

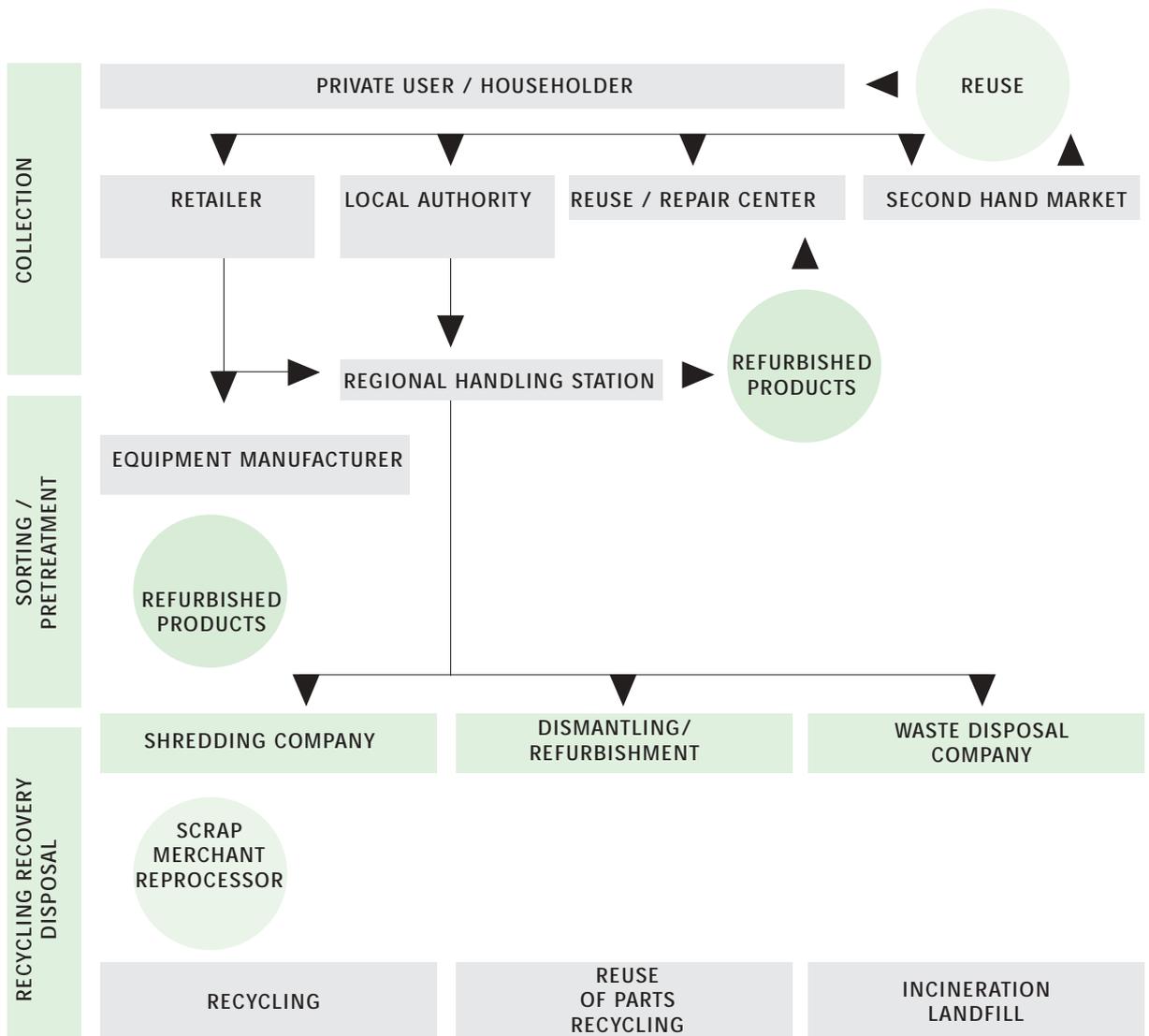


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## 4. THE COLLECTION AND SORTING OF WEEE



#### 4.1. MUNICIPAL WEEE MANAGEMENT STREAMS: GENERAL VIEW



The WEEE directive will affect the current management of WEEE as regards :

- **requirements and standards** for collection and treatment processes (recycling facilities using the Best Available Technologies)
- the **sharing of responsibilities** between the various actors involved.

There will also be an increased need for procedures to quantify the collected WEEE and **record data**.

### 4.2. GENERAL SCOPE OF ACTION FOR LRAs

Currently, it is recognised that collection directly from retailers may provide better quality products. Manufacturers have an easy supply from their take-back schemes – 80% of the returned units are estimated to be in working order and 10% of the whole appliances and their parts, less than ten years old, are suitable for the remanufacturing process<sup>49</sup>.

But even if worldwide producers decide to set up their own take-back schemes and recycling centres, local authorities, even if not directly charged with specific duties by the European WEEE Directive, will remain the interface between producers and consumers, and current municipal collection facilities a basis of the system, as it makes sense to use the existing collection, sorting and dismantling infrastructures.

The real challenge for LRAs lies in ensuring that WEEE is collected separately, that reusable machines are separated from non reusable ones, and both are sent to the adequate treatment facilities. Consequently, they will have to :

- ▶ make the most of their infrastructure regarding :
  - the setting up of separate containers for WEEE in civic amenity sites
  - the development of other bringing schemes (banks) for smaller items
  - an expanded collection via the voluntary sector, ... in order to prioritise reuse
- ▶ ensure public access (last owners and distributors) for free disposal of WEEE
- ▶ quantify the collected WEEE and record data's.

### 4.3. ESTIMATING THE POTENTIAL QUANTITIES OF WEEE IN A GIVEN AREA

For the OECD countries, the annual WEEE potential has been roughly estimated at an average of 20 kilograms per capita. To this total amount, private households are expected to contribute 12 kilograms, while 5 kg come from the industrial sectors and 3 kg from cables.

One of the difficulties for the management of WEEE is that there is no connection between the quantities on the market and the waste streams, because :

- their use life is often shorter than their estimated technical life span
- of the phenomenon of storage (residence time), reuse or reselling...

So that when a product is given back depends not only on its lifespan, but also on the household's storage capacity (which are larger in rural areas than in cities), and on human behaviours and psychology.

Two fundamental methods are generally used to estimate the potential amount of waste electrical and electronic equipment (WEEE) in a given area : the "Consumption and Use method", and the "Market Supply method". Both methods rely on assumptions about a typical catalogue of EEE, their average weight, their average life-time, the socio-economic situation in a geographical region and a statistical residence time of electrical and electronic appliances in private households.

More information on these aspects can be found within a study made by Ökopol for the European Commission in 1998<sup>53</sup>.

From October this year, Japanese citizens will be able to get rid of their laptop or private computer by dumping it at their post office in a labelled parcel, that a logistic enterprise will forward and redistribute to each of the 21 manufacturers which have implemented this take-back scheme together with the Japanese Economy and the Environment Ministries.<sup>50</sup>

**Average age of household appliances when discarded by UK households<sup>51</sup>**

Product category	Age of discarded appliances (years)
Electric cooker	12
Refrigerators and freezers	11
Televisions	10
Hi-fi and stereo	9
Washing machines, dishwashers and tumble dryers	9
Vacuum cleaners and carpet cleaners	8
Video equipment	7
Home and garden tools	7
Microwave ovens	7
Computers and peripherals	6
Radio and personal radio, stereo and CD	6
Telephones, faxes and answering machines	6
Mobile phones and pagers	4
Small work or personal car appliances	4
Toys	4

*Note : the data including the products donated or sold and subsequently reused, as well as products discarded as "in need of repair", or "broken beyond repair".*

ZVEI, the German electrical and electronic manufacturers' association, estimates that the average age of washing machines that will be returned in Germany during the year 2005 is about 16 years<sup>52</sup>.



In the near future all the appliances will be marked by means of a crossed wheeled bin, to inform the consumers that they should not dump them in the waste bin.

## 4.4. ORGANISING THE COLLECTION OF WEEE

An efficient collection system is dependent on :

- accessible and efficient collection facilities
- adequate and consistent information to the users.

Transport, handling, but also sorting and storage issues are crucial to preserve reuse opportunities and to avoid damaging or breaking the components that contain hazardous substances. The good practice recommends to have procedures ensuring that everything is operated in an efficient and safe manner. To reduce the risk of harm to people and the environment, the system should ensure minimal movements of products and minimise manual handling. It should also aim to remove hazardous substances and to separate reusable appliances as early as possible in the process.

The collection means will vary, following distances, rural or urban patterns, and the size of collected appliances. Some categories will require specific collection routes like flatbed collection (for fridges and other reusable household appliances). Others will be deposited in bulk containers, banks or put in parcels or envelopes.

### 4.4.1. MUNICIPAL COLLECTION SCHEMES

Local authorities are responsible for municipal waste management in general, and they already collect WEEE through the domestic collection methods they operate in the form of :

#### - **Kerbside collection (separate or not, scheduled or on request)**

Sometimes local authorities offer separate collection, sometimes WEEE is collected together with the collection of bulky household waste; some local authorities may collect WEEE on call.

#### - **Bring systems (recycling parks and collection points)**

The consumer can bring his old appliance to a municipal recycling park or collection point. WEEE can be stored there as far as separate bins and suitable containers are available.

Mobile collection points for WEEE do also exist in the USA for instance, and in Germany : collection trucks remain at the public disposal at scheduled times, in identified areas of the municipality, so that citizens can bring their discarded electrical and electronic appliances.

#### - **Others**

In all other cases the WEEE is disposed of or incinerated together with other waste streams. This is especially the case for small household appliances, tools, telephones or Hi-fi devices, which end up in household waste bins, as little has yet been done to discourage householders from disposing of WEEE with other municipal waste : for instance, in the UK, only 1% of small household appliances enters the recycling process<sup>54</sup>.

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#### 4.4.2. TAKE BACK BY RETAILERS

When buying or delivering a new large household appliance, retailers usually offer to take it back in store or via other arrangements. This "extra service" for the consumer allows them either:

- to send back the appliance to the distributor or manufacturer of the product
- to use the old appliance to recover spare parts
- to sell it as second hand goods
- or to sell it to a scrap merchant for its residual value.

With the new WEEE Directive, this free service may become mandatory.

#### 4.4.3. TAKE BACK BY SOCIAL ECONOMY ENTERPRISES

In various member states, social economy enterprises have been active for years in the collection and management of WEEE. They sometimes represent the main route for the citizens to leave their appliances for proper management, as they can :

- bring their discarded appliances to a re-use centre
- donate them to a charity organisation or community recycling shop with re-use activities
- or make a call to have their appliance(s) collected at home.

#### 4.4.4. OTHER CHANNELS

**Serviceable old appliances** can also be :

- sold privately to second hand shops or dealers,
- sold consumer to consumer (through advertising in newspapers and magazines ...)
- or donated free to family and friends.

These are opportunities to contribute to reuse and life span extension.

**Damaged WEEE** may be :

- given to a repairer for the spare parts
- given to scrap merchants or other recycling companies.



<sup>48</sup>WEEE Remarket, DARP Environmental Ltd, [www.darpenvironmental.com](http://www.darpenvironmental.com), p. 95.

<sup>49</sup>ENVIRO 2B, 25 June 2003 - <http://www.enviro2b.com/france/web/serv/enviro/ActusDetail?index=0&current=615&List=verity>

<sup>51</sup>T. Coopers and K. Mayers, "Prospects for household appliances", E-SCOPE, UK, 2000.

<sup>52</sup>"How much WEEE in your cupboard ?", O. Frey (ZVEI), Green Week, Tuesday 3rd June 2003.

<sup>53</sup>Institut für Ökologie und Politik GmbH (Ökopol), „Collection targets for Waste from Electrical and Electronic Equipment (WEEE), Final Report compiled for the DG XI, May 1998.

<http://www.oekopol.de/de/Archiv/Stoffstrom/weee.htm#Methods>

<sup>54</sup>Discussion Paper of 28 March 2003 by the UK Government, Scottish executive, Welsh assembly government, and Northern Ireland administration on the implementation of Directives of the European Council and Parliament 2002/96/EC of 27 January 2003 (WEEE) and 2002/95/EC of 27 January 2003 (ROHS), Department of Trade and Industry, Publication Number URN 03/B11, p. 81. [www.dti.gov.uk/sustainability/weee/index.htm](http://www.dti.gov.uk/sustainability/weee/index.htm)

For an interesting study on that topic : "The Measurement of WEEE", Resource Recovery Forum, May 2003.



## 4.5. DATA KEEPING

With the coming into force of the Directive, local authorities will need to compile figures about weight and/or numbers of appliances and parts collected, reused, recycled, recovered and exported.

This information will have to be compiled in reports, in order to set up national databases and to document for instance the evidence of a 4 kg WEEE collection per inhabitant per year. The data capture methods will depend on those of segregated collection. Electronic tagging (e.i. bar-codes) could be developed for that purpose by manufacturers. In the meantime, the weight and kind of appliances will have to be determined by weighing mixed collected WEEE and classifying them into the different directive's categories by sampling, or even better, by gathering more precise information upstream thanks to a segregated collection whenever possible.

As regards data records, it might be advisable to ensure and keep track that all hazardous substances (e.g. CFCs) have been recovered by treatment plants which comply with the technical requirements framed by the WEEE Directive (see chapter 5).

## 4.6. CHOOSING THE BEST ROUTE FOR THE COLLECTED APPLIANCES

Sometimes the best environmental option for collected WEEE might be dismantling or shredding for recycling. But, when it is better for the environment, reuse must be encouraged, especially when the product has been discarded for the only reason that it no longer matched the user's needs. Keeping appliances fit for reuse requires the correct organisation and type of collection, transport, assessment, sorting and storage operations in order to maintain the "reusability" of such appliances.

### 4.6.1. HOW TO SEPARATE ITEMS ?

Electrical and electronic appliances are a highly diverse group of products; the WEEE directive has defined 10 categories. But beyond reuse aspects, and for waste management purposes (collection, recycling and data monitoring), sorting the collected items into the following categories may be appropriate<sup>55</sup>.

Categories	Reason for separation
1. Refrigerators & freezers	need for safe transport (without destruction) and subsequent separate treatment.
2. Large white goods [except refrigerators]	may be sent to shredders for ferrous metals recovery.
3. TV sets & monitors	CRT need safe transport (without destruction) and subsequent separate-treatment.
4. Light sources	they need special recycling or recovery processes.
5. Other WEEE	all remaining WEEE (office and IT equipment, brown goods & small appliances) are expected to go into very similar recycling or recovery operations.

## 4.6.2. ENSURING THE PROPER HANDLING OF APPLIANCES

What is at stake ? To preserve the integrity of the collected appliances by avoiding damage or breakage, to ensure sending them by the best management route to adequate management facilities and to avoid the leakage of hazardous substances.

### 4.6.2.1. DURING MUNICIPAL KERBSIDE COLLECTION

Considerations for organising WEEE kerbside collection will depend on :

- the costs of collection (area, frequency, number collected)
- the storage capacities
- the possibilities to work with local social enterprises.

Collectors should be able to assess the appliance for reusability and spares requirements at the collection point, and as soon as an appliance is deemed un-reusable, it should be moved to where it can be treated as waste, before any time and money are put into refurbishing and repairing them.

To ensure that handling and loading do not affect reusability, the staff should be trained regarding handling aspects (ex : fridges and freezers should be transported upright) and proper organisation of transport :

- appropriate vehicles with tail lifts for heavy items
- equipment to fasten the appliances to the transport vehicle in order to prevent damage and the release of liquid pollutants
- reusable protective wrapping
- boxes for smaller items.

After an initial selection test, in order to identify whether the appliance can profitably be repaired or refurbished, the appliances should be sorted by type and condition and labelled with their destination, i.e. :

- reuse of whole appliances
- reuse of components
- recycling
- recovery/disposal.

### **First of all : informing your citizens that second-hand channels are not waste bins**

The good condition of the product and its re-saleability are not always easy to appreciate by the public : it is important to make him aware of the difference between WEEE and EEE which could be reused, repaired or resold, and of the different channels which can respectively deal with each of the categories. It is worth raising citizens' awareness on this topic, and maybe implementing criteria for collection or acceptance at municipal collection points.

Since January 2003, a leaflet has been distributed in Brussels' area to promote second-hand, reuse and repair of electrical appliances notably, and to explain to citizens that if a product is too old or broken, it won't be resold through repair workshops or social economy enterprises, but maybe dismantled for the spare parts, or simply shredded to be recycled.

<sup>55</sup> Institut für Ökologie und Politik GmbH (Ökopool), „Collection targets for Waste from Electrical and Electronic Equipment (WEEE), Final Report compiled for the DG XI, May 1998. <http://www.oekopol.de/de/Archiv/Stoffstrom/weee.htm#Methods>

#### 4.6.2.2. AT MUNICIPAL COLLECTION POINTS

At the collection points like recycling parks small and large equipment can be separated immediately. The segregation between reusable and non-reusable can also be done, in order to send them by the appropriate route to the adequate treatment facilities.

If municipal officers are expected to separate the reusable from non reusable appliances it will be necessary to provide them with transparent information and to train them in giving directives to the citizens or in first making a visual selection on re-usability.

At collection points, the storage of WEEE requires :

- a sufficient storage capacity
- a covered and closed area, with adequate flooring and storage boxes in order to :
  - ▶ preserve reuse potential
  - ▶ ease the dismantling of appliances
  - ▶ prevent the theft of appliances or components with a commercial value
  - ▶ prevent leakages and pollutions
- a limited storage time.

#### 4.6.2.3. AT REGIONAL HANDLING STATIONS

Regional handling stations optimise the scale of collection and transport to treatment facilities. If no selection on reuse is done before, then the regional handling station is the place to do so.

It is possible to pre-treat some of the product groups during their stay in the regional handling station. For instance, CFC-containing appliances can be degassed to ensure environmentally safe transport, or television sets can be dismantled partly to transport the different parts to treatment facilities at different locations.



### 4.7. COLLECTION AND TRANSPORT COSTS

According to the WEEE Directive the final holder should be able to get rid of his old appliances free of charge<sup>56</sup>, but separate WEEE collection will necessarily require some investment : containers, box pallets, specific scales, registration tools information campaigns...

How will the financial costs of separate collection be shared ? Producers will have to finance the collection from the so-called "recycling points", the treatment, recycling and environmental disposal of their waste. In the scope of agreements for the definition and use of these collection points, they might provide local authorities, private companies or social economy enterprises with equipment for collection facilities and regional handling stations, as this is already the case in most European producers schemes.

Factors for collection and transport costs include notably :

- the level of service : pick up or delivery
- the kind of products collected (necessary containers, necessary number of transports per tonne, special handling for CFC-containing appliances ...)
- the serviced area and transport distances
- the existing infrastructure.

These costs will probably go down over time once :

- basic infrastructure investments have been made
- logistics have been optimised
- the awareness of citizens has allowed to achieve increased collection rates and create economies of scale.



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Management channel	Responsible actors	Collection costs/ tonne
Civic amenity sites	Local Authorities	~ 150 €
Collection on demand		~ 250 €
Scheduled kerb-side collection		~ 215 €
Take-back on delivery	Retailers	~ 235 €
In-store take-back		~ 340 €

Estimated separate collection costs in the UK<sup>57</sup>

<sup>56</sup>Art.5§2,a) WEEE Directive  
<sup>57</sup>Discussion Paper of 28 March 2003 by the UK Government, Scottish executive, Welsh assembly government, and Northern Ireland administration on the implementation of Directives of the European Council and Parliament 2002/96/EC of 27 January 2003 (WEEE) and 2002/95/EC of 27 January 2003 (ROHS), Department of Trade and Industry, Publication Number URN 03/811  
[www.dti.gov.uk/sustainability/weee/index.htm](http://www.dti.gov.uk/sustainability/weee/index.htm)



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## 5. PRE-TREATMENT AND RECYCLING





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## 5.1 BEFORE DISMANTLING

Before dismantling, shredding, cutting, compressing ... all components and substances which could create environmental or health problems should be removed before the appliance's metal, glass and plastic parts are recycled : capacitors (PCB), cathode ray tubes (CRT), batteries and substances like mercury (e.g. switches in coffee machines) or CFC in refrigerating appliances...

Pre-treatment facilities will need to be clear about their obligations and about which will be the standards and the minimum levels in relation to the removal of liquids etc... For their security and the efficiency of the operations, the WEEE Directive requires that producers inform refurbishment centres, and recycling and treatment facilities about procedures and standards to be followed.

In its annexe III, the Directive defines some technical requirements for treatment and storage which cover: balances/scales to measure the weight of treated waste, impermeable surfaces, waterproof covering, spillage collection facilities, availability of decanters and degreasers, appropriate storage for spare parts, appropriate containment for batteries, condensers and hazardous waste, water treatment equipment...

Any establishment or enterprise carrying out treatment operations should use the best available treatment, recovery and recycling techniques and must necessarily obtain a permit which will define:

- ▶ permitted types and quantities of appliances;
- ▶ general techniques to comply with;
- ▶ safety precautions to be undertaken;

It will have to be inspected at least once per year and reported on.

These activities require the LRA or their sub-contractors to check the compliance of the above requirements.

### 5.1.1. OZONE-DEPLETING SUBSTANCES (ODSs)

Ozone-depleting chlorofluorocarbons (CFCs) and other atmospherically relevant substances listed in the European regulation (EC) 2037/2000 have been banned from the market, because once released into the atmosphere, they damage the ozone layer. From 1st January 2002 all ODSs used in domestic refrigeration appliances must also be recovered (during servicing and maintenance of equipment, or prior to dismantling or disposal) for destruction by an environmentally acceptable technology, or recycled rather than destroyed.

CFC refrigerant gases can be found in the cooling circuits of refrigerators, freezers, air conditioners, water coolers, heat pumps and dehumidifiers. CFCs are also found in wall panel insulating foam in freezers and refrigerators, packaging, aerosols and degreasing agents.



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### Requirements to be met by fridge recycling operations

The major objectives of any scheme designed to collect and treat waste refrigeration equipment must be the loss-free recovery and subsequent destruction of CFCs. Fundamental to its success is the proper collection and storage of the end-of-life appliances before they are subjected to the actual recycling operations.

There are typically two main sources of CFCs in domestic refrigerators and freezers. Approximately 150 g of CFCs (i.e. about 1/3 of the total CFC content) is contained in the cooling circuit, while 300–400 g of CFCs (2/3 of the total) are locked within the polyurethane foam that is used to thermally insulate the appliance. To ensure that all waste appliances are fully recycled, involves treating both the cooling circuit and the insulation foam.

Standards and their enforcement are critical in the ODS recovery operations : these require qualified operators, traceable achievements and efficiencies, and localised solutions whenever possible.

### 5.1.2. POLYCHLORINATED BIPHENYLS (PCBS) AND HEAVY METALS IN METAL DOMINATED PRODUCTS

The main problem for metal dominated products is to separate precious metals from hazardous substances such as polychlorinated biphenyls (PCBs) and heavy metals. PCBs are carcinogens that do not break down in the environment. Some appliances contain electrical parts such as capacitors that have PCBs : refrigerators, freezers, washing machines, microwave ovens, televisions, heating and cooling equipment and electronic equipment. Shredding these products could produce waste contaminated by PCBs. During disassembly of capacitors there is a danger of receiving an electric shock, and of getting cauterised if the PCBs liquid substances come into contact with skin or organs. The metal separation process also produces fine metal dust containing gold, aluminium, copper and iron, which may harm workers' health.



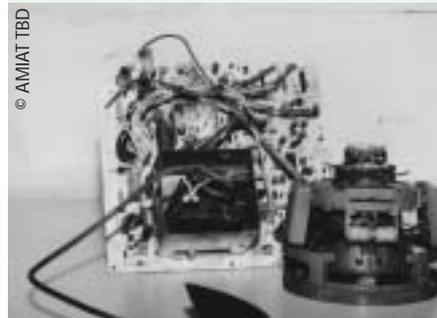
The **RAL Quality Mark** is the distinctive label accorded to those operators which comply with the specifications and requirements defined by the RAL Quality Assurance Association for the de-manufacture of Refrigeration Equipment Containing CFCs. These specifications are a comprehensive compilation of requirements that cover all stages of the de-manufacturing process. With complete documentation and logging stipulated for every step, the RAL standard ensures that de-manufacturing is a totally transparent process.

More information:

<http://www.ral-online.org/>

In the Grand-Duchy of Luxembourg, the amount of discarded refrigerating appliances is currently about 15.000 units per year. Thanks to an initiative called the "Superfreonskescht" lead by the Minister of the Environment and the Luxembourg municipalities, the collected appliances are regularly gathered (on demand, when municipalities are about to reach their storage capacity) at a grouping centre, where they are pre-treated by mobile plants for recovering the hazardous substances contained in the cooling circuits, before the insulating foam and other recoverable parts are recycled.

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### 5.1.3. CATHODE RAY TUBES (CRT)

The panel glass of cathode ray tubes contains heavy metals like barium, strontium, zirconium... and the funnel glass has got a heavy lead content. Both must be separated and follow a specific treatment. The fluorescent tube has to be removed under special hygienic circumstances to avoid any contact with skin, while during the removing of barium the inhalation of dust should be avoided. Handling of CRTs can generate a danger of implosion. As a consequence, protection for the face and the neck is needed, hands and arteries have to be covered with special gloves, and stable boots and a thick apron are obligatory for protecting the stomach and hips.

### 5.1.4. BROMINATED FLAME RETARDANTS

They ensure flammability protection of appliances and are mainly used in printed circuit boards, or components such as connectors, plastic covers and cables (of TV sets and domestic kitchen appliances for instance). If incinerated, they can lead to the emission of toxic furans and dioxins. EEE components with brominated flame retardants must so be prevented from entering incineration processes.

## 5.2. DISMANTLING METHODS

In order to recover materials, equipment has to be taken apart. This can be done by hand, mechanically or by using a blend of the two approaches. Manual dismantling is normally more costly than mechanical one but often produces higher yields of useful material. Some manual dismantling is essential if components are to be recovered for re-use, as it allows :

- an easier identification of working components for remarketing
- greater separation with little energy consumption
- efficient removal of hazardous waste (but a serious problem is workers' exposure in that respect).

### 5.2.1. CODES OF PRACTICE FOR DISMANTLING AND RECYCLING

Dismantling of appliances has to be optimal in order to provide components that can be used as spares. Materials of a commercial value (like copper) must be retained for sale while low-value waste material should be collected for processing. Data should also be gathered to inform product designers about making recycling more efficient.

Since the WEEE legislation was introduced, specific processes for dismantling are required, and producers and manufacturers will have to make the necessary information available to organisations involved in dismantling operations. These requirements should be seen as an opportunity for the re-use sector to offer new services and consequently gain more appliances of better quality, and a wealth of spares for repair.

**5.2.2. MAIN CRITERIA FOR DISMANTLING:**

- ▶ Do you save money by reusing components ?
- ▶ Is it economically feasible to dismantle and recover any value from parts and materials ?
- ▶ Do any pre-treatment operations require the appliance to be dismantled ?
- ▶ Is there a market for the material recovered ?

**Dismantling** is mainly a manual exercise, and labour costs are a variable cost element, depending on the type of product to treat. But these costs may decrease rapidly together with the experience gained and the investment made in training and equipment.

The costs for dismantling may be roughly estimated on the basis of the dismantling time. For example, the dismantling costs for a PC have been estimated at :

**20 –25 minutes labour x average wages + 30% of the average wages to reflect non-labour costs.**

Based on the assumption that dismantling a PC of 20 kg costs £5 - £6 (or about 8,00 €) per unit in the UK, the following estimations have been made regarding different categories of appliances which are assumed to be easier to dismantle, and made of less components than PCs<sup>58</sup>.

	Composition	Average weight	Dismantling time	Dismantling costs (£)	Dismantling costs (in €)
ICT products 1	30% PC	20 kg	PC	£5 - £6	~ 8,00 €
ICT products 2	70% other	50 kg	= 1/2PC	£2,5 - £3	~ 4,00 €
Brown goods	66% TV sets	26 kg	= 1/2PC	£2,5 - £3	~ 4,00 €
Large white goods		47 kg	= 1/2PC	£2,5 - £3	~ 4,00 €
Small HH appliances		2 kg	= 1/2PC	£1,25 - £1,5	~ 2,00 €

<sup>58</sup>Discussion Paper of 28 March 2003 by the UK Government, Scottish executive, Welsh assembly government, and Northern Ireland administration on the implementation of Directives of the European Council and Parliament 2002/96/EC of 27 January 2003 (WEEE) and 2002/95/EC of 27 January 2003 (ROHS), Department of Trade and Industry, Publication Number URN 03/811 [www.dti.gov.uk/sustainability/weee/index.htm](http://www.dti.gov.uk/sustainability/weee/index.htm)

When products are too obsolete to be repaired, or are worn, they can still be recycled. For instance, all large domestic appliances have historically been deemed recyclable due to their size and weight, and the composition of the pressed steel used for their structures.

### 5.3. RECYCLING MATERIAL AND COMPONENTS

Equipment category	Ferrous metals	Non-ferrous metals	Glass	Platics	Other
Large household appliances	61%	7%	3%	9%	21%
Small household appliances	19%	1%	0%	48%	32%
IT equipment	43%	0%	4%	30%	20%
Telecomms	13%	7%	0%	74%	6%
TV, Radio etc...	11%	2%	35%	31%	22%
Gas discharge lamps	2%	2%	89%	3%	3%

Source : ICER 2000

#### 5.3.1. RECYCLING TECHNIQUES

There are four broad methods currently employed for recycling:

- ▶ Equipment dismantling : the manual separation of reusable and recyclable components.
- ▶ Mechanical recycling : the removal of hazardous components followed by granulating and shredding in order to remove the recyclable raw materials such as plastic and ferrous metal.
- ▶ Incineration and refining : metal can be recovered after the more combustible materials have been incinerated.
- ▶ Chemical recycling : precious metals such as gold and silver can be removed from printed circuit boards and components via chemical processes<sup>59</sup>.

However, according to wide industry practices, the dismantling process is still mostly done by hand. The challenges in the future focus on less manual and more automated processes and on finding more markets for recycled raw materials.

New technologies available for recycling vary according to the type and main components of appliances.

##### 5.3.1.1. FOR PLASTICS

**Plastics** are used in WEEE mainly for the casing/housing of appliances, and some plastic dominated products may find less recycling outlets than metal ones– the predominant disposal route for plastics is incineration with energy recovery or even landfill. In fact, the recycling of plastics is not more difficult than other materials : the challenges are to clearly identify the polymers and to separate them from the different materials attached, e.g. filters, stabilisers, flame retarding additives and pigments used to change the properties of the basic polymeric material. To complicate matters, current plastic housings often have labels, felts, shock pads etc. attached to them.

Most of the recyclers still rely on manual identification and sorting techniques. Nevertheless, in order to improve plastics' recycling efficiency, recycling facilities are beginning to use new automated **sorting systems** that identify common polymers by using x-rays and visible light sensors or infrared rays. Other mechanical systems available include air classification, flotation, electrostatic or spectroscopic separation.



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Potential **chemical processes** include methanolysis (a depolymerisation process), which reduces old plastics to their original ingredients by applying heat and pressure in the presence of methanol. This combination not only causes the polymer chains to break down, leaving pure monomers which are purified and re-polymerized into new resin: it also allows destruction of contaminants. This chemical process can now be used to make food containers from recycled plastics, thus closing the loop for many plastic containers.

### 5.3.1.2. FOR METALS

**Metals dominated products** may be ferrous (iron, steel) or non ferrous (aluminium, copper, precious metal). They are mainly white goods such as washing machines, dishwashers, and small household appliances, but also PC components or mobile phones.

Metals can be recycled an almost unlimited number of times. Separation of ferromagnetic materials with magnetic methods is fairly simple. Recent investigations have demonstrated the feasibility of the use of true colour machine vision combined with high performance computing, enabling cost effective and accurate sorting of recycled and shredded non-ferromagnetic metals (aluminium, copper, brass, bronze, coated brass, lead, zinc, stainless steel). Metals can be recovered by shredding, incineration or cooling (applications with printed circuit boards<sup>60</sup>). Precious metals such as gold and silver can be removed from printed circuit boards and components via chemical processes.

### 5.3.1.2. FOR GLASS

Identification and separation of **glass dominated products** (such as TV-sets and monitors) is currently one of the problematic areas. The cathode ray tube that accounts for 50-55% of a TV set must be divided into screen (or panel) glass and conical (funnel) glass. The first consists of barium and strontium, while the latter contains mainly lead. Separation of panel glass from funnel glass is the most critical issue in CRT glass separation. There are several mechanical (such as plasma, water jet or laser cutting) or thermal methods (with electrical resistance) that have been tested to separate and recycle them. Different mechanical or chemical methods are also used for cleaning CRT panel glasses from covering films.

There are now more than 100 different CRT panel compositions (sometimes with lead, sometimes without lead) plus several different transmission technologies for each composition. In addition, TVs, monochrome computer monitors, and the vast array of colour monitors have all very different constructions. The result is that development of a standardised disassembly technique is difficult due to the lack of uniformity in this technology.



#### Recovery of printed circuit boards

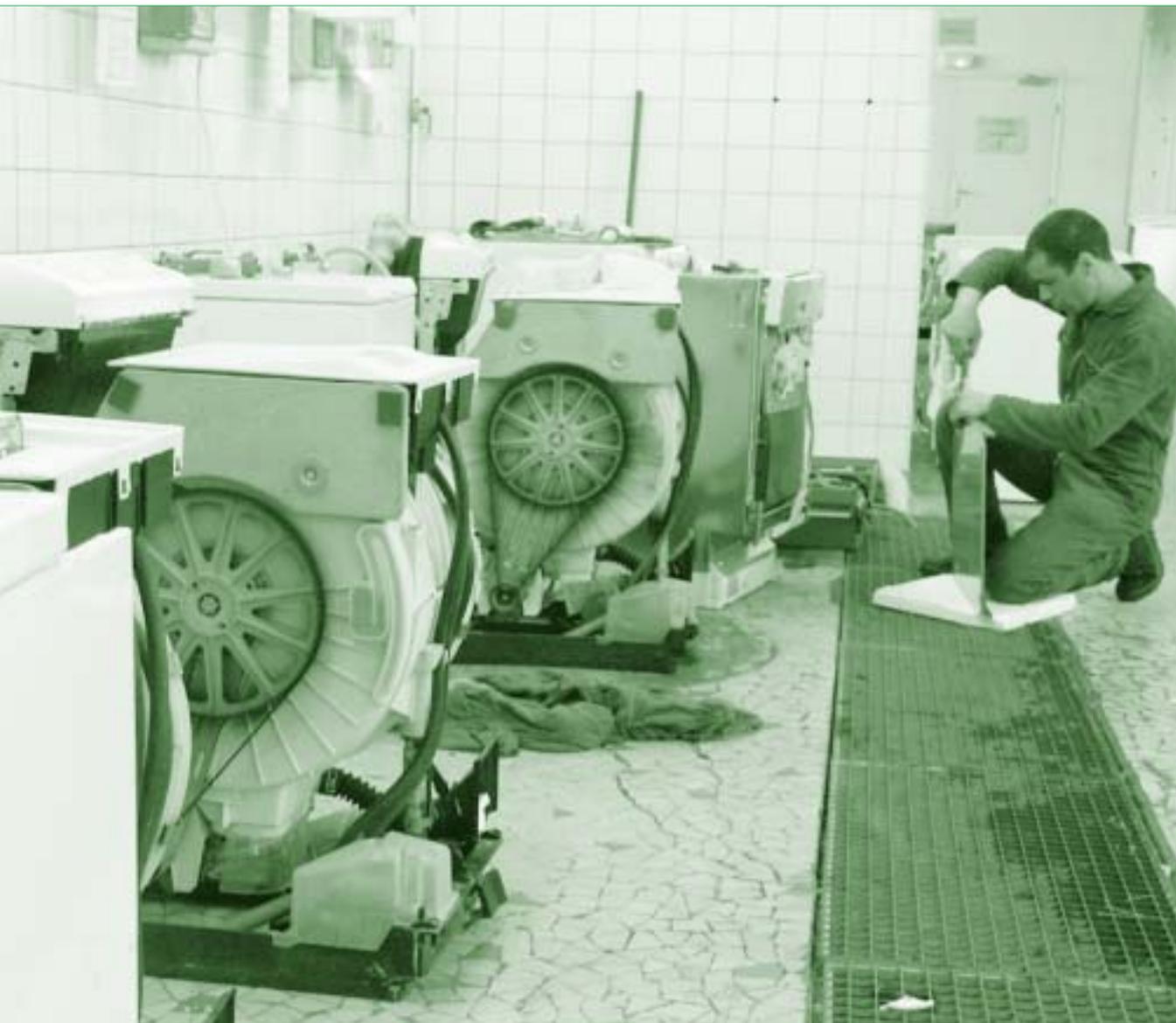
A method of recovery by cooling has been developed by Daimler-Benz-Research : steel as well as polymers get brittle when cooled down to  $-70^{\circ}\text{C}$  or less, while the toughness of copper and aluminium is increased. Consequently, the pre-cut (to a size of around  $20 \times 20 \text{ mm}$ ) printed circuit boards are cooled with liquid nitrogen, then grinded into smallest parts in a hammer mill, where the polymers fall from metal parts. In addition to cooling, nitrogen prevents polymers to oxidise and thus hinders the development of dioxin and furan. The separation of the different resource fractions is done with conventional methods like sieving, magnets, eddy-current separators and so on<sup>60</sup>.

<sup>59</sup>Environmental Strategy Briefing Note, August 2000  
<sup>60</sup>ECOLIFE – Closing the loop of elect(ron)ic products and domestic appliances. From product planning to end-of-life technologies.  
 Thematic network n° BRT-CT 98 5076  
<http://www.ihrt.tuwien.ac.at/sat/base/ecolife/>



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## 6. THE REPAIR AND REUSE OF OLD APPLIANCES



## THE ENVIRONMENTAL BENEFITS OF WEEE REPAIR AND REUSE

In its report on Virtual dematerialisation "Ebusiness and Factor X", the Wuppertal Institute estimates that the production of end appliances accounts for a high proportion of the entire product's resource consumption. A case study has shown that for a notebook PC, the production phase consumes almost the same quantity of resources as the use phase (40 to 50 percent depending on users' behaviours). This is a result of its material content (which requires intensive processing upstream for components such as PWBs, LCDs, chips and precious metals). Considering the great efforts in producing one single end appliance, the Wuppertal Institute concludes that reuse and recycling as well as the extension of the use phase of EEE are important improvement options from a life-cycle perspective<sup>62</sup>.

## 6.1. WHY REPAIR AND REUSE WEEE ?

Reconditioning, repair and reuse are attractive means to tackle the WEEE problem by extending the lifespan of old appliances. European authorities have attempted to encourage the development of those activities since it is explicitly stated in the Directive that "Member States shall give priority to the reuse of whole appliances"(art. 7 §1).

Reconditioning, repair and reuse will extend the lifespan of used products and components so that they can be put back into the market. Unlike recycling which requires the breaking down of technical components, that have often been carefully and expensively machined into lower value raw materials, reconditioning, repair and reuse keep units or components in their entire state (therefore retaining higher value with a lower expenditure of efforts<sup>61</sup>).

These activities are already well developed in Europe and beyond, and are known to be profitable. For example, there are more than 70.000 firms operating in the US alone<sup>63</sup>. In the UK, there are over 300 community organisations supplying second hand goods to people in need, and according to them, electrical appliances are on the top of the list of customers desires<sup>64</sup>.

The repair and reuse of products not only allows to save recycling and treatment costs, but also give economic benefits from the resale of the products at a lower price than new ones. They constitute a new economic sector (with little overlap with existing activities) where a new kind of industry (small businesses and community groups) can find great opportunities in the remarketing of white goods for example. They are especially suitable for social enterprises engaged in reuse activities, offering work, training and skills to long-term unemployed or disabled people.

Indeed, the social benefits associated to reuse and repair of old appliances are particularly important on two grounds:

- ▶ these activities offer interesting work in sorting and recycling as well as the training of low-skilled workers or those with few employment prospects
- ▶ reused goods being significantly cheaper than new ones allows households with lower incomes to access goods they would otherwise not be able to afford - thereby reducing social exclusion.



## 6.2. PROSPECTS FOR REPAIR AND REUSE

Despite the fact that reuse is explicitly protected in the Directive, there are no clear drivers to encourage the development of repair and reuse activities, and art.5 §4 stipulates that the envisaged reuse activities must not lead "to a circumvention of the provisions related to the treatment or recovery of WEEE".

Besides, up to 31st December 2008, and unlike reused components, materials and substances, whole appliances which are reused won't be taken into account for the calculation of the recovery and recycling targets of art. 7 §1. This provision does not really constitute a motivation for producers to favour the reuse of their products, and LRAs will have their role to play in paying attention to the protection of existing reuse systems, in preserving the potential of appliances capable of being reused as a whole, and in directing them to the appropriate paths.

Among the main barriers to repair or reuse are :

- ▶ the rapid pace of technologies and the changing design of appliances
- ▶ the scarcity of knowledge about the goods and their components
- ▶ the composition of recent appliances : mainly plastic products are usually more difficult to repair than metal ones
- ▶ the costs of repair, which often exceed the costs of manufacturing a new product
- ▶ the decreasing quality and lifespan of new products put on the market
- ▶ the need for definition and quality standards of the reuse/repair processes
- ▶ the lack of commercial tools for secondary markets.

These barriers limit the scope of repair or reuse activities to appliances which fulfil criteria's both in terms of :

- 1) reusability / saleability, depending on :
  - ▶ the age of the machine : this will determine notably its energy/water consumption and its intrinsic hazardousness
  - ▶ the type and model of the machine : determine whether the product has not been made obsolete by alternative technology
  - ▶ the demand for such appliances as regards capacity, function, utilities : the appliances for which there is the most important demand from the social economy are fridges, ovens, washing machines, and ICT products
  - ▶ the goods' overall conditions
- 2) attractiveness of repair, which is linked to:
  - ▶ the presence of valuable spares
  - ▶ the type of main fault occurrence
  - ▶ the feasibility of repair (notably – availability of spare parts...)
  - ▶ the costs of repair versus sale
  - ▶ the price of a new machine.



<sup>61</sup>White goods, Remarketing and the WEEE Directive, Amy Griffiths in *Waste Management World*, pp. 36-40, Jan-Feb 2003.

<sup>62</sup>Digital Europe: virtual dematerialisation and factor X, Wuppertal Institute, March 2003; <http://www.digital-eu.org/publications/Default.asp?pubid=32>

<sup>63</sup>White goods, Remarketing and the WEEE Directive, Amy Griffiths, Op. Cit. n°61

<sup>64</sup>Fit for re-use, a guide to the repair, refurbishment and reuse of domestic electrical appliances, Craig Anderson, Furniture Recycling Network, UK, 2001.



**Social economy enterprises** are businesses of very diverse forms with primarily social objectives, instead of profit making ones.

*(Social Enterprise, a strategy for success..., Department of Trade and Industry, UK, July 2002)*

### 6.3. SOCIAL ECONOMY ENTERPRISES : KEY PARTNERS OF LOCAL AUTHORITIES

One approach to encourage reuse is to persuade social economy enterprises to become more involved in areas like collection and dismantling, and by creating a place for them in waste management contracts.

#### 6.3.1. A DEVELOPING ECONOMIC SECTOR

In the past 50 years, recycling and refurbishing have emerged as an important sector for the development and growth of social enterprises. Organised collection, sorting and resale of used clothes, household furniture or other materials (like paper) were initially undertaken by charitable organisations such as the Salvation Army.

Along with the economic crisis of the 1990s, these experiences were supplemented with entrepreneurial groups combining social and economic objectives. Many of these enterprises emerged from labour market integration projects, traditionally focusing on the social aspects of their enterprises rather than on economic performances.

These entities have developed new skills and more sophisticated practices involving the use of modern technologies for the reclamation of end of life goods, exploring new opportunities in recycling and recuperation markets, or providing LRAs with the delivery of waste management services like the selective collection at source of waste goods and materials. Furthermore, social enterprises often combine these entrepreneurial activities in the recycling sector with awareness raising campaigns to promote more sustainable consumption behaviours. Such campaigns are often conducted with the financial support and co-ordination of local authorities interested in reducing the impacts of waste and consumption patterns on the environment.

### 6.3.2. ENSURING THE QUALITY OF REUSE ACTIVITIES

The success of reuse initiatives will directly depend on the trust of customers within the quality and security of second-hand appliances, which require to organise reuse activities with professionalism.

For instance, the identification of appliances which could be profitably remarketed calls for initial visual, electrical and safety tests. These will allow to assess the completeness and the condition of the appliances, as well as to ascertain that it is not electrically hazardous under normal operating conditions.

After repair/refurbishment, operation tests should also assess the fitness of the product through high voltage tests, for example, and a cosmetic cleaning should give it an attractive appearance.

The experience of social economy enterprises in managing reuse activities can bring a useful and profitable expertise.



© Recycle-IT!

#### CASE STUDY 1

##### Ensuring quality and safety of reused appliances in Flanders

In Belgium, the Flemish Region (6 million inhabitants) is entirely covered by a network of re-use centres, which in 2002 employed over 1.700 persons and collected nearly 25.000 tonnes of waste of which more than 70% could be re-sold.

KVK is the branch organisation, which supports these centres in professionalising their re-use activities through the common development of strategies and marketing activities. KVK also represents its members towards all relevant authorities from the local to the European level.

Preparations for Flemish WEEE legislation started in 1995. The lobbying of KVK resulted in the explicit integration of re-use within the legislation (VLAREA, 12/1997), which states that all collected appliances (regardless they are collected by local authorities or retailers) must be separated into reusable and non-reusable streams.

Since July 2001 the producers are obliged to organise and to finance the collection, recycling and treatment of WEEE and have set up a collective management structure. Consumers now pay a visible fee when they buy a new product. This fee is used to finance the collection, centralisation and treatment of old appliances.

Producers feared that potential lack of quality in the reuse and refurbishment of discarded appliances could cause safety problems. The Flemish re-use sector decided to respond to the producers' concerns : from 1998 onwards the KVK started to build a network of specialised refurbishment centres for household appliances at a regional scale (ca 300.000 - 500.000 inhabitants), instead of the local level of re-use shops : appliances collected by the local re-use centres are tested and refurbished in specialised refurbishment centres, and finally resold in the local shops.

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KVK has developed a standard business-plan and created a common label (Revisie®) for the marketing of re-used appliances. It also organises training for instructors, and informs re-use centres on safety, quality and juridical responsibility.

To obtain the authorisation to use the trademark "Revisie®", re-use centres need to fulfil a list of criteria:

- ▶ to test and refurbish appliances according to standardised procedures
- ▶ to ensure a proper control of the quality by qualified responsible persons
- ▶ to offer a 6-month guarantee
- ▶ to have an insurance policy that covers all applicable liabilities and responsibilities
- ▶ to use the agreed programme for registration and monitoring
- ▶ to report data to the KVK to allow comparison between the refurbishment centres
- ▶ ...

So far, half the Flemish region is covered by seven refurbishment centres using the Revisie-trademark.

For more information on the management of reuse activities, you can consult :  
"Fit for re-use, a guide to the repair, refurbishment and reuse of domestic electrical appliances", Craig Anderson, Furniture Recycling Network, UK, 2001

### 6.3.3. ENCOMPASSING SOCIAL OBJECTIVES

Social enterprises have an added value in providing goods and services for people with low incomes who are dependent of social welfare mechanisms, and in fighting unemployment by setting up new activities and by training or employing specific groups of people.



© GOAB

### 6.3.3.1. EMPLOYEE TRAINING

Mostly skills are acquired on-the-job in addition to specific training courses. Vocational training and qualifications (such as working with shredders, computing, learning to drive special vehicles...) are usually provided to workers as part of the whole integration process, which also involves social training (life and work skills training, social behaviour, conflict solving, etc.).

At ENVIE, in France, 50 - 60% of all workers leave the enterprise as skilled workers and are able to get permanent contracts in other companies. A partnership ENVIE-Thomson-Darty-AFPA (a French vocational training association) has created a vocational training pool.

CREATE in the UK provides training with nationally recognised qualification standards (NVQs). Trainees are not limited to training in repairing appliances, but also gain qualifications in Engineering Assembly, etc.

At Recycle-IT!, another UK based social enterprise, training and qualifications are offered by partners, the Training Agencies and Barnfield College, and is supplemented in-house when necessary.

RREUSE (the organisation which represents and supports national networks and federations of social economy enterprises carrying out re-use and recycling activities in Europe) is also developing currently a specific training course for the recycling operators at the European level.

### 6.3.3.2. SUPPORT TO IMPOVERISHED PEOPLE

By reducing differences in service provision and job opportunities, social economy enterprises contribute to build cohesion and reduce poverty within a geographical area.

Social enterprises address the demand of unmet needs through the supply of second-hand equipment.

Moreover, people they employ are often disadvantaged by the labour market, so that social economy enterprises not only contribute to reducing exclusion, but also create an added value of „employability“, as people grow in professional skills thanks to their training.





### 6.3.3.3. CREATING LOCAL JOBS

Reuse and recycling activities provide work to around 40.000 people in social economy organisations throughout the EU. The most important sectors are WEEE, bulky furniture and textiles, followed by paper and glass. The number of jobs and amount of waste treated are estimated as follows :

	Number of jobs	Quantities of waste treated (tons)
<b>WEEE</b>	10.000	200.000
<b>Bulky waste</b>	4.500	350.000
<b>Textile</b>	2.000	110.000

For an extrapolation at the European level, it is probably necessary to double these numbers.

#### CASE STUDY 2

##### **A partnership with social economy for refurbishing electrical household appliances in Nantes (France)**

In 1992, the neighbouring municipalities of Nantes and St-Herblain were confronted with excessive unemployment rates in several suburbs. An employment team was set up as an independent association to seek opportunities in creating additional employment with added value, i.e. without harming the private sector. The team had heard of the success story of ENVIE (Entreprise Nouvelle Vers l'Insertion Economique – New enterprise towards economic integration).

##### **The activity of ENVIE**

The ENVIE network in France was founded in 1984 by a few people coming from the Emmaüs association. Its main activity is to recondition equipment while allowing young people in difficulty to obtain work. The network is now made of 38 member companies located on 28 sites across France and employing 650 people (200 permanent staff and 450 salaried being trained). They collect and treat 300.000 electrical appliances annually, of which 25% can be resold at one third of the price of new equipment, with a one-year guarantee.

### The Nantes project

ENVIE 44 in Nantes has been created thanks to :

- 1) **start up capital** covering at least 6 months rent and salaries, obtained from the state, the region, the municipality, a large endowment charity and a few gifts
- 2) **support from distributing companies** of large electrical appliances (Darty, Leclerc and Conforama) which agreed to give access to the equipment they were taking back (transport by professionals bringing new equipment would ensure the provision of quality products)
- 3) **an advertising campaign for second hand equipment** focusing on both the social and the environmental dimensions to contribute to the local economy (which worked well with youngsters customers coming from the suburbs, and with better-off people equipping their summer house).

### Results achieved

The organisation collects today 16.000 electrical appliances per year and has a stable employment of around 40 people, including 10 permanent technicians and trainers.

At the end of their training, half the trainees obtain an employment either in the electrical sector, or e.g. as a lorry driver, the important being to have a first successful professional experience.

The environmental function of ENVIE 44 (collection, sorting, refurbishment and treatment of WEEE) is now recognised besides its employment function, as it is now paid by appliance treated like traditional collectors. The success of the collaboration with ENVIE has even led to a review of the waste policies and other projects have now been developed regarding second hand clothing, used paper, old books and personal computers.

### A new pilot project anticipating the implementation of the WEEE Directive

Under the forthcoming transposition of the European WEEE Directive into French legislation, the French manufacturers and distributors of electrical equipment will become responsible for the take-back, recycling and treatment of used equipment in compliance with environmental best practices. In order to appreciate the reality of technical, logistical and financial constraints, generated by the implementation of the WEEE Directive, manufacturers have undertaken a pilot project with ENVIE 44 on a representative sample of the French population and territory (1% of the French population – 555.518 habitants – within an area of 24 municipalities with varied profiles where all distributors' brands are represented).

The pilot, which started in July 2002, covers both re-use and dismantling / recycling. It allows ENVIE to become a full economic operator combining re-use and recycling activities. It also allows the manufacturers to design an organisational scheme suitable at the scale of France and to determine with some precision the costs of the collection and treatment systems to be implemented (and consequently the fee to be put on new appliances).



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## 7. BEYOND SORTING AND RECYCLING WASTE : AN EVOLVING ROLE FOR LRAs

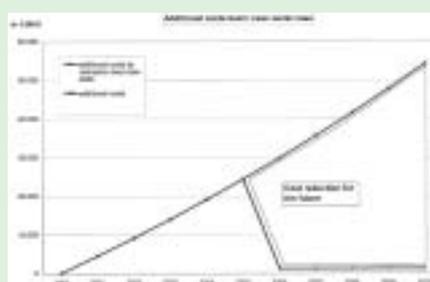
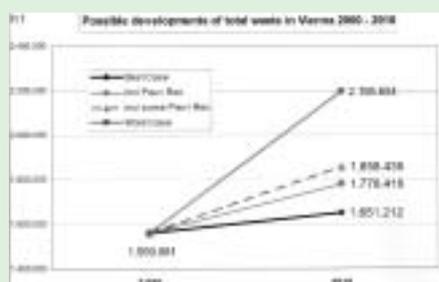


## 7.1. TACKLING WASTE GROWTH : A CHALLENGE FOR LRAs

Waste is generated at the local level but results from a more global issue : our current lifestyles and consumption patterns. This means that tackling the waste problem must not be restricted to end-of-pipe solutions, but must also encompass strategies to tackle production and consumption. Local authorities have major incentives to act resolutely in these fields : after all they are the final recipients of our waste, and it is in their interest to avoid waste growth.

### Prevention is worth it

The 1.600.000 inhabitants of Vienna produced 1.560.000 tons of municipal waste in 2000 (including 800.000 tons of household waste). The municipality has calculated that, with the current growth rate, the total amount of municipal waste will reach 2.200.000 tons by 2010, requiring the building of additional disposal and incineration facilities for the 600.000 extra tons.



Source : Prof. Gerhard Vogel, Department of Technology and Community Science, Vienna University of Economics and Business

Based on this assessment, the municipality calculated that developing a strategy aiming at avoiding and reducing waste in the future could save up to 55.000.000 € (for waste management facilities' capacity expansion) in 10 years. The feasibility of waste reduction, through promotion campaigns for more sustainable consumption patterns, was tested in pilot projects. These showed that correctly informed consumers could reduce their waste production by 15% quite easily, by changing their consuming and shopping behaviours. This made clear that efforts towards prevention would be profitable : therefore the Government of Vienna decided to allocate a budget of 3 million € per year during the next ten years for waste prevention activities. This support is covered by the waste fee.

The improvement of our global environment requires action at the local level and, beyond encouraging recycling, local and regional authorities have their role to play in :

1. promoting eco-design
2. promoting repair and second-hand goods
3. raising awareness on the proper use of products
4. changing consumption behaviours
5. promoting the replacement of products by services
6. tacking the best from Information and Communication Technologies (ITC)
7. raising awareness and changing habits.

<sup>66</sup>BREZET J.C., VAN HEMEL C., *Eco-design: a promising approach to sustainable production and consumption*, UNEP, Paris, 1997.

<sup>67</sup>*Environmentally improved product design case studies of the European electrical and electronics industry. Eco-design subgroup. ECOLIFE Thematic Network, July 2002.*

Downloadable at:  
<http://www.ihrt.tuwien.ac.at/sat/base/Ecolife/ECOIndex.html>

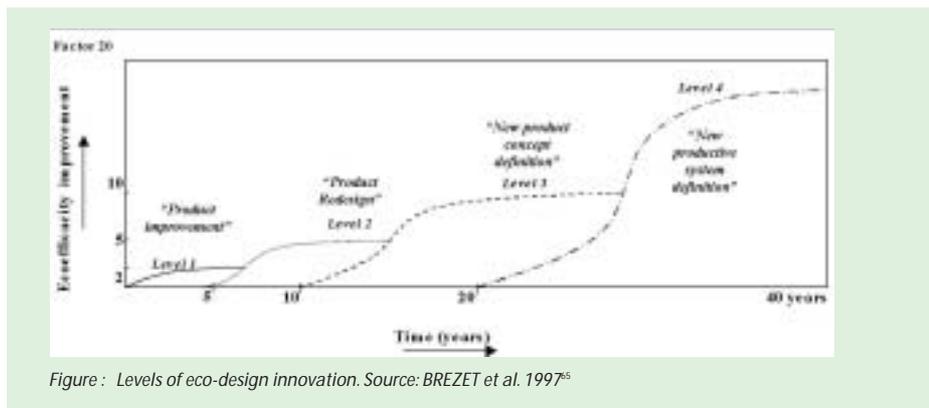
<sup>68</sup>*Integrated Product Policy*

<sup>69</sup>*Integrated product Policy as a Tool in Environmental Protection – the Bavarian Point of View, Dr. H-C. Steinmetzer, in proceedings of the Citizens Parliament on Sustainable Consumption, Brussels 14 March 2003, organised by ACRR, IBGE-BIM, CRIOC-OIVO and the European Commission*

## 7.2. PROMOTING ECO-DESIGN

'Eco-design' or 'design for the environment' is the systematic incorporation of life cycle considerations into the design of products or services. It has emerged from the observation that a proactive approach of systems thinking in the form of eco-design could lead to direct cost reductions as well as to environmental improvements, but also to increasing sales by bringing products to the market which have both a good environmental performance ("social benefit") and a good performance for the individual customer ("customer benefit").

There is an increasing trend today towards considering the entire lifecycle effects of product: the effects of suppliers upstream, and of product use and disposal downstream. These effects must increasingly be considered as the emphasis in environmental management is currently shifting from being defensive to being proactive i.e. competing in the market on environmental performance. The increasing adoption of voluntary environmental management systems (ISO 14001 and EMAS) and product standards (e.g. eco-labelling) is part of this process. It is expected that this development will continue, from product improvement to productive system innovation as depicted in the following figure:



Four levels of eco-design can be defined as follows:

- Level 1: **product improvement**, re-styling which can consist of decreasing the use of materials or replacing one type of fastener by another, and may already lead to a 25-50% reduction in environmental pressure per consumption unit.
- Level 2: **product redesign**: a new product is redesigned on the basis of an existing product.
- Level 3: **new product concept definition**, with different functionalities.
- Level 4: **new production system definition**: this occurs when innovation in the productive system is necessary<sup>56</sup>.

Some regional authorities such as the city of Torino (I) or the Bavarian State (D) have started cooperation projects with local universities and industry to promote eco-design in local industrial processes.

In Torino, the municipality and the Politecnico (High School of Science and Technology) have finalised an agreement to organise a special degree in eco-design. The programme, organised in 4 periods of 6 months, is open to graduate students and already experienced engineers, and provides education on a variety of issues centred on eco-design such as composition of products, lighting techniques and lighting appliances, innovation, management and communication.

In Bavaria, the Ministry of State Development and Environmental Protection made IPP<sup>67</sup> one of the central field of its environmental policy and, with this particular objective, created a specific IPP unit. The State authority held a congress in April 2000 which resulted in the selection of several R&D projects combining business, science and the state authorities. One of these has allowed to reduce by a factor two (in comparison to the ecologically best performing customary product) the energy consumption and the overall number of different materials of a vacuum cleaner, as well as to reduce its time of disassembly by a factor 14 (from 182 to 13 sec)<sup>68</sup>. Many other projects are still underway. Some of them are targeting consumers and aim for instance to identify which elements of IPP may be used in marketing strategies to create demand for "green" products, or to find out how a product panel should be composed and work in order to improve the eco-design of products.



### "Aus. Wirklich aus ?" – A "stand-by" Campaign in Schleswig-Holstein (D)

Stand-by consumption in Germany in 1995<sup>69</sup> was equivalent to 14 billion kWh/year or Berlin's electricity needs for one year. This resulted in the emission of some 14 million tons CO<sub>2</sub>/year, which contribute to climate change. End of 2000 the federal state of Schleswig-Holstein (D) started a campaign on the unnecessary electric power consumption through idle losses, with electronic appliances (especially the communication- and conversation- electronics) remaining on the "stand by" position<sup>70</sup>.

<sup>69</sup>German Federal Environment Minister, [http://www.umwelt-deutschland.de/index\\_englisch.html](http://www.umwelt-deutschland.de/index_englisch.html)

<sup>70</sup>For more information :

Energiestiftung Schleswig-Holstein, Stiftung öffentlichen Rechts, Dänische Straße 3 – 9, D-24103 Kiel - Tel.: ++49-(0)431/9805-600 - Fax: ++49-(0)431/9805-699 - E-Mail: [info@essh.de](mailto:info@essh.de) - <http://www.energiestiftung.de/>

<sup>71</sup>Study on different types of Environmental Labelling (ISO Type II and III Labels): Proposal for an Environmental Labelling Strategy, by Charles Allison & Anthea Carter (Environmental Resources Management) for the DG Environment, European Commission, September 2000 <http://europa.eu.int/comm/environment/ecolabel/pdf/studies/erm.pdf>

<sup>72</sup>For more information : <http://europa.eu.int/comm/environment/ecolabel/> or <http://www.eco-label.com>

## 7.3. PROMOTING REPAIR AND SECOND-HAND GOODS

Cities like Vienna have already taken initiatives in order to promote the repair and reuse of Electrical and Electronic Equipment, by editing guides of repair enterprises to the attention of citizens.

In 1994, the Munich municipality published a brochure which compiles a list of addresses of repair shops in Munich. This was followed-up by the "Repairwork-day" organised for the first time in 1997. On this day, citizens could bring their broken utensils for repair by experts free of charge. The surprising result was that more than two-third of the household utensils could be restored by minor repair work.

In March 1999, the Municipal Department 22 (Environmental Protection) of Vienna, in collaboration with the Municipal Department 48 (Waste Management), launched the first exchange platform for second-hand goods on the Internet : <http://service.wien.gv.at/wab/> The repair guide, the guide to renting facilities and the waste disposal manual are also available online.

Promoting of second-hand goods, repair etc. may stress aspects like :

- low prices
- warranty
- green choice supporting local enterprises...

## 7.4. RAISING AWARENESS ON THE PROPER USE OF PRODUCTS

There are ways to use products in a more or less environmental friendly manner. Examples include:

- ▶ the use the "eco-programmes" for washing machines and dishwashers
- ▶ not leaving appliances on the stand-by position,...

Local authorities can raise public awareness on these topics, and the results of such awareness campaign can sometimes be amazing at the scale of a local authority.

## 7.5. CHANGING CONSUMPTION BEHAVIOURS

Consumers represent the demand side and should be informed about their environmental impacts in buying, using and discarding EEE and about the possibilities available to them for reducing these impacts : they can choose to buy long-life and eco-efficient products, stop using useless ones and so influence the offer side.

### Promoting eco-labelled products

Companies are increasingly approaching customers with environmental messages to win their attention and choice. One of such environmental communication tools are eco-labels that allow manufacturers to distinguish their products according to established criteria. There are three types of labels: type I, type II, and type III that have been established by the International Standardisation Committee (ISO).

- Type I labels are environmental claims that are based on criteria established by a third party and are multi-issue, being based on the product's life cycle impacts.
- Type II claims are based on self-declarations of manufacturers and retailers.
- Type III claims consist of quantified product information based on the lifecycle impact. These impacts are presented in a form that facilitates a comparison between products, e.g. a set of parameters.

Type I labels are rather well-established with almost each European country promoting its own label, the most known ones being Blue Angel in Germany, and the Nordic Swan Label in Scandinavian countries. The European Union has established its own eco-label : the EU Flower.

Though lacking in objectivity, type II labels are sometimes preferred by manufacturers due to notably : the cost of some type I labels (feasible for large multinationals but not affordable for SMEs), the length of the application procedure (that due to fast technology cycles of electronic products makes application meaningless), the fact that national labels are not coordinated with the labels in other countries, and that eco-labels have little visibility and understanding for consumers. All the above mentioned may contribute to considering type I eco-labels as trade barriers especially in developing countries<sup>71</sup>.



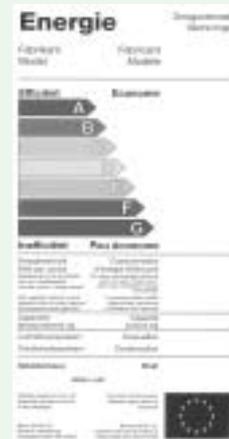
### The European Eco-label – the Flower<sup>72</sup>

This label is of the ISO I type, and awarded to products which comply with very stringent environmental and performing criteria following a "cradle to grave approach" taking into account the impacts of production, use and disposal of the product :

- a guaranteed performance
- their energy (electricity) and resources use (detergents, water)
- the ease of dismantling/recycling
- their content in hazardous substances
- the availability of spare parts
- the availability of instructions for users for environmental use
- their noise.

**The European Energy Label** has been introduced by a European directive, on the labelling of domestic appliances (Directive 92/75/EC). It must be visible on all appliances for sale in shops, and allows consumers to compare easily (thanks to a graduate scale from A to G) the energy performance of various ranges of products among which : refrigerating appliances, freezers, washing machines, dryers, dishwashers, ovens, refrigerators, bulbs, air conditioners...

The label gives also other specific information, such as energy consumption, noise...





**Energy Star**<sup>73</sup> is a voluntary labelling program introduced by the US Environmental Protection Agency (EPA) in 1992 to identify and promote energy-efficient products, in order to reduce greenhouse gas emissions. Computers and monitors were the first labelled products. The ENERGY STAR label is now on major appliances, office equipment, lighting, cooling equipment, home electronics, and more. For instance, producers participating within this program agree to produce equipment which consume less when not in the use phase, etc...

#### PROMOTING ENERGY ECO-LABELS

In January 2002, the **Local Energy Management Agency of Clermont-Ferrand (F)** (ADUHME, created in 1996 thanks to the European SAVE II Programme), has launched a six-month communication campaign whose aim was to promote the use of the Energy label. The initiative was mainly based on the assessment that in energy invoices of dwellings built since the early eighties, domestic appliances count for as much as heating, and that substantial savings could be made if white goods were all energy efficient. For instance, **the use of efficient refrigerating appliances could allow to reduce by 3,2 times on average their energy consumption** so that savings could amount to 725 kWh per household per year<sup>74</sup>. The idea was to promote energy labels among :

- retailers, and inform them so that they use them as selling points
- consumers, whose awareness must be raised so that they prefer energy efficient equipment.

Beyond that, a network of 36 retailers-partners has been gathered within a "Charter of the dealer" through which they notably committed themselves to relay the information to their customers. Some 40 sellers were given an half-day training providing them with tools to "sell" energy efficiency<sup>75</sup>.

In November 2001, the **Energy Foundation Schleswig-Holstein (D)** started a campaign on energy-efficient illumination, wherein lies a key energy (and money) savings potential after the "stand-by" issue. The main goal of this information campaign was to convince users that a range of prejudices are today no longer applicable against energy-savings-lamps, since it has undergone new developments like more diverse forms and colours, and better technology (higher switch-reliability). The main advertising events ran from November 2001 until February 2002, but other activities, like information spreading through the trade or in the framework of the energy-advice of the consumer-headquarters, are still running<sup>76</sup>.

The **Walloon Region in Belgium** went further and decided to provide subsidies for the purchase of eco-efficient electrical domestic appliances : from 2004 onwards, the purchase by private households of fridges, washing machines or dishwashers with the A+, A++ or AAA labels will receive a premium of 75,00 €. The premium may amount to 200,00 € for a gas tumble dryer. Lighting is also addressed and a 5,00 € subsidy will be awarded for the purchase of 2 class A light bulbs<sup>77</sup>.

<sup>73</sup>For more information : <http://www.energystar.gov>

<sup>74</sup>"L'étiquette énergie, pensez-y ! Campagne d'information sur l'électroménager blanc performant », rapport final, p.5 -

<http://www.aduhme.org/images/pdf/RAPfinal.doc>

<sup>75</sup>For more information : ADUHME (Association pour un Développement Urbain Harmonieux par la Maîtrise de l'Energie), 14, rue du Buffon, F - 63100 Clermont-Ferrand, <http://www.aduhme.org>

<sup>76</sup>For more information : **Energiestiftung Schleswig-Holstein**, Stiftung öffentlichen Rechts, Dänische Straße 3 - 9, D-24103 Kiel - Tel.: ++49-(0)431/9805-600 - Fax: ++49-(0)431/9805-699 - E-Mail: [info@essh.de](mailto:info@essh.de) - <http://www.energiestiftung.de/>

<sup>77</sup>Le Soir Eco, 19,20,21 July 2003.

## 7.6. PROMOTING THE REPLACEMENT OF PRODUCTS BY SERVICES

Dematerialisation (a shift from product ownership to service emphasis) seems a promising way to encourage a more efficient use of materials and a lowered production of waste<sup>78</sup>. Providing services through renting, sharing, pooling or leasing... are new approaches to save materials and resources: in such systems, value derives from the service provided by the producer, while the product becomes a means of delivering this service and remains its property.

According to a report on Product Service Systems (PSS), dematerialisation changes a user's need fulfilment in such a way that the necessary material and energy flows decrease significantly<sup>79</sup>. Besides, Product Service Systems increase the involvement of the producers with the product during its use (maintenance, upgrade) and after use phases (take back, repair, recycling).

Product Service Systems are nothing new in the electronic equipment industry; companies are offering service packages that include hard- and software maintenance. Recent developments within the IT industry have resulted in an explosion of new service techniques and service segments. Product service systems can offer big stable market for specialised service providers; some producers of electronic appliances, such as XEROX, have already opted resolutely for the leasing approach.

### XEROX : INTEGRATED SUPPLY CHAIN AND DIGITAL DOCUMENTS – OR ABOUT RENTING A COPY SERVICE INSTEAD OF BUYING COPY MACHINES

As a result of a strict environmental policy, the end-of-life potential of products, components and supplies has been maximised by building the concepts of easy disassembly, durability, reuse and recycling into equipment design. XEROX document systems are designed in such a way that a large proportion can be reused or recycled in a new product from the same family. XEROX offers the same guarantee for products regardless of the reprocessed content.

The reuse and recycling rate is enhanced by situations where XEROX remains in contact with the customer throughout the product life cycle. Examples of such customer relationships include the servicing and maintenance of equipment, and arrangements whereby the customer purchases a document service rather than the equipment.

This policy yields important results : between 1997 and 2001,

- parts re-use and recycling has diverted an average of 65KT/year from landfills,
- returned equipment can be rebuilt re-using 70-90% by weight of components,
- designs based on previous models may have 60% of parts in common with previous equipment<sup>80</sup>.

<sup>78</sup>Product Service Systems, Ecological and Economic Basics, March 1999

<sup>79</sup>Product Service Systems, Ecological and Economic Basics, March 1999

<sup>80</sup>For further information and more case studies please visit ECOLIFE webpage:  
<http://www.ihrt.tuwien.ac.at/sat/base/Ecolife/ECOIndex.html>.



#### DIGITAL TECHNOLOGIES CAN REDUCE ENVIRONMENTAL IMPACTS

A report by Digital Europe found that digital technologies can dramatically reduce pressure on the environment. E-commerce can – under specific circumstances – provide significant resource efficiency potentials, especially if products are replaced by services. Public administrations can lead in offering e-services (push strategy) as part of their e-government strategies. Besides, they can request services rather than products from their suppliers whenever possible (pull-strategy).

<sup>81</sup>Digital Europe: virtual dematerialisation and factor X, Wuppertal Institute, March 2003; <http://www.digital-eu.org/publications/Default.asp?pubid=32>

<sup>82</sup>Idem

<sup>83</sup>Information and Communication Technology

<sup>84</sup>Digital Europe: virtual dematerialisation and factor X, see here above.

## 7.7. TAKING THE BEST OUT OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)

If WEEE is the fastest growing waste stream and contains large quantity of dangerous substances, the development of e-technologies can also create opportunities in the field of dematerialisation and savings of material resources through telecommuting, tele-shopping, teleconferences, e-mails, e-books and services offered on the Internet.

The same report found in particular that:

- ▶ Music downloaded legally from the internet can have less than half the environmental impact of buying a pre-recorded CD. Researchers compared three methods of purchasing 56 minutes of pre-recorded music and found that<sup>81</sup>:

	Material used (kg)	Equivalent in producing aluminum drinks cans
Purchasing a CD online	1,31	5
Buying a CD in the high street	1,56	6
Downloading music online	0,67	< 3

- ▶ Online banking can have almost one third of the environmental impact of branch banking<sup>82</sup>

	Material used (kg)	Equivalent in producing aluminum drinks cans
Paying a bill at a counter	2,56	10
Paying bills online	1	4

Teleworking appears to be another interesting way towards dematerialisation. Modern and forth-coming ICT<sup>83</sup> can positively save on transportation, either through the substitution of physical transport or by more sophisticated organisation of transport use. The Ministry of Environment in Finland for instance has estimated that 450.000 workers (about 20% of the population) could potentially become telecommuters and thus perform all or a part of their job outside the workplace. If all of them would work one day a week at home, distances travelled by car would be reduced by about 216 million kilometres, thus reducing by 1% CO2 and air pollutant emissions from privately owned motor vehicles in Finland.

## 7.8. RAISING AWARENESS AND CHANGING HABITS

ICT technologies have a significant "dematerialisation" potential and can contribute to decouple economic growth from resource consumption. However, the positive impact will largely depend on changing consumers' habits and tackling the so-called rebound effects which are likely to have a counterbalancing influence. Indeed, tele-working or tele-shopping make it possible to adapt travelling times to people needs but what takes the place of a car journey to work or to the supermarket ? The time gained could be used for recreational activities such as cycling or playing football but it might also be used by some people for travelling to the countryside by car !

- ▶ E-mails are a good example of the potential to reduce envelopes and paper consumption as long as they are not all printed as soon as we receive them.
- ▶ Music downloads from the internet have substantial positive effects as long as consumers do not re-materialise digital information by burning music files on CDs. Digital Europe has shown that this habit might even over-compensate the savings from a purely digital distribution<sup>84</sup>.

Sustainable production and consumption must go hand in hand! But, with virtual products, the responsibility shifts significantly to the consumer. This reinforces substantially the importance of awareness raising, consumer education and the promotion of cultural changes. All domains in which local authorities can have a significant role to play !



### ICT – a path to paperless office

The Brussels Region has launched pilot projects in public and private enterprises to assess the potential of paper and energy savings allowed by the proper use of advanced IT equipment. The project also aimed to identify factors which influence consumption and to determine ways to impact positively on those factors.

Ten pilot entities have been selected, and **3 potential scenarios for improvement** identified :

- ▶ awareness and education of employees
- ▶ introduction of new technologies and eco-efficient tools
- ▶ reflection on the structural organisation and the management of information flows for the whole organisation.

The main conclusions of the project are the following :

- The **reduction potential of paper consumption** can range **from 10% to 30%** only by making the most of existing tools (employees often have a bad knowledge of the available material). For the Brussels Region's offices, this means a reduction potential for paper consumption between 1.900 and 5.700 tons per year.
- If an integrated approach was implemented, **with the aforementioned improvement opportunities**, this rate of **30% could be exceeded**.

# GLOSSARY

TERM	MEANING
<b>Electrical and Electronic Equipment (EEE)</b>	Equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields falling under the categories set out in Annex IA and designed for use with a voltage rating not exceeding 1000 Volt for alternating current and 1500 Volt for direct current. <i>(art. 3, a) WEEE Directive)</i>
<b>Energy recovery</b>	Use of combustible waste as a means of generating energy through direct incineration with or without other waste, but with recovery of the heat. <i>(art. 3, e) WEEE Directive)</i>
<b>Historical waste</b>	WEEE from products put onto the market before the 13th August 2005.
<b>Orphans</b>	WEEE whose producer is not capable of being identified or does not exist anymore when waste management costs occur.
<b>Prevention</b>	Measures aimed at reducing the quantity and the harmfulness to the environment of WEEE and materials and substances contained therein. <i>(art. 3, c) WEEE Directive)</i>
<b>Producer</b>	Anyone who : <ul style="list-style-type: none"> <li>- manufactures and sells EEE under his own brand</li> <li>- resells EEE produced by other suppliers</li> <li>- or imports or exports EEE on a professional basis into a Member State.</li> </ul> <i>(following art. 3, l) WEEE Directive)</i>
<b>Producer responsibility</b>	Application of the polluter-pays principle, aiming at integrating the environmental externalities within the price of products : the WEEE Directive entails an individual producer responsibility, requiring that producers bear the costs for the collection (from collection points), treatment, recycling and environmentally sound disposal of the products of their own brand. A collective producer responsibility would allow to share the treatment and recycling costs following the market shares of producers.
<b>Reconditioning</b>	Process of returning a used product to a satisfactory working condition.

TERM	MEANING
<b>Recovery</b>	Any of the applicable operations provided for in Annex IIB to Council Directive of 15 July 1975 on Waste (75/442/EEC) <sup>1</sup> . (art. 3, f) WEEE Directive)
<b>Recycling</b>	Reprocessing in a production process of the waste materials for the original purpose or for other purposes, but excluding energy recovery. (art. 3, e) WEEE Directive)
<b>Repair</b>	Fixing of specified faults in a product.
<b>Re-use</b>	Any operation by which WEEE or components thereof are used for the same purpose for which they were conceived, including the continued use of the equipment or components thereof which are returned to collection points, distributors, recyclers or manufacturers. (art. 3, d) WEEE Directive)
<b>Treatment</b>	Any activity after the WEEE has been handed over to a facility for depollution, disassembly, shredding, recovery or preparation for disposal and any other operation carried out for the recovery and/or the disposal of the WEEE. (art. 3, h) WEEE Directive)
<b>Waste</b>	Any substance or object in the categories set out in Annex I of Council Directive of 15 July 1975 on waste (75/442/EEC), which the holder discards or intends or is required to discard.
<b>Waste Electrical and Electronic Equipment (WEEE)</b>	Electrical or electronic equipment which is waste within the meaning of Article 1(a) of Directive 75/442/EEC, including all components, subassemblies and consumables which are part of the product at the time of discarding. (art. 3, b) WEEE Directive) Screens, keyboards, capacitors, tubes, printed circuits boards are <b>components</b> . <b>Subassemblies</b> are for example shelves of a refrigerator, without which the equipment of origin could not function as foreseen by the manufacturer. The <b>consumables</b> are pieces of the equipment that must be replaced in the short-term, like ink cartridges or batteries <sup>2</sup> .

<sup>1</sup>OJ L 37, 13.02.2003, p. 24

<sup>2</sup>OJ L 194, 25.07.1975, p. 39.

<sup>3</sup>Explanatory Memorandum WEEE and ROHS Directives, COM (2000) 347 Final, Brussels, 13 June 2000, p.32.