.1. Eurostat LHA re-use figures.

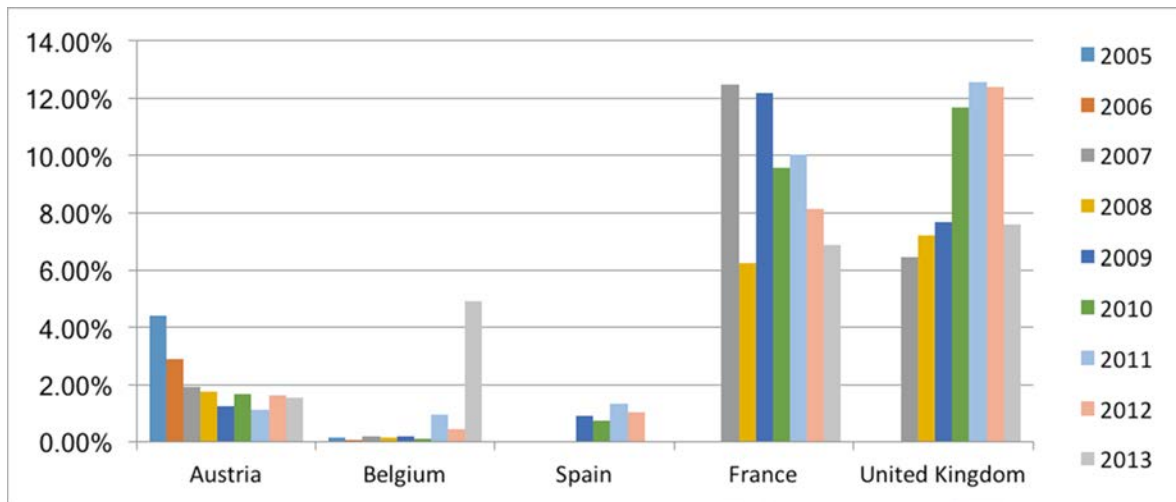


Figure 3.2. Eurostat IT and telecoms re-use figures.

correspondence. Interviews were conducted by semi-structured telephone interviews, site visits and email correspondence. All telephone interviews were recorded using two programs simultaneously, to prevent loss of information and information quality, and were then transcribed, summarised and made available to interviewed organisations to ensure quality and accuracy. Site visits were not recorded; however, photographs were taken. Information was then analysed in relation to common themes, as presented in the following section.

One organisation was interviewed per selected country; an effort was made to interview networks comprising a number of organisations in order to be representative of more than one single experience.

3.2 Identified Themes

3.2.1 Social enterprises

The first theme emerging from this list, even prior to discussion with the organisations, is the almost universal social focus defining preparation for re-use organisations across the EU (Table 3.1). All organisations identified one or more social endeavours, including the employment of disabled or long-term unemployed persons, discounts for the underprivileged and unemployed, donations to charities and schools, and the workforce integration and training of both young and elderly employees. These were reported by each organisation to be an essential part of the main company mission and are involved in the contracts

between French compliance schemes and preparation for re-use organisations. Considering these results, adopting a social component appears to contribute significantly to the success of organisations, mainly by providing a suitable workforce. Funding as a social enterprise was less consistent across the groups, although it was similarly a significantly tying theme, with all parties reporting main revenue stemming from economic activity, but with varying degrees of subsidised funds (Table 3.2).

3.2.2 Additional legislation and standards

Related legislation also varied from country to country but mostly consisted of the national transcription of the WEEE Directive without further legislative measures. Standards followed were varied, although PAS 141 occurs most frequently (Table 3.3).

3.2.3 Access to equipment

The processing of equipment between countries and organisations was reported to be more varied. Firstly, the sourcing of equipment functions in a number of ways (Table 3.4), the most common of which is direct access to equipment from retailers, civic amenity sites and sometimes door-to-door collection. All parties agreed that the highest quality and most desirable equipment comes from retailer take-back systems. These direct access systems exist under specific agreements between preparation for re-use organisations and compliance schemes, such as between Envie and the French compliance scheme

Table 3.1. Interview preparation for re-use organisations per chosen country

Country	Organisation	Description	Products covered	Social enterprise?
Austria	DRZ	Re-use organisation	Mixed WEEE	Yes
Belgium	Komosie	Network	WEEE, clothing, furniture, bicycles, etc.	Yes
France	Envie	Network	Mixed WEEE	Yes
Spain	Aeress	Network	WEEE, textiles, furniture	Yes
UK (Northern Ireland)	Refresh Appliances	Re-use organisation	LHA	Yes

DRZ, Demontage- und Recycling Zentrum.

Table 3.2. Funding awarded to organisations as social enterprises

Country	Organisation	Funding
Austria	DRZ	70% of budget subsidised or refunded by unemployment agency
Belgium	Komosie	Just under half funded by government supports, grants and contracts
France	Envie	~€10,000 per professional integration employee per year
Spain	Aeress	Members receive social subsidies
UK (Northern Ireland)	Refresh Appliances	Does not receive regular subsidies, but has received grants

DRZ, Demontage- und Recycling Zentrum.

Table 3.3. Preparation for re-use standards adhered to by interviewed organisations

Country	Organisation	Standards
Austria	DRZ	National standards
Belgium	Komosie	OVAM
France	Envie	Some PAS 141 standards
Spain	Aeress	Network-specific protocols loosely based on PAS 141
UK (Northern Ireland)	Refresh Appliances	PAS 141

DRZ, Demontage- und Recycling Zentrum.

Table 3.4. Sourcing of WEEE by interviewed organisations

Country	Organisation	Collection source
Austria	DRZ	Municipal amenity sites mainly
Belgium	Komosie	Door-to-door, end user drop-off
France	Envie	Municipality collection points, retailers
Spain	Aeress	Municipal collection points, retailers, door-to-door
UK (Northern Ireland)	Refresh Appliances	Municipal collection points, retailers

DRZ, Demontage- und Recycling Zentrum.

Eco-Systèmes. Limiting the transport of materials by accessing equipment directly from the retailers or homes of consumers is reported as a benefit that allows protection against damage commonly caused

in transport between locations. Damage is a common occurrence and is reported to be a limiting factor for organisations gaining access to good-quality materials suitable for the preparation for re-use process.

Along with limiting the transport of materials, gaining access to equipment closest to the point of customer drop-off prevents the possibility that equipment will be stored in undesirable conditions. Civic amenity sites were reported to often have unsuitable facilities for storage of WEEE if the equipment is to be re-used, exposing the equipment to harsh weather conditions. Lack of suitable space also serves as a small barrier to re-use organisations once equipment has been collected, with less desirable equipment, or equipment damaged previously within the process, being kept outside while indoor space is saved for good-quality or sensitive equipment (Figures 3.3 and 3.4).

Sorting was universally reported to occur initially by visual inspection on the site of pick-up by the re-use organisation. In Austria, it was reported that prior to any contact with re-use organisations, the equipment is sorted to an extent by asking those who drop off

the equipment to deposit it in sections depending on type of equipment. Once equipment passes the visual inspection and is transported to the preparation for re-use facilities, further tests on safety and functionality are conducted, typically following a similar process to that illustrated within PAS 141 and Chapter 2 (Figure 2.4).

While not all equipment is in fact suitable for preparation for re-use, the collection of spare parts is an important task for these companies. For example, in Figures 3.5 and 3.6, although the pieces of equipment are clearly damaged, useful parts such as motors and oven knobs can be removed and used to repair other appliances. This not only saves organisations money, but also creates a stock pile of equipment to keep up with demand even when the flow of materials into the process may be slow. Market demand for products that have passed through the



Figure 3.3. Storage of equipment outdoors, depending on equipment type and space available.



Figure 3.5. Damaged WEEE suitable for spare parts removal or repair.



Figure 3.4. Storage of equipment indoors, depending on equipment type and space available.



Figure 3.6. Damaged WEEE suitable for spare parts removal or repair.

preparing for re-use process is reported to be sufficient to support these businesses, as no organisations reported difficulty in turning around a product for resale; this is essential to the success of re-use. After sorting and processing, whatever material is not able to be prepared for re-use or pulled for spare parts is passed on to recycling. Organisations were responsible for making use of certain percentages of WEEE collected to prevent an overabundance of unnecessary materials being taken for re-use.

As is required under the WEEE Directive and its transpositions, all equipment is sold with an attached warranty, although the length of this warranty varied between countries and organisations. All warranties offered were for a minimum of 6 months; however, they often exceeded this legal minimum. Warranties were reported to occasionally vary between types of equipment at the same organisation, allowing an extended warranty on high-confidence products to make them more desirable for customers.

3.2.4 Important relationships

The most influential relationship in a successful preparation for re-use system is clearly the one between the compliance schemes representing the producers and the organisations undertaking the preparation for re-use. This relationship is essential in obtaining and maintaining access to quality materials. This relationship was most positively reported by both parties, the compliance scheme Eco-systèmes and the preparing for re-use network Envie (in France) and by Refresh Appliances (in the UK), as well as within the comparable structure between the Belgian non-profit organisation in charge of recycling, Recupel, and the Komosie re-use network. Thus, those countries with the highest reported re-use rates according to Eurostat are also those with the best reported relationships between compliance schemes and preparation for re-use organisations. The relationship between the Spanish interviewed network, Aerness, and the accompanying compliance schemes was less certain, and it reported hesitance from the schemes to support re-use.

3.2.5 Targets

As previously noted, Spain is currently the only EU Member State with legally obligatory separate preparation for re-use targets. Support for this

measure is strong within the interviewed preparation for re-use organisations, with open support given by both Envie in France and Aerness in Spain. It is suggested that separate re-use targets in Spain address the issue of hesitance from Spanish producers and compliance schemes with regard to preparation for re-use.

3.3 UpWEEE EU Analysis – In Review

This analysis has served to pull together the experiences of successful preparing for re-use of WEEE organisations across the EU to identify particular barriers and facilitators to the success of such organisations. The chapter has detailed rationale and gathered literature used in the development of methods and the collection of data from selected and interviewed operations. Subsequently, the results gathered from interviews and site visits have been presented in several emerging themes: social enterprises, related standards and legislation, access to equipment, important relationships, and targets.

Some key points to consider from the results of this chapter include:

- Financial support of the integrated social enterprises was universally reported by interviewed organisations to be highly beneficial to the preparation for re-use of WEEE and its success in each country.
- Adherence to standards, specifically international ones such as PAS 141, is of importance to the success of interviewed preparation for re-use organisations.
- Demand was not reported as a barrier. However, a lack of access to the supply of good-quality material serves as a significant barrier to preparation for re-use of WEEE.
- Interviewed organisations that do not report access to good-quality WEEE streams as a significant barrier at the current time attribute the overcoming of this barrier to a positive relationship with the respective PROs or compliance schemes, which control the flow of materials.
- All interviewed organisations collect material at a point as close to the end user drop-off as possible, varying from door-to-door collection at end user homes to pick-up from end user drop-off points, most commonly municipal collection points.

- When the system largely came to a standstill in Spain, targets were necessary to ensure the flow of materials to preparation for re-use organisations.

4 Irish Stakeholder Analysis

4.1 Introduction and Methods

This chapter describes the input from stakeholders in preparation for re-use within Ireland and is essential in understanding how the Irish system has similarities and differences with other EU Member States, taking into account any unique circumstances. Interviews were conducted similarly to those in Chapter 3, with representatives from four main categories: preparation for re-use organisations, PROs, recycling operations and consolidation points, and WEEE collection points. Social enterprise was added as a stakeholder on account of the high incidence of involvement in other EU Member States. Interview guides (Appendix 1) were developed from relevant information gathered in the literature review and EU analysis sections of this report for each stakeholder type and were provided to stakeholders prior to scheduled interviews. Both telephone and in-person interviews were recorded and transcribed, with summaries of interviews subsequently provided to interviewees for review and clarification where appropriate. The results are presented in the following section, grouped by category of organisation.

4.2 Interviews

4.2.1 *Preparation for re-use organisations*

At the time of writing this report, two organisations, Rehab Recycle and Phoenix Recycling, have been successfully approved to conduct the preparation for re-use of WEEE. Similar themes to those found across other EU organisations emerged during the interviews with Rehab Recycle and Phoenix Recycling, despite the differences between the Irish system and those of other countries.

The first notable difference is that of the funding of preparation for re-use organisations. Although both Irish organisations could be considered social enterprises through their missions of employing people with disabilities and long-term unemployed individuals, nearly all income for the organisations is obtained through commercial activities. External funding was reported to exist only in wage subsidies

for those employed through a scheme, reported by Rehab Recycle to amount to just under half of the hourly rate provided to such employees. Thus, preparation for re-use in Ireland is entirely dependent on the commercial activities of these companies and therefore their access to materials.

While many of the organisations across the EU had multiple focuses in regard to materials prepared for re-use, the Irish organisations are unique in that their commercial activities in re-use of business-to-business WEEE predated their involvement with WEEE, with preparation for re-use being added more recently as a new opportunity. Because of the capacity of this previous involvement, Rehab Recycle and Phoenix Recycling were able to demonstrate the requirements for PAS 141 certification. While this process, along with the further requirements for becoming an approved preparation for re-use organisation, is comprehensive, neither organisation reported this as a barrier to their specific success in the area.

The biggest barrier reported by both organisations is hesitation from or poor communication with PROs, largely involving a lack of access to suitable materials. Although Rehab Recycle had already been approved in 2015, the first access to material was not supplied until July 2016. Similarly, Phoenix Recycling, having been approved in the summer of 2016, has not reported access to a suitable quality or quantity of material, although access has been opened in an official sense.

To alleviate concerns over the quality of material, it is recommended by both organisations that material should be sorted at the earliest possible point to limit any damage, with Rehab Recycle noting the process of “cherry-picking” suitable materials prior to their being handled further and Phoenix Recycling suggesting the importance of educating as far back as consumers, specifically at civic amenity sites, to preserve the quality of material suitable for the preparation for re-use process. Segregating materials at retailers was also strongly recommended and the importance of weatherproofing facilities will also be essential in ensuring the least amount of damage prior

to access of the materials by preparation for re-use organisations.

4.2.2 *Producer representative organisations*

Interviews were conducted with the two compliance schemes representing producers and controlling the flow of WEEE nationwide, ERP and WEEE Ireland. Both schemes are highly invested in placing materials into the hands of the proper organisations and preventing the leakage of materials out of the formal system. This concern was noted to be high for ERP, along with a necessity for a level playing field between the two compliance schemes to ensure that all organisations are required to supply the same services regarding preparation or re-use. WEEE Ireland included further concerns. WEEE Ireland stresses that the Irish system, both culturally and in regard to the composition of producers (few true producers and mostly representative organisations on the ground), differs from that of the EU, and the scheme is unsure if the question of how preparation for re-use of WEEE enhances circularity on an Irish scale has been addressed thoroughly and appropriately, suggesting a greater focus on the re-use of materials prior to entering the waste stream, thus hopefully requiring a lesser focus on the formal preparation for re-use activities. A large amount of work has gone into reaching recycling targets, and it is important that any changes to the system do not jeopardise these efforts and that new systems need to be commercially sustainable. Both gave strong support for a highly regulated and structured system for the passage of materials through the waste stream to preparation for re-use organisations. Both schemes acknowledge and support the effort put into establishing this system in Ireland to ensure that WEEE destined for preparation for re-use is supplied only to competent organisations with the means to turn that equipment around appropriately, accomplished through the approval process set forth by the PRL. Furthermore, ERP describes the system as functional on paper but with room for improvement in practice, with concern over the lack of preparation for re-use equipment on the market after such a period of time.

The schemes are aware that preparation for re-use organisations are not satisfied with the quantity of good-quality material being provided to them, further highlighting the point that there is something lacking

in the practice of the system, although the system is functional on paper. It is agreed that if the system is to work, organisations must be provided with more and better equipment. To solve this problem in practice, ERP suggests that it may be necessary to allow access to materials closer to the consumer, where all parties are agreed that the highest quality material can be found. WEEE Ireland notes that suitable material can be difficult to obtain farther down the waste stream, and ERP notes that the farther waste travels down the stream, the less likely it is to be fit for purpose. Both compliance schemes presented a number of suggestions on how this may be achieved:

ERP

- Allow access to civic amenity sites to preparation for re-use organisations and explore the opportunity to allow access to retailers as well, although the latter is felt to have potential for conflict.
 - An effort has been made to successfully limit the leakage of WEEE from the formal system, and restricting access to only those approved and certified by the governing authority will preserve this effort.
 - Along these lines, the scheme is committed to following the aims of the Department of Communication, Climate Action and Environment and will limit or supply access as legislation permits.
- Educate civic amenity site staff on the process for preparation for re-use of WEEE, the importance of the process and how best to support the process; and establish a sense of personal investment in supporting the process.
 - This approach has been successful for ERP in Northern Ireland.

WEEE Ireland

- Enhance the educational approach taken to consumers and place some responsibility on them to understand the products they leave behind.
 - Source preparation for re-use materials from collection days, where the material has been passed directly from the consumers to the schemes and can therefore be properly assessed for suitability for preparation for re-use on collection.

- WEEE Ireland is not entirely opposed to opening access at civic amenity sites, but it is also not in outright support, because, as a business, it has concerns over leakage, particularly at civic amenity sites, and is mindful of the needs of retailers.
 - If retailers are to be included, perhaps they could be empowered through support such as financial incentives from the We'll Take It Back marketing fund or a similar programme, or a sticker system to streamline the process of identifying suitable material.
 - Empathy and understanding for the operational logistics on the ground will go a long way in ensuring the success of preparation for re-use.

With regard to the motivations of the compliance schemes to engage with preparation for re-use, ERP reports their motivation through making a commitment to follow the legislation and the needs of the Department as well as the desire for the scheme to function above and beyond what is strictly required of them within the legislation. WEEE Ireland notes that incentives could provide motivation to encourage preparation for re-use and would be most effective at the producer level, rewarding producers who participate in supporting these initiatives.

4.2.3 Recycling operations

KMK Metals Recycling Ltd serves as a representative of an organisation recycling WEEE and of a consolidation point for WEEE collected by the compliance scheme from retailers and civic amenity sites. Firstly, KMK acknowledges the consideration of the market for re-used goods, stressing that the modern technology and energy ratings should be taken into account when using re-use to achieve sustainable development. With this in mind, the recycler has engaged an electronics engineer to evaluate the potential for flat panel displays as a target material for preparation for re-use. It notes that the positive implications of becoming involved in preparation for re-use are conducting a desirable activity as a well-focused company, making the best use of resources and filling a demand for products, and that the negative implications are the cost of product liability insurance and the difficulty of obtaining

product information from the original producer. In consideration of the potential for involvement in this sector, KMK supports the approval process for preparation for re-use operators, noting the requirement for achieving PAS 141 certification as an essential point for gaining acceptance from original manufacturers, as well as preventing the illegal export of WEEE.

As a consolidation point for collected WEEE, KMK is invested in this process and encourages communication between involved parties to identify and provide the most appropriate equipment. In regard to separate logistics for items to be prepared for re-use, the organisation notes that this possibility requires the support and goodwill of the compliance schemes, as those who pay for such processes, and thus this extra cost must be retrievable from the value of the prepared for re-use products. KMK stresses the importance of cooperation between the producer and preparation for re-use organisations and in an ideal scenario envisages producer support in areas such as supply of damaged or obsolete goods, manuals, spare parts, test programmes and reverse logistics. It believes that, without the support and understanding of producers, preparation for re-use exists in a grey zone, and that this zone must be regulated to build cooperation between parties. However, it also noted that, while there are benefits in brand accessibility and reputation as a goodwill organisation for original producers encouraging preparation for re-use, these benefits may not be applicable to the more common trading organisations operating in Ireland.

Lastly, this interview makes the important observation of the need for developing systems that measure the re-use of EEE prior to it entering the waste stream, which is currently a largely unmeasurable, and therefore underregulated, activity outside the formal sector.

4.2.4 Collection points

Retail Excellence Ireland

Speaking as a representative of the Irish retailer, Retail Excellence Ireland reported the lack of opportunity for re-use seen by retailers, who view the value of WEEE to lie in the price given for scrap and may feel concern over other parties putting WEEE that has been

prepared for re-use into the market as competitors. However, the largest concern for retailers in relation to WEEE is the cost associated with the take-back collection required within stores, storage and handling of collected WEEE. This cost, including costs for the establishment of secure storage areas, insurance, and health and safety measures, was reported to be considered excessive and likely to currently be resulting in retailers losing money. Segregation of waste does occur on site at retailers; however, this segregation is conducted by size of equipment, as the payment rates per tonnage differ between large and small equipment. The main goal of the retailer regarding WEEE is to move the equipment to the next point as quickly and at as low a cost as possible, as retailers often see the WEEE as a distraction to other business activities. Thus, the retailers would probably have no objection to preparation for re-use organisations collecting the materials directly from their sites in place of collection by compliance scheme contractors. However, the shops would probably be resistant to requests for further segregation of suitable materials following original collection from the consumer. Incentives offered to encourage such behaviour would need to ensure that the costs to the retailer are covered and they would also need to outweigh the feeling that such behaviour benefits a potential competitor.

Civic amenity site(s)

Representatives at Mungret Recycling Centre in Limerick expressed willingness to work with compliance schemes and preparation for re-use organisations on separating WEEE fit for preparation for re-use on site. Similar schemes for re-use of other items (e.g. bicycles, paint, books) are currently successful at the recycling centre. From first-hand experience, material best suited from collection at civic amenity sites is reported to be LHA, with the possibility of including televisions and vacuum cleaners, also noting that the highest quality material and IT equipment would be better sourced from businesses/retailers. It is suggested that material taken from end users at civic amenity sites should be collected at the gate and stored in a secure and weatherproof container to prevent damage and scavenging. It is suggested that any new schemes are best introduced

in January to allow time to prepare adequately for the busier season.

4.2.5 Others – social enterprise

Because of the high involvement of social enterprise in preparation for re-use systems across Europe, it is imperative to include Irish input in this category. Currently, both preparation for re-use organisations function with no support for social activities beyond wage subsidies for individuals entering employment through a scheme. However, as previously mentioned, both organisations function with a social goal to employ individuals who may otherwise have difficulty in seeking employment. Community Re-use Network Ireland (CRNI), a network of which Rehab Recycle is a member and with which Phoenix Recycling is in communication, provided input on behalf of social enterprises in this section. CRNI is very supportive of the involvement of social enterprise in the preparation for re-use of WEEE, and it added that social enterprise best benefits re-use in that positions involved in this process are often highly labour intensive, involving a very broad range of skills, and tend to be successfully filled through social enterprise models. In turn, re-use supplies a significant amount of jobs and training for those availing themselves of these employment schemes, creating more than 690 reported jobs in the re-use sector compared with the fewer than 10 jobs that may have been created to handle the same material as waste in a landfill. These numbers are attributed to re-use outside the waste stream, which sees a much higher involvement of social enterprise in Ireland, while the same concepts apply to both sectors.

4.3 UpWEEE Irish Stakeholder Analysis – In Review

This chapter has presented the results of interviews with stakeholders in the Irish preparation for re-use of WEEE system, including those that initially collect WEEE from end users, those that transport and consolidate WEEE, those that treat the WEEE that is to be put back onto the market as a prepared for re-use item, and those that are responsible for controlling the WEEE throughout the process. The relevant information gathered from each interview has been recorded and summarised here.

Some key points to consider from this chapter include:

- The approval process for preparation for re-use organisations, although extensive, is well received.
- Funding for preparing for re-use of WEEE operations as social enterprises is very limited in comparison with European equivalents.
- Receipt of a suitable amount of good-quality WEEE fit for the purpose of preparation for re-use by preparation for re-use organisations has not thus far occurred.
- Best quality material is generally accepted to be obtained as close to the end user as possible; all parties are open to exploring access to this material at point of collection by approved preparation for re-use organisations.
- Civic amenity sites are open to separating material on site; however, retailers may be more hesitant on account of the extra costs.

5 Product Review

5.1 Introduction

According to the WEEE Directive, product design should not deliberately hinder re-use or recycling. However, it does not provide any concrete insight into what such design features might be. This section of the report considers such design features, identifying key features and aspects of product design that would facilitate product re-use, since products that are modular and repairable are better suited to re-use.

The most effective method for dictating environmental criteria for product design is arguably through the EU Eco-design and Energy Labelling Framework Directives, which include specific “ecological criteria” for different product categories in their implementing measures. To date, these have largely focused on energy consumption in the use phase for the various product categories being considered. However, the mandate from the Framework Directive is to consider the entire product life cycle.

Therefore, a scientific analysis of the impact of specific design features for key product groups is presented in this chapter of the report. For the purposes of this project, the key product groups identified were washing machines and dishwashers in the LHA category and computers, mobile phones and tablets in the ICT category. The data gathered on these product groups can then be used to inform the preparation of the relevant implementing measures necessary to ensure that the products would better support re-use.

Section 5.2 of this report details the Eco-design and Energy Labelling Directives in more detail, describing the legislation, implementing measures and current status. Section 5.3 considers the case of household washing machines and dishwashers and the current Eco-design Directive. Section 5.4 considers the equivalent directive implementing measures for ICT equipment.

Section 5.5 presents a review of product design options for the LHA/washing machine class, reviewing preparation for re-use data and studies for these appliances. Section 5.6 presents a comparable review of ICT devices, predominantly focusing on mobile phones and computer tablets. Finally, the review of

both of these products and the recommended product design modifications resulting from this analysis are presented in section 5.7.

5.2 Eco-design Directive and Energy Labelling Directives

The EU legislation on eco-design and energy labelling establishes a framework to set mandatory ecological requirements for EuPs and ErPs sold in all EU Member States. The Eco-design Directive (2009/125/EC) lists products identified by the Council and the European Parliament as priorities for European Commission implementing measures. The Energy Labelling Directive (2010/30/EU) provides a complementary set of labelling guidelines and requirements for products that meet these performance objectives, such that they are immediately recognisable and identifiable in the marketplace.

The original Eco-design Directive, EU Directive 2005/32/EC, establishes a framework for the setting of eco-design requirements for EuPs and is commonly referred to as the EuP Directive. It prioritised EuPs using electricity or fuel and set out provisions for allowing products to be placed on the market. Mandatory, technical eco-design requirements were set through product-specific regulations called “implementing measures”.

The second Eco-design Directive (2009/125/EC) has an extended scope that also covers ErPs. The extended Directive includes both EuPs and ErPs. EuPs are those products that use, generate, transfer or measure energy (e.g. electricity, gas, other fossil fuels), whereas ErPs are products that do not necessarily use energy but have an (direct or indirect) impact on energy consumption and can therefore contribute to saving energy. The Directive sets out the requirements that these ErPs must meet in order for them to be placed on the market and/or put into service within the EU.

Both directives are framework directives, according to which mandatory product requirements are set through specific regulations or implementing measures for each product group. The Eco-design Directive lays

down a framework for the European Commission, assisted by a Regulatory Committee, to set eco-design requirements for ErPs. It is one of the priorities of the European Economic Recovery Plan.²²

The Directive now provides policymakers with a toolset to be used for improving the environmental performance of products. By promoting better, environmentally friendly and more energy-efficient designs and products, it hopes to eliminate the lower performing products in these fields from the market, with a goal of significantly contributing to the EU 2020 energy efficiency objective. It is also advertised as a support tool for improving industrial competitiveness and innovation through the promotion of better environmental product performance throughout the EU Market.

The Directive also aims to contribute to sustainable development by increasing energy efficiency and the level of protection of the environment, while at the same time increasing the security of the energy supply. According to the Directive, preventative actions should be taken as early as possible during the design phase of ErPs, as it is understood that the pollution caused during a product's life cycle is determined at this stage, with most of the associated costs involved being committed then (Wang *et al.*, 2015). According to an Ecofys study, the main advantages of the Eco-design Directive include increasing the EU's security of supply, creating jobs and helping achieve the EU mid- and long-term climate and energy objectives (Molenbroek *et al.*, 2012).

The first Working Plan of the Eco-design Directive was adopted on 21 October 2008. It established a list of 10 product groups to be considered as priorities for implementing measures in the timeframe 2009–2011:

1. air-conditioning and ventilation systems, including air-conditioning system pumps;
2. electric and fossil-fuelled heating equipment;
3. food-preparing equipment;
4. industrial and laboratory furnaces and ovens;
5. machine tools;

6. network, data-processing and data-storing equipment;
7. refrigerating and freezing equipment;
8. sound and imaging equipment;
9. transformers;
10. water-using equipment.

The Eco-design Working Plan 2009–2011, established in COM(2008) 660, sets out a list of ErPs that are the priorities for the adoption of implementing measures. The Eco-design Working Plan 2012–2014, followed by the newest version in 2016–2019,²³ was adopted by the European Commission at the end of 2012. It adds a few new ErPs to the list of the Working Plan 2009–2011. Of these, nine implementing measures have been adopted to date, with several preparatory studies ongoing or completed.²⁴

Within the Directive, there are requirements that have to be met before a product category can be considered for inclusion under the Eco-design Framework. Products will be included if they:

- sell more than 200,000 units per year in the EU;
- have a significant environmental impact;
- have the potential for significant improvement.

On the implementation side, measures proposed under the Framework Directive must not have a significant negative impact on:

- a product's price;
- a product's functionality or performance;
- the competitiveness of industry within the EU.

National contact points exist across all EU Member States for the implementation of the Eco-design Directive and for associated market surveillance under the Directive. The scope of the Directive currently covers more than 40 product groups (including boilers, lightbulbs, and EEE such as televisions and fridges). The ultimate aim of the Directive is for manufacturers of EuPs to be obliged, at the design stage, to reduce the energy consumption and other negative environmental impacts of these products.

22 http://ec.europa.eu/economy_finance/publications/publication13504_en.pdf (accessed 10 January 2018).

23 https://ec.europa.eu/energy/sites/ener/files/documents/com_2016_773_en_.pdf (accessed 10 January 2018).

24 EU Commission Enterprise and Industry pages on Products – <http://ec.europa.eu/growth/> (accessed 10 January 2018).

Both of these are framework directives, meaning that they do not directly set minimum ecological requirements. Instead, they are to be adopted through specific implementing measures for each group of products under the scope of the directives. The implementing measures are then adopted through the so-called comitology procedure, implemented based on EU internal market rules governing which products may be placed on the market. Manufacturers who begin marketing an EuP covered by an implementing measure in the EU area have to ensure that it conforms to the energy and environmental standards set out by the measure. In practice, this means that the introduction of a new minimum requirement specification effectively bans all non-compliant products from being sold in the EU from then on.

Finally, under the Eco-design Directive, voluntary agreements may also be implemented by any interested parties. It is envisaged that these self-regulating agreements may achieve the eco-design policy objectives more quickly or at lesser expense than mandatory requirements. To this end, industry companies, sectors, etc., may propose voluntary agreements as alternatives to potential eco-design regulations. Such agreements need to fulfil specific criteria of the Eco-design Directive and are assessed and monitored by the European Commission. To date, these have not proved to be very popular with industry.

5.3 Energy-related Products and Washing Machines/Dishwashers

Energy labelling of household washing machines was addressed in Commission Directive 95/12/EC implementing Council Directive 92/75/EC. Household dishwashers were also addressed in Commission Directive 97/17/EC, which implemented Council Directive 92/75/EC with regard to energy labelling of household dishwashers. Unlike other domestic appliances, such as cold and freezing categories, household dishwashers and washing machines are

not subject to requirements regarding minimum energy efficiency or other performance aspects.

A draft Commission Regulation implementing Directive 2009/125/EC with regard to eco-design requirements for household washing machines is currently under development and review.²⁵ Since recent market transformation calls for a revision of the labelling scheme, the Action Plan for Energy Efficiency: Realising the Potential²⁶ identified “wet” household appliances (i.e. household washing machines and dishwashers) as one of the 14 priority product groups for which an update of the existing labelling together with minimum energy performance standards should be adopted.

To accomplish this, the proposed approach to implementing eco-design measures for household dishwashers has been structured into four distinct stages:

1. Assessment of the criteria for an eco-design implementing measure as set out in Article 15(2) (a)–(c) of the Eco-design Directive, taking into account the eco-design parameters listed in Annex I and the method for setting specific requirements laid down in Annex II of the Eco-design Directive. This involved carrying out a technical, environmental and economic analysis (or “preparatory study”) of household dishwashers.²⁷ The main findings of the study were that household dishwashers are placed on the EU market in large quantities, that the environmental impact of household dishwashers is to a large extent related to the consumption of electricity and water during use and remains significant despite ongoing improvements, and, finally, that technical cost-effective solutions exist that could lead to significant improvements.
2. Consideration of relevant EU initiatives, market forces and disparities in the environmental performance of equipment on the market with equivalent functionality, as set out in Article 15(2)

25 https://ec.europa.eu/energy/sites/ener/files/documents/comm_native_sec_2010_1354_1_en_impact_assessment.pdf (accessed 10 January 2018).

26 <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV%3A127064> (accessed 10 January 2018).

27 Preparatory study for eco-design requirements of EuPs, Lot 14: “Domestic Dishwashers and Washing Machines”. Available online: [http://susproc.jrc.ec.europa.eu/Dishwashers/docs/JRC106993_Prepstudy_DW_%2020171116%20\(3\).pdf](http://susproc.jrc.ec.europa.eu/Dishwashers/docs/JRC106993_Prepstudy_DW_%2020171116%20(3).pdf) (accessed 10 January 2018).

of the Eco-design Directive. To this end, relevant EU and national environmental legislations were considered. The findings of the study²⁸ include an impact assessment of energy labelling (combined with voluntary commitment by industry), which notes that in addition to phasing out the least efficient household dishwashers, they have improved their energy efficiency by some 35% in the last 10 years, with the EU Energy Label becoming one of the most important market drivers. This means that 90% of household dishwashers are now in the highest energy efficiency class of energy labels. Moving forward, the study finds that the appliances should be covered by an eco-design implementing measure, complemented by an upgraded energy labelling scheme.

3. Establishment of policy objectives, including the desirable level of ambition, the policy options to achieve them and the key elements of the eco-design implementing measure, as required by Annex VII of the Eco-design Directive. The level of ambition for improving the environmental performance and electricity consumption was to be determined by an analysis of the lowest life-cycle cost for the end user. Furthermore, benchmarks for technologies yielding best performance were considered.²⁹ From this, means to trigger a market transformation to realise the improvement potential were considered. Several policy options were investigated, including self-regulation, revision of the energy labelling and the introduction of minimum energy performance requirements.
4. Assessment of the impact on the environment, consumers and industry, with a view to the criteria for implementing measures set out in Article 15(5) of the Eco-design Directive. An analysis of the proposed implementing measure was carried out. It concluded that the most significant environmental impact of household dishwashers

is their energy consumption during use, and sub-options for gradual eco-design requirements together with revised energy efficiency classes were analysed.

Washing machine energy labelling Regulation 1061/2010 calls for a review of washing machines in the light of the technological progress in the market to date and an assessment of verification tolerances. The associated Eco-design Regulation 1015/2010 calls for an associated review “in light of technological progress” and associated issues such as an assessment of eco-design requirements.

The European Commission is currently revising the eco-design and energy/resource label implementing measures for the product group “household washing machines (WM) and washer-dryers (WD)”. The revision study for these products is being coordinated by the European Commission’s Directorate-General (DG) Environment and DG Energy, and is undertaken by the Commission’s Joint Research Centre (JRC) with technical support from the Öko-Institut and the University of Bonn. The JRC is presently completing a comprehensive analysis of household washing machines and washer dryers, leading to the development of a methodology for the eco-design of ErPs (MEErP). This will include the collection, processing and production of environmental, economic and technical information. The draft version of the resulting study on material efficiency is available from the JRC website³⁰ and will be published soon. Based on this evidence, the existing eco-design, labelling regulations and impact assessment will be revised in the light of these findings.

The draft preparatory studies on washing machines³¹ and dishwashers³² are both available online for review. The research utilises a life-cycle thinking approach using available scientific information and data, and engages product experts to discuss key issues and develop wide consensus. The current working document focuses on the definition and

28 Commission Directive 97/17/EC amended by Commission Directive 1999/9/EC implementing Directive 92/75/EEC with regard to energy labelling of household dishwashers.

29 Developed in the preparatory study and the discussions with stakeholders during the meeting of the Eco-design Consultation Forum on 4 December 2008.

30 <http://epica.jrc.ec.europa.eu/?p=1452> (accessed 10 January 2018).

31 http://susproc.jrc.ec.europa.eu/Washing_machines_and_washer_dryers/documents.html (accessed 10 January 2018).

32 <http://susproc.jrc.ec.europa.eu/Dishwashers/documents.html> (accessed 10 January 2018).

assessment of environmental and economic “base” cases for the product group, the selection of design options implementing best available technologies to improve the environmental impact for this product group, and environmental and economic assessment of these design options. In addition, the report also considers some technologies, which are currently not available or in development, but which are envisaged to have a dramatic impact on this product group. Finally, the working document analyses government policies and assesses different scenarios, preliminary impact assessment for industry and consumers, and sensitivity analysis of the main parameters to finally derive main policy recommendations per product.

5.4 ErP and ICT

Users of ICT, including computers, tablets, phones, displays, imaging equipment and servers, are some of the fastest growing electricity end users in the EU and worldwide.

EU Commission Regulation No 617/2013 of 26 June 2013 details the eco-design requirements for computers and computer servers. As is the case for washing machines and dishwashers, computers and other ICT equipment have also been identified as one of the 14 key product groups for consideration under the EU Action Plan for Energy Efficiency and will adhere to the same multi-step process outlined in section 5.3.

Council Decision 2006/1005/EC and Regulation (EC) No 106/2008 on a Union energy-efficiency labelling programme for office equipment is currently implemented through the ENERGY STAR programme in the EU. ENERGY STAR is an integral part of the EU’s energy efficiency policy, as set out in the Action Plan for Energy Efficiency. It aims to “pull” the office equipment market towards greater efficiency and it thus complements the Eco-design Directive 2009/125/EC.

With regard to ICT, the preparatory study on personal computers and computer tablets is ongoing and stakeholder consultations took place in early 2017.³³ No actions are ongoing or about to start for smartphones at present.

5.5 Product Design – Washing Machines

From 4 November 2013 to 30 June 2014, Rehab Recycle conducted a LHA WEEE preparation for re-use trial at its site in Ballymount. The aim of the trial was to determine the viability of preparation for re-use for LHAs from the post-collection B2C WEEE stream. The Ballymount trial was instigated to investigate the preparation for re-use process, consider the logistics and implementation issues of such a process, and identify necessary parameters for the successful implementation of such a system on a larger scale going forward.

The LHA preparation for re-use trial at Ballymount used a multi-stage visual and functional assessment process to evaluate the re-use potential of LHA WEEE that was delivered to Ballymount for recycling. A number of units were selected across the duration of the trial for preparation for re-use and subsequently prepared to market standards as re-used appliances. Figure 5.1 shows the five-step methodology adopted by Rehab Recycle for this project.

The project specifically focused on the viability of refurbishing unwanted/waste washing machines/LHA appliances discarded by the end user. Difficulties with refrigerator gas management in cold WEEE (fridges and freezers) excluded these appliances from this trial. Excessive and specialised labour requirements precluded hobs, ovens and cookers from the study. Similarly, no gas-powered appliances were to be considered for refurbishment.

Figure 5.2 shows the process flow model used during the Rehab Trial for the refurbishment and re-use of selected LHA washing machine appliances during the study. During the trial, LHA WEEE was examined upon entry to the Ballymount recycling centre and pre-inspected for potential re-use. WEEE passing pre-inspection then underwent a full visual inspection and functional assessment to definitively decide if the appliance was eligible for preparation for re-use. If so, a travel card was assigned to document the appliance’s preparation for re-use status and its subsequent passage through associated repair and testing phases. If the appliance failed any of these stages, it was optionally harvested for re-use parts

³³ <https://computerregulationreview.eu/planning> (accessed 10 January 2018).

1	Definition of the scope of the study
2	Development of the Process Flow Model
3	Data Gathering
4	Analysis of Data & Derivation of Results
5	Recommendations

Figure 5.1. Ballymount preparation for re-use trial methodology.

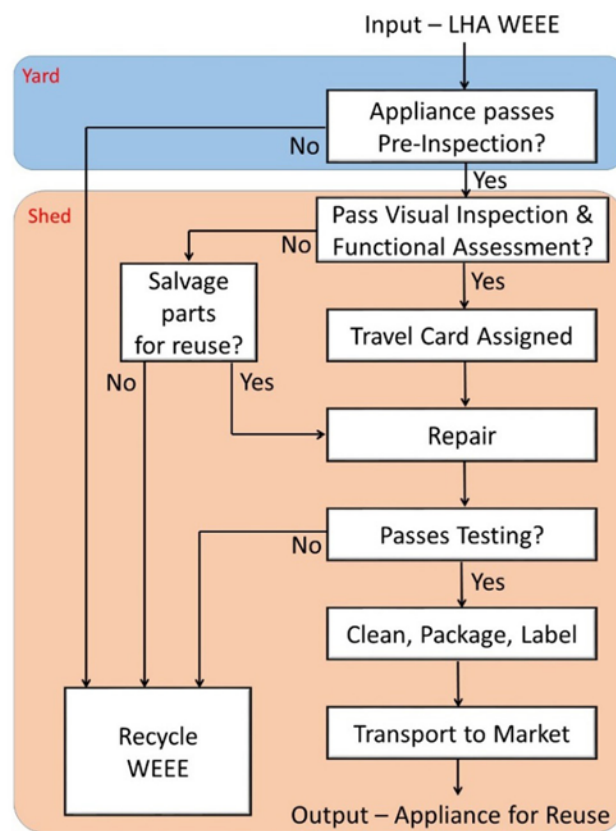


Figure 5.2. Ballymount preparation for re-use trial process flow diagram. Image reproduced courtesy of Rehab Recycle Ltd: www.rehabrecycle.ie.

before being re-assigned for recycling. Appliances that were successfully prepared for re-use were then cleaned, labelled and packaged before being shipped to market for sale as re-used/refurbished appliances.

Figure 5.3 shows the percentage of LHA WEEE that was selected each week during the trial for subsequent testing (visual inspection and functional assessment). The figure graphs the number of

washing machines visually inspected in the recycling yard of the Ballymount collection point versus the number of machines actually selected for testing for preparation for re-use in the warehouse housing the preparation for re-use trial. As evidenced by the chart, the percentage of appliances for recycling selected at the pre-testing phase each week was approximately 5% across all the weeks of the trial. Note that during

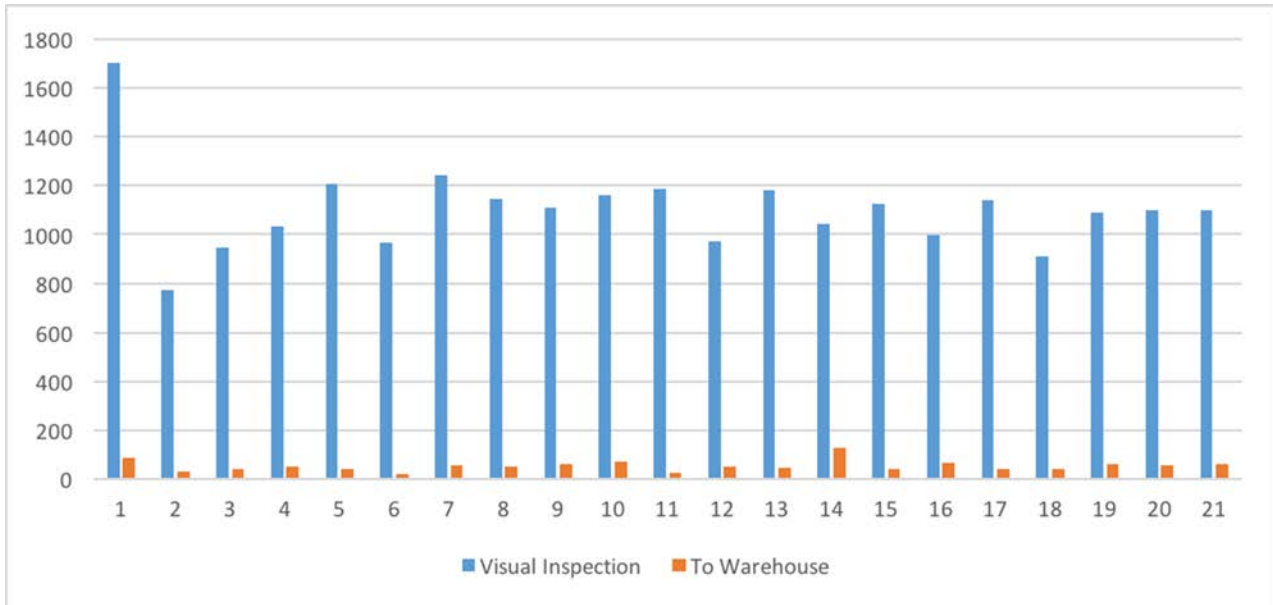


Figure 5.3. Ratio of appliances inspected versus appliances selected for testing during the Ballymount preparation for re-use trial.

week 21 of the Rehab Recycle preparation for re-use trial, no LHA WEEE was inspected or tested because of on-site training of the workforce.

As can be seen from these data, an inordinately small percentage of the LHA/washing machine WEEE that was visually inspected passed the first stage of visual inspection for preparation for re-use. The main reason for this was the condition of the LHA WEEE delivered to the Ballymount yard. Factors such as damage to the structural integrity of the appliance, the presence of (often significant) cosmetic dents, scratches and blemishes, and general transport damage to the appliances meant that, on average over the course of this study, only 4.91% of all LHA WEEE inspected passed the first stage of the trial process flow, i.e. pre-inspection. This is a significant and potentially fatal detractor to any preparation for re-use undertaking of this magnitude, especially when it is considered that the pre-inspection phase is only visual and does not consider the functionality of the appliances in question.

Figure 5.4 shows the number of appliances tested versus the number of appliances that passed assessment and subsequently were repaired, tested and sold as re-used/refurbished washing machines. The trial data show the number of washing machines that passed the second stage of the preparation for re-use process flow employed during this trial. All of the appliances that passed the pre-inspection were

then subjected to a thorough visual inspection and functional assessment, to determine if the washing machine was repairable, if cosmetic repairs or replacements were required, and the associated overheads for such refurbishment.

As can be seen from these data, the average percentage of appliances that pass the functional assessment and visual inspection phase of the preparation for re-use process is 32.49%. While this is a much better return on investment from a preparation for re-use viewpoint (representing one in three appliances re-used as opposed to the 19 in 20 appliances that fail the visual pre-inspection test), this still results in a cumulative repair rate of only 1.42% across all of the appliances inspected throughout the entire duration of the preparation for re-use trial. In other words, only one in approximately 70 washing machines was successfully prepared for re-use during the course of this study.

In total, 23,129 LHA WEEE appliances were visually pre-inspected during the course of this trial. Of these, 1134 machines were selected for inspection and functional assessment in the second step of the trial process. From these, 327 washing machines were successfully prepared for re-use, refurbished and sold as re-used appliances from the trial. Of the remainder, 635 appliances either could not be repaired or failed the testing phase and were recycled, with the

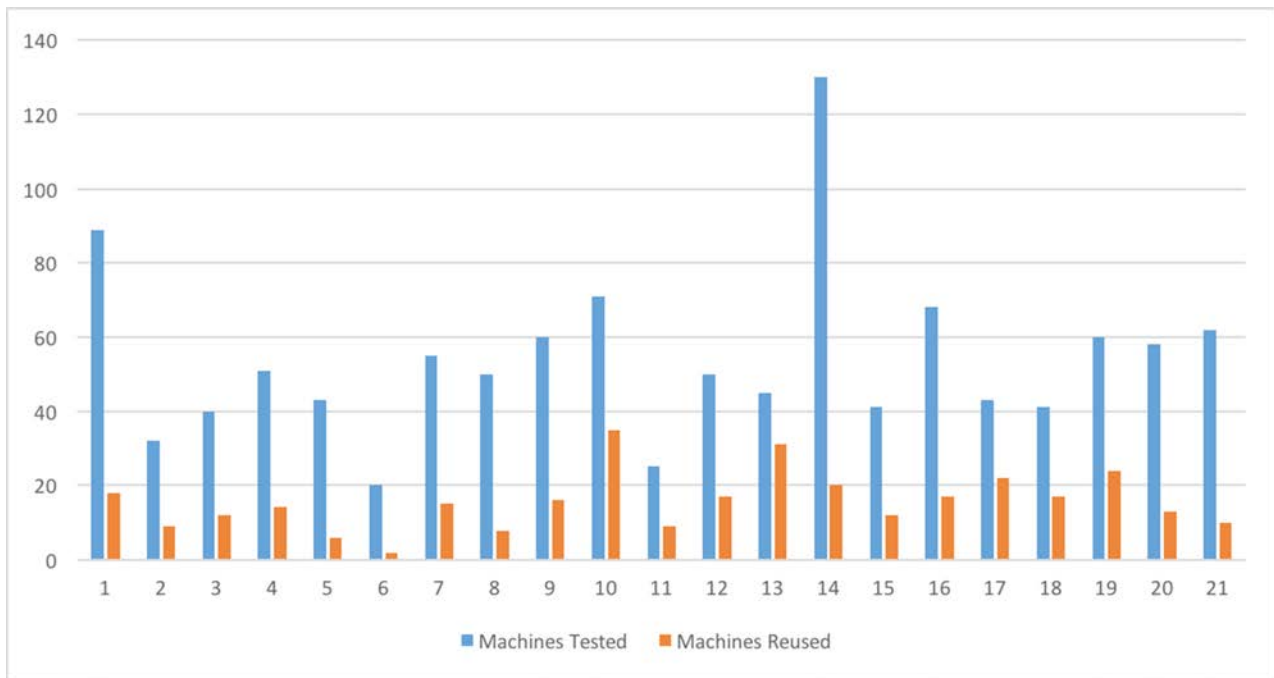


Figure 5.4. Ratio of appliances tested versus appliances successfully re-used during Ballymount preparation for re-use trial.

remaining machines used for spare parts and parts harvesting operations during the course of the trial.

Over the course of the 21-week trial, this represented an average of 1.5% of machines being re-used per week during the trial. These 327 washing machines equate to a figure of 810 washing machines repaired over the course of a year. Based on Eurostat figures from 2014 of 430,024 LHA appliances placed on the market (the latest complete dataset available for the project), this yields a figure of approximately 0.20% of machines being re-used (Eurostat, 2014).

Of the 1134 machines selected for functional assessment, 535 passed assessment and proceeded to the repair and testing stages of the trial. In total, 327 washing machines were successfully repaired, tested and re-labelled as re-used appliances. A total of 660 repairs and refurbishments were successfully carried out on these 327 appliances, as described in Table 5.1.

These repairs are graphically presented in Figure 5.5, which shows the appliance repairs and refurbishments sorted in descending order, followed by “other” repairs, with the most common repairs and refurbishments on the left.

Table 5.1. Summary of all refurbishments completed during the Ballymount preparation for re-use trial

Modification	Total
Brushes	157
New motor	114
Door seal	82
Mains lead	67
Drain pump	47
Door	39
Printed circuit board	22
Heating element	18
Front panel	18
Filter	17
Panels	13
Outlet hose	12
Inlet valves	12
Belt	8
Drum	8
Soap box	7
Cabinet	3
Pressure switch	3
Capacitor	2
Drum bearings	2
Other	9

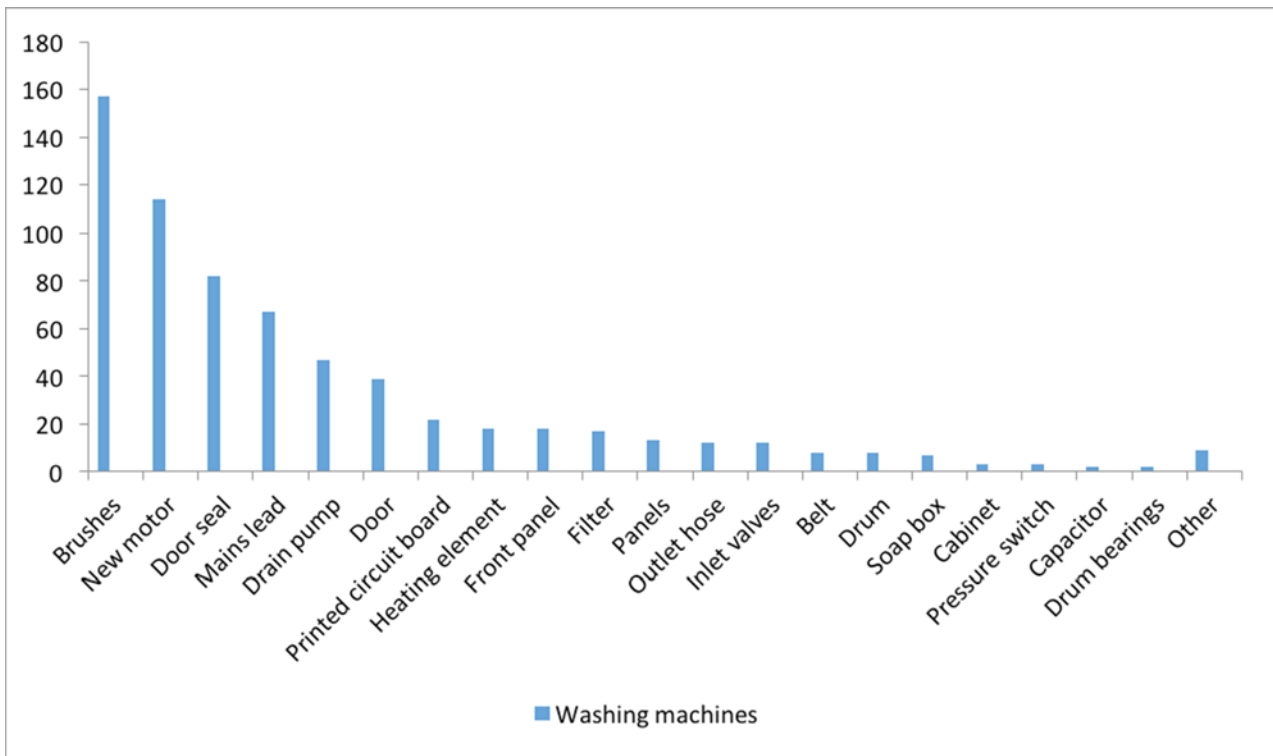


Figure 5.5. Repairs and refurbishments on washing machines during the Ballymount preparation for re-use trial. PCB, printed circuit.

As can be seen from the data, the top six repairs carried out on all the washing machines repaired during this preparation for re-use trial accounted for 76.67% of all the appliance repairs carried out, or approximately three out of every four repairs made. Specifically, the repairs in question were the replacement of motor brushes in existing washing machines, the installation of a new motor, replacement door(s) and/or door seals, installation of new mains leads, and the installation of a new drain pump. All of these repairs are relatively straightforward and easy to implement. If existing product designs were adopted to allow easier access and replacement of these key components, the resulting appliances could be more easily repaired and maintained, resulting in better product lifetimes, re-use potential and overall refurbishment potential going forward.

In addition to these product design findings, the results from the preparation for re-use trial highlighted to Rehab Recycle the range, scope and diversity of washing machine makes and models, especially evident within the offerings of some of the larger washing machine producers. Each of these washing machine models potentially had unique specifications and associated diagnostic requirements, meaning that

the volume of the information required to successfully repair and test all of the models encountered was, in some cases, prohibitive. Furthermore, the lack of publicly available information on some of the washing machine brands/models further hampered repairs, testing and associated production yield in this regard.

Another factor adversely impacting the financial viability of the preparation for re-use trial was the availability and cost of OEM replacement parts for the washing machines repaired during the course of the study. OEM replacement parts for washing machines were not always readily available or easily sourced during this study, and where replacement parts were considered, the relatively high cost of these OEM replacement parts added a disproportionately large overhead to the running costs of the trial.

Finally, a third factor that had a negative impact on the preparation for re-use trial initially was the sourcing of suitably qualified and skilled personnel to carry out the repair, testing and refurbishment operations during the trial. Additional unskilled labour and associated overheads, such as record-keeping, logging of data and asset management, were also required for the duration of the trial, in addition to the skilled refurbishment personnel.

5.6 Product Design – ICT

The second product category identified as having a large potential for re-use and contributing through product design to extending product lifetime and contributing towards a circular economy is the ICT product category, specifically mobile phones, computer tablets and laptops. While these products are not as substantial as LHAs in terms of weight and overall contribution to annual WEEE returns, the sheer volume and number of units sold and employed means that any product design changes and modifications will be magnified greatly in the market.

A comparable preparation for re-use trial for ICT equipment with sufficiently detailed data could not be located in Ireland, so alternative data sources were employed to gain sufficient repair and refurbishment information on ICT equipment to analyse for this study. To this end, repair shop information for ICT was used instead to analyse mobile phone and computer tablet repairs within Ireland in an effort to identify key product components that contribute to the re-usability and reparability of this product group.

Data were gathered for ICT repairs in Pair Mobile shops in Dublin and Limerick for 12 months. In total, 28,203 repairs on mobile phone and computer tablets were logged for the 12-month period: 22,879 in the greater Dublin area and 5324 in the Limerick area. These data were then analysed and examined to identify the key repairs carried out and the number of each type of repair conducted. Table 5.2 shows a breakdown of all these repairs conducted across this period, organised by repair shop location.

Table 5.3 shows the same data normalised to percentages of the total repairs carried out across all shops for the 12-month period. Figure 5.6 shows the same Pair Mobile repair data in a graphical format, sorted by number of repairs in descending order.

Figures 5.7 and 5.8 show the repair data for Dublin and Limerick, respectively, again sorted in descending order of repairs conducted over the 12-month period.

Analysis of the data shows that the top four repairs for the ICT equipment considered are screen and

Table 5.2. Breakdown of all ICT repairs in a 12-month period at Pair Mobile repair shops

Repair type	Dublin	Limerick	Total
Screens	12,112	3517	15,629
Battery	3932	829	4761
Charging	2577	341	2918
Digitiser	1723	224	1947
Buttons	658	99	757
Camera	637	80	717
Cover	573	125	698
Speakers	219	52	271
SIM card	219	27	246
Wi-Fi/antenna	141	8	149
Glass	88	22	110
Total	22,879	5324	28,203

Table 5.3. Percentage of ICT repairs in a 12-month period at Pair Mobile repair shops

Repair type	Dublin (%)	Limerick (%)	Totals (%)
Screens	42.95	12.47	55.42
Battery	13.94	2.94	16.88
Charging	9.14	1.21	10.35
Digitiser	6.11	0.79	6.90
Buttons	2.33	0.35	2.68
Camera	2.26	0.28	2.54
Cover	2.03	0.44	2.47
Speakers	0.78	0.18	0.96
SIM card	0.78	0.10	0.87
Wi-Fi/antenna	0.50	0.03	0.53
Glass	0.31	0.08	0.39
Total	81.12	18.88	100.00

digitiser replacements, along with the installation of new batteries/charging connectors. Between them, these screen-/power-related repairs and refurbishments account for 89.55% of all the mobile phone/computer tablet repairs logged at the repair centre in the 12-month period. ICT product designers wishing to enhance re-usability and reparability in their appliances should focus on making screens and batteries modular and easily replaceable/accessible, and standardising power connectors on these devices.

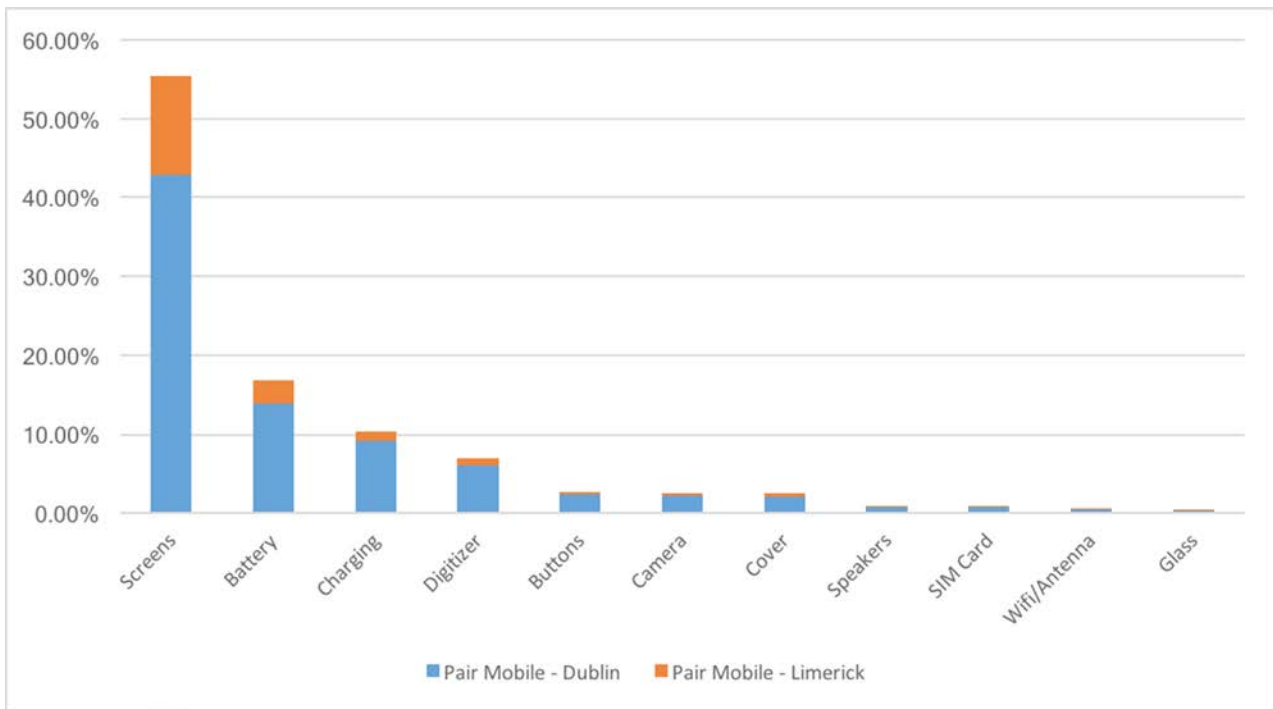


Figure 5.6. All ICT repairs in a 12-month period at Pair Mobile repair shops.

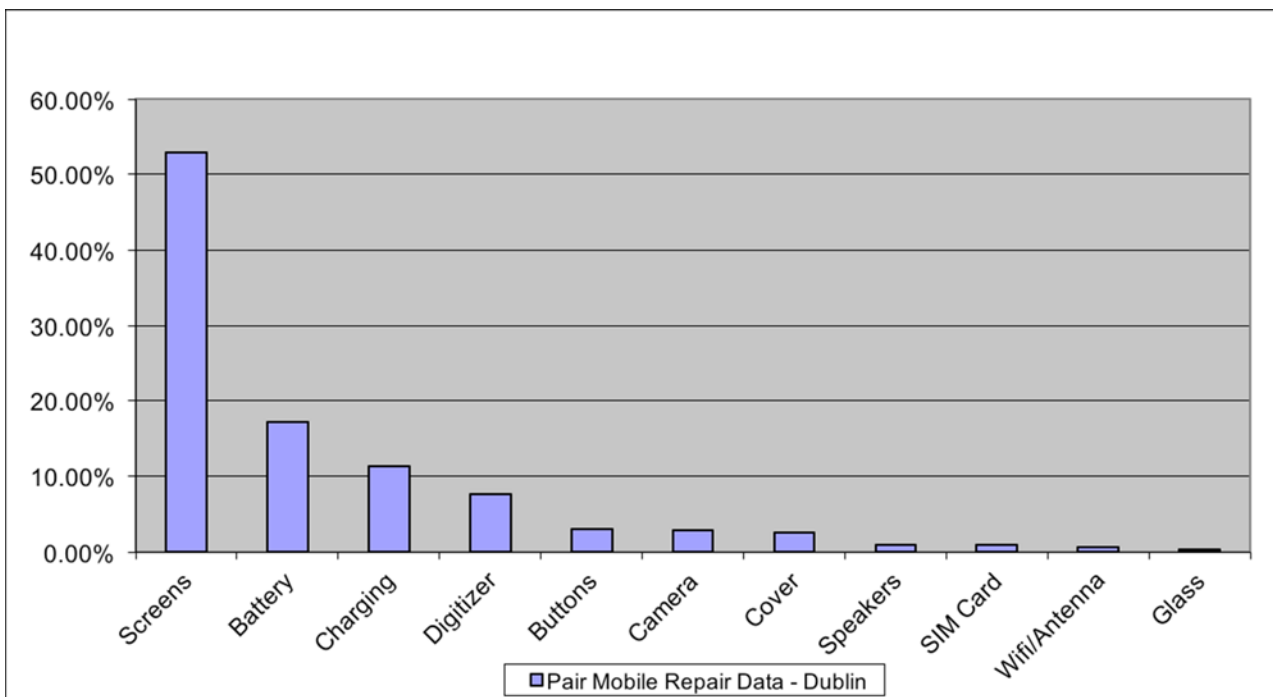


Figure 5.7. Pair Mobile repair shop repairs in a 12-month period by category (%) – Dublin.

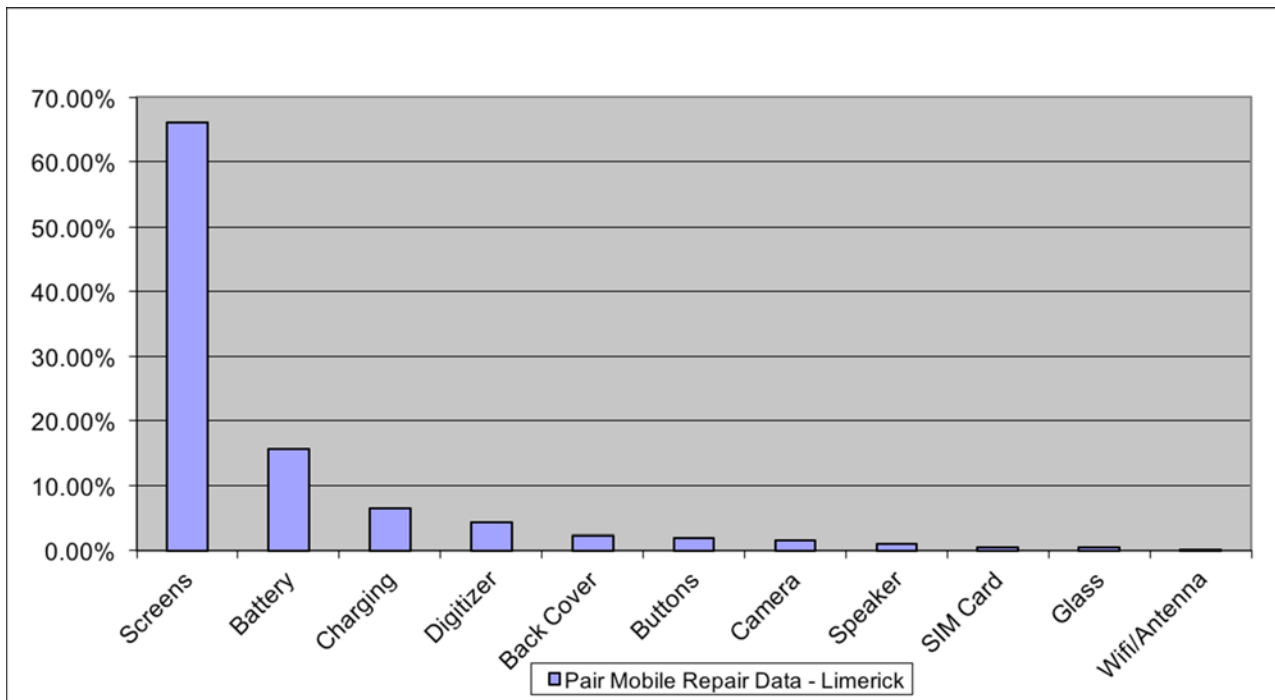


Figure 5.8. Pair Mobile repair shop repairs in a 12-month period by category (%) – Limerick.

6 Conclusions and Recommendations

6.1 Conclusions – Summary of Findings from European Case Studies

Previous research, discussed in detail within the literature review (Chapter 2), has examined barriers to the success of preparation for re-use systems for WEEE within individual countries. Adding to the body of knowledge surrounding the preparation for re-use of WEEE, this study of the systems across five EU Member States (Chapter 3) has allowed the identification of patterns and trends that have emerged in measurably successful systems developed under the WEEE Directive, regardless of differences in national interpretations and cultural behaviour. Because these patterns appear on an international scale, the lessons learned should be applicable and considered when developing any preparation for re-use system established under the rules of the WEEE Directive, as well as supporting those seeking to establish similar systems outside Europe.

6.1.1 Social enterprises

The overarching theme of all preparation for re-use organisations interviewed in the chosen research countries is that of high involvement of social enterprise. While each organisation strives for a self-financing model and reported a high turnaround of some materials, the funding provided, particularly in wages, is of major importance to the success of the systems. It is clear that there is an important relationship between the preparation for re-use organisations, which provide suitable and attainable jobs and training for long-term unemployed individuals and disabled people doing what is often labour-intensive work. An integral relationship with social enterprise can be seen throughout the re-use sector, including within systems for different materials (often with organisations dealing with multiple materials in addition to WEEE) and within the re-use of EEE that has not yet become waste. This is a significant finding and the conclusion is simple: the integration of social enterprise appears to be highly influential in the success of any preparation for re-use, or similarly

re-use, system and should be considered in the development of new and improving systems.

6.1.2 Access to suitable equipment

Beyond the consideration of the importance of social enterprise involvement, previous work from Kissling *et al.* (2013) suggests that one of the strongest barriers to preparation for re-use is access to material. This work also confirmed that access to material is a highly reported barrier across the countries examined. However, in many of the interviewed organisations, this barrier had been addressed at least to some extent. It is largely agreed that the material most fit for purpose can be found at the point closest to the end user and that, the farther down the process equipment travels, and the more it is handled and transported, the higher the chance of it being damaged and no longer suitable to be prepared for re-use. Addressing the degradation of material moving from the consumers to preparation for re-use organisations is a common theme across all five systems examined, with a variety of solutions utilised. The universal solution for the observed scenarios within this study is providing permission for preparation for re-use organisations to access material at the point where the end user has surrendered it, whether that be a civic amenity site, a retailer, the site of the preparing for re-use operation or an end user's own home. This ensures that the amount of material fit for preparation for re-use is preserved and is not lost to damage through unnecessary handling and transport. Article 6 of the WEEE Directive supports appropriate measures limiting potential damage to WEEE due to unnecessary transport and handling, and early separation and access for re-use organisations, specifying that:

Member States shall ensure that the collection and transport of separately collected WEEE is carried out in a way which allows optimal conditions for preparing for re-use, recycling and the confinement of hazardous substances.

EU, 2012

and that

In order to maximize preparing for re-use, Member States shall promote that, prior to any further transfer, collection schemes or facilities provide, where appropriate, for the separation at the collection points of WEEE that is to be prepared for re-use from other separately collected WEEE, in particular by granting access for personnel from re-use centers.

EU, 2012

For example, the Austrian civic amenity sites encourage consumer separation of suitable material, not only preventing additional handling of material, but also investing end users in the success of the system. This “feel-good factor”, and public education, is also highly involved in the Belgian system, and it is an important consideration in ensuring that a greater quantity of good-quality material is received from end users. Options such as collections from home/retailer will need to be considered carefully and will need to be subject to appropriate consultations to ensure the continued buy-in from affected stakeholders and to avoid illegal opportunism.

6.1.3 Compliance schemes and re-use

When addressing concerns and solutions over access to material, all success is dependent on a positive relationship with the compliance scheme responsible for making material accessible. Successful organisations that report suitable access to material note that their most important relationship is that between the compliance scheme and themselves, and that this relationship is essential. It seems that, in the most efficient systems, this relationship is supported by a long history of re-using waste prior to the implementation of the WEEE Directive. For example, the Belgian system, having been established decades prior to the WEEE Directive, utilises the most open system, with WEEE collected door to door and dropped by end users at re-use facilities. This is then all reported back to compliance schemes as evidence, because there is long-established trust and a positive relationship as Belgian re-use operators have long since established a niche in this manner of waste treatment.

However, an interesting example of this relationship is one in which it has not worked. In Spain, support for

preparation for re-use and the accompanying access to the WEEE stream, as called for in the Directive, could only be achieved by establishing targets for producers. As recycling systems were established solely to meet recycling targets, introducing a new system for re-use, with little history and trust established, meant that preparation for re-use was not met with a lot of support. While the legislation dictated the necessity of prioritising preparation for re-use, no soft motivation proved strong enough to disrupt the current system’s preference for WEEE recycling.

It is the view of the project team that, if targets can be met with the existing recycling network, the establishment of preparation for re-use systems will not be given priority by producers, especially considering the disputes between re-use and original producers over competition and concerns over potential increases in the logistical costs. It is an important observation that, in this instance, where the system was not able to establish appropriate prioritisation in compliance with the established waste hierarchy and a history of preparation for re-use was not established, regulatory intervention was necessary.

6.2 Discussion of Findings in an Irish Context

In the context of applying recommendations within Ireland, it is necessary to focus the findings of this report with a discussion of the input from Irish stakeholders, found in Chapter 4. Since the enactment of the WEEE Directive and the 2012 recast, Ireland has moved forward steadily with its attempt to establish a thoroughly designed preparation for re-use system in which the EU legislation is upheld in a way that will function appropriately within the Irish environment. This process involved a great amount of time and effort from a number of bodies, as illustrated in the timeline in Chapter 2. A lot of focus within this process was placed on eliminating potential sources of leakage of equipment out of the formal system, resulting in a detailed process for ensuring that only competent and certified preparation for re-use organisations have access to WEEE from the system. The criteria by which organisations are assessed for certification, with which all stakeholders are satisfied, ensures that organisations preparing WEEE for re-use are held to the highest standards and accountability. As a result of this work, this report concludes that as long as this criterion is kept in place and access to

waste material is granted only to those organisations approved by the appropriate bodies, leakage should no longer be of such great concern with regard to preparation for re-use. Ireland has essentially built this system from scratch, as there is not a history of any similar system functioning prior to it being necessitated by the WEEE Directive. The approval of the two certified preparing for re-use operators, Rehab Recycle and Phoenix Recycling, is because of the success of the process so far. However, as noted in Chapter 4, the system requires further development to increase the volumes and quality of material actually being prepared for re-use.

In line with the findings from the European analysis, the greatest barrier to the continued success of establishing a preparation for re-use system for WEEE in Ireland is access to sufficient volumes of good-quality material. The Irish setup for collection and distribution of WEEE is unique, being influenced and informed by domestic considerations, including high levels of WEEE leakage in the past and the absence of a formal WEEE re-use system. As agreed by all parties, the highest quality of WEEE is found at the point closest to the end user. However, within the current system, WEEE must pass from end users, through a drop-off point, such as a retailer or a civic amenity site, in addition to a formal consolidation point, before it comes into the possession of a preparing for re-use operation. The movement of material through this number of parties and facilities, specifically the storage and handling conditions necessitated by civic amenity site collection and transport, allows a significant increase in the chances of damage to material, resulting in a lower output of WEEE that has potential for re-use upon arrival at a preparing for re-use facility. It is logical to conclude that an adjustment within this system to allow for earlier access to WEEE by approved preparation for re-use organisations will result in a higher yield of good-quality material.

Both European and Irish data gathered in this report support encouraging communication and a positive relationship between preparation for re-use organisations and the compliance schemes through which they gain access to materials. Thus far in the period after the development of a set of criteria for approved preparation for re-use organisations and the approval of Rehab Recycle and Phoenix Recycling, communication between the parties involved has

reportedly been slow and largely unproductive, as the concerns of neither party have been met in a way that has allowed the process to move forward. As this is highlighted throughout the report to be the factor that most facilitates the success of preparation for re-use systems, establishing a scenario in which this relationship is fostered must be prioritised. Expanding on the discussion of the European analysis, Ireland does not have an established history of the preparation for re-use of WEEE. While both approved preparation for re-use organisations are well established in the area of B2B EEE re-use, and various other social enterprises are involved in similar activities, the system for conducting the same activities on material designated as waste is new since the enactment of the WEEE Directive. Thus, the responsibility within Ireland to meet targets, which currently combine recycling and preparation for re-use, has fallen exclusively on WEEE recycling conducted by the PROs. As the existing EPR model currently in operation for WEEE take-back and recycling in Ireland is centred around the fact that targets can be and are being met by recycling alone, the PROs are not motivated to implement a preparation for re-use system under the current market model. The European EPR model, as it is currently constituted, is not well suited to preparation for re-use, with many of the current market stakeholders having little or no incentive to enable such a re-use system to work. It may be argued that some of these stakeholders in fact have incentives against the introduction of such a preparation for re-use system. In order to address the current barriers to action and ensure the success of a preparation for re-use of WEEE system in accordance with the spirit of the WEEE Directive and the waste hierarchy, it appears that targets will be necessary.

Furthermore, when compared with the systems examined across Europe, Ireland is distinct in its low involvement of social enterprise. The cost and lack of financial support in establishing the proper permits and certifications needed to become an approved preparation for re-use organisation has resulted in capable and already established organisations involved in re-use of EEE outside the waste stream showing largely no interest in participating in the preparation for re-use of WEEE system. This is compounded by the inability to guarantee access to supply of material of an appropriate quality to be fit for preparation for re-use, as it makes investment very

speculative. Social enterprises serve as a keystone in the support of preparation for re-use systems and it must be considered how the integration of social enterprises would serve in an Irish context.

Recommendations for solutions to these issues, as well as expanded conclusions, are presented within the following section.

6.3 System-related Recommendations

Based on these conclusions, the authors have developed a set of recommendations that they believe are necessary to support a functional preparation for re-use system within Ireland. These can be summarised as

- creating an obligation for PROs to fully engage with preparation for re-use;
- removing barriers to access WEEE with potential for re-use at the most appropriate locations;
- maintaining high operating standards of approved preparation for re-use of WEEE organisations.

The authors recommend the following:

1. Align the interests of the PROs and the approved preparation for re-use of WEEE organisations through the introduction of preparation for re-use targets.

- Much like the situation was in Spain, the Irish system is currently struggling to achieve the outcomes expected from preparation for re-use systems. The status quo functions with preference towards recycling of materials to meet targets and does little to encourage the success of preparation for re-use, with little incentive for PROs to offer wholehearted support. Until mandatory targets are introduced, preparation for re-use will not be a priority, as the schemes will understandably continue to focus their energy on achieving existing targets at the lowest cost because of competitive pressures to offer lowest cost compliance and satisfy their members' strategic interests, which do not include preparation for re-use. While the European Commission has chosen not to impose uniform preparation for re-use targets across all Member States, countries are permitted to do so. The authors advise that such a target will be necessary for Ireland to

establish a satisfactory preparation for re-use

system and provide a level playing field for PROs to engage, and for approved preparation for re-use of WEEE organisations to invest in business development. Such a move will align the interests of the compliance schemes and preparation for re-use organisations, and facilitate a relationship that will support greater levels of re-use.

- At this time, only targets for LHAs and IT equipment are recommended, as these are the main product categories that have demonstrated potential for re-use. Further consideration and feasibility studies for alternative WEEE product categories and the introduction of preparation for re-use is necessary before increasing the number of product categories that preparation for re-use will apply to.
- Initial preparation for re-use targets should be modest, with an increasing threshold implemented over a specified timeframe as a means of achieving the desired final preparation for re-use targets nationally. On examination of targets elsewhere in the EU, and considering existing trial data for LHAs in Ireland, a recommended preparation for re-use target should be 1% in year 1, increasing to 2% in year 2 and 3% in year 3, at which time they should be re-evaluated.
- To achieve the above measures:
 - An express condition of the Ministerial approvals that the compliance schemes operate pursuant to Regulation 33 of S.I. 149/2014 should be included specifying the re-use targets that need to be met by approved bodies.
 - Non-compliance with these re-use targets would result in a PRO being in contravention of its Ministerial approval, which would place its continued operation at risk.
 - An update to S.I. 149/2014 would be required within Schedule 10, Parts 2 and 3, in regard to WEEE targets for Category 1 equipment, LHAs (excluding refrigerant and cooling appliances) and Category 3, IT.
- Deterrents should be applied for non-compliance with the re-use targets.
- In any scenario there should be no specific prescription of how targets are to be achieved by PROs, leaving room for creative and innovative solutions.

2. Remove barriers to accessing suitable equipment

- Selected collection points for WEEE (civic amenity sites, retailers, special collection days, etc.) should be supported to separate material suitable for preparation for re-use at source and the opportunity to access these provided to approved preparation for re-use of WEEE organisations.
 - The highest quality material can be found closest to the end user, and especially where returned to the retailer in the case of LHAs. Therefore, it should be a priority that material is accessed as close to the consumer as possible to limit damage and achieve a higher yield of material fit for purpose. Separation of material suitable for preparation for re-use allows proper handling and transport of preparation for re-use material versus WEEE for recycling, with the aim of maximising the re-usability and re-use potential of any such WEEE. Costs should be covered in the same manner as in existing take-back infrastructure. Compliance schemes and approved preparation for re-use of WEEE organisations should cooperate to identify the sites with the best potential to return the maximum amount of suitable equipment and no specific regulations should prevent preparation for re-use organisations from doing so in cooperation with the compliance schemes.
 - This should not involve a change in the text of S.I. 149, but rather a change in interpretation of S.I. 149 and the PRL documents. Within the frequently asked questions (FAQs) section for PRL, it is stated that access by preparation for re-use organisations to retailers and civic amenity sites is “expressly prohibited in the WEEE2 Regulations from allowing WEEE to be transferred to anyone except a producer/authorised representative, an organisation acting on behalf of a producer or an approved body (WEEE Compliance Schemes)”. Interpreting a preparation for re-use organisation as acting on behalf of an approved body enables this access. Specifically, S.I. 149 states within Part III that “prior to any further transfer for treatment a producer or authorised representative shall provide for the separation at their

collection points of waste electrical and electronic equipment that is to be prepared for re-use from other separately collected waste electrical and electronic equipment by granting access for personnel from approved preparing for re-use of waste electrical and electronic equipment organisations that have been approved and registered by the registration body”, where a collection point is defined as a “civic amenity facility, or other facility for the receipt, storage, including temporary storage or recovery of waste electrical and electronic equipment”. With this interpretation, it is understood that those who have been approved and certified by the PRL and maintain a relationship with compliance schemes should be allowed access to these sites.

- Enable approved preparation for re-use of WEEE organisations and charity shops to become approved collection points for WEEE suitable for preparation for re-use.
 - Preparation for re-use organisations and interested charity shops should be allowed to receive WEEE from the general public, specifically targeting items with potential for re-use. Interested charity shops should be capable of accepting donations of IT WEEE at their own discretion on the provision that the material is only collected by accredited preparation for re-use organisations in cooperation with the relevant compliance scheme.

3. Operating standards

- Retain required criteria for approval of preparation for re-use organisations, specifically internationally recognised standards such as PAS 141, transitioning to EN 50614 in due course.
 - All parties are in agreement about the need for a recognised standard for preparation for re-use organisations, which currently is PAS 141. This requirement should transition to EN 50614 once released by CENELEC. This will require an update to the criteria for certification as a preparation for re-use organisation run by the PRL.
- Integrate social enterprise by supporting the establishment and approval of preparation for

re-use organisations, particularly small-scale operations outside large population centres.

- Social enterprises play a significant role in all successful preparation for re-use systems analysed within this report and it therefore is logical that the integration of social enterprise within Ireland is a necessary step towards success. In cooperating with the Department of Employment Affairs and Social Protection, the Department of Communications, Climate Action and Environment should seek to support the further development of a social economy sector in the social enterprise space integrated with the preparation for re-use system. This should be advanced upon the forthcoming publication of the National Policy for Social Enterprise, and funding should be sought from the European Fund for Strategic Investment to support it.
- Social enterprises should be especially encouraged outside large population centres, as the volumes of suitable material available will in all likelihood be too small to encourage for-profit operators to establish, particularly given the overheads involved in obtaining waste collection permits, a waste facility permit and PAS 141 accreditation. Therefore, financial support should be sought for the following : (1) consulting and training to achieve competence in preparation for re-use; (2) the cost of certification to the appropriate standard (e.g. EN 50614); (3) workspace; (4) waste collection and facility permits.
- These supports should be available to all organisations seeking to be involved in a social enterprise preparing for re-use scheme to ensure a fair and competitive scenario.
- Encourage the involvement of organisations that are currently part of the WEEE logistics and treatment system to become involved with the preparation for re-use of WEEE.
 - Contingent on approved preparation for re-use of WEEE organisations being able to access material with potential for re-use prior to it entering the WEEE logistics system, as it is presently constituted, organisations currently operating logistics and pre-processing of WEEE should be encouraged to exploit the opportunities that they may identify and thus

should be encouraged to become preparation for re-use of WEEE organisations.

6.4 Product Design Recommendations

Based on the analysis of the LHAs/washing machines and ICT mobile phones and tablets described in the preceding sections of this report, a number of recommendations for product designers to enhance the refurbishment potential of their appliances and devices can be made.

For LHAs/washing machines, based on the data analysed from the Rehab Recycle preparation for re-use trial, the following recommendations can be made for washing machine product design:

- Washing machine manufacturers should ensure that all washing machine motors and drain pumps are modular and easily replaceable. Access to the motors and drain pumps should be easily attained by repair/refurbishment personnel, and replacement of these elements should be achievable with the minimum number of specialised tools.
- All motors installed on washing machines should have modular and replaceable brushes that can be easily accessed and swapped out with the minimum amount of time and effort on the part of the repair engineer.
- All power/mains leads on the washing machines should not be fused to the washing machine body. Instead, the mains cable for the washing machine should be modular and should fit into an AC cable socket at the point of contact with the case of the washing machine. In that way, cables that are damaged or in need of repair can be replaced with a new cable immediately.
- Washing machine doors and door seals are identified as another common point of failure for washing machine appliances; therefore, doors and door seals should be standardised and easily replaceable on all washing machine models.

For ICT mobile phones and computer tablets, a review of the repair data from Pair Mobile repair shops yields the following product design feedback for mobile phone and computer tablet product designers:

- As the single largest point of failure on ICT equipment, all ICT device screens should be

designed such that they are easy to remove and replace on all machines. Screen and digitiser connectors and cabling should use standardised connectors and cables.

- Batteries for all ICT devices should be modular and replaceable. The user should be able to replace the battery in the mobile phone or computer tablet device quickly and easily.
- Chargers and charging connectors used for the ICT devices should also be standardised and use industry recognisable formats that are readily available on the market and allow cabling and connector interchange.

The feedback and findings of these product design reviews will be input into the respective public

consultation and working group discussions for the respective product categories as part of the revision of the existing Energy Label Regulation (EC) 1061/2010 (EU, 2010a) and the Eco-design Regulation (EC) 1015/2010 on household washing machines (EU, 2010b). In regard to washing machines, the University of Limerick is registered as a stakeholder (Technical Working Group member) in the JRC Institute for Prospective Technological Studies (IPTS) stakeholder communication and will communicate the findings of this review through that medium. For ICT, the study findings outlined here will be included in the preparatory study on the review of Commission Regulation (EU) No 617/2013 on Computers and Computer Servers.³⁴

³⁴ <https://computerregulationreview.eu/> (accessed 10 January 2018).

References

- Achillas, C., Vlachokostas, C., Moussiopoulos, N., Perkoulidis, G., Baniyas, G. and Mastropavlos, M., 2011. Electronic waste management cost: a scenario-based analysis for Greece. *Waste Management & Research* 29: 963–972.
- Allwood, J.M., Ashby, M.F., Gutowski, T.G. and Worrell, E., 2011. Material efficiency: a white paper. *Resources, Conservation and Recycling* 55: 362–381.
- Allwood, J.M., Ashby, M.F., Gutowski, T.G. and Worrell, E., 2013. Material efficiency: providing material services with less material production. *Philosophical Transactions. Series A, Mathematical, Physical and Engineering Sciences* 371: 20120496.
- Atasu, A. and Wassenhove, L.N., 2012. An operations perspective on product take-back legislation for e-waste: theory, practice, and research needs. *Production and Operations Management* 21: 407–422.
- Baird, J., Curry, R. and Cruz, P., 2014. An overview of waste crime, its characteristics, and the vulnerability of the EU waste sector. *Waste Management & Research* 32(2): 97–105.
- Bansal, P.K., Braun, J.E. and Groll, E.A., 2001. Improving the energy efficiency of conventional tumbler clothes drying systems. *International Journal of Energy Research* 25: 1315–1332.
- Bertoldi, P. and Atanasiu, B., 2007. Electricity consumption and efficiency trends in the enlarged European Union. Publications Office of the European Union, Luxembourg.
- Bornstein, D. and Davis, S., 2010. *Social Entrepreneurship: What Everyone Needs to Know?* Oxford University Press, Oxford.
- Chancerel, P., Meskers, C.E., Hagelüken, C. and Rotter, V.S., 2009. Assessment of precious metal flows during preprocessing of waste electrical and electronic equipment. *Journal of Industrial Ecology* 13: 791–810.
- Clairmont, J., 1996. Imports and exports of hazardous waste: implementation of OECD Council Decision C (92) 39 concerning the transfrontier movements of recoverable wastes. *Environmental Law* 3: 545.
- Cooper, D.R. and Gutowski, T.G., 2017. The environmental impacts of reuse: a review. *Journal of Industrial Ecology* 21: 38–56.
- Dalhammar, C., 2014. Policies promoting ecodesign for energy and resource efficiency in Europe: experiences, barriers and future options. In *11th International Conference on EcoBalance (EcoBalance 2014)*. Proceedings of the 11th International Conference on EcoBalance, Japan.
- EC (European Commission), 2016. *Regulatory Barriers For The Circular Economy: Lessons From Ten Case Studies*. Available online: http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8986&lang=en (accessed 10 January 2018).
- Estrada-Ayub, J.A. and Kahhat, R., 2014. Decision factors for e-waste in Northern Mexico: to waste or trade. *Resources, Conservation and Recycling* 86: 93–106.
- EU (European Union), 2002. Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE). OJ L 37, 13.2.2003, p. 24–38.
- EU (European Union), 2009. Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products. OJ L 285, 31.10.2009, p. 10–35. Available online: <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009L0125> (accessed 10 January 2018).
- EU (European Union), 2010a. Commission Delegated Regulation (EU) No 1061/2010 of 28 September 2010 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of household washing machines. OJ L 314, 30.11.2010, p. 47–63. Available online: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010R1061> (accessed 10 January 2018).
- EU (European Union), 2010b. Commission Regulation (EU) No 1015/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household washing machines. OJ L 293, 11.11.2010, p. 21–30. Available online: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010R1015> (accessed 10 January 2018).

- EU (European Union), 2012. Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment. OJ L 197, 24.7.2012, p. 38–71. Available online: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0019> (accessed 10 January 2018).
- Eurostat, 2014. Waste electrical and electronic equipment (WEEE) by waste operations. Available online: <http://ec.europa.eu/eurostat/web/waste/key-waste-streams/weee> (accessed 10 January 2018).
- Farrant, L., Olsen, S.I. and Wang, A., 2010. Environmental benefits from reusing clothes. *The International Journal of Life Cycle Assessment* 15(7): 726–736.
- Forfás, 2012. *Social Enterprise in Ireland: Sectoral Opportunities and Policy Issues*. Available online: https://www.chg.gov.ie/app/uploads/1970/01/forfas_social_enterprise_in_ireland_sectoral_opportunities_and_policy_issues_publication-3.pdf (accessed 10 January 2018).
- Guide Jr, V.D.R. and Li, J., 2010. The potential for cannibalization of new products sales by remanufactured products. *Decision Sciences* 41: 547–572.
- Guide Jr, V.D.R. and Van Wassenhove, L.N., 2009. OR FORUM – the evolution of closed-loop supply chain research. *Operations Research* 57: 10–18.
- Hagelüken, C. and Meskers, C.E.M., 2008. Mining our computers-opportunities and challenges to recover scarce and valuable metals from end-of-life electronic devices. Electronics Goes Green. Presented at the OECD–UNEP Conference on Resource Efficiency, Paris, 4 April 2008.
- Hertwich, E.G., 2005. Consumption and the rebound effect: an industrial ecology perspective. *Journal of Industrial Ecology* 9: 85–98.
- Huijbregts, M.A., Hellweg, S., Frischknecht, R., Hendriks, H.W., Hungerbühler, K. and Hendriks, A.J., 2010. Cumulative energy demand as predictor for the environmental burden of commodity production. *Environmental Science & Technology* 44: 2189–2196.
- Jofre, S. and Morioka, T., 2005. Waste management of electric and electronic equipment: comparative analysis of end-of-life strategies. *Journal of Material Cycles and Waste Management* 7: 24–32.
- Kahhat, R., Kim, J., Xu, M., Allenby, B., Williams, E. and Zhang, P., 2008. Exploring e-waste management systems in the United States. *Resources, Conservation and Recycling* 52: 955–964.
- Kallis, G. and Butler, D., 2001. The EU water framework directive: measures and implications. *Water Policy* 3: 125–142.
- Kang, H.Y. and Schoenung, J.M., 2005. Electronic waste recycling: a review of US infrastructure and technology options. *Resources, Conservation and Recycling* 45: 368–400.
- Kilic, H.S., Cebeci, U. and Ayhan, M.B., 2015. Reverse logistics system design for the waste of electrical and electronic equipment (WEEE) in Turkey. *Resources, Conservation and Recycling* 95: 120–132.
- Kimura, F., Hata, T. and Suzuki, H., 1998. Product quality evaluation based on behaviour simulation of used products. *CIRP Annals-Manufacturing Technology* 47: 119–122.
- Kissling, R., Fitzpatrick, C., Boeni, H., Luepschen, C., Andrew, S. and Dickenson, J., 2012. Definition of generic re-use operating models for electrical and electronic equipment. *Resources, Conservation and Recycling* 65: 85–99.
- Kissling, R., Coughlan, D., Fitzpatrick, C., Boeni, H., Luepschen, C., Andrew, S. and Dickenson, J., 2013. Success factors and barriers in re-use of electrical and electronic equipment. *Resources, Conservation and Recycling* 80: 21–31.
- Krueger, J., 2001. The Basel Convention and the international trade in hazardous wastes. In Schram Stokke, O. and Thommessen, Ø.B. (eds), *Yearbook of International Co-operation on Environment and Development, 2001/2002*. Earthscan Publications, London, pp. 43–51.
- Illinois General Assembly, 2008. Electronic Products Recycling and Re-use Act. Available online: <http://www.ilga.gov/legislation/publicacts/fulltext.asp?Name=098-0714> (accessed 10 January 2018).
- Lau, C., 2008. Reasons for the slow development of reverse logistics in the electronic industry of China: a case study. *Global Logistics Management: Sustainability, Quality, Risks* 9: 113.
- Lin, C.K., Yan, L. and Davis, A.N., 2001. Globalization, extended producer responsibility and the problem of discarded computers in China: an exploratory proposal for environmental protection. *Georgetown Environmental Review* 14: 525.
- Manomaivibool, P. and Hong, J.H., 2014. Two decades, three WEEE systems: how far did EPR evolve in Korea's resource circulation policy? *Resources, Conservation and Recycling* 83: 202–212.

- Milovantseva, N. and Fitzpatrick, C., 2015. Barriers to electronics reuse of transboundary e-waste shipment regulations: an evaluation based on industry experiences. *Resources, Conservation and Recycling* 102: 170–177.
- Molenbroek, E., Cuijpers, M. and Blok, K., 2012. *Economic Benefits of the EU Ecodesign Directive – Improving European Economies*. Ecofys, Utrecht. Available online: https://www.ecofys.com/files/files/ecofys_2012_economic_benefits_ecodesign.pdf (accessed 10 January 2018).
- Navaretti, G.B. and Tarr, D.G., 2000. International knowledge flows and economic performance: a review of the evidence. *The World Bank Economic Review* 14(1): 1–15.
- O'Connell, M. and Fitzpatrick, C., 2013. *Re-Evaluate Re-use of Electrical and Electronic Equipment (Evaluation and Mainstreaming)*. Environmental Protection Agency, Johnstown Castle, Ireland. Available online: <http://www.epa.ie/pubs/reports/research/waste/strive110-re-evaluate-re-useofelectricalandelectronicequipment.html> (accessed 10 January 2018).
- O'Connell, M., Fitzpatrick, C. and Hickey, S., 2010. Investigating reuse of B2C WEEE in Ireland. Presented at Sustainable Systems and Technology (ISSST), 2010 IEEE International Symposium on Sustainable Systems and Technology, Arlington, VA, 17–19 May 2010, pp. 1–6.
- O'Connell, M.W., Hickey, S.W. and Fitzpatrick, C., 2013. Evaluating the sustainability potential of a white goods refurbishment program. *Sustainability Science* 8: 529–541.
- OECD (Organisation for Economic Co-operation and Development), 2001. Decision C(2001)107/Final of the OECD Council concerning the revision of Decision C (92) 39. Final on the control of transboundary movements of wastes destined for recovery operations. OECD, Paris.
- OECD (Organisation for Economic Co-operation and Development), 2009. *Guidance Manual for the Control of Transboundary Movements of Recoverable Wastes*. OECD, Paris. <http://dx.doi.org/10.1787/9789264060753-en>
- OVAM (Openbare Vlaamse Afvalstoffenmaatschappij), 2012. *Code of Good Practice for the Re-use of (W)EEE*. Available online: <http://www.ovam.be/> (accessed 10 January 2018).
- Ovchinnikov, A., Blass, V. and Raz, G., 2014. Economic and environmental assessment of remanufacturing strategies for product + service firms. *Production and Operations Management* 23: 744–761.
- Özkır, V.Ç., Efendigil, T., Demirel, T., Demirel, N.C., Deveci, M. and Topçu, B., 2015. A three-stage methodology for initiating an effective management system for electronic waste in Turkey. *Resources, Conservation and Recycling* 96: 61–70.
- Pachauri, R.K., Allen, M.R., Barros, V.R., Broome, J., Cramer, W., Christ, R., Church, J.A., Clarke, L., Dahe, Q., Dasgupta, P. and Dubash, N.K., 2014. *Climate Change 2014: Synthesis Report*. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, Pachauri, R.K. and Meyer, L.A. (eds). IPCC, Geneva.
- Phillips, P.S., Tudor, T., Bird, H. and Bates, M., 2011. A critical review of a key waste strategy initiative in England: zero waste places projects 2008–2009. *Resources, Conservation and Recycling* 55(3): 335–343.
- Santos, F.M., 2012. A positive theory of social entrepreneurship. *Journal of Business Ethics* 111: 335–351.
- Saunders, H.D., 1992. The Khazzoom–Brookes postulate and neoclassical growth. *Energy Journal* 13(4): 131–148.
- Scheuer, S., 2005. *EU Environmental Policy Handbook: A Critical Analysis of EU Environmental Legislation – Making It Accessible to Environmentalists and Decision Makers*. European Environmental Bureau, Brussels.
- Schridde, S., Kreiß, C. and Winzer, J., 2013. Geplante Obsoleszenz: Entstehungsursachen, Konkrete Beispiele, Schadensfolgen, Handlungsprogramm. Gutachten im Auftrag der Bundestagsfraktion Bündnis 90/Die Grünen. Available online: https://www.gruenebundestag.de/fileadmin/media/gruenebundestag_de/themen_az/umwelt/PDF/Studie-Obsoleszenz-aktuell.pdf (accessed 10 January 2018).
- Scitovsky, T., 1994. Towards a theory of second-hand markets. *Kyklos* 47: 33–52.
- Sepúlveda, A., Schluep, M., Renaud, F.G., Streicher, M., Kuehr, R., Hagelüken, C. and Gerecke, A.C., 2010. A review of the environmental fate and effects of hazardous substances released from electrical and electronic equipments during recycling: examples from China and India. *Environmental Impact Assessment Review* 30: 28–41.
- Seyring, N., Kling, M., Weissenbacher, J., Hestin, M., Lecerf, L., Magalini, F., Khatriwal, D.S. and Kuehr, R., 2015. *Study on WEEE Recovery Targets, Preparation for Re-use Targets and on the Method for Calculation of the Recovery Targets*. European Commission, Brussels.

- Skelton, A.C. and Allwood, J.M., 2013. The incentives for supply chain collaboration to improve material efficiency in the use of steel: an analysis using input output techniques. *Ecological Economics* 89: 33–42.
- Skerlos, S.J., Morrow, W.R., Chan, K.Y., Zhao, F., Hula, A., Seliger, G., Basdere, B. and Prasitnarit, A., 2003. Economic and environmental characteristics of global cellular telephone remanufacturing. Presented at Electronics and the Environment, 2003. IEEE International Symposium on Electronics and the Environment, Boston, MA, 19–22 May 2003, pp. 99–104.
- Streicher-Porte, M., Marthaler, C., Böni, H., Schluep, M., Camacho, A. and Hilty, L.M., 2009. One laptop per child, local refurbishment or overseas donations? Sustainability assessment of computer supply scenarios for schools in Colombia. *Journal of Environmental Management* 90: 3498–3511.
- Thomas, V.M., 2003. Demand and dematerialization impacts of second-hand markets. *Journal of Industrial Ecology* 7(2): 65–78.
- Tojo, N., 2004. *Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality?* The International Institute for Industrial Environmental Economics, Lund.
- Truttmann, N. and Rechberger, H., 2006. Contribution to resource conservation by reuse of electrical and electronic household appliances. *Resources, Conservation and Recycling* 48: 249–262.
- Vasi, I.B., 2009. New heroes, old theories? Toward a sociological perspective on social entrepreneurship. In Ziegler, R. (ed.), *An Introduction to Social Entrepreneurship: Voices, Preconditions, Contexts*. Edward Elgar, Cheltenham, pp. 155–173.
- Wang, X., Chan, H.K., Lee, C.K.M. and Li, D., 2015. A hierarchical model for eco-design of consumer electronic products. *Technological and Economic Development of Economy* 21: 48–64.
- Williams, E., 2004. Energy intensity of computer manufacturing: hybrid assessment combining process and economic input – output methods. *Environmental Science & Technology* 38: 6166–6174.
- Williams, E., Kahhat, R., Allenby, B., Kavazanjian, E., Kim, J. and Xu, M., 2008. Environmental, social, and economic implications of global reuse and recycling of personal computers. *Environmental Science & Technology* 42: 6446–6454.
- Ylä-Mella, J., Poikela, K., Lehtinen, U., Keiski, R.L. and Pongrácz, E., 2014. Implementation of waste electrical and electronic equipment directive in Finland: evaluation of the collection network and challenges of the effective WEEE management. *Resources, Conservation and Recycling* 86: 38–46.
- Yokoo, H., 2009. An economic theory of reuse. *Sustainability Science* 5: 143–150.
- Zheng, J.L., Zheng, C., Chen, P. and Luk, C.Y., 2015. An evaluation model for the coordinated development of a circular economy in China and its application to energy-intensive industries. *Frontiers of Engineering Management* 1: 364–371.

Glossary

EEE	Electrical and electronic equipment. This refers to equipment that is dependent on electric currents or electromagnetic fields to work properly and includes equipment for the generation, transfer and measurement of such currents and fields, designed for use with a voltage rating not exceeding 1000 V for alternating current and 1500 V for direct current
WEEE	Waste electrical and electronic equipment. WEEE refers to EEE that is waste, including all components, subassemblies and consumables that are part of the product at the time of discarding. This covers all types of EEE that have entered or could enter the waste stream
UEEE	Used electrical and electronic equipment. EEE that has been used but which is not necessarily considered waste. This includes, for example, second-hand and pre-owned equipment, service repairs, warranty returns and display stock
REEE	Re-use electrical and electronic equipment. REEE is UEEE or WEEE that has been prepared for re-use for the same purpose for which it was conceived and may now be re-introduced to the market as second-hand EEE
Second-hand EEE	EEE that has already been used but which meets all the applicable re-use criteria
Re-use	Any act whereby products or components that are not waste are re-used for the same purpose for which they were intended
Re-use centre	A company or organisation where UEEE and WEEE that is suitable for product re-use is stored, sorted, tested, cleaned and/or repaired and where re-usable EEE is separated from non-re-usable EEE
Preparing for re-use	Checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing
The WEEE Directive	The 'former' WEEE Directive, Directive 2002/96/EC on waste electrical and electronic equipment
The 'Recast' WEEE Directive (WEEE 2 Directive)	Directive 2012/19/EU on waste electrical and electronic equipment

Abbreviations

B2B	Business-to-business
B2C	Business-to-consumer
CE	Circular economy
CED	Cumulative energy demand
CENELEC	European Committee for Electrotechnical Standardization
CRNI	Community Re-use Network Ireland
DG	Directorate-General
EEE	Electrical and electronic equipment
EPEAT	Electronic Product Environmental Assessment Tool
EPR	Extended Producer Responsibility (scheme) ⁶
ErP	Energy-related product
ERP	European Recycling Platform
EU	European Union
EuP	Energy-using product
IT	Information technology
JRC	Joint Research Centre
LHA	Large household appliance
OECD	Organisation for Economic Co-operation and Development
OEM	Original equipment manufacturer
OVAM	Openbare Vlaamse Afvalstoffenmaatschappij (Public Waste Agency of Flanders)
PAS	Publicly Available Specification
PRI	Producer Responsibility Initiative
PRL	Producer Register Limited
PRO	Producer Responsibility Organisation
REEE	Re-used electrical and electronic equipment
UEEE	Used electrical and electronic equipment
VAT	Value-added tax
WEEE	Waste electrical and electronic equipment
WEEELABEX	WEEE Label of Excellence
WFD	Waste Framework Directive

Appendix 1 Interview Questionnaire EU and Irish Stakeholders

Interview Guide

Country of Organisation:

Name of Organisation:

Name/Position of Organisation Representative:

Name of Interviewer:

Date of Interview:

Questions

How would the organisation be classified (social enterprise, for profit, etc.)?

Does the organisation receive any subsidies or funding? What is the main source?

How many individuals does the organisation employ?

What is the break-down of number of employees in each job type?

Is there a particular social group the organisation focuses on for employment?

Does the source of employees present any particular challenges?

Across how many stores/other facilities are these individuals employed?

What sort of equipment is processed by the organisation?

How many units were prepared for re-use this past year? Overall?

How many prepared units were sold?

What sort of warranty is offered with sold units?

What is the breakdown of sourcing for equipment?

Is there any partnership between the organisation and retailers or local authority collection points?

What legislation regarding re-use of WEEE affects the organisation?

How is the movement of materials organised under current legislation?

What are the national targets for re-use? Are they joined with those for recycling?

How is equipment sorted upon collection?

How does the quality, age and brand of equipment factor into sorting and processing?

Who is responsible for registering organisations for preparing for re-use?

What is required in order to achieve such registration?

Does the organisation comply with any standards such as PAS 141 or WEELABEX and is such certification required?

How does the organisation deal with insurance, both on products and as an employer?

Is there any hesitance or difficulty experience from retailers and producers in regard to competition or brand image?

Does complying with standards and obtaining appropriate insurance alleviate retailer/producer concern?

What would be considered the biggest barriers to success for the organisation?

Is there a particular sector or organisation that specifically hinders the organisation?

Who are the organisation's most important relationships with?

What works best about the organisation's system? What should other countries try to replicate?

What changes would be recommended to increase the amount of material prepared for re-use?

Compliance Schemes

What are your thoughts/opinions on how “preparation for re-use” is operating in Ireland at the moment?

Can you tell us about your plans for engaging with “preparation for re-use”?

How do you think it should work/be improved?

How would you measure success?

What works differently in ROI as opposed to other countries that you have experience/knowledge of as far as structure of material movement and concerns over leakage?

What motivation exists to move forward with re-use?

What is your attitude/opinion towards targets for re-use?

Recyclers/Consolidation Points

Would you have interest in being involved as a “preparation for re-use” organisation? What are the pros and cons from your perspective?

Have you seen/how do you feel about the approval process to become a “preparation for re-use” organisation?

[How] does re-use moving forward impact your business? Have there been arrangements made to provide access to a “preparation for re-use” organisation? Are they under discussion with the compliance scheme(s) that you work with?

What would your attitude be to having separate logistics for items to be prepared for re-use?

What does the system of treating materials suitable to be prepared for re-use look like to you?

CRNI

With regard to WEEE what are your thoughts/opinions on how re-use and preparation for re-use are operating in Ireland at the moment?

What benefits do social enterprises bring to re-use and vice versa? How could the system better benefit?

Would supports be required to get preparation for re-use up and running in Ireland?

What sort of supports would be most effective? How should they work? Who would provide them?

Why might it be that re-use and preparation for re-use seem to depend so strongly on social enterprises in other countries?

What lessons can be learned from re-use of other materials that may apply to WEEE?

Is there interest in CRNI organisations in becoming involved in preparation for re-use of WEEE (re-use of materials classified as waste)? What about the process for registration; is it a deterrent or not?

Any further comments?

Retail Excellence Ireland

Is there any particular attitude/opinion towards the preparation for re-use and sale of electrical and electronic equipment?

What is the procedure for taking back used electrical and electronic equipment in retailers?

Is there an assessment of quality/function?

Would retailers be willing to separate equipment suitable for re-use upon collection?

What might be involved in this process?

What might make this task easier for retailers to complete?

What might be the attitude towards licensed/approved preparing for re-use organisations collecting WEEE directly from retailers?

What might this attitude be given that the organisations are social enterprises and are highly regulated?

Civic Amenity Site

Is preparation for re-use a familiar topic at civic amenity sites to management/employees?

What are your thoughts on the process?

What is the standard process for the collection and separation of WEEE on site?

Is there any separation of WEEE based on quality or suitability for re-use?

Would civic amenity sites be open to further separation of suitable WEEE by employees/customers?

What might facilitate this?

Would you be open to approved and licensed preparing for re-use organisations (in agreement with compliance schemes) collecting WEEE from civic amenity sites in place of compliance schemes?

Any additional comments?

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL
Tá an Gníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaoil a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaoil a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialú: Déanaimid córais éifeachtacha rialaithe agus comhlionta comhshaoil a chur i bhfeidhm chun torthaí maithe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcloíonn leis na córais sin.

Eolas: Soláthraimid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírthe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.

Tacaíocht: Bimid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaoil atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaoil inbhuanaithe.

Ár bhFreagrachtaí

Ceadúnú

Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaoil:

- saoráidí dramhaíola (*m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola*);
- gníomhaíochtaí tionsclaíocha ar scála mór (*m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta*);
- an diantalmhaíocht (*m.sh. muca, éanlaith*);
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe (*OGM*);
- foinsí radaíochta ianúcháin (*m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha*);
- áiseanna móra stórála peitril;
- scardadh dramhuisce;
- gníomhaíochtaí dumpála ar farraige.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil

- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhíriú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a ídionn an ciseal ózóin.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaoil.

Bainistíocht Uisce

- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uisce idirchriosacha agus cósta na hÉireann, agus screamhuisc; leibhéil uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

Monatóireacht, Anailís agus Tuairisciú ar an gComhshaoil

- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil (*m.sh. tuairisciú tréimhsiúil ar staid Chomhshaoil na hÉireann agus Tuarascálacha ar Tháscairí*).

Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn

- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis cheaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

Taighde agus Forbairt Comhshaoil

- Taighde comhshaoil a chistiú chun brúnna a shainaitheint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

Measúnacht Straitéiseach Timpeallachta

- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaoil in Éirinn (*m.sh. mórfhleananna forbartha*).

Cosaint Raideolaíoch

- Monatóireacht a dhéanamh ar leibhéil radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Faisnéis Inrochtana agus Oideachas

- Comhairle agus treoir a chur ar fáil d’earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaoil ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnnteoireacht i ndáil leis an gcomhshaoil (*m.sh. Timpeall an Tí, léarscáileanna radóin*).
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhaíl ghuaiseach a chosaint agus a bhainistiú.

Múscailt Feasachta agus Athrú Iompraíochta

- Feasacht chomhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil

Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d’Oifigí:

- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- Oifig um Chosaint Radaíochta agus Monatóireachta Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair inní agus le comhairle a chur ar an mBord.

Authors: Michael Johnson, Kathleen McMahon and Colin Fitzpatrick

Identifying Pressures

While Ireland enjoys relatively high WEEE recycling rates, re-use has yet to attain the success in Ireland that it enjoys in other EU member states. Re-use offers numerous benefits over recycling - it conserves the high embodied energy involved in the manufacturing of electrical and electronic equipment, creates higher levels of employment, makes higher quality equipment available to low-income households and conserves critical raw materials which do not emerge from the current recycling systems.

Acknowledging these many benefits, Ireland has made recent efforts to establish a “preparation for reuse of WEEE” sector with the introduction of a certification system for organisations which can demonstrate that they operate to sufficiently high standards. There have also been protocols put in place to arrange for access to WEEE for these organisations.

The Research highlighted that despite the advances in preparation for reuse of WEEE in Ireland we are still at the developmental stage and not availing of the improvement in the resource efficiency, economic opportunities and social benefits to our WEEE management system.

Informing Policy

This project identified two key themes which should be addressed in order to support the success of a “preparation for reuse of WEEE” sector in Ireland.

The first theme is in the operation and regulation of our national WEEE management system. Based on an extensive analysis of organisations successfully conducting preparation for reuse in France, Belgium, Austria, UK and Spain, findings show that there are a number of structural barriers to preparation for reuse in place in Ireland which need to be addressed.

The second area which requires attention is in product design regulations. By examining the most common points of failure for large household appliances and IT products in large scale operations, it was possible to isolate the most relevant product design features which should become mandatory in implementing measures under the Energy related Products Directive.

Developing Solutions

With regard to how the Irish WEEE management system could be adapted to support preparation for reuse of WEEE, the Research identified the following solutions:

- Align the interests of the Producer Representative Organisations and the approved preparation for re-use of WEEE organisations through the introduction of preparation for re-use targets.
- Remove barriers to accessing suitable equipment through better segregation and enable access by approved preparation for re-use operators
- Integrate social enterprises in cooperation with the Department of Employment Affairs and Social Protection by supporting the establishment and approval of preparation for re-use organisations, particularly outside large population centres;
- Charity shops should be enabled to become approved collection points for information technology (IT) WEEE suitable for preparation for re-use
- To maintain the high standards required to become a certified preparation for reuse organisation specifically internationally recognised standards such as PAS 141 or EN 50614

Regarding product policy solutions, the report provides a host of technical recommendations on specific design features for large household appliances and ICT equipment.