Toxic Tech:
Not in Our Backyard

Uncovering the Hidden Flows of e-Waste

FULL REPORT

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Creating a Toxic-Free Future

Toxic Tech:
Not in Our Backyard

Uncovering the Hidden Flows of e-Waste

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Contents

◀ *A worker sorts through a pile of e-waste, Longgang, China.*
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Executive Summary

1

A dangerous new waste stream is rapidly emerging.

Greenpeace has commissioned the report, *Toxic Tech: Not in Our Backyard*, to investigate the global sales of electrical and electronic products and assess the amount of waste arising from this.

The UN estimates that some 20 to 50m tonnes of e-waste are generated worldwide each year, comprising more than 5% of all municipal solid waste. The fate of large quantities of this so-called e-waste is unknown. This "hidden flow" is the e-waste that escapes responsible collection, reuse and recycling systems and as such is unaccounted for.

While some might be found stored in attics or garages or disposed of with mixed waste in landfills and incinerators, thousands more electrical and electronic products that have reached the end of their lives are exported, often illegally, for dumping in Africa or for rudimentary recovery by Asian informal recyclers. There, workers at scrap yards - some of whom are children – are exposed to a cocktail of toxic chemicals when the products are broken apart, and as water, air and soil are polluted.

The quantities of e-waste generated are predicted to grow substantially in the future, both in industrialised countries and in developing countries, which are expected to triple their e-waste by 2010. The rich countries often legally or illegally divert this problem from their own backyards. The hidden flow of e-waste that results causes environmental damage in the backyards and scrapyards of poorer countries.

Ultimately, the principle of producer responsibility, which requires producers to take financial and/or management responsibility for their products when they reach the end-of-life phase, needs to be at the core of any measures to address the e-waste problem. The escalating e-waste problem makes it imperative to also address the source, the design of electrical and electronic products.

Greenpeace continues to push the major electronics makers to:

- Embrace the principle of 'Individual Producer Responsibility'; where companies take financial responsibility for their products once discarded by customers. Individual producer responsibility calls for the cost of waste management to be incorporated into the product price, enacting the "polluter pays" principle and by differentiating between companies it motivates them to improve the environmental design of the products.

- Design out toxics; clean up their products by eliminating hazardous substances, replacing harmful ingredients through use of safer alternatives or design changes. Greenpeace believes that the e-waste crisis should not be regarded only as a waste management issue but that the solution also lies in product design.

Greenpeace is challenging manufacturers of electronic goods to take responsibility for the entire lifecycle of their products, from production, through manufacture and to the very end of their products' lives. Only in this way can we ensure that the dangerous tide of toxic e-waste can be stemmed, and that the hidden flow of e-waste does not become a problem in *anybody's* backyard.

◀ *Young workers at an e-waste recycling yard in Delhi.*
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Introduction

2

Waste from electrical and electronic equipment (WEEE) – also known as e-waste - is one of the fastest growing types of hazardous waste globally. WEEE is classified as hazardous waste because it contains many toxic ingredients, including heavy metals and harmful, persistent chemicals, with the potential to pollute the environment and damage human health when it is processed, recycled or disposed of. At the same time the development and introduction of appropriate reuse, recycling and recovery technologies is not keeping pace with this growth. This will have a big impact on how the hazards inherent in e-waste are dealt with, as far as the effects on human health and the environment that will result from reuse, recycling and disposal are concerned. Nevertheless, the growing quantities of e-waste also represent a huge resource potential.

The objective of this study is to provide a picture of the amount of waste electrical and electronic equipment arising in selected countries and where it ends up, with a focus on the 'hidden flows' of e-waste that are escaping any form of treatment/management. The study considered both industrialised countries, such as the US and the EU and the newly industrialised countries China, India, Thailand and Argentina.

Specific focus was given to TVs, PCs, and mobile phones (and in some cases also large household appliances); remaining categories of e-waste are grouped together in the category "other" where appropriate.

What's in electronic devices?

Electronic devices are a complex mixture of several hundred materials. A mobile phone, for example, contains 500 to 1000 components. Many of these contain toxic heavy metals such as lead, mercury, cadmium and beryllium and hazardous chemicals, such as brominated flame retardants. Polluting polyvinyl chloride (PVC) plastic is also frequently used.

These dangerous substances cause serious pollution and put workers at risk of exposure when the products are produced or disposed of. Of particular concern is the exposure of children and pregnant women to lead and mercury. These metals are highly toxic and can harm children and developing foetuses even at low levels of exposure.

More on the health hazards of chemicals in electronics.

- *Some brominated flame retardants, used in circuit boards and plastic casings, do not break down easily and build up in the environment. Long-term exposure can lead to impaired learning and memory functions. They can also interfere with thyroid and oestrogen hormone systems and exposure in the womb has been linked to behavioural problems.*
- *As much as 1450 tonnes of a brominated flame retardant called TBBPA was used to manufacture 991 million mobile phones sold in 2006. This chemical has been linked to neurotoxicity.*
- *The cathode ray tubes (CRT) in monitors contain lead. Exposure to lead can cause intellectual impairment in children and can damage the nervous, blood and reproductive systems in adults.*
- *Cadmium, used in rechargeable computer batteries, contacts and switches and in older CRTs, can bioaccumulate in the environment and is highly toxic, primarily affecting the kidneys and bones.*
- *Mercury, used in lighting devices for flat screen displays, can damage the brain and central nervous system, particularly during early development.*
- *Compounds of hexavalent chromium, used in the production of metal housings, are highly toxic and are human carcinogens.*
- *PVC is a chlorinated plastic used in some electronics products and for insulation on wires and cables. Chlorinated dioxins and furans are released when PVC is produced or disposed of by incineration (or simply burning). These chemicals are highly persistent in the environment and many are toxic even in very low concentrations.*

For more information and animations of what's in a computer and a mobile phone, see: http://www.greenpeace.org/international/campaigns/toxics/electronics/what-s-in-electronic-devices

◀ *© Greenpeace. Hatvalne*

Summary of Findings

3

The hidden flows of e-waste

The fate of large quantities of e-waste that arise every year is unknown, even in regions such as the EU that are beginning to be more tightly regulated.

While the current WEEE arising across the EU27 is estimated at 8.7 million tonnes a year the amount collected and treated is estimated at only 2.1 million tonnes or 25%[1]; this estimate includes all categories of e-waste defined by the legislation.

- *The remaining **6.6 million tonnes, or 75%, is the EU's general 'hidden flow'**; no precise data is available on what happens to this waste, whether it is stored, disposed of otherwise within the EU, or exported, to be either reused, recycled or disposed of in Asian countries such as India and China as well as Africa.*

Furthermore, it is probable that part of the 25% collected is also exported, although it is impossible to quantify how much. It is also important to note that exports are taking place despite EU legislation that bans exports of hazardous waste to non-OECD (Organisation for Economic Co-operation and Development) countries and ratification of the Basel Ban by EU member states.

What's the Hidden Flow?

*The Hidden Flow is the amount of WEEE arising based on past product sales that escapes responsible collection, reuse and recycling systems and as such is unaccounted for, but which can end up causing environmental damage, often in poorer parts of the world. Greenpeace distinguishes between the General Hidden Flow (all the e-waste that fails to be captured by recycling programmes) and the more specific Producer's Hidden Flow. The latter is the amount of **own-branded** WEEE arising (based on past sales) that escapes the control of a given producer (brand owner) and as such the rewards of better eco-designed products cannot be reaped by that producer.*

◀ *Shredded metals in an e-waste recycling facility owned by the Arguss company in Slovakia.© Greenpeace. Rizman*

In the US the 'hidden flows' of e-waste are even larger. Overall, less than 20% of the e-waste categories televisions, PCs including peripherals and mobile phones were separated from other waste streams for "further processing and recovery" – and this figure includes part of the export of e-waste to countries such as India and China[2].

- *The remaining general **hidden flow of 80%** is incinerated, sent to landfill, put into 'storage or reuse', or exported.*

Figures for the recycling of PCs and TVs show that only 10% and 14% of the quantities sold in the past, respectively, were recycled in 2005[3]; the amounts of PCs recycled are also declining as a percentage of sales, which continue to increase.

- *This leaves a general **hidden flow of 90%** and **86%** for these two product categories, not considering the fact that some of the remaining 10-15% of e-waste that has been separated for processing and recovery is also likely to have been exported.*

For newly industrialised countries like China and India with large informal recycling sectors, it is just not possible even to estimate the percentage of the "hidden flow" of e-waste. In these countries collection rates are determined by the informal recycling sector, where the focus is on the recovery (albeit inefficient reclamation) of valuable raw materials and not on the health and environmental hazards inherent in e-waste, resulting in environmental pollution and exposure of workers to hazardous substances from the recycling of e-waste. These primitive treatment methods result in lower end-of-life costs than in OECD countries. This 'cheap' form of recycling drives the import of e-waste from developed countries such as the US and the EU, which add to the growing e-waste problem in non-OECD countries such as India, China and West African countries. As domestic sales of electrical and electronic appliances are set to escalate in non-OECD countries, the quantities of e-waste will be much higher in the future. If electronic products continue to contain hazardous ingredients and the current methods of recovering raw materials carry on this will lead to further environmental and health problems from the recycling of e-waste.

- *When looking at the authorised treatment facilities in India the general **hidden flows** can be considered **to be over 99%,** representing 143,000 tonnes[4].*

1 Huisman, J., et al (2007), 2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment (WEEE), Final Report, United Nations University, AEA Technology, Gaiker, Regional Environmental Centre for Central and Eastern Europe, Delft University of Technology, for the European Commission, Study No. 07010401/2006/442493/ETU/G4, August 2007.

2 US EPA (2007), US EPA 2007: Management Of Electronic Waste In The United States, Draft, April 2007, Epa530-D-07-002

3 See pages 54 -56

4 MAIT-GTZ 2007, First MAIT-GTZ study reveals extent of e-waste challenge, Press release, New Delhi, December 13 2007, http://www.mait.com/pressupdate1.jsp?Id=77, see also pages 87–88.

Producer responsibility

Ultimately, the principle of producer responsibility, which requires producers to take financial and/or management responsibility for their products when they reach the end-of-life phase, needs to be at the core of any measures to address the e-waste problem. The EU's WEEE Directive (Art. 8.2) makes each producer responsible for **its own-branded discarded products brought on the market since August 2005** (Individual Producer Responsibility). The aim is to provide producers with an incentive for product eco-design and prevention of the problem of e-waste at source. Products designed after August 2005 are increasingly expected to take recycling problems into account. The key question in this context is: *what portion of the amount of own-branded end-of-life products is actually already controlled globally by the producers either financially and/or physically?* The principle of producer responsibility is based on the assumption that the bigger this portion is, the greater the incentive to improve the design of products and product systems, e.g. by designing out toxic ingredients to reduce end-of-life costs by offsetting the costs of collection and reprocessing with the revenues from reclaiming valuable materials like precious metals. Brand owners that are seriously improving product design by using higher value, recyclable and less toxic materials will not want to see their branded e-waste escape their stewardship; for example Apple's new Macbook Air uses a highly recyclable aluminum enclosure, rather than flame retarded plastics[5].

In several cases and in a number of non-EU countries, manufacturers do (or try to) also take responsibility voluntarily for the end-of-life phase of their products. However, this sometimes takes the form of temporary or isolated actions (e.g. in the US); this means that the consumer does not have a constant and reliable way to deliver end-of-life appliances to recovery facilities. The consumer is often required to temporarily store the waste appliances until he is able to deliver it for recovery. A systematic and comprehensive approach of producers taking responsibility for their end-of-life products has been found predominantly in those countries where it is required by legal frameworks (such as the EU) or where public awareness is high.

In the EU, the WEEE Directive is underpinned by (individual) producer responsibility, although poor transposition means that so far implementation varies across the various Member States. Given some more time and sufficient support from the EU executive and proactive initiatives on the part of some producers there is no reason not to believe that the implementation will improve. Despite some hiccups in its implementation the WEEE Directive is providing an important model for addressing the e-waste problem globally, with WEEE type legislation now being adopted in various forms in other countries.

5 See: http://www.apple.com/macbookair/specs.html

Hidden flows of own-branded e-waste

The figures provided by four PC producers suggest that global responsibility is currently taken for between 8.8% to 12.4% of own-branded end-of-life products that are available for collection and recovery; these producers have also developed take back and recycling activities within certain quality standards. Recycling rates for own-branded mobiles are much lower, at about 2-3%[6].

- *This information means that for those few brands that are reporting on the collection and recycling of their own brand PCs and mobile phones as a percentage of past sales, the* ***'hidden flow' of e-waste branded products currently amounts to an average of 91% of past sales.***

The exception is Sony, where a recycling rate of 53% has been achieved in Japan, where WEEE legislation is in force, leaving a hidden flow of 47%. This shows that higher take-back and recycling targets can be achieved with a combination of government legislation and company practice.

The fate of these 'hidden flows' of e-waste

There are only few cases in the countries that were analysed where the relatively systematic take back of e-waste has been achieved, as is beginning to happen in European Union, where the field of e-waste is regulated in detail by European and national law[7].

- *Even in countries with regulations there is a surprisingly large amount of waste that is not captured by the producer responsibility programmes; the key question is: what happens to this large 'hidden flow' of e-waste?*

The newly industrialised countries

China, India and Thailand have several things in common; all these countries have a typically informal recycling sector, which focuses primarily on the recovery of the valuable raw materials present in e-waste and the reuse of components for second-hand equipment. This means that there is a relatively high collection rate, as end-users often sell their old appliances for reuse or recovery. The quantities that are reused and recycled are not well documented since figures are not easily available, because this informal recycling is undertaken by very lucrative downstream businesses that are illegal and hidden.

6 See: 'Recycling by manufacturers' page 20.

7 Japan, Korea and Taiwan are other countries with producer responsibility legislation embracing four large home appliances and PCs, but are not included in this report.

As well as environmental and human health consequences from these recycling methods, the lower end-of-life costs in the informal sector mean that formal recyclers find it hard to compete; as a result there is a virtual lack of a formal recycling infrastructure (less than 1% of the total capacity in India in 2007[8]). Moreover, the informal sector is also 'fed' by illegal and legal imports of e-waste from industrialised countries. The legal imports are for so-called 'reuse' but very soon most of it ends up in the informal sector; the reality in India is that 99% of all WEEE, including imports, ultimately ends up in the informal sector.

Newly industrialised countries are also experiencing a rapid increase in domestic consumption of consumer electronics. However, the quantities involved in India are not yet as high as in China. For example, sales of PCs in India are estimated at about 5 million in 2006/7[9] compared to 20 million in 2007 in China[10]. Likewise, the quantities of mobile phones sold are much less – 15 million in 2004/5[11] compared to 80 million in China in the same period[12]. It is remarkable that the expected annual growth in electric and electronic equipment (EEE) consumption in India up to 2015 is around 30%[13]. China has already experienced immense growth in EEE consumption since the mid 1990s and this is set to continue through to 2020. The newly industrialised countries are catching up fast.

- *This rapid increase in consumption means that in the future the quantities of e-waste in newly industrialised countries are projected to grow substantially. This raises serious concerns about the impacts on health and the environment from recycling and disposal of e-waste, even without taking imports of e-waste into account.*

8 Manomaivibool, P., et al (2007), p. 15. Manomaivibool, P., Lindhqvist, T. and Tojo N., Extended Producer Responsibility in a non-OECD Context: The Management of Waste Electrical and Electronic Equipment in India. Lund: Iiiee, Lund University; 2007

9 http://www.mait.com/industry.jsp

10 English.People.Com.Cn 2007: China Leads Pc Sales In Asia-Pacific, http://english.people.com.cn/english/200105/02/eng20010502_69114.html, Accessed In August 2007, English.People.Com.Cn 2007a: Personal Computer Sales To Reach 6 Million Units, http://english.people.com.cn/english/200011/27/eng20001127_56233.html, Accessed In August 2007; TDC Trade 2007a: China's Colour Tv Sales Up In First Quarter http://www.tdctrade.com/report/mkt/mkt_030602.htm, Accessed August 2007

11 V&D 2005: Pravin Prashant: Mobile Handsets: Gsm Up, Cdma Down, Voice&Data, Monday, June 13, 2005 http://www.voicendata.com/content/vnd100/2005/105061325.asp

12 Cellular-news 2007: http://eng.cnews.ru/news/top/indexen.shtml?2007/02/06/234434; Crienglish.Com: China's Mobile Phone Market Witnessed Robust Demand For Low-End Products In The Third Quarter Of 2005, With Products With Multimedia Functions Becoming The Hotspot., http://english.cri.cn/855/2005/11/29/262@33515.htm Accessed May 2007

13 ISA and Frost and Sullivan 2005, ISA, Frost and Sullivan holds study on Indian semiconductor industry, Feb. 2, 2006, www.eetasia.com/MARKET/NEWS/200602/ISAFROST.doc

The industrialised countries

The picture in industrialised countries is slightly different. In general, markets for electrical and electronic appliances are more saturated and where they are increasing this is much more slowly than in countries like India and China; for some products there is barely any increase, whereas others, such as PCs, continue to grow. Even so, the quantities of e-waste generated are expected to grow over the next few years; overall, sales of EEE in the EU are expected to increase by 28% by 2020[14].

The situation in the US is quite different to the EU. The US represents a large consumer market with high sales of electrical and electronic appliances, but with a relatively unsophisticated infrastructure for the collection and recycling of e-waste. This situation is now beginning to change, however, as certain US States implement their own WEEE initiatives and some of the major companies begin to take producer responsibility by setting up take-back and recycling schemes. The low levels of collection at the moment, however, mean that such schemes have a long way to go before they begin to make an impact.

Like the US, the EU also has high levels of consumption of electrical and electronic appliances and in general is a relatively saturated market, with a few exceptions in some countries where markets are still relatively undeveloped. In contrast to the US, the implementation of the WEEE Directive in the 27 EU Member States means that a relatively sophisticated system for collecting and recycling e-waste is now being set up, with the involvement of governments, producers and sometimes retailers. The evolution of these collection and recycling systems will need to keep pace with the growing quantities of e-waste that are projected to arise in the future. The continuing evolution of new technologies will ensure that sales – and e-waste - will continue to grow, for example, the move to digital TV in North America and the EU and the development of flat screen TVs is already driving sales of new TVs.

- *The major issue for both the US and the EU to address is that e-waste is currently exported to less industrialised countries such as China and India, where recycling and recovery takes place with little regard for the human health or environmental consequences. The key difference between these two regions is that in the US, the export of e-waste to developing countries is legal, whereas in the EU export of e-waste to non-OECD countries is banned by the Waste Shipment Regulation, based on the Basel Convention and more precisely the Basel Ban Amendment, that completely bans the export of hazardous waste from OECD to non-OECD countries even for recycling. (The US has not yet ratified the Basel Convention).*

14 Sander, K., et.al., (2007), The Producer Responsibility Principle of the WEEE Directive, Final Report, Okopol GmbH;, IIIEE, Lund University; and Risk and Policy Analysts, UK; DG ENV Study Contract, August 19th 2007

- *In the EU the revision of the WEEE Directive[15] is an opportunity to strengthen collection and recycling targets and reinforce Individual Producer Responsibility. The revision of the RoHS Directive[16] also opens the prospect for bans and restrictions on additional hazardous substances (e.g. antimony, beryllium, arsenic) and for lifting exemptions on certain uses of the substances, like mercury that are already restricted by RoHS.*

Implementing Producer Responsibility

This snowballing e-waste problem makes it imperative to address the source, the design of electrical and electronic products. Many environmental considerations can be factored into a product at its design stage, but the most crucial issues raised by the e-waste problem are the use of hazardous substances, the durability of products and their recyclability at the end of their lives. The presence of hazardous substances such as brominated flame retardants, PVC plastic and many of the heavy metals lead to environmental and human health problems when e-waste is recycled and disposed of; as well as releasing hazardous by-products when recycled, PVC plastic hampers the recyclability of discarded products. Fortunately, some manufacturers are proving that it is possible to avoid the use of these substances altogether through product redesign[17]. As the designer of these products, the producer is the prime stakeholder responsible for the solution.

However, designing out toxics must be taken up by the majority of manufacturers in order to effect a major change to the make-up of e-waste that will arise in the future. In the meantime, the historical e-waste and products that are becoming obsolescent now contain a cocktail of hazardous substances which need to be addressed with the least possible damage to human health and the environment. However, even though the growing mountains of e-waste represent a potentially huge source of toxic pollution in the future, they also contain valuable and increasingly scarce raw materials.

Moreover, with the fast rising prices of commodities such as ferrous, non-ferrous and precious metals, e-waste recycling is becoming more and more profitable as the costs of collection and recycling are offset by the prices received for the recovered materials. However, this is not always the case; when dealing with phased out technologies such as cathode ray tube TVs, hazardous materials – in this particular case leaded glass – add extra costs to recycling because the costs have been internalised. Regardless of the economics to the companies concerned, collection and recycling of e-waste has to occur to prevent these 'costs' being externalised as environmental pollution.

In countries like China and India the activities of the informal sector present a particular challenge to companies aiming to implement the producer responsibility principle. Specifically, producers will find it hard to compete economically with the performance and efficiency of the informal sector in collecting end-of-life products, which saves massively on their costs by paying little regard to human health and environmental issues at the point where e-waste is recycled or recovered.

However, the primitive recycling typical in many developing countries also squanders material resources. A recent study[18] estimates the overall efficiency of a wet chemical process to recover gold from printed wiring boards in India at a maximum of 20%. This compares to 95% in a state-of-the-art facility in the EU that can recover not only gold but also 16 other precious metals with lower total emissions.

- *The growing quantities of e-waste also represent a huge resource potential.*
- *It is essential that producers apply their resources, both technical and economic, to ensure that the treatment of collected waste in newly industrialised countries is improved. This will not only bring immediate benefits from the reduced pollution, but will reduce demand for raw materials and the environmental and human health effects that are associated with mining.*
- *In all countries, it is essential to increase the collection of e-waste and channel it towards formal recyclers; mandatory collection targets are needed based on past sales which need to increase over time.*
- *Ultimately, manufacturers should aim to 'close the loop' as far as their own brand products are concerned by designing out hazardous materials in electronic products to facilitate full 100% high quality recycling (and not down-cycling) which is safer for both production and recycling workers.*

15 WEEE Directive, Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE)

16 RoHS – Restriction of Hazardous Substances, refers to the EU Directive 2002/95/EC of the European Parliament and of the Council on the restriction of the use of certain hazardous substance in electrical and electronic equipment (RoHS Directive).

17 See the Greenpeace Guide to Greener Electronics, which score 18 major electronics manufacturers on their policies and practices on reducing the use of hazardous substances and voluntary take-back and recycling of end-of-life products. Several companies have developed products that are totally or partially free from brominated flame retardants and/or PVC, which are listed and updated quarterly. See: http://www.greenpeace.org/international/campaigns/toxics/electronics/how-the-companies-line-up

18 cited in Manomaivibool 2007,p.1, op.cit

Approach

Data collection was performed to a large extent by literature and internet research. In addition investigations and personal interviews have been performed in selected countries.

Data about e-waste are often general and in many cases they do not provide the degree of detail that is necessary for the aim of this study. In these cases exemplary figures have been used as far as possible as a basis for extrapolations.

The country specific part of the report is structured in different sections. "**Put on the market**" describes the number of appliances sold in the country. Where no reliable data about the end-of-life phase is available the amount of e-waste is calculated on the basis of the past sales data. "**End-of-life**" describes the amount of e-waste occurring in the country. Imports are excluded from the scope. "**Destinations**" shows where the e-waste ends up, focusing on how waste is treated within the country, but exports are also taken into account where appropriate.

The term "e-waste" is not defined in a uniform way all over the world. It is a generic term embracing various forms of discarded or obsolete post-consumer electrical and electronic equipment that have ceased to be of any value to their owners. E-waste, as used in this report, does not refer to processing (factory) waste from the manufacture of electrical or electronic equipment, parts, components and sub-assemblies.

In this report the term "e-waste" is used for waste electrical and electronic equipment as it is covered by the analysis in each respective country. This might differ from country to country slightly and is explained where the necessary information is available. The term WEEE is used exclusively for waste from electrical and electronic equipment as it is defined in the EU WEEE Directive 2002/96/EC.

◀ *A worker in a electronics waste recycling yard in Delhi. © Greenpeace. Hatvalne*

Global Sales and e-Waste Arisings

5

Put on the market

An initial estimate for the amount of electrical and electronic products currently placed on the market in the EU 27 countries is 9.3 million tonnes a year. This is significantly higher than the predictions made in the 1990s which estimated the tonnage at about 7 million tonnes[19].

Information on the sales of electronic products is divided into the types of appliances. In this report we will focus mainly on PCs, mobile phones and TVs.

PCs

Worldwide PC sales are growing, despite slower growth in the US, Europe and Japan. The growth in emerging markets and in the markets for portable PCs is faster than expected[20].

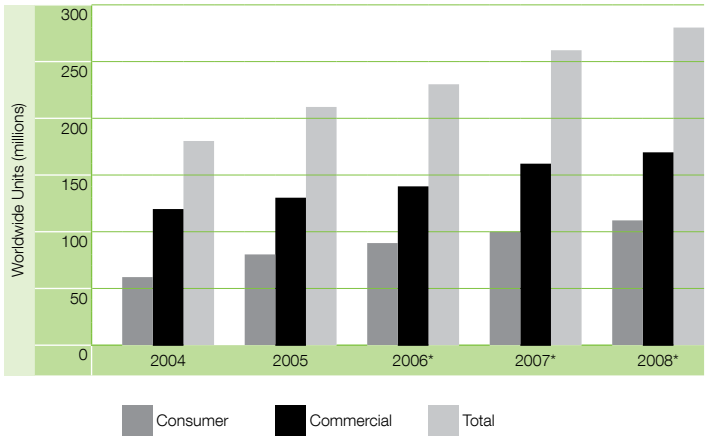


Figure 1: US and Worldwide PC Shipments and Growth, 2004-2008
***Forecast data** (Shipments are in millions of units). PCs include Desktop, Notebook, Ultra Portable, and x86 Server and do not include handhelds. Source: IDC Worldwide Quarterly PC Tracker, December 2006*

Table 1: US and Worldwide PC Shipments and Growth, 2004-2008

Worldwide Growth (%)	2004	2005	2006	2007	2008*
Consumer		21.1%	13.8%	11.8%	11.4%
Commercial		13.1%	8.3%	11.0%	10.5%
Total		**16.0%**	**10.4%**	**11.3%**	**10.9%**

◀ *© Greenpeace. Behring-Chisholm*

19 Huisman, J., et al (2007), op.cit

20 IDC (2006), Press Release, Slow PC Sales in the United States Constrain Global Outlook While International Growth Remains Strong, 20 Dec 2006. http://www.idc.com/getdoc.jsp?containerId=prUS20497806

In 2006 the worldwide market leaders were Dell and Hewlett Packard, each with a 15.9% share of the market, followed by Lenovo (7%) Acer (5.8%) and Toshiba (3.8%)[21].

Mobiles

In 2006 more than one billion mobile phones were shipped worldwide, 22.5% more than the quantity shipped in 2005. By 2008 the number of mobile phone users around the world is projected to reach some two billion[22].

Nokia is the clear market leader worldwide, with a 37% share in the second quarter of 2007, followed by Samsung (13.7%), Motorola (13%), Sony Ericsson (9.1%) and LG Electronics (7%)[23].

TVs

45.5 million TVs were sold in 2005/6, a growth of 3% year on year, driven by fast growth in China (17%) and North America (8%), which more than offset decreases in Europe (16% and Japan (7%)[24]. LCD (liquid crystal display) TVs are taking up a growing share of the market. The worldwide market leaders are as follows:

Table 2: Global TV market revenue share by company/brand, Q4 2006[25]

Company	Share
Samsung	14.4%
Sony	12.7%
LGE	8.2%
Philips	8.2%
Panasonic	8.0%
Others	48.5%

21 Garnet Dataquest (January 2007), referenced by Computer Take-back Campaign, www.computertakeback.com

22 United Nations Environment Programme (2006) Basel Conference Addressed Electronic Wastes Challenge, Press Release, 27 November 2006, http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=485&ArticleID=5431&l=en

23 IDC (2007), Samsung Beats Motorola for No. 2 Spot as Apple Joins the Handset Club with Iconic Device, Notes IDC, Press Release, 02 Aug 2007, http://www.idc.com/getdoc.jsp?containerId=pr2007_01_17_133455

24 Display Search (2006) Display Search Report Indicates Samsung Takes the Top Position in Glboal TV Units and Revenues, press release, November 27, 2006: http://www.displaysearch.com/cps/rde/xchg/SID-0A424DE8-8AC31197/displaysearch/hs.xsl/pr_298.asp

25 report released by research firm DisplaySearch, February 2007

End-of-life

The United Nations estimates that some 20 to 50 million tonnes of e-waste are generated worldwide each year, comprising more than 5% of all municipal solid waste. The quantities of e-waste generated are expect to grow substantially in the future; developing countries are expected to triple their output of e-wastes by 2010, and the volume of e-waste in the EU is expected to increase by 3 – 5% a year[26].

Global information on what happens to this growing mountain of e-waste is not easily available. However, a picture can be pieced together by looking individually at some countries and regions, where more detailed information is available, and at the data provided by some manufacturers, as outlined in the following section.

Two studies have recently been prepared for the EU, as part of the WEEE Directive review. One report by the United Nations University (UNU)[27] estimates the various typical lifetimes of electrical and electronic products used in a typical EU household. A second report by Okopol[28] has calculated the average lifetime of these products at nine years (based on lifetimes of product categories calculated by UNU) therefore as the estimated quantity of EEE put on the market in 2006 is 9.3 million tonnes, Okopol projects that 9.5 million tonnes of WEEE will arise in 2016. The following graph shows the projection made by Okopol for EEE put on the market up to 2020, and depicts the possible future WEEE arisings in the EU 27 based on these projected sales and the average product lifetime of nine years.

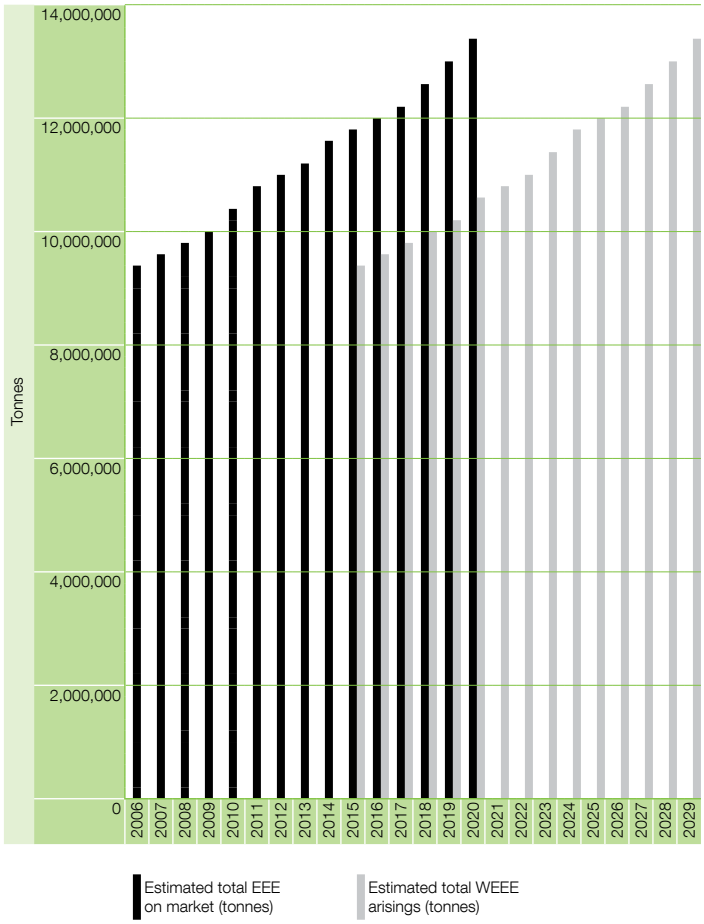


Figure 2: Estimated total EEE on market and future WEEE arisings, EU27[29]

This estimate can be compared to the actual forecast of household WEEE arisings made in the UNU report[30], as well as their estimate for both household and non-household WEEE. This shows that the projected amounts of total WEEE based on sales data are very similar to the figures estimated by UNU for household WEEE arisings, whereas the total WEEE arisings as estimated by UNU (for both household and non-household WEEE) are somewhat higher.

26 United Nations Environment Programme (2006) op.cit.

27 Huisman, J., et al (2007), op.cit.

28 Sander, K., et.al., (2007), op.cit.

29 Sander (2007), op.cit.

30 Huisman, J., et al (2007), op.cit.

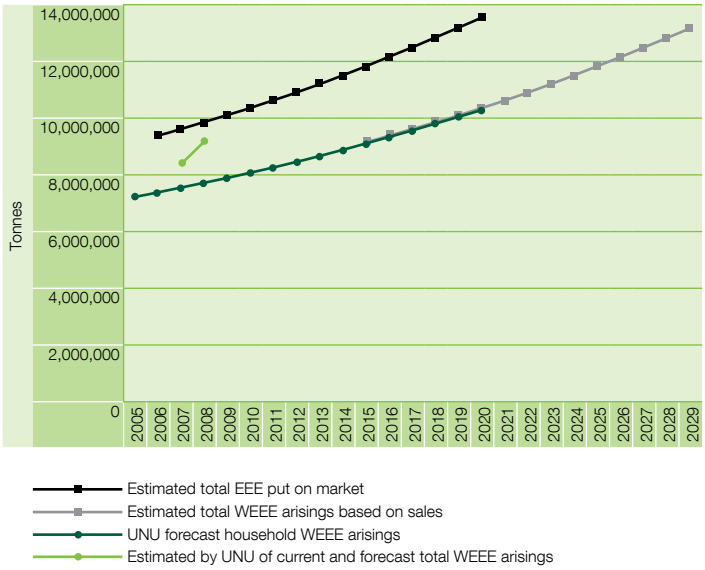


Figure 3: Estimated total EEE put on market and WEEE arisings, compared to UNU forecast household WEEE arisings and current WEEE estimate (EU27)

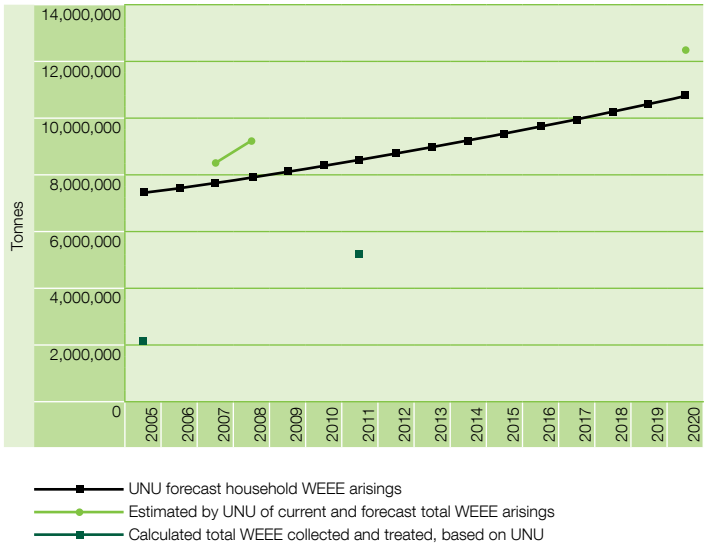


Figure 4: Proportion of WEEE collected and treated in EU27, compared to arisings

The quantities forecast by the UNU for both household and total WEEE arisings can be compared with the amount of WEEE that is actually collected and treated in the EU 27, based on figures presented in the UNU report. This can be calculated as a total of 2.1 million tonnes for 2005, and can be projected to be 5.3 million tonnes in 2011 – representing about 30% and 73% of household WEEE arisings respectively. It is more realistic to compare these collection rates to the current total WEEE arisings of between 8.3 – 9.1 million tonnes a year, which include non-household waste; taking the average at 8.7 million tonnes, this leads to a percentage of 24.5%. However, the UNU figures for collection assume that all collected WEEE will be recycled in the EU, which is not necessarily the case as some is likely to escape the Producer Responsibility programmes and be exported – often under the pretext of reuse. Therefore **at a minimum, over 75% of WEEE in the EU is not collected or treated** at the moment, representing a 'hidden flow' for which little information exists.

Worldwide PC waste arisings

Following the same methodology of projecting future WEEE arisings based on the quantities of products put on the market, the global numbers of waste PCs likely to arise in the future can be projected, based on Figure 1 (Worldwide PC shipments) above, taking the typical life of seven years for a computer estimated by PC manufacturers[31].

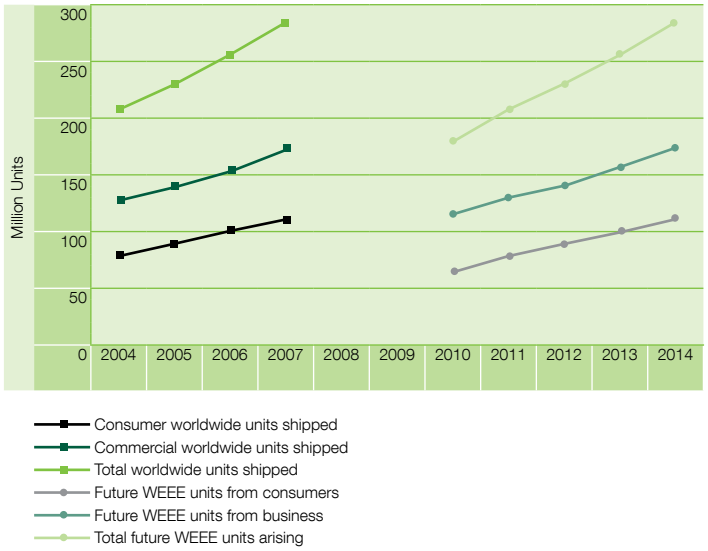


Figure 5: US and Worldwide PC shipments and projected WEEE units arising, based on typical life of seven years

It is also possible to project an estimate of WEEE arising in 2016 from PCs, mobile phones and TVs, based on the global sales data above.

Table 3: Estimated global WEEE arising in 2010 and 2016 from PCs, mobile phones and TVs.

	Units sold in 2006	Typical weight (kg) [32]	Typical life (years)[33*]	Estimated weight sold in 2006 (Metric Tonnes)	Estimated WEEE arising in 2010 (Metric Tonnes)	Estimated WEEE arising in 2016 (Metric Tonnes)
Computers	229.4 million [34]	25	7, (+/- 11%[35])	5,735,000	4,193,382	7,843,364
Mobile phones	1 billion[36].	0.113[37]	2[38] (+ 22%[39])	113,000	168,189	554,571
TVs	45.5 million (2005/6) [40]	30	10 (- 3%[41 42])	1,365,000	1,143,166	1,365,000
TOTAL	**1,274.9million**			**7,259,000**	**5,504,737**	**9,762,935**

31 As used by Apple and Dell.

32 See Annex 2. Huisman, J., et al (2007), op.cit.

33 See Annex 2, op.cit.

34 See Table 1, Source, IDC Worldwide Quarterly PC Tracker, December 2006

35 11% annual increase in sales – ie. projected sales 2009 and projected back to 2003.

36 United Nations Environment Programme (2006), op.cit.

37 Nokia (2005), referred to in http://www.eoearth.org/article/Cell_phone_recycling

38 2 years is the maximum lifetime estimated by Motorola, see http://www.motorola.com/content.jsp?globalObjectId=8508

39 22% annual increase in sales , ie. projected sales in 2008 and 2014

40 Display Search (2006) op.cit

41 Display Search (2006) op.cit

42 annual increase in sales, projected back to 2000

Recycling by manufacturers

A few of the major producers of electronic equipment are now providing an estimate of the percentage of waste that they are recycling, compared to past sales, according to expected life cycle of the average product.

The following PC manufacturers are now reporting on waste recycled. The amounts recycled range from 8.8% to 53% of past sales. It should be noted that in many cases the figures provided by PC makers of e-waste collected and recycled are not only of their own-brand e-waste, but also the e-waste (similar product types) of other brands, which are collected as either as part of a business to business (B2B) contract or a collection event organised by one brand.

Hewlett Packard (HP) reports a reuse and recycling rate in 2006 of 10% of relevant sales (165 million pounds), but this metric includes consumable items like printer cartridges http://www.hp.com/hpinfo/globalcitizenship/gcreport/productreuse/performance.html

A July 2007 press release reports that HP recovered 187 million pounds of e-waste globally in 2006 and sets a new target of 2 billion pounds by 2010 at: http://www.hp.com/hpinfo/newsroom/press/2007/070713a.html

Dell reports its recycling rate based on sales seven years ago, which show they are ahead of schedule to meet their 2009 goal, and report a recycling rate of 12.4% (as percentage of sales seven years ago) at: http://www.dell.com/content/topics/global.aspx/corp/pressoffice/en/2007/2007_07_19_rr_001?c=us&l=en&s=corp

Apple reports its recycling rate as a percentage of sales seven years ago. In 2006, Apple recycled 9.5% of the weight of all products sold seven years earlier and has set goals to recycle 13% in 2007, to 20% in 2008 and nearly 30% in 2010. at: http://www.apple.com/environment/recycling/

Lenovo provides figures of e-waste recycled based on past sales (8.8% of the weight of product shipped in 1998 is recycled from customer owned returns), but is hampered by many of its business customers selling their e-waste to other companies and the fact that Lenovo's global sales operations are only three years old.

See Sustainability Report 06/07 (p.45-46) at: http://www.pc.ibm.com/ww/lenovo/about/sustainability/environment/Lenovo_2006.2007_Sustainability_Report.pdf Also at: http://www.pc.ibm.com/ww/lenovo/about/sustainability/environment/EnvReport.html

In fiscal 2006, Sony recovered 36,355 tonnes of resources from Japanese consumers, which included end-of-life TVs and PCs, equating to a "resource reuse/recycling ratio of around 53% based on average lifespan of TVs and PCs". http://www.sony.net/SonyInfo/Environment/recycle/index.html

Toshiba now reports on the quantities recycled worldwide for TV sets, refrigerators, washing machines, air-conditioners and personal computers. It calculates the rate of weight recycled against the weight of material shipped as products in FY2006 as approximately 19%, but does not provide a recycling percentage based on past sales, based on the average lifespan of specific product groups. http://www.toshiba.co.jp/env/en/industry/resource3.htm

Mobiles

Lower figures are reported for the recycling of mobile phones, possibly because of difficulties in collection. Two companies have now provided estimates:

Nokia now provides a figure of 2% for mobiles recycled, but it is unclear if this is as a percentage of all Nokia sales, or all brands of mobiles returned – and over which period. http://www.nokia.com/link?cid=PLAIN_TEXT_43564 http://www.nokia.com/A4226041 Nokia does attempt to identify the fate of the remaining 98% of end-of-life mobiles, as follows:

Table 4: Fate of Nokia products

Taking up drawer space	48%
Traded in for a new phone through vendor	27%
Passed on to another person	13%
Did something else	7%
National collection	3%
Recycled through Nokia take back points	2%

Motorola is now reporting its recycling rate of 3.32%, as a percentage of sales, comparing them with sales 12-24 months prior, their estimate of the lifespan of a mobile phone. http://www.motorola.com/content.jsp?globalObjectId=8508

Manufacturers are therefore voluntarily recycling from between 2% - 53% of their own branded products – the average rate however, is 9%. This information means that for those few brands that are reporting on the collection and recycling of their own brand PCs and mobile phones as a percentage of past sales, the **'hidden flow' of branded e-waste currently amounts to an average of 91% of past sales.** The exception is Sony, where a recycling rate of 53% has been achieved in Japan, where WEEE legislation is in force and most of Sony's products are sold, leaving a hidden flow of 47%. This shows that higher take-back and recycling targets can be achieved with a combination of government legislation and good company practice.

Country Reports

6

China

Put on the market

PCs

It is estimated that nearly 20 million computers (500 000 tonnes) will be sold in China in 2007 – a big increase from just under 5 million in 1999.

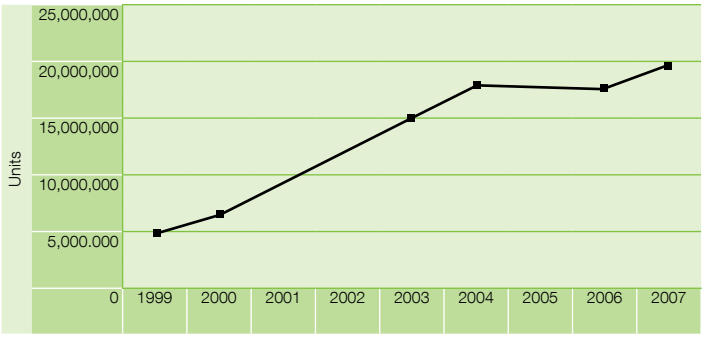


Figure 6: PC Sales (units) [43]

The Chinese multinational Lenovo has the largest share of the PC market, with over a third of total sales in 2006 (see Table 3), followed by the Chinese companies Founder and Tongfang, then the global electronics companies Dell and HP.

Table 5: Market shares for PC sales in China

Vendor	2005 Market Share (%) [Analysis International 2006a]	2006 Market Shares (%) Q2 [Analysis International 2006]
Lenovo	30.6	35.4
Founder	10.8	14.1
Tongfang	8.3	8.9
Dell	7.8	7.5
HP	6.1	5.2

Mobile phones

The sales of mobile phones are also rapidly increasing. It is estimated that over 150 million new mobile phones (16,950 tonnes) will be sold in China in 2007, about twice as many as were sold in 2004.

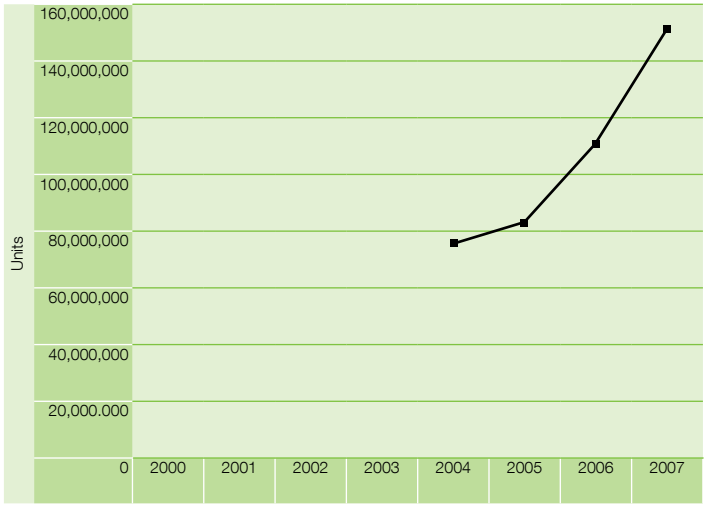


Figure 7: Mobile phone sales (units)[44]

Three global electronics companies dominate the market; Nokia (more than 35%), Motorola (more than 20%) and Samsung (see following table and figure). In the mobile phone market Chinese companies do not play as significant a role as in the PC market; Lenovo's share of mobile phone sales was 6.5% in 2006 (from 4.7% in 2005).

◀ *A small Chinese child sitting among cables and e-waste, Guiyu, China. © Greenpeace. Behring-Chisholm*

43 English.People.Com.Cn 2007: op.cit., English.People.Com.Cn 2007a: op.cit.

44 Cellular-news 2007: http://eng.cnews.ru/news/top/indexen.shtml?2007/02/06/234434; Crienglish.Com: China's Mobile Phone Market Witnessed Robust Demand For Low-End Products In The Third Quarter Of 2005, With Products With Multimedia Functions Becoming The Hotspot., http://english.cri.cn/855/2005/11/29/262@33515.htm Accessed May 2007

Table 6: Market share of mobile phone sales in China

Vendor	2006 Market Share (%) Jan.-Jun.[45]	2006 Market Share (%) Q3[46]
Nokia	30.3	36.6
Motorola	21.4	23.3

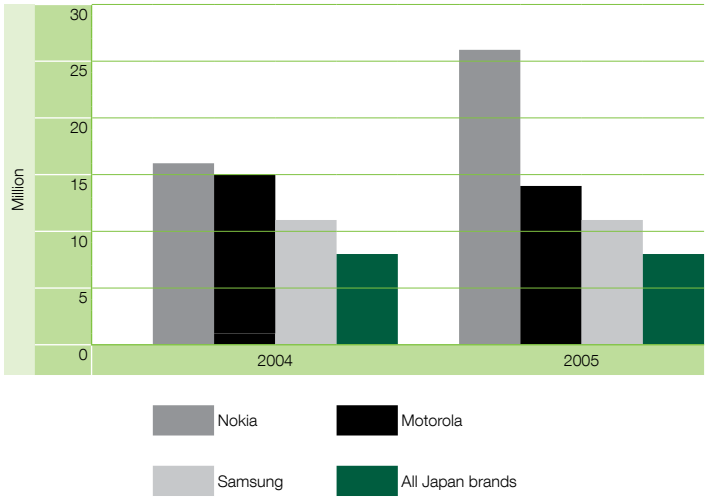


Figure 8: Top 3 mobile phone brands in China vs. Japanese brands (units sold) Source: [47]

TV

The sales figures for TVs in China show a steady rise over the last few years and although the data is contradictory[48], there appears to be slower growth than for PCs or mobile phones. However, as in other countries, CRT technology is increasingly being replaced with flat screen technologies.

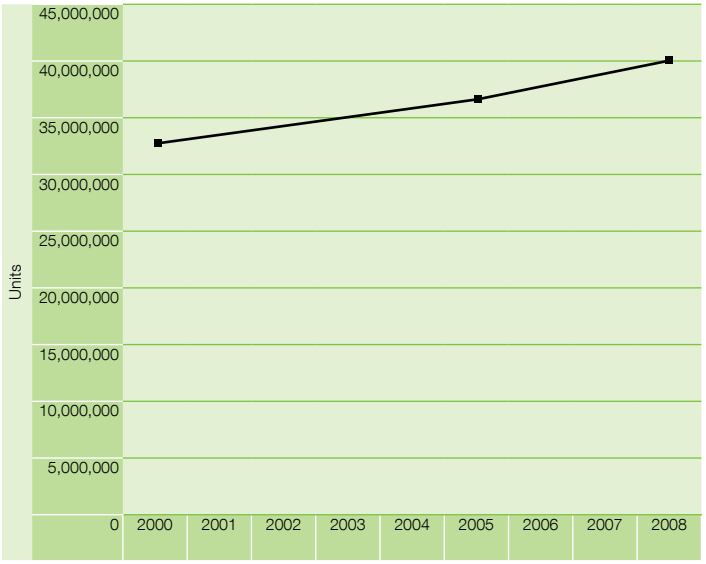


Figure 9: TV sales (units)[49]

White goods

In 2003 around 4 million refrigerators and 5 million washing machines were sold in China[50].

45 http://www.textually.org/textually/archives/2006/07/013050.htm

46 Taipei Times, January 6, 2007, Share prices, profits slipping in cellphone price war, http://www.taipeitimes.com/News/worldbiz/archives/2007/01/06/2003343645

47 THT Research: Myers, Susan: China's Mobile Phone Market Market Barriers For Japanese Vendors, THT Research, No Year

48 Diverging figures have been published [Xinhuanet, May 23 2004] states sales of around 10 million televisions in 2003.

49 Bing Zhang (2006), China TV Market Trends by Technology, DisplaySearch, February 2006

50 Xinhuanet, May 23, 2004.

Ownership figures

The following figures show that in urban areas, refrigerator and washing machine ownership has nearly reached the saturation phase. Ownership of colour TVs is also increasing and ownership of air conditioners and personal computers is increasing rapidly. In rural areas, black and white TVs are rapidly being replaced by colour sets. Ownership of refrigerators and washing machines is beginning to show rapid growth, whereas ownership of air conditioners is still in the introductory phase[51].

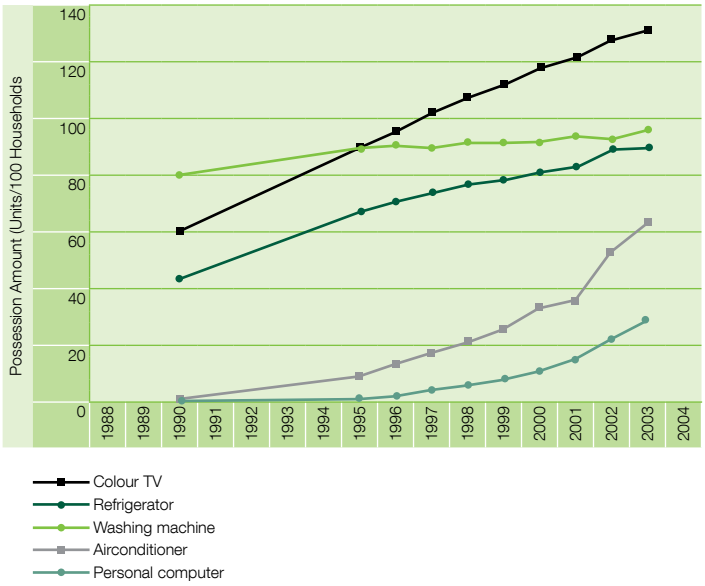


Figure 10: Urban residential household ownership of main electronic appliances in China[52].

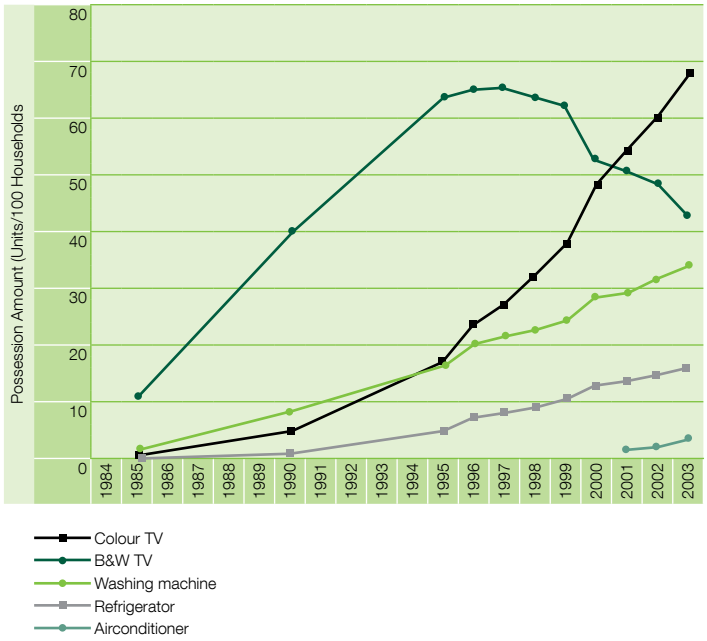


Figure 11: Rural residential household ownership of main electronic appliances in China [53]

51 Liu 2006: Xianbing Liu, Masaru Tanaka And Yasuhiro Matsui: Electrical And Electronic Waste Management In China: Progress And The Barriers To Overcome, In: Waste Management Research 2006; 24; 92

52 Liu 2006, op.cit.

53 Liu (2006) op.cit.

End-of-life - Arisings

Figures on e-waste are also contradictory. Streicher[54] reports that more than 33 million TVs and 4.48 million PCs occur as e-waste in China each year[55], compared to the higher figure of 10 million obsolete PCs published by Liu 2006[56]. CBCSD cites a report by XINHUANET which states that at least 5 million televisions, 4 million refrigerators and 6 million washing machines are discarded in China each year[57].

Some limited information on mobile phones is also available; according to the Ministry of Information Industry[58] in the first half of 2004, 70 million mobile phones became obsolete which produced 4000 tonnes of waste.

The total figure of 74 million units of the six appliances has been calculated by Liu[59] to result in around **2.5 million tonnes of e-waste in 2005**. This seems to be a large amount, but for comparison, in the 27 EU countries, it is estimated that total WEEE arisings in 2005 are between 8.3 – 9.1 million tonnes a year. It is also worth comparing these e-waste estimates with sales figures, for example sales of PCs in 2001 were 10 million units, which would correlate with Liu's estimate of 10 million PC waste appliances in 2006, assuming a five year lifespan.

Table 7: Numbers of E-Waste appliances in China (million)[60]

	[Streicher 2007]	In Tonnes	[Liu 2006]		[CBCSD 2007]	
PCs	4,48	112 000	10	250 000		
TV sets	33,5	1 005 000	32	960 000	5	150 000
Refrigerators	9,76	341 600	14	490 000	4	140 000
Washing Machines	7,56	491 400	16	1 040 000	6	390 000
Air Conditioners	0,65		2			
Total	**55,95**	**1 950 000**	**74**	**2 740 000**		**680 000**

The following graph shows the proportion of each type of appliance based on number and weight.

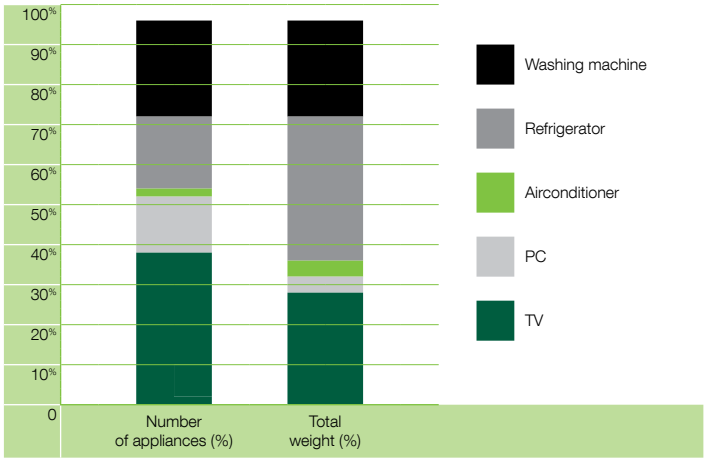


Figure 12: Composition of e-waste in China[61]

Liu[62] also projects that by 2010 the total number of waste appliances for the five categories of appliances will be at around 100 million and the total weight[63] of e-waste will be around **3 million tonnes.**

54 Streicher-Porte, M. and Yang, J., 2007. WEEE recycling in China. Present situation and main obstacles for improvement. Paper published for the IEEE International Symposium on Electronics and the Environment (ISEE). 07 May - 10 May 2007, Orlando, FL.

55 Calculation based on the market supply method and life time of the appliances as described by the Chinese official statistics (TV 8 years, refrigerator 9 years, washing machine 9 years and air conditioners 10years).

56 Liu 2006] use the same life time data as [Streicher 2007]

57 CBCSD 2007: Home Appliance Makers To Pay For Waste Recycling, Http://english.cbcsd.org.cn/dynamic/associator/3177.shtml, Accessed August 2007

58 cited according to GP pers.com 2007

59 Liu (2006) Op.Cit. And Liu 2006a: Xianbing Liu, Masaru Tanaka And Yasuhiro Matsui: Generation Amount Prediction And Material Flow Analysis Of Electronic Waste: A Case Study In Beijing, China, In: Waste Management Research 2006; 24; 434

60 Streicher (2007), Liu (2006), CBCSD (2007) op.cit.

61 Liu (2006) op.cit.

62 Liu (2006) op.cit.

63 (again in combination with [Liu 2006a]

Destination

Streicher[64] states that China's domestic WEEE flows are far from understood. One important reason for this is the fact that private individual collectors and loosely organised collection networks dominate the collection of e-waste. Second-hand appliance markets also play an important role. For Beijing a survey suggests that there are approximately 5000 individual collectors[65] and 17 second-hand markets[66].

According to Streicher a relatively high portion of the e-waste occurring each year is stored at home and in offices. The time of storage and thus the amount of e-waste from storage into treatment is unknown. He estimates that 40% of the e-waste appliances that occur are sold second-hand, with 14% being dismantled manually for second-hand parts. 24% are sent for recycling after being dismantled manually.

Liu[67] published the following results from a survey on the collection of e-waste in Beijing. He differentiates the volume flows in addition to their destinations also by addressee: Most of the e-waste is collected by individuals, 13% is submitted to recyclers and 4% to producers resulting in an overall percentage that is not directly discarded 74% (plus stored amount of 9%).

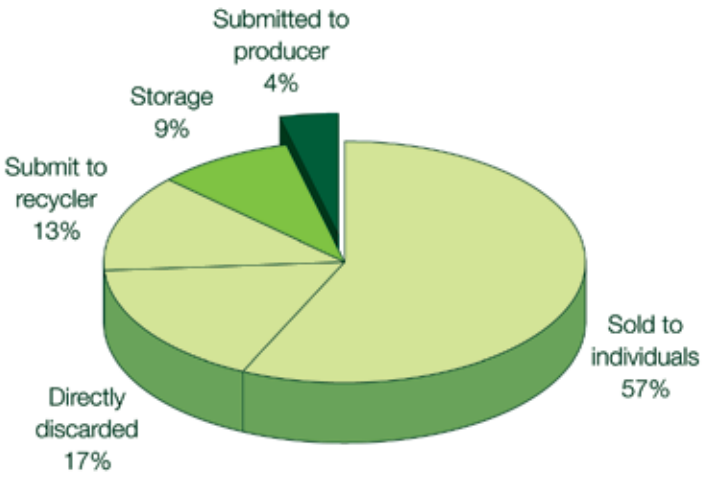


Figure 13: Percentage of Beijing residential obsolete options for e-waste.

Consumers sell their old, used and non-working appliances to private individual collectors who then pass them into informal treatment and recovery processes, accounting for nearly 60% of the e-waste that occurs in China[68].

The majority of e-waste is processed in small workshops using very basic methods such as manual disassembly and open incineration. The appliances are dismantled (separation of printed circuit boards, cathode ray tubes, cables, plastics, metals, condensers) in order to get valuable and easily extracted components and materials, while the remainder is dumped [69].

A number of pilot programmes for e-waste recovery facilities have been started in China. China's Huaxing Group is planning a site in Beijing for a pilot WEEE recycling and treatment plant[70].

Some individual producers have started campaigns for the collection of their products in China. The following examples include information from the manufacturers' websites:

64 Streicher (2007) op.cit.

65 These individual collectors do not have business licences and fixed workshops.

66 Liu (2006a), op.cit.

67 Liu (2006a) op.cit.

68 Liu (2006), op.cit.

69 Hicks (2005): C. Hicks, R. Dietmar, M. Eugster: The Recycling And Disposal Of Electrical And Electronic Waste In China—Legislative And Market Responses, In: Environmental Impact Assessment Review 25 (2005) 459– 471

70 The People's Daily, February 7, 2005.

Computers

- In January 2008 the Computer Recycling Programme (CRP) was launched; this is a voluntary Producer Responsibility Scheme set up and funded by 20 local and international computer equipment suppliers, including Microsoft, Canon, HP, Lenovo, Samsung and Philips. The goals of the CRP are to provide means for the public to manage their used computer equipment in an environmentally sound manner and to raise public awareness of the need to reduce, reuse and recycle computer waste. See: https://www.wastereduction.gov.hk/en/workplace/crp_intro.htm.
- The initiative will start by placing over 60 public collection points for electronics throughout Hong Kong along with providing collection services for over 600 partnering public and private estates and commercial buildings. The target for the first two years is to recover 50,000 items of computer equipment. The plan is to donate 10% of the better quality, re-usable equipment to charity, while the rest is safely recycled. http://www.psfk.com/2008/01/electronics-makers-launch-e-waste-recycling-programs-in-china.html
- HP offers a take-back service for HP branded products at the end of their life.http://h50055.www5.hp.com/ipg/supplies/recycling/hardware/cn/eng/index.asp However producers' take back systems often focus on users in the big cities and businesses. The HP system for example has the following restrictions:

  HP's recycling service is available for HP customers only.

  HP lists service centres that will accept end-of-life electronic products; locations for pick-up and collection must be close to or within large metropolitan areas. http://h50055.www5.hp.com/ipg/supplies/recycling/hardware/cn/eng/individual.asp
- Dell offers free recycling of all Dell brand products within China, see: http://supportapj.dell.com/support/topics/topic.aspx/ap/shared/support/recycle/en/recycle?c=hk&l=en&s=gen for Hong Kong (English) and http://supportapj.dell.com/support/topics/topic.aspx/ap/shared/support/recycle/zh/cn/recycle?c=cn&l=zh&s=gen (in Chinese).
- Lenovo announced on 25 December 2006 recycling of all Lenovo, Legend and IBM products in China http://www.pc.ibm.com/ww/lenovo/about/sustainability/environment/Product_Recycling_Programme.html and http://supportapj.dell.com/support/topics/topic.aspx/ap/shared/support/recycle/en/recycle?c=hk&l=en&s=gen

Mobiles

- In December 2005, Chinese mobile service provider China Mobile, Motorola and Nokia jointly initiated a Green Box programme in 40 cities across China. http://www.chinacsr.com/2006/04/20/432-china-mobile-extends-green-box-programme/
- Motorola publishes details of the programme on: http://www.motorola.com.cn/service/recycling/recycling.asp
- Nokia launched a campaign in China in 2002 in which recycling bins were placed in around 100 major cities at Nokia service centres. However, the campaign was not very successful because consumers prefer to sell old mobile phones on the second-hand market. Nokia's website gives Service Points where Nokia will take-back used mobile phones for recycling: http://www.nokia.com/NOKIA_COM_1/Corporate_Responsibility/Environment/Consumer_Information/Mobile_Phone_Take-back/swf/main.html
- Other mobile brands that participate in the Green Box scheme include: Samsung, LG Mobile, Panasonic, Bird, Lenovo, NEC and Amoi.

The Taizhou Environmental Protection Bureau states that Taizhou now has 42 fixed-point waste processing enterprises[71] capable of processing waste including WEEE[72].

It has been reported that the e-waste processing industry in Guiyu "has been valued at about RMB 600 million per year, or approximately US$72 million"[73].

At the same time the pilot programmes in Qingdao and Zhejiang, as well as newly established facilities, are finding it difficult to compete with China's large and unregulated informal sector[74].

71 These are government-established industrial parks, where processing enterprises can set up regulated recycling and disposal businesses

72 Hicks (2005) op.cit.

73 Dayoo Daily News, October 19, 2004, quoted according to Hicks 2005

74 Hicks (2005) and Liu (2006) op.cit.

Summary of results for China

The quality of the sales data for China is relatively good. There has been an immense increase in the ownership of electrical appliances since the mid 1990s, and sales for several appliances are set to continue increasing through to the year 2010 and beyond to 2020. This will ultimately lead to ever larger quantities of end-of-life products in the future.

There are no officially published data currently available on the quantity of end-of-life appliances, and there are inconsistencies and uncertainties in the data published in studies. This is especially true in relation to the quantities of materials actually recovered.

Unsurprisingly, there is also no reliable and comprehensive quantification of the destinations of the e-waste. This is due to the fact that most e-waste (>60%) that is collected separately is collected and treated by the informal sector. In addition, it can be assumed that there is a relatively high reuse rate and a high percentage of storage in China.

The high collection rates are driven by economics, as the end users often get paid for their e-waste by collectors. The treatment of e-waste in the informal sector is therefore most likely to prioritise the reclamation of valuable substances; however, reclamation rates are poor, since primitive recycling yields much lower levels of precious metals, for example 90+% can be achieved in a dedicated smelter compared to 20% via backyard recycling. There is also much less emphasis on the health and safety of workers and the impacts on the environment that can result from hazardous substances present in e-waste. A lower proportion of the e-waste will be recycled with the mixed plastics fraction being burnt in the open or simply dumped.

Thus, it might not be necessary to focus on improving collection rates (as is the case in several European countries, for example) but on reducing the environmental hazards and negative health effects from treatment in the informal sector and investing in dedicated infrastructure to ensure high efficiencies of recycling – at least until the time that hazardous ingredients are designed out of electronics. There is also a challenge for multinational electronics companies that are committed to producer responsibility, which is to compete economically with the informal sector, since there is little incentive for end-users to return their e-waste to the producer even for free, when they can easily sell it to be recycled in the informal sector. This points to the need to develop and enforce high recycling standards to level the playing field for all recyclers.

China is fairly typical of a rapidly industrialising country where there is already a large quantity of end-of-life appliances being generated domestically, with high collection rates by the informal sector. The value of raw materials found in e-waste combined with the low costs of processing in China due to lack of regard for health and environmental concerns, also leads to e-waste imports from industrialised countries such as the US and Europe, sometimes illegal. The projected growth in consumption of electrical appliances in China in the future will lead to an explosion in the quantities of electronic scrap, even without imports, and will only exacerbate the existing health and environmental problems[75]. China is developing new legislation modelled on the EU's WEEE Directive in an attempt to anticipate this future problem and has already introduced the so-called China RoHS, which requires labelling of specified hazardous substances in electronic products. It is also encouraging that some companies are beginning to implement take-back and recycling of their end-of-life products, although it is unclear how much of an impact this can make on the e-waste stream as they will need to compete with the informal recycling sector that is paying last owners for the discarded e-waste.

75 Greenpeace 2005, Recycling of Electronic Waste in India and China, http://www.greenpeace.org/international/press/reports/recycling-of-electronic-waste

India

Put on the market

India is considered to be a latecomer on the EEE market, which is now growing rapidly, with the expected annual value growth in the EEE hardware market from 2005 to 2015 estimated to be 29.8%[76]. India is best known as an exporter of software but it is increasingly becoming a sought after destination for global brands to market their EEE products; Dell is making India its favourite investment destination. The IT sector in the Indian economy is pegged as the main driver for India's future economic growth.

PCs/IT equipment

Sales data for IT equipment show a considerable increase especially for PCs, which have risen by nearly 400% in the last six years, while sale of laptops have grown by over 500% in two years.

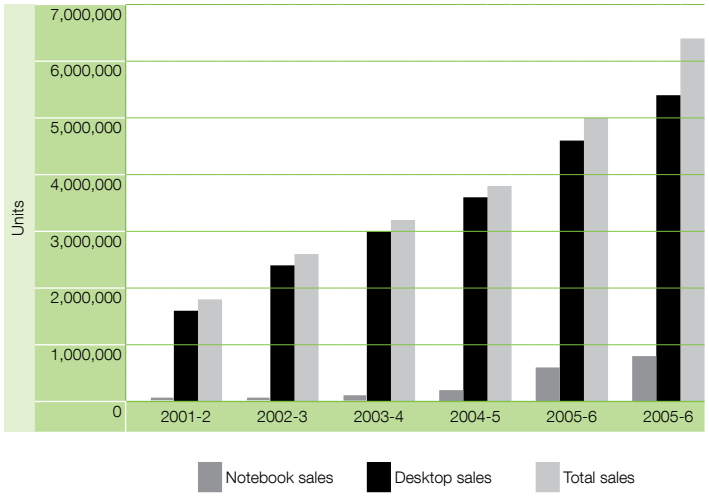


Figure 14: Total PC (Desktop and Notebook) sales, India 2001 - 2007, MAIT Annual Review 2006/7[77]

Notebooks account for 13% of the PC market in 2006/7 and grew by 97%. The growth in the overall shipments of PCs has been attributed mainly to demand from small and midsize businesses and the higher education sector, which has contributed significantly to the growth of the notebook PC market.[78]

This increase is projected to continue as shown by the following forecast[79].

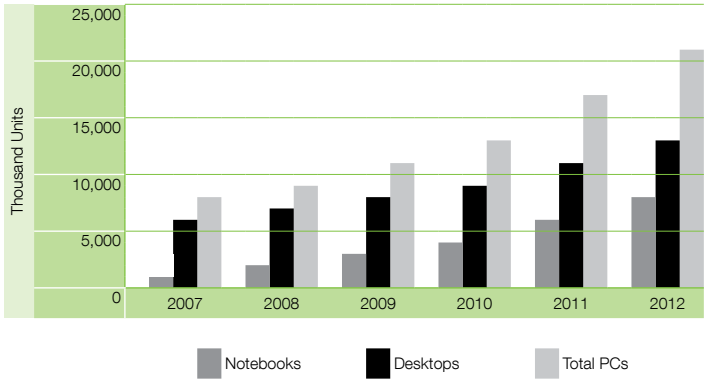


Figure 15: Sales Forecasts of Desktops and Notebooks for next five years, India

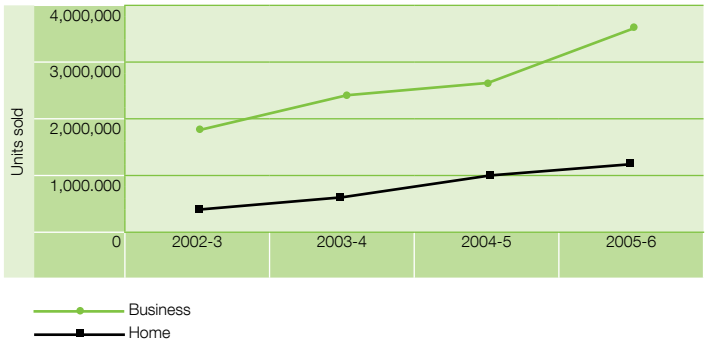


Figure 16: Consumers of IT equipment[80]

76 ISA and Frost and Sullivan 2005, ISA, Frost and Sullivan holds study on Indian semiconductor industry, Feb. 2, 2006, www.eetasia.com/MARKET/NEWS/200602/ISAFROST.doc

77 http://www.mait.com/industry.jsp

78 The Hindu Business line, Friday, Dec 01, 2006, e-paper, http://www.blonnet.com/2006/12/01/stories/2006120103830400.htm

79 MAIT-GTZ 2007, First MAIT-GTZ study reveals extent of e-waste challenge, Press release, New Delhi, December 13 2007, http://www.mait.com/pressupdate1.jsp?Id=77

80 MAIT 2007, IT Industry Performance: Mid-Year Review 2006-07, MAIT, New Delhi: January 31, 2007

IT equipment is increasingly being sold outside the big cities. While the share of PC shipments to the eight biggest cities in the period 2000-2001 was 85% it was only 35% in the period from 2005-2006 (see 16).

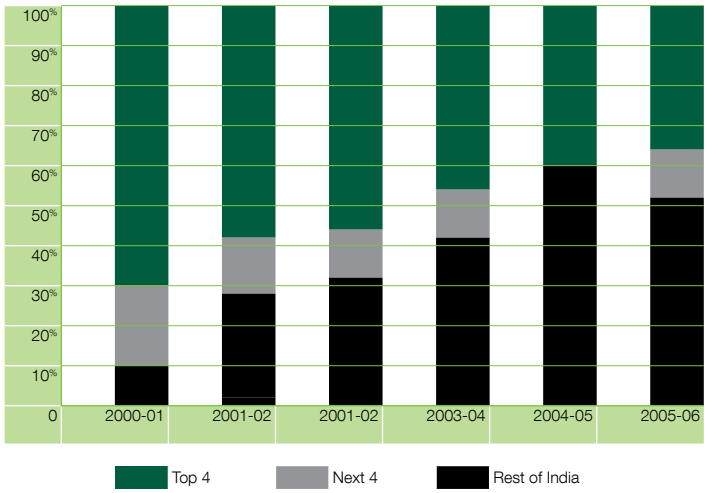


Figure 17: Regional spread of PC shipments: Cities vs. "Rest of India"[81]

The US multinational HP has the largest market share for PC shipments, followed by the Indian company HCL, with Lenovo taking the third largest share.

Table 8: Market shares for PC shipments[82]

Vendor	**2005 Market Share (%)** [The Hindu Businessline]	**2006 Market Share (%)** [IDC India 2006]
HP	17	21
HCL	13	12
Lenovo	7	9
Dell	(5%)	

Mobile phones

Mobile phone subscription in India is growing at a rate of 82.2%[83] and has been identified as the market with the greatest scope for growth, set to become the second largest mobile handset market globally by 2007[84].

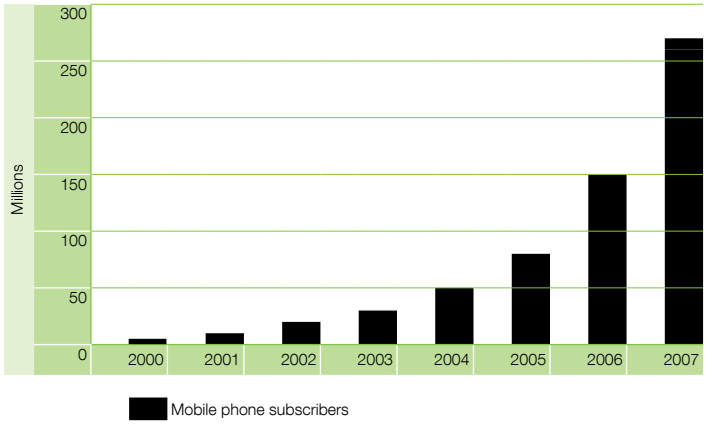


Figure 18: Year on Year Growth of Mobile Phone Subscribers in India[85]

15.4 million mobile phones were sold in the financial year 2004-2005[86], a market which is worth 1.5 billion EUR. The price per mobile phone varied between 30 EUR and about 340 EUR, although the majority (60%) cost less than 70 EUR[87].

Since then the market has increased enormously, including an increase in replacement sales. MAIT-GTZ[88] reports that sales of mobile handsets, including new users and replacements, have increased to 93 million units in 2007. Two years ago, the replacement market was barely 8-10% of total sales; at present it accounts for a 20-25% share.

The market leader is the OEM Nokia, with over half of the market, followed by Samsung and LG.

81 Mait 2006: IT Industry Performance Annual Review: 2005-06; Press Conference New Delhi: June 29, 2006

82 Asia Time Online 2006: Pc Market Heats Up In India, Asia Times Online, June 21, 2006 http://209.85.129.104/search?q=cache:f-1rwhjo4xkj:www.atimes.com/atimes/south_asia/hf21df02.html+thailand+pc+market+share+hp&hl=nl&gl=nl&ct=clnk&cd=5&client=firefox-a

83 Business Wire, Wednesday, September 27 2006http://www.allbusiness.com/services/business-services/3935730-1.html

84 India has emerged as the second largest mobile handset market, poised for explosive growth by 2007, Saturday, September 3, 2005: http://www.ciol.com/content/news/2005/105090305.asp

85 MAIT-GTZ 2007, First MAIT-GTZ study reveals extent of e-waste challenge, Press release, New Delhi, December 13 2007, http://www.mait.com/pressupdate1.jsp?id=77

86 V and D 2005: op.cit.

87 V and D (2005) op.cit.

88 MAIT-GTZ 2007, op.cit.

Table 9: Market shares for Mobile Phone shipments

Vendor	2005 Market Share (%) [V&D 2005]
Nokia	55.1
Samsung	10.5
LG	11.8
Motorola	8.6
Sony Ericsson	3.4

TVs

The sales data for TVs shows that sales doubled between 1990 and 1998, levelled off briefly until 2001 but have nearly tripled since then. Black and white TVs are increasingly being replaced by colour TVs.

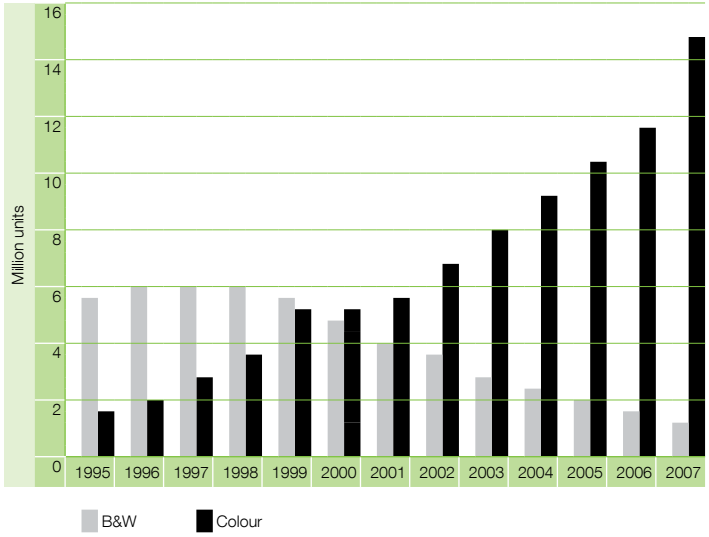


Figure 19: Market Size of Televisions in India, 1995 - 2007[89]

The size of the colour TV market is estimated at 15 million units and is expected to increase to 20 million units by 2015[90]. Around 50% of TVs are owned by consumers in rural areas[91].

The market for black and white TVs is dominated by companies that are not member of producers' associations; the largest identified producers of black and white TVs are Videocon (19.8% in 2003) and Onida (12.6% in 2003). For colour TVs three producers have a market share above 10% in 2003; LG (20.1%) Samsung (15.2%) and Onida (11.2%).

Table 10: Market shares for colour TV[92]

	Market share in 2003		Market share in 2002
LG	20,1%	**Others**	19,0%
Samsung	15,2%	**LG**	14,6%
Onida	11,2%	**Samsung**	11,3%
Others	9,0%	**BPL**	10,3%
Videocon	8,5%	**Onida**	8,6%
Sansui	7,9%	**Videocon**	7,9%
BPL	6,3%	**Sansui**	6,0%
Akai	4,6%	**Akai**	5,5%
Philips	4,6%	**Philips**	4,6%
Thomson	2,7%	**Sony**	3,0%
Oscar	2,5%	**Thomson**	2,4%
Sony	2,3%	**Sharp**	2,0%
Sharp	1,7%	**Panasonic**	1,1%
Beltek	1,6%	**Toshiba**	0,7%
Panasonic	1,1%		
Toshiba	0,8%		

More recent data on LCD and flat TVs shows that, as of October 2007, Samsung leads the LCD TV market with a 45.7% share, and holds the number two position in flat TVs with a 22% market share[93].

89 CEAMA, reported in MAIT-GTZ 2007, First MAIT-GTZ study reveals extent of e-waste challenge, Press release, New Delhi, December 13 2007, http://www.mait.com/pressupdate1.jsp?Id=77

90 MAIT-GTZ 2007, op.cit.

91 National Council Of Applied Economic Research: The Great Indian Market; 2005

92 ICRA 2005: ICRA: Consumer Durables - February 2005, Icra Sector Reports, New Delhi, 2005

93 http://in.news.yahoo.com/071230/203/6p0pf.html

White goods

After a steep rise in sales of washing machines during the 90s the figures have levelled off since the year 2000. The sales of refrigerators are much higher, however, the rise in sales figures has been more moderate and steady (see following table 9).

Table 11: White goods market (FY: April-March/ CY: January-December)[94]

Growth in Domestic Washing Machines Market											
	FY1994	FY1995	FY1996	FY1997	FY1998	CY1998	CY1999	FY2001	FY2002	FY2003	FY2004
thousand units	**550**	**740**	**690**	**890**	**984**	**1160**	**1275**	**1342**	**1296**	**1360**	**1361**
Indian Refrigerator Market: Trends in Growth											
	FY1994	FY1995	FY1996	FY1997	CY1998	CY1999	CY2000	FY2002	FY2003	FY2004	
million units	**1,39**	**1,64**	**2,25**	**2,25**	**2,95**	**3,07**	**3,22**	**3,00**	**3,38**	**3,7**	

In rural areas 9.8% of households own a washing machine compared to 16.7% in the cities[95]. However for white goods as a whole the absolute market in rural areas is the same size as in urban areas[96].

Regarding refrigerators four companies had market shares above 10% in 2004 (with Whirlpool the biggest at 23%). For washing machines LG has the largest share of the market at 27.3%, followed by Videocon, Whirlpool and Samsung.

Table 12: Market shares for refrigerators[97]

	FY2004		**FY2003**
Whirlpool	23,0%	**Whirlpool**	26,7%
LG	22,0%	**Godrej**	20,4%
Godrej	19,7%	**Electrolux**	16,3%
Electrolux	13,2%	**LG**	14,5%
Videocon	9,8%	**Videocon**	10,7%
Samsung	9,1%	**Samsung**	5,9%
BPL	1,4%	**BPL**	4,0%
Voltas	1,2%	**Others**	1,5%
Others	0,5%		

Table 13: Market shares for washing machines [98]*[ICRA 2005]*

	FY2004		**FY2003**
LG	27,3%	**LG**	25,7%
Videocon	16,9%	**Videocon**	21,3%
Whirlpool	14,0%	**Whirlpool**	16,0%
Samsung	15,8%	**Samsung**	14,7%
Godrej	6,3%	**Godrej**	4,4%
IFB	5,1%	**IFB**	3,7%
Onida	3,3%	**Onida**	2,2%
National	3,3%	**National**	2,9%
Others	2,2%	**BPL**	2,8%
BPL	2,1%	**Electrolux**	2,6%
Electrolux	2,0%	**Others**	1,6%
Kenstar	1,8%	**Kenstar**	1,9%

94 ICRA (2005) op.cit.

95 ICRA (2005), op.cit.

96 National Council Of Applied Economic Research 2005:

97 ICRA (2005), op.cit.

98 ICRA (2005), op.cit.

End-of-life

Amounts

A recent study by MAIT-GTZ[99] reported that a total of 330,000 metric tonnes of e-waste (computers, televisions and mobile handsets only) was generated in 2007. An additional 50,000 tonnes were illegally imported into the country, mostly mislabelled as charitable donations or scrap, and not specified as electronic scrap, giving a total annual e-waste arising of about 380,000. Of this, only 19,000 tonnes were recycled 'due to high refurbishing and reuse of electronics products in the country and also due to poor recycling infrastructure'. Generation of e-waste in India is estimated to rise to 470,000 metric tonnes by 2011. MAIT-GTZ calculates the breakdown of e-waste generation as follows[100]:

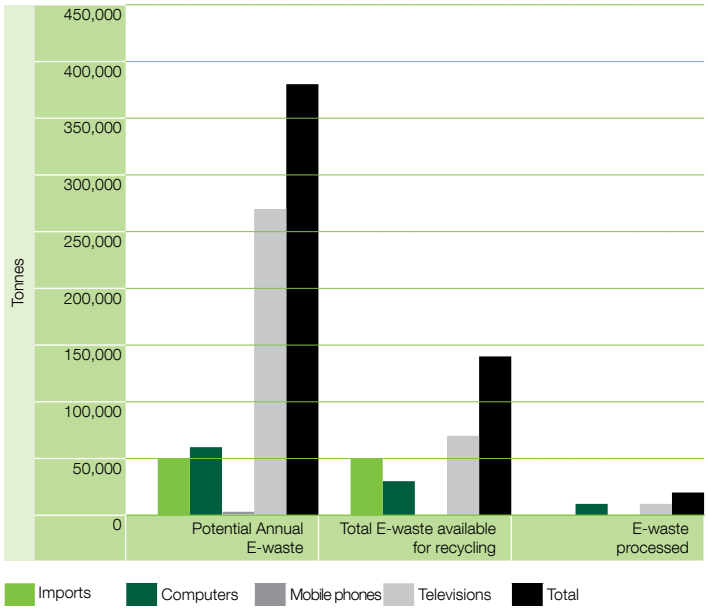


Figure 20: Breakdown of E-Waste Generated (Imports, Computers, Mobiles and Televisions), India

Previous estimates put the annual generation of e-waste in India at around 146 000 tonnes per year[101] which is around 0.1327kg per inhabitant per year, a very low figure which is unlikely. However, the proportions of the types of e-waste generated are given, showing that three categories of e-waste account for almost 90% of the generation

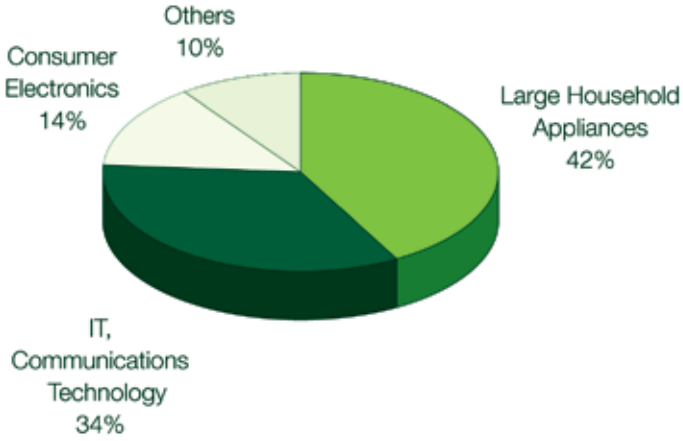


Figure 21: Composition of e-waste[102]

At a minimum 52% of e-waste - large household appliances and 'other' - is not included in the estimate of 330,000 metric tonnes of computers, TVs and mobiles in the study by MAIT-GTZ. It can therefore be reasonably assumed that a total of at least 660,000 metric tonnes of e-waste was generated in India in 2007, which can be projected to increase to at least 970,000 metric tonnes by 2011.

With regard to the occurrence of e-waste Mumbai, Delhi and Bangalore are the "highest ranking" cities. It is estimated that in Bangalore alone around 30,000 computers become obsolete every year from the IT industry because of a high obsolescence rate of 30% per year[103]. At least for IT equipment it can be expected that in the future the absolute amount of end-of-life PCs will be higher in rural areas compared to the big cities.

99 MAIT-GTZ 2007, First MAIT-GTZ study reveals extent of e-waste challenge, Press release, New Delhi, December 13 2007, http://www.mait.com/pressupdate1.jsp?Id=77

100 MAIT-GTZ 2007, op.cit.

101 E-Waste India 2007: Http://www.e-waste.in/weee_basics/weee_statistics/ The life time of appliances assumed for India is: Computer 7 years, TV, Refrigerator, washing machine: 15 years [Jain 2006] Jain, A.: E-Waste Management In India (Current Status and Needs), Presentation At: Creation Of Optimum Knowledge Bank For Efficient E-Waste Management In India, 8th May 2006, N.Delhi, India.

102 E-waste India (2007), op.cit.

103 E-waste India (2007) op.cit.

Destinations

Most recycling or disposal happens in the "informal treatment sector" in India. However, most used electronics products are not recycled but 'either put to use for less resource intensive applications or given to relatives/friends for further use', put into storage or sole or exchanged; these products are then refurbished and resold[104].

The second-hand market plays an important role in India. MAIT-GTZ reports that almost 50% of the PC's sold in India are products of the secondary market that have been re-assembled from old components[105].

It can be assumed that a relatively high portion of the e-waste is collected in India because of the value of the raw materials and the second-hand market. However, reports about the treatment of e-waste in India show that much of it is treated in a way that involves high risks for human health and the environment and is inefficient in terms of squandering valuable resources due to primitive reprocessing practices.

The study by MAIT-GTZ (see above) reports on recycling practices and estimates that of the 19,000 tonnes of waste recycled '95% of the e-waste is segregated dismantled and recycled in the informal sector based in urban slums'. The remaining 5% is recycled by the two formal recyclers operating in the South and West of India; it is expected that several more formal recycling facilities will be coming on line in the next few years[106]. This means that of the total amount of e-waste 'available for recycling' (144,143 metric tonnes), only 0.7% is currently recycled in formal recycling facilities, which means that at least **99.3% is the hidden flow** of e-waste that escapes formal recycling.

The West and South of India account for the largest proportion of the e-waste generated at 35% and 30% respectively. While the North of India is not a leading generator of e-waste, at 21%, it is the leading processing centre of e-waste in the country, all of which is in the informal recycling sector[107].

Initiatives by Manufacturers

Some producers have started to build up their own take-back systems. However, these approaches often focus primarily on business users and are restricted to big cities. Some examples are:

Computers

- Hewlett Packard offers recycling of hardware but only for its business customers in India, see: http://h50055.www5.hp.com/ipg/supplies/recycling/hardware/in/index.asp
- Dell offers free recycling of Dell branded products in India, customers can apply via its website, see: http://supportapj.dell.com/support/topics/topic.aspx/ap/shared/support/recycle/en/recycle?c=in&l=en&s=gen
- Lenovo offers recycling and/or environmentally conscious disposal services for all Lenovo branded PCs, products and IBM branded PCs, Notebooks, and Monitors manufactured by Lenovo after 1 May, 2005. See: http://www.pc.ibm.com/ww/lenovo/about/sustainability/environment/ptb_india.html
- Acer has an e-waste programme to recycle their products in the Indian market. The programme takes website or e-mail registrations followed by consumers sending their old items back to Acer India for treatment. Recyclable items include desktop computers, notebook computers, screens, projectors and servers. The programme is Acer's initial step into product recycling. http://www.global.acer.com/about/sustainability32.htm#5 and http://www.acer.co.in/home/ewaste.asp

104 MAIT-GTZ 2007, First MAIT-GTZ study reveals extent of e-waste challenge, Press release, New Delhi, December 13 2007, http://www.mait.com/pressupdate1.jsp?Id=77

105 MAIT annual report 2003.

106 News Watch 2007, MAIT-GTZ Study Reveals Extent of e-Waste Challenge, 15 December 2007, http://www.businessgyan.com/content/view/3762/169

107 MAIT-GTZ 2007, op.cit.

Mobiles

- Nokia's website states that the company offers take-back of mobile phones at service points in India, at: http://www.nokia.com/NOKIA_COM_1/Corporate_Responsibility/Environment/Consumer_Information/Mobile_Phone_Take-back/swf/main.html However, a Greenpeace survey found that Nokia staff at these service points were not well informed about product take-back.

- Samsung offers free take-back of old mobile phones for recycling, and gives contact details in Delhi on its website, see: http://uk.samsungmobile.com/greenmanagement/information/map.jsp?depth1=5&depth2=2

- Motorola has initiated the ECOMOTO Take-back initiative in India for end-of-life Motorola products, and provides take-back bins at five locations, see: http://www.motorola.com/content.jsp?globalObjectId=7749

- LGE launched a programme in August 2007 where it offers take-back of mobile phones at 392 locations globally and at nine locations in India, see: http://www.lge.com/about/sustainability/list/oldphone.jhtml

Summary of results for India

India can be considered a significant global hotspot for e-waste in the coming years. In contrast with China no specific WEEE related regulation or legislation is proposed in India, and is not yet on the political agenda.

Data quality on sales in India is quite good and calculations are now available on the overall amounts of e-waste that arise. However, real life quantitative figures about amounts of e-waste that arise and its destination have not been made for all types of e-waste. As in China, most discarded equipment is sold to the informal market which by its nature is uncontrolled and does not report reuse and recycling data.

The sales figures show that unsaturated markets still exist in India for many types of appliances, where a newly sold appliance does not yet replace an existing appliance. However, the markets are now becoming saturated in urban areas, with more growth, and potential for future growth, in rural areas.

It can therefore be concluded that in the future the development of e-waste collection systems outside of the big cities will become increasingly important. The cost for collection per collected kilogram could also be expected to rise due to greater collection efforts in areas with lower population density involving higher costs.

Currently, the percentage of collected e-waste is not well documented but the available estimations show that relatively high rates are collected, probably due to the high value of some components of electronic waste that are then recovered by the informal treatment sector.

Because the sales data is reported in units and e-waste generation in weight it is not possible to determine the recovery rate as a value relative to the sales data.

Businesses continue to play an important role in the consumption patterns for IT equipment, and sales to businesses continue to increase. This fact could be used by producers of IT equipment as a starting point for their own activities to take over responsibility for their own-branded end-of-life products, as the relationship between producer and business user is closer than the relationship between producer and private end user (except for Dell).

Like China, collection rates in India are determined by the informal sector, where the focus is on the recovery of valuable raw materials and not on the health and environmental hazards inherent in e-waste, resulting in environmental pollution and exposure of workers to hazardous substances in the recycling of e-waste. This also leads to the import of e-waste from developed countries such as the US and the EU, which add to the growing e-waste problem in India. As domestic sales of electrical and electronic appliances are set to escalate the quantities of e-waste will be much higher in the future. If the current methods of recovering raw materials continue this will lead to further environmental and health problems from the recycling of e-waste. Unlike China, there is no plan to develop legislation to tackle the e-waste problem.

Thailand

Put on the market

It is estimated that 1.9 million TVs, around 750 000 PCs and 550 000 monitors, 21.7 million mobile phones and almost 2 million household white goods (580 000 washing machines, 1 million refrigerators and 340 000 air conditioners) were sold in Thailand in 2004[108]. Excluding air conditioners, this amounts to 145,400 tonnes[109]

EEI[110] states that two years ago there were 12 million mobile phones used, 3 million units were substituted and 9 million units were new. This compares with 340,000 mobile phones ten years previously. The average service life of the phones was three to five years and the batteries 12-18 months.

End-of-life

According to EEI in 2005 1.4 million TVs, 430 000 PCs and 21 million mobile phones occurred as e-waste[111]. The growth in the amount of e-waste is shown in the following figure.

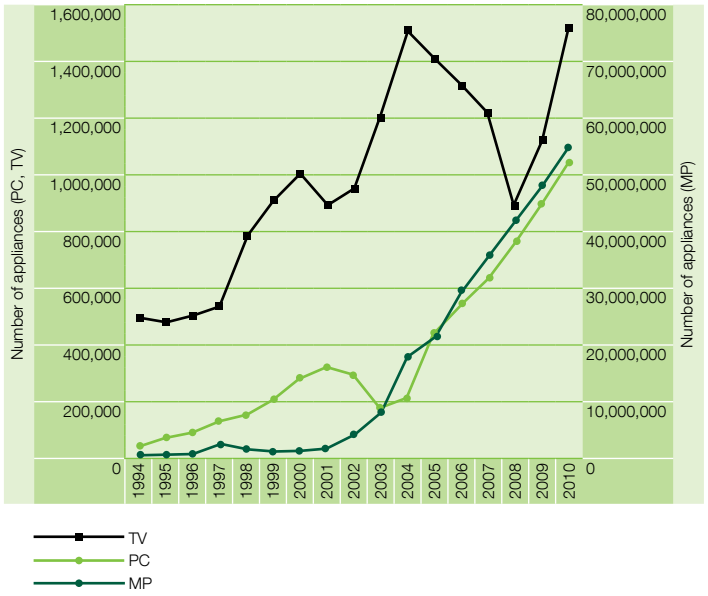


Figure 22: Amount of e-waste from 3 types of appliances [112]

According to the Pollution Control Department, in 2003, e-wastes generation in Thailand for five major appliances (i.e. refrigerator, washing machine, air conditioner, TV, PC) was estimated at 1.7 million units or approximately 58,000 tonnes. The figure is projected to increase by 12% a year to 4.3 million units in 2010, or approximately 128,220 tonnes. It is also estimated that the number of waste mobile phones and their batteries was 11.5 million units in 2003 and will continue to rise up to 203.27 million units in 2010[113].

108 3RKH 2006: 3R Gap Analysis Thailand, Bangkok, 2006

109 Based on average weights of EEE given in Huisman et. al. (2007), see Annex 2.

110 EEI (2007), Electrical and Electronics Institute, E-waste in Thailand, February 2007

111 EEI applied the following life time of appliances in their calculation of waste amounts: TV 10 years, PC 5 years, mobile phones 2 years

112 EEI (2007), op.cit.

113 PCD 2006 data source not available.

Another estimation made in 2003 shows that around 90,000 tonnes of e-waste was generated each year in Thailand[114] (see table below).

Table 14: Calculation of waste amounts

Type of Appliances	Sales in 2003 (piece)	Weight (kg)	Sales in 2003 (Tonne)	Replacement factor	Tonne	Piece
Washing machine	580000	49.2	28536	0.51	14553	295800
Refrigerator	1000000	40.8	40800	0.82	33456	820000
Air conditioner	340000	51.4	17476	0.67	11709	227800
Television	1900000	25.3	48070	0.53	25477	1007000
Computer	750000	5.2	3900	0.36	1404	270000
Computer monitor	550000	10.5	5775	0.2	1155	110000
Mobile phone	21730000	0.1	2173	0.44	956	9561200

The figures of 3RKH are plausible if compared with the situation in other countries, taking into account the relationship between GDP and EEE and the fact that for some appliances the market in Thailand is already a replacement market (for example 92% of households in Thailand have a TV).

Destinations

According to the Pollution Control Department of Thailand more than 90% of the e-waste that occurred in 2003 was disposed together with other waste[115].

End-of-life electronic products are not uniformly managed, TVs, PCs and CRT are dismantled by informal collectors, and saleable parts are sold to private traders[116]. There is not yet a proper management system, i.e. segregation and collection, for e-waste in the country. When products reach their end-of-life, some are sold to the second-hand market and some are simply disposed of along with municipal wastes[117].

114 3RKH (2006), op.cit.

115 The Nation 2004: The Nation: Govt Moves To Stem Tide Of 'E-Waste', Bangkok, 2004

116 EEI (2007) op.cit.

117 PCD (2006) op.cit.

The "informal sector" plays an important part in the e-waste management system[118]; most of the e-waste from households is dismantled and recovered in the informal sector. A large proportion of e-waste is refurbished and resold, and not always for appropriate uses - for example, computer monitors have even been converted into aquariums with no consideration of the hazards involved[119]. The rate of recovery of materials from the treatment of e-waste is described by the same source as 60-70%. Most e-waste activities such as dismantling and material reclamation are done by bare hand or with small tools in scrap yards or people's own homes[120]. There have been several documented cases of damage to human health or the environment caused directly by the processing of WEEE[121]

When e-wastes are discarded with other wastes, individual waste collectors pick up the valuable/recyclable wastes, sort them, and sell them on to waste dealers or bigger recycling shops. The recyclable parts are then sold to material recycling industries based on the type of waste.

Imports of e-waste occur either for reconditioning and resale or for recycling. For example, second-hand computers and notebooks are increasingly being imported from Japan and sold; the parts are upgraded in Japan and the repaired notebooks are sold at a lower price. Mobile phones are imported from the US and EU for reconditioning and resale. The destination of most e-waste imported for recycling is not known, apart from three formal recycling factories where the WEEE has been properly managed[122].

Recovery by manufacturers

Computers

- Hewlett Packard offers recycling of hardware but only for its business customers in Thailand, see: http://h50055.www5.hp.com/ipg/supplies/apac/recycling/hardware.asp
- Dell offers free recycling of Dell branded products in Thailand, customers can apply via its website, see: http://supportapj.dell.com/support/topics/topic.aspx/ap/shared/support/recycle/en/recycle?c=th&l=en&s=gen
- Lenovo offers recycling and/or environmentally conscious disposal services for all Lenovo branded PCs, products and IBM branded PCs, Notebooks, and Monitors manufactured by Lenovo after 1 May, 2005. See: http://www.pc.ibm.com/ww/lenovo/about/sustainability/environment/ptb_thailand.html

118 3RKH (2006), op.cit
119 EEI (2007, op.cit
120 3RKH (2006), op.cit.
121 EEI (2007), op.cit.
122 EEI (2007), op.cit.

Mobiles

In December 2004 the large mobile phone providers, Nokia and the Pollution Control Department aimed to set up a mobile phone and battery waste collection system in the year 2007, for further management by the private sector[123].

- Nokia's website states that the company offers take-back of mobile phones at service points in Thailand, at: http://www.nokia.com/NOKIA_COM_1/Corporate_Responsibility/Environment/Consumer_Information/Mobile_Phone_Take-back/swf/main.html However, a Greenpeace survey in October 2007 showed that Nokia staff in Thailand were not aware that a take-back service was offered, contrary to the website information, and in the Philippines staff were poorly informed about the take-back service offered.
- Samsung offers free take-back of old mobile phones for recycling, and gives contact details in Bangkok on its website, see: http://uk.samsungmobile.com/greenmanagement/information/map.jsp?depth1=5&depth2=2
- Motorola has initiated the ECOMOTO Take-back initiative in Thailand for end-of-life Motorola products, and provides take-back bins at five locations in Bangkok, see: http://direct.motorola.com/hellomoto/th/recycling/ However, a Greenpeace survey undertaken in October 2007 found unsatisfactory take-back service in Thailand and the Philippines, contrary to the information published on the Motorola website.
- LGE launched a programme in August 2007 where it offers take-back of mobile phones at 392 locations globally and at three locations in Bangkok, see: http://www.lge.com/about/sustainability/list/oldphone.jhtml

Summary of results for Thailand

The quality of data for sales figures is limited, and although some data on e-waste quantities are available from calculations, they are based on a survey in 2003. There are also contradictions in the figures provided by the two different sources[124]. There is no quantification of the rate of recovered waste or other aspects of the treatment of e-waste in Thailand.

Thailand does not yet have a comprehensive management system for e-waste in place which makes it difficult to obtain information on the quantities of e-waste and their treatment and recovery rates. As for China and India, the informal sector plays an important role in managing e-wastes and since it's "informal", it is not really controlled. The large OEM manufacturers are beginning to offer take-back and recycling services for some product types, but there is no information yet on their success, as these are in early stages and they will be competing with the informal sector for the return of end-of-life products.

A strategy of integrated WEEE management is under consideration by the National Pollution Control Committee and is due to be approved by the National Environment Committee and Cabinet in the near future[125]. Although the strategy was based on the polluter pays principle and the responsibilities of importers, manufacturers and consumers it has weak producer responsibility requirements.

123 EEI (2007), op.cit.

124 3RKH (2006) and PCD (2006)

125 EEI (2007), op.cit.

Argentina

Put on the market

PCs

PC sales for 2007 are projected at 1.5 million (37,500 tonnes), and 12% of this figure represents portable computers. PC ownership in Argentina is at 29%[126]. Projecting the likely arisings of e-waste from this figure, assuming an average life-time of seven years[127], e-waste arisings in 2014 from PCs alone would be 37,500 tonnes

End-of-life

WEEE for Argentina is estimated at 1.3 million printers and 9.5 million computer units in 2007.

Table 15: Electronic Apparatuses in Disuse in Argentina[128].

Argentina – Electronic Devices in Disuse 2006 and 2007 Projection				
	2006		2007	
Category	**Units**	**Tonnes**	**Units**	**Tonnes**
Printers	1155300	9752	1329700	12622.6
Computers	8290001	18540	9465000	20765
Printer cartridges	16500001	4900	19400000	5780
Bank cash machines	243000	1258	249000	1241
Other electrical equipment	13882601	3734	17853700	4207
Parts pieces and peripherals in disuse (equipos, aparatos, piezas partes e insumos no incluidos en otros rubros.	10000000	2000	12000000	2400
TOTAL	**50070900**	**40184**	**60297400**	**47015.6**

These figures suggest that the size of the e-waste problem for the categories listed above, which does not include TVs, mobile phones or white goods, is considerable, when compared, for example, to the 58,000 tonnes estimated for Thailand in 2003.

Recovery by manufacturers

Computers

- Dell offers an Asset Recovery for business customers in Argentina from late 2007 but no recycling of Dell branded products for individual customers, see: http://www.dell.com/content/topics/global.aspx/corp/environment/en/warsmap?c=us&l=en&s=corp http://www.dell.com/content/topics/global.aspx/services/en/assetrecoveryservices?c=us&l=en&s=corp
- Lenovo offers recycling and/or environmentally conscious disposal services for all Lenovo branded PCs, products and IBM branded PCs, Notebooks, and Monitors manufactured by Lenovo after 1 May, 2005. See http://www.pc.ibm.com/ww/lenovo/about/sustainability/environment/ptb_argentina.html

Mobiles

- Nokia's website states that the company offers take-back of mobile phones at service points in Argentina, at: http://www.nokia.com/NOKIA_COM_1/Corporate_Responsibility/Environment/Consumer_Information/Mobile_Phone_Take-back/swf/main.html However, a Greenpeace survey in October 2007 found that Nokia staff at these service points were not well informed about product take-back. Staff in Thailand and the Philippines were also poorly informed about the take-back service offered.
- Samsung offers free take-back of old mobile phones for recycling, and gives contact details for two service points in Buenos Aires on its website, see: http://uk.samsungmobile.com/greenmanagement/information/map.jsp?depth1=5&depth2=2
- LGE launched a programme in August 2007 where it offers take-back of mobile phones at 392 locations globally and at two locations in Argentina, see: http://www.lge.com/about/sustainability/list/oldphone.jhtml

Summary for Argentina

Although the Basel Convention Regional Centre for the South American Region (BCRC) is investigating the e-waste situtuation, the current information available on Argentina and for Latin America as a whole is extremely limited.

126 Ripley, Keith, (2007), Perspectives on Electronic Waste in Latin America and the Caribbean, Temas Actuales LLC, presentation at E-scrap conference, Georgia, www.temasactuales.com

127 As used by Apple and Dell.

128 CAMOCA, INDEC, reported in Ripley, Keith 2007, op.cit.

United States

Put on the market

PCs

The sales figures for PCs show a constant steep rise. As a result a "wave" of obsolete appliances is still building up at the end-of-life phase.

The market is dominated by US multinationals, with Dell selling the highest percentage, followed by HP which has a growing share of the market.

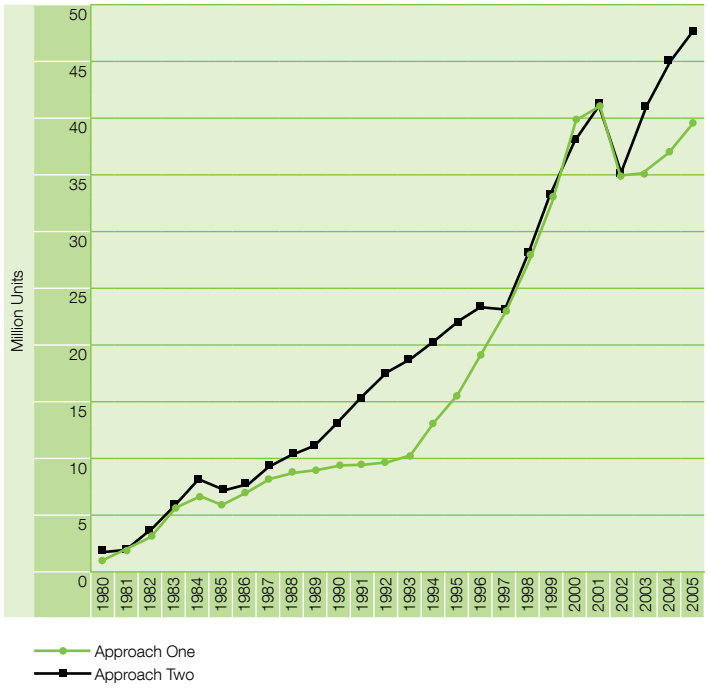


Figure 23: Desktop sales in the US [129]

("Approach One" relied primarily on market research data for sales. "Approach Two" relied primarily on government statistics for sales.)

Table 16: US PC Shipments 2006 (Units Shipments are in thousands)[130]

Rank	Vendor	2006 Shipments	Market Share	2005 Shipments	Market Share	2006/2005 Growth
1	Dell	20,472	31.2%	21,466	33.6%	-4.6%
2	HP	14,104	21.5%	12,456	19.5%	13.2%
3	Gateway	4,411	6.7%	3,886	6.1%	13.5%
4	Apple	3,109	4.7%	2,555	4.0%	21.7%
5	Toshiba	2,846	4.3%	2,327	3.6%	22.3%
Others		20,589	31.4%	21,184	33.2%	-2.8%
All Vendors		**65,531**	**100.0%**	**63,874**	**100.0%**	**2.6%**

129 US EPA (2007), US EPA 2007: Management Of Electronic Waste In The United States, Draft, April 2007, Epa530-D-07-002

130 IDC, Press Release, January 17, 2007, HP Gains Continue As Dell Struggles And Slow Commercial Demand Limits Growth in the United States, According To IDC, http://www.idc.com/getdoc.jsp?containerId=prUS20525907

Mobile phones

The sales figures for mobile phones show an impressive increase of 120 million appliances within ten years. However, the average weight of appliances is low and constantly decreasing.

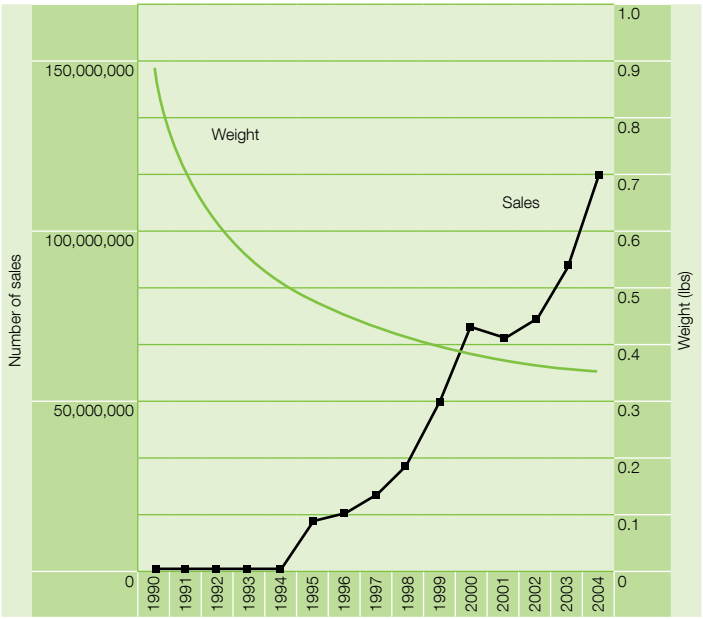


Figure 24: Sales of mobile phones in the US [US EPA 2007] [131]

The big six mobile vendors - Nokia, Motorola, Samsung, LG, Sony Ericsson and Siemens - increased their share as a group during the year to control 79.4% of the market.

TV

In contrast to the PC and mobile market, data on sales of TVs in the US show a saturated market, with moderate increases in sales where a very high percentage of new TVs replace old TVs.

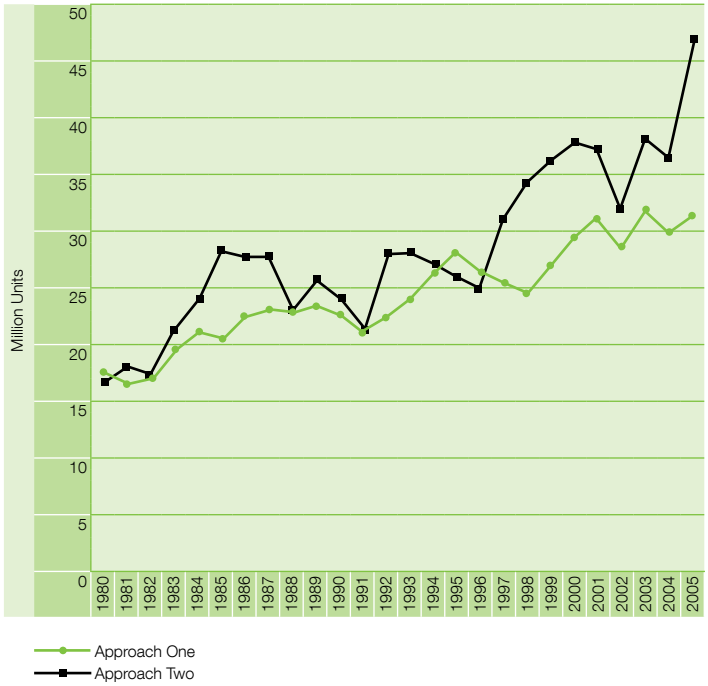


Figure 25: TV sales in the US [132]

("Approach One" relied primarily on market research data for sales. "Approach Two" relied primarily on government statistics for sales.)

The following data shows the change in technology that is going on in the US and other countries in a similar economic situation, where cathode ray tube TVs are being replaced by flat screen TVs. This also results in a change in producer's share of the market or the replacement of previous producers by new producers. The increase in sales of new TVs is being driven in part also by the move to digital TV.

131 US EPA (2007) op.cit.

132 US EPA (2007) op.cit.

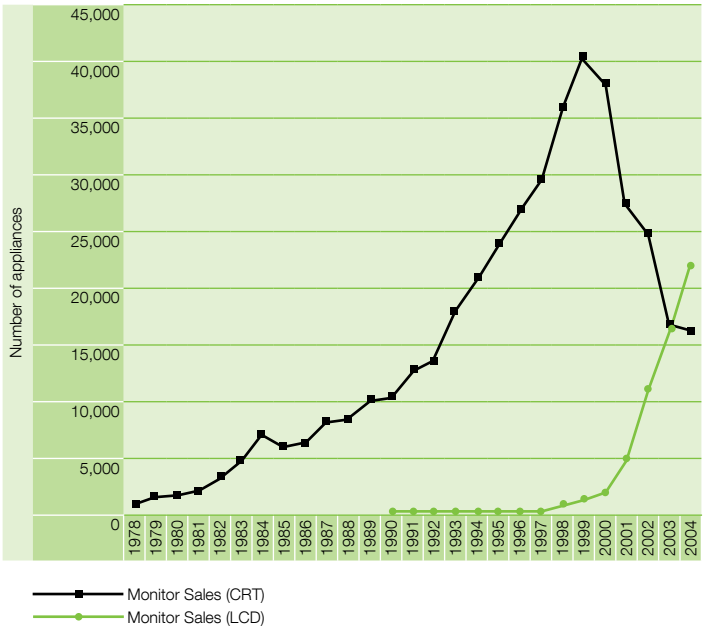


Figure 26: Sales of Monitors[133]

Large household appliances

There is limited and scattered heterogeneous data about the quantities of electrical appliances sold on the US market. This data does exist but seems to be only accessible via costly market research reports.

End-of-life

Total Quantities of e-waste generated in the US

The US Environmental Protection Agency (EPA) published a report in 2005 that estimates the amount of e-waste from selected appliances (TVs, VCRs, DVD players, video cameras, stereo systems, telephones, and computer equipment). According to this source 2.63 million tons[134] of e-waste occurred in 2005[135].

In 2007 a new report by the US EPA was published that covers televisions, PCs (including peripherals) and mobile phones. It estimates that the amount of e-waste that occurred in 2005 was up to 2 million tons. The following tables (15 and 16) show the numbers of e-waste appliances that are calculated to have been discarded, which rise from 200 million units in 2003 to nearly 350 million in 2005, and their weight.

133 US EPA (2007), op.cit.

134 The US EPA refers to tons, rather than metric tonnes, which is used elsewhere in this report. 1 ton = 2240lbs, 1 tonne = 1000kg

135 US EPA, Municipal Solid Waste In the United States, 2005 Facts and Figures, October 2006. http://www.epa.gov/msw/pubs/mswchar05.pdf

Table 17: Estimated Products Ready for end-of-life Management (Million units)[136]

Year	Desktops	Laptops	CRT Monitors	LCD Monitors	Mice / Keyboards	Total TVs	Cell Phones	Hard Copy Peripherals	Total
2003	18.5 - 24.7	4.0 - 6.9	24.5 - 27.7	0.1 - 4.6	64.3 - 92.8	23.5 - 24.4	49.0 - 75.8	19.6	**207.1 - 275.6**
2004	19.4 - 26.6	4.8 - 7.8	22.5 - 27.8	0.3 - 7.8	72.8 - 103,2	23.5 - 25.2	57.0 - 96.8	21.3	**227.9 - 314.8**
2005	19.8 - 28.4	6.1 - 9.0	22.8 - 28.5	0.8 - 10.0	76.4 - 107.9	24.0 - 26.3	70.6 - 116.5	22.9	**251.0 - 347.2**

Table 18: Estimated Products Ready for end-of-life Management (Thousand tons)[137]

Year	Desktops	Laptops	CRT Monitors	LCD Monitors	Mice / Keyboards	Total TVs	Cell Phones	Hard Copy Peripherals	Total
2003	241.1 - 275.0	23.3 - 25.4	418.6 - 597.8	0.6 - 56.4	51.6 - 97.0	734.1 - 795.4	7.5 - 8.6	166.7	**1,747.9 - 1,959.9**
2004	253.6 - 293.6	26.4 - 28.2	383.9 - 627.8	1.8 - 96.2	58.9 - 96.3	753.6 - 837.8	7.5 - 9.8	181.7	**1,813.2 - 2,084.9**
2005	259.5 - 322.6	30.8 - 31.8	389.8 - 673.1	4.9 - 122.6	61.1 - 80.6	786.0 - 891.9	8.2 - 11.7	198.3	**1,918.5 - 2,232.6**

Although the average weight of individual mobile phones is decreasing, the weight of end-of-life products continues to increase due to the higher number of devices being discarded.

The International Association of Electronics Recyclers (IAER) provides a slightly higher estimate of an average of about 400 million units a year will be scrapped in the US, of the various categories of consumer electronics, amounting to 3 billion units in the rest of this decade[138]. This is a projection based on the current growth and obsolescence rates. It is possible that more categories of consumer electronics are included in these figures.

136 US EPA (2007) op.cit.

137 US EPA (2007) op.cit.

138 International Association of Electronics Recyclers Industry Report, 2006, Available at: http://www.iaer.org/communications/indreport.htm, cited by Computer Take-back Campaign, www.computertakeback.com

Destinations

According to the US EPA in 2005, less than 20% of the e-waste categories televisions, PC including peripherals and mobile phones were separated from other waste streams for "further processing and recovery[139]. It has to be taken into account that "further processing and recovery" includes the export of e-waste. The following figure shows the destinations of some e-waste categories in 2005.

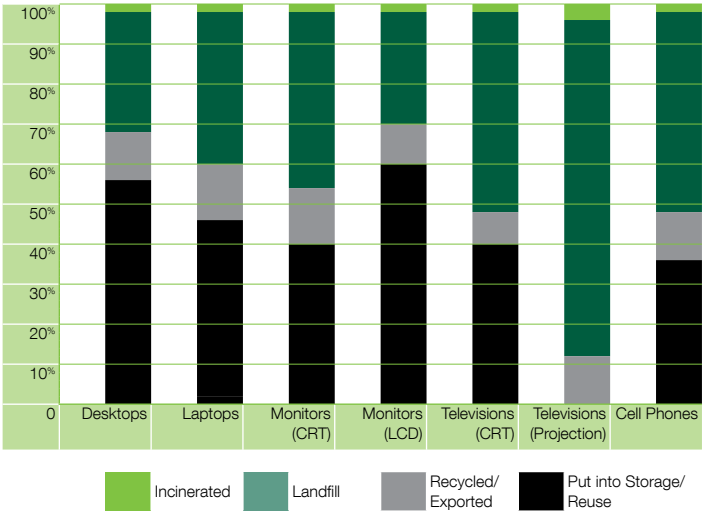


Figure 27: Destination of certain e-waste categories in 2005

The IAER states that around 500 treatment and recycling companies were in operation in the US in 2005 (up to 450 in 2003). The total amount of e-waste for 2003 is estimated by IAER as 2.8 million tons. 1.4 million tons were treated by IAER member companies and 0.7 million tons of recyclable fractions were reclaimed [140]. It has to be taken into account that this data includes exports and that some types of appliances are included that were not in the scope of the EPA study.

Figure 28 shows the proportions of e-waste that are recycled, disposed and put into storage; the US EPA calculates that a high percentage of appliances are assumed to be stored or reused.

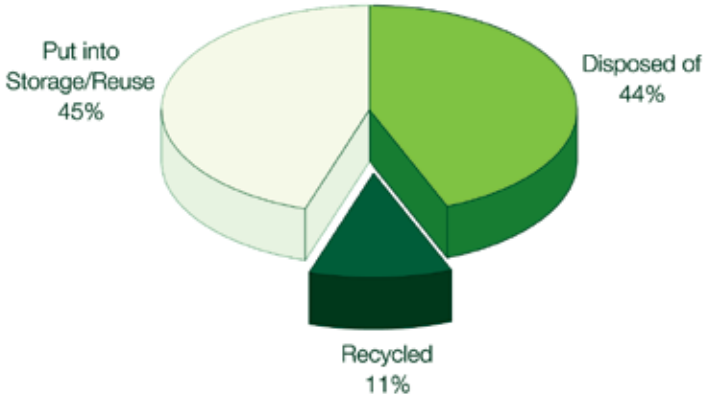


Figure 28: Electronic Products Recycled, Disposed, or Going into Storage/ Reuse 2003 – 2005 (% by weight) [141]

End-of-life PCs and the 'hidden flow'

The US EPA [2007] gives the following figures on the amount of treated[142] end-of-life desktop PCs.

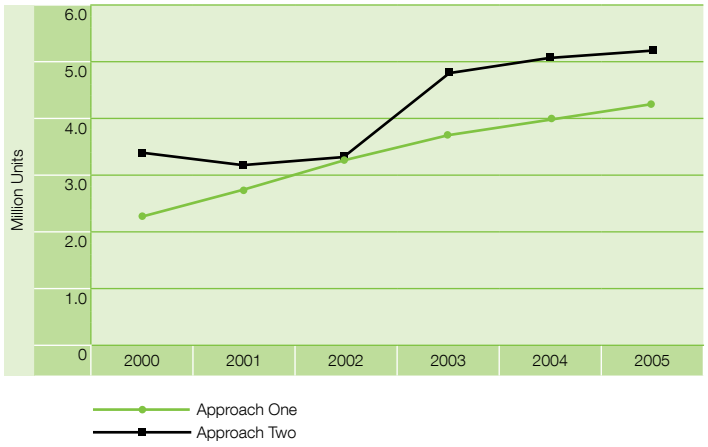


Figure 29 - Number of Desktops treated (values calculated by US EPA)[143]

139 US EPA (2007) op.cit. "Recovered for recycling:" which means that products are separated out from waste stream for recycling

140 IAER (2006), IAER, Electronics Recycling 2006.

141 US EPA (2007), op.cit.

142 The term "recycled" as used in the US EPA study could be misleading because the data reflect amounts that are processed in treatment plants

143 US EPA (2007) op.cit.

The US EPA explains the two approaches as follows: "**Approach One** determined the amount recycled based on industry sources, and estimated the disposal amounts by calculating the difference between what is generated for end-of-life management and what is collected for recycling on an annual basis: disposal amount equals quantity generated for end-of-life management minus the amount recycled. **Approach Two** calculated the amount disposed of based on five states' waste sorting studies extrapolated to the national rate, and estimated the amount recycled by calculating the difference between what is generated for end-of-life management and what is disposed of: recycled amount equals quantity generated for end-of-life management minus amount disposed"."

When compared to the sales figures it becomes obvious that US EPA sees much lower quantities of end-of-life desktop PCs that are available for recovery or disposal and much slower growth in e-waste quantities, than the amounts that are sold.

The following Greenpeace analysis compares the figures on PC sales (Figure 23) and PCs disposed of (Figure 29). (In both cases the median between Approaches One and Two were used for calculation.) An average lifespan of seven years[144] has been assumed for these calculations.

Table 19: Comparison of PC sales and PCs treated

Desktops Units treated in mln (Fig 5)	Year treated	Desktop units sold in mln	Year of sales	Treated as a % of sales in year x (lifespan of product = 7 years for laptops)
c. 3.6	2005	33	1998	10.9%
c. 3.5	2004	27	1997	12.9%
c. 3.4	2003	23	1996	14.7
c. 3.1	2002	21	1995	14.7
c. 2.9	2001	18	1994	16
c. 2.8	2000	16.5	1993	16.9

This shows that recycling rates for desktops are going down, from almost 17% in 2000 to 10.9% in 2005, due to the fact that sales have increased more than recycling efforts. The key question is, where are the other 80-90% of the desktops sold between 1993 and 1998?

US EPA calculations also show that the percentage of recovered end-of-life desktop PCs, compared to sales actually declined between 1990 and 2004.

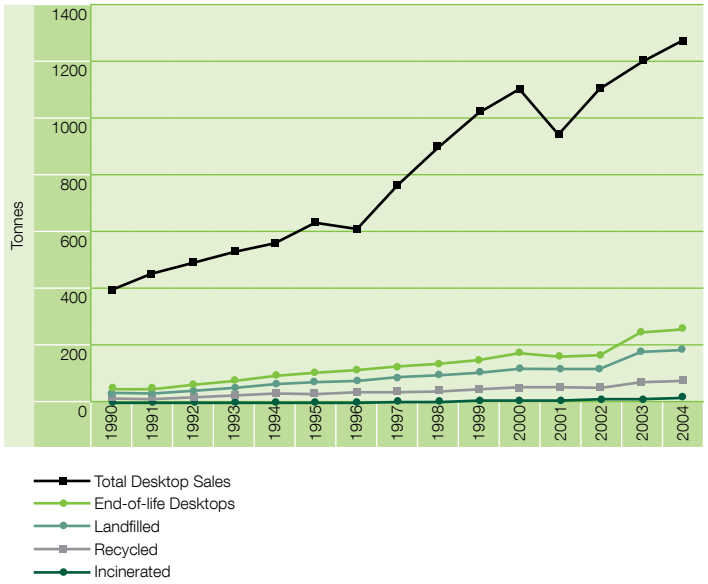


Figure 30: Mass of desktops sold and disposed [based on values calculated by US EPA) [145]

144 As used by Dell and Apple

145 US EPA (2007) op.cit.

End-of-life TVs and the 'hidden flow'

Theoretical figures for the disposal of end-of-life TVs have also been calculated, and can be compared to the sales figures.

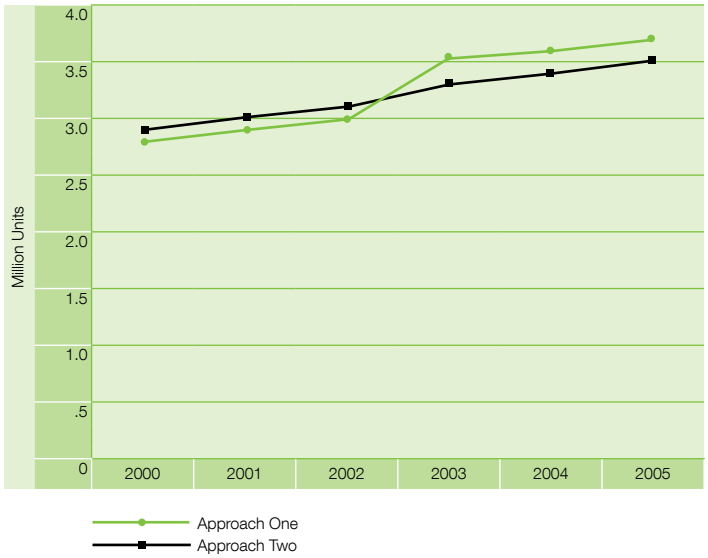


Figure 31: Number of TVs treated [146]

The following Greenpeace analysis compares the figures on TV sales (Figure 25) and TVs disposed of (Figure 31). (In both cases the median between Approaches One and Two were used for calculation.) The various TV technologies (CRT, LCD, plasma) have different life spans; for the purposes of these calculations a lifespan of 20 years has been assumed.

This shows that between 83% and 87% of all TV sales from 1980 to 1985 are either still in people's homes (used or obsolete) or have escaped any waste management, and that the percentage of e-waste remains more or less at the same level, due to the increase in sales.

The US EPA has also calculated the sales and disposal flows for CRTs, which shows a similar picture, as follows:

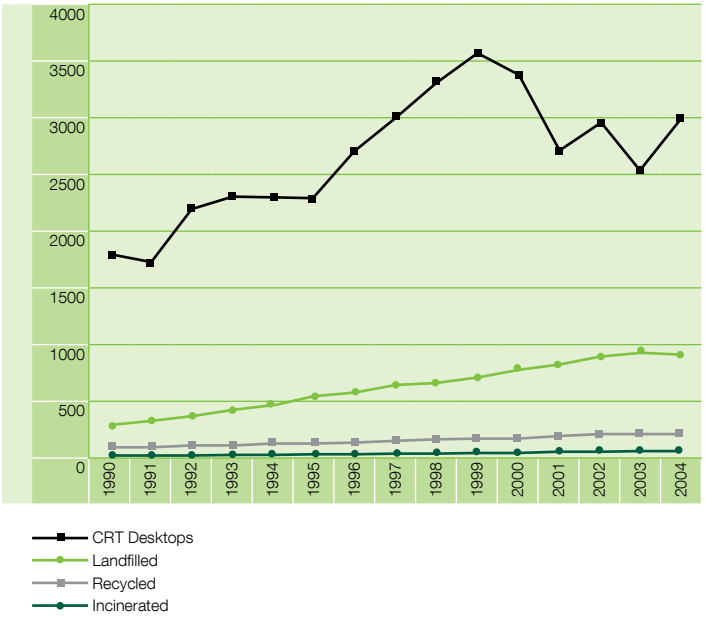


Figure 32: CRT sales and disposal (tonnes)[147] *[US EPA 2007]*

Table 20: Comparison of TV sales and TVs disposed of

TV Units treated in mln (Fig 5)	Year treated	TV units sold in mln	Year of sales	Treated as a % of sales in year x (lifespan of product = 10 years for TVs)
c. 3.55	2005	26	1995	13.6%
c. 3.5	2004	27	1984	12.9%
c. 3.45	2003	26.5	1993	13.0%
c. 3.05	2002	25.5	1992	11.9%
c. 2.95	2001	21	1991	14.0%
c. 2.85	2000	23.5	1990	12.1%

146 US EPA (2007) op.cit.

147 US EPA (2007) op.cit.

The US EPA presents detailed information for the destination of cathode ray tube TVs and monitors (CRT), which contain lead; 75% of the CRT is exported for "refurbishing or remanufacturing into new TVs or specialty monitors abroad" and "CRT glass-to-glass factories abroad". However, about 30% of the CRT destined for remanufacturing abroad is not technically suitable for this purpose and has to be recycled or disposed of, which also occurs abroad.

Table 21: End Markets for end-of-life TVs and CRT Monitors Collected for Recycling in the US in 2005[148]

End Market	Tons/Year	% of total
Resale "as is" or after some repair/upgrade in the US	3,000	2%
Resale "as is" or after some repair/upgrade abroad	3,500	2%
Refurbishing or remanufacturing into specialty monitors in the US	2,500	1%
Refurbishing or remanufacturing into new TVs or specialty monitors abroad*	107,500	61%
CRT glass-to-glass factories in the US	4,000	2%
CRT glass-to-glass factories abroad	24,000	14%
CRT glass to smelters in North America for lead recovery**	10,000	6%
Plastic, metal and other material recovery from demanufacturing***	20,500	12%
Total	**175,000**	**100%**

*Industry experts interviewed by Robin Ingenthron report that about 30% of material destined for remanufacturing abroad is not technically suitable for remanufacturing and has to be recycled or disposed. The recycling or disposal of unsuitable units occurs abroad.

**Includes units shipped to one smelter in the US and one in Canada.

***End markets for these materials are both domestic and abroad.

The comparison of sales figures for CRT TVs plus CRT monitors with the total numbers of CRT monitors disposed of, as described by the US EPA, suggests that there is a knowledge gap about the final destination of several 100,000 tons of CRT[149].

148 World Reuse, Repair and Recycling Association, 2005. Figures for CRT glass-to-glass factories are based on EPA research

149 Within the US EPA figures the calculation is coherent because the calculation is based on relatively long usage times and a relatively high percentage of CRT appliances getting a "second life" (stored or reused).

Take Back Activity in US

As yet there is no federal e-waste legislation and the management of end-of-life electronic products varies from State to State within the US. In 2003, 38 States had some sort of WEEE management programme and CRTs were prohibited from landfill sites in four states. There are also regional initiatives for WEEE management[150]. At the national level the general focus of the US EPA is on the concept of product stewardship.

Individual US States are enacting legislation to address e-waste, so far nine have passed e-waste recycling laws; Connecticut, Maine, Maryland, Minnesota, Oregon, North Carolina, Texas, Washington and California. All of these laws, except for California, require producer responsibility to a greater or lesser degree[151]. In California, the legislation requires an Advanced Recycling Fee (ARF), a policy supported by a coalition of TV manufacturers, which requires consumers to pay a $6 – $10 recycling tax when purchasing electronic products, which provides no incentive for producers to improve the design of their products.

Key players in industry that are engaged in WEEE management include the National Electrical Manufacturers Association (NEMA) and the US trade association representing electro industry manufacturers. US-based multinational companies have also become involved in WEEE management both in the US and globally. Particularly active companies include Apple, AT&T, HP, IBM and Motorola.

A wide range of federal projects has been established to address particular aspects of the problem. Many of these are mirrored by regulatory approaches and associated programmes in a number of US states.

One of the main issues facing the US is the challenge of establishing effective governance structures to deal with the waste electronics issue. The political structure of the US makes it difficult to develop national scale programmes, since the power invested in state legislatures enables states to make decisions and implement policies that relate to their own political, economic and environmental agendas.

A report for the European Commission states “However, one of the main issues facing the US is the challenge of establishing effective governance structures to deal with the WEEE issue. The political structure of the US makes it difficult to develop national scale programmes. The case of the US highlights the importance of a proper legal framework and controls needed to accompany WEEE directive or any similar measure”[152]. Most crucial to any e-waste recycling federal law, would be a ban on the export of collected e-waste.

There have been, however, some significant regulatory developments and multi stakeholder dialogues in the US. There are a number of regional initiatives, such as the NorthEast Recycling Council, NorthEast Waste Management Officials Association and the Northwest Product Stewardship Council. These bodies work at regional level to develop legislative policy with states and local communities.

Examples of active WEEE programmes at state level include the Minnesota Office of Environmental Assistance. (MOEA) developed a state product stewardship policy that is being implementing through voluntary partnerships with businesses and government agencies. An electronics task force focusing on CRTs will make recommendations for recovery and recycling goals in the state, identify alternative (non-governmental) financing mechanisms, and obtain commitments for managing end-of-life electronics from manufacturers, sellers, and product users.

150 IPTS 2006: Institute For Prospective Technological Studies: Implementation Of The Waste Electric And Electronic Equipment Directive In The Eu, 2006

151 The Computer Take Back Campaign, http://www.e-take-back.org/docs%20open/Toolkit_Legislators/state%20legislation/state_leg_main.htm, checked 7/11/07, http://www.e-take-back.org/docs%20open/Toolkit_Legislators/tools/Contents%20of%20state%20bills.ppt#266 ,12,Four Categories, checked 8/11/07 See latest overview of US legislation at: http://www.e-take-back.org/docs%20open/Toolkit_Legislators/tools/Regional_Mtgs_tools.htm http://www.e-take-back.org/docs%20open/Toolkit_Legislators/tools/Tools_main.htm

152 BIOIS 2006: Gather, Process, And Summarise Information For The Review Of The Waste Electric And Electronic Equipment Directive (2002/96/EC) Synthesis Report, Final Version, September 21, 2006

Take-back and recycling by manufacturers

Computers

Hewlett Packard will take-back end-of-life hardware, printer cartridges and batteries for recycling, in the US, see: http://www.hp.com/hpinfo/globalcitizenship/environment/recycle/index.html

Dell plans for its voluntary take-back service to be virtually worldwide by the end of 2007, see: http://www.dell.com/content/topics/global.aspx/corp/environment/en/warsmap?c=us&l=en&s=corp

Apple offers free take-back and recycling of old computers with the purchase of a new Mac http://www.apple.com/environment/recycling/nationalservices/us.html

Sony Electronics Inc. has voluntarily established a nationwide recycling programme for consumer electronics in the US with Waste Management (WM) Recycle America. Beginning September 15, 2007, the Sony Take Back Recycling Programme allows consumers to recycle all Sony-branded products free-of-charge at 75 WM Recycle America eCycling drop-off centers throughout the US The programme also allows consumers to recycle other manufacturers' consumer electronics products at market prices. http://www.sony.net/SonyInfo/Environment/recycle/america/index.html

Toshiba offers a trade in programme where used PCs of any brand can be traded in for a new Toshiba product: http://www.toshiba.co.jp/pc_env/recycle/index.html

Mobiles

Nokia offers free mail-back for end-of-life mobiles in the US at: http://www.nokiausa.com/recycle

Samsung offers recycling for mobile phones in the US, and provides contact details on its website at: http://uk.samsungmobile.com/greenmanagement/information/phone.jsp?depth1=5&depth2=1

Sony Ericsson participates in the national recycling programme of the CTIA – the Wireless Association, in which members commit to collect used mobile devices, recycle or refurbish them, and raise consumer awareness of the fact that their used mobile devices are in fact recyclable products. http://www.recyclewirelessphones.com/index.cfm?fuseaction=about.wireless

Motorola provides pre-paid address labels to return old mobile phones for recycling with the purchase of a new product; these are also available on request, see: http://www.racetorecycle.com/about.html

LG provides contact details of its nearest mobile phone collection point, and get further information about the collection of end-of-life electronic product regionally, including mobile phones. http://www.lge.com/about/sustainability/list/oldphone.jhtml

Summary of results for the US

The sales figures show that the US has mature markets for most electrical and electronic products such as TVs (although the switch to digital is driving TV sales), and although sales of PCs and mobile phones are growing faster, overall these are still relatively low growth rates, compared to countries like India and China. In spite of this situation the rates of separately collected and recovered waste appliances is growing at a much slower pace, and, for some products, the percentage of quantities collected are even declining compared to past sales. This low growth in collection and recovery figures is also starting from low collection rates.

The US EPA states, for example, that 25% of end-of-life PCs, laptops and monitors have been collected for recovery in 2005, 13% of TVs and 19% of mobile phones. With regard to these numbers two points have to be taken into account:

- the US EPA data assume that a relatively high percentage of appliances are stored at home or reused. Based on comparison with other data from saturated replacement markets lower storage and reuse rates would be expected, resulting in even lower actual collection rates.
- The data on e-waste collected for recovery includes e-waste for export. For example, for CRT monitors and TVs the US EPA itself publishes concerns on whether the exported waste is treated in an appropriate way.

Overall the available data give a picture of a relatively undeveloped collection and recovery system for e-waste in a mature and developed market for electrical and electronic appliances.

Available data about actual e-waste amounts generated (as opposed to calculated theoretical data) are most often exemplary data from individual regions of the US, individual activities like take back actions or sporadic calculated data. The lack of nationwide collection and monitoring approaches for e-waste results in a situation where no comprehensive data is available. The publication by US EPA in 2007 is an important overview that is unfortunately restricted to few selected types of appliances. The most relevant appliances as far as quantities are concerned (white goods) are not included in this analysis. Published figures on the sales of white goods such as washing machines and refrigerators are also not easily available. Based on figures from other countries with comparable consumption patterns it can be assumed that the total amount of e-waste from private households is three times the size of the US EPA figure of 2.63 million tons (1.19 million tonnes), at 7.89 million tons (3.58 million tonnes).

The US is an example of what happens when the e-waste problem is relatively unregulated in an industrialised country. Without the economic incentive that consumers have in China and India to sell their old equipment for reuse or recycling, only small amounts of e-waste are collected and much of that is not recycled within the US, but is exported instead, thus shifting the problem to newly industrialised countries that are even less equipped to deal with the hazardous substances in e-waste. Although many of the large manufacturers are now operating their own take-back schemes, and certain US States have developed or are developing take-back legislation, the challenges will be to substantially increase collection rates and at the same time to develop an infrastructure and capacity where e-waste is safely dismantled, recycled or reused domestically. The first priority within this scenario is to end the export of e-waste from the US.

Europe

Put on the market

The United Nations University (UNU)[153] published a report in 2007, which states that in the EU27, 9.3 million tonnes of electrical and electronic products were put on the market in 2005, based on scaled up data from nine national registries. This is significantly higher than the estimates made in the 1990s of about 7 million tonnes.

Markets for electrical and electronic products within the European Union are diverse. The markets in the "new" Member States are not yet as saturated as the "old" Member States and sales figures per inhabitant as well as use patterns for electronics differ widely. These differences can influence the amount of WEEE occurring in each Member State and have to be kept in mind when considering the following figures.

The following table summarises sales data for different types of appliances and the future quantities of appliances that will be in use (stock) in EU25[154].

PCs

72 million new PCs were sold in Europe in 2005. The numbers of PCs in use (stock) has been estimated to be 126 million.

Table 22: PC sales and stock data for selected IT equipment in EU25[155]

	Sales per year (million)	Lifetime (years)	Stock (million)		
			2005	2010	2020
PC	62 (2004) 72 (2005)	3-5	126	193	243
Monitors	60 (2005)	3-5	104.5	141	205

Other sources calculate the sales for PCs to be slightly lower. The following table summarises data mainly based on producers' figures.

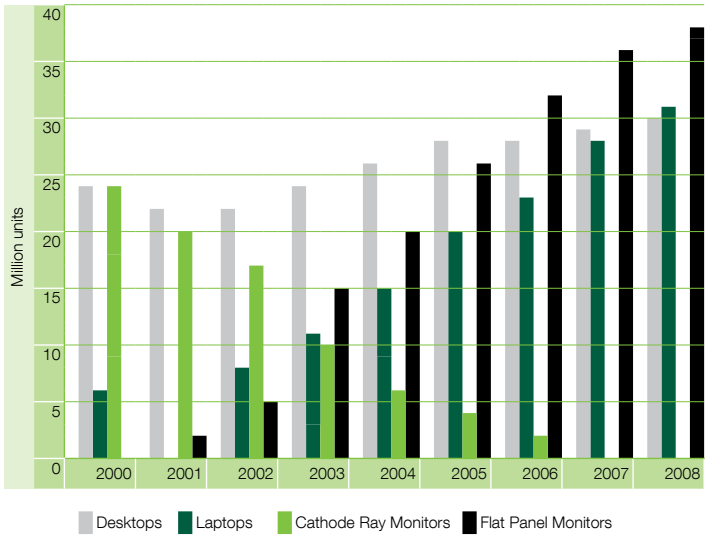


Figure 33: Approximation of apparent consumption in EU 25, calculated mainly from figures from industry survey[156]

The average lifetime of desktop PCs in offices was estimated by industry to be six years and for home users five years[157]. Laptops are used in both markets for around four and a half years. The sale of laptops is increasing at a faster rate than desktops, and flat panel monitors are now replacing sales of cathode ray monitors. 20% of equipment in Europe goes on to have a "second life" with an additional lifetime of two to three years[158].

Mobile phones

In 2004 around 260 million mobile phones were sold in EU25.

Table 23: Sales and stock data for mobile phones in EU25[159].

	Sales per year (million)	Lifetime (years)	Stock (million)		
			2005	2010	2020
Mobile Phones	260 (2004)	3	780	863	962

153 Huisman, J., et al (2007), op.cit.

154 Romania and Bulgaria not included.

155 Nissen 2007: Nissen, N.: Standby And Off-Mode Losses (Lot 6), Public Report For Task 2, Draft Final Status Before Stakeholder Meeting, Fraunhofer Izm: Faberi 2007: Faberi, Stefano: Preparatory Studies For Eco-Design Requirements Of Eups Lot 13: Domestic Refrigerators and Freezers Part I – Present Situation Task 2: Economic And Market Analysis Rev. 1.0, Isis: Faberi 2007a: Faberi, Stefano: Preparatory Studies For Eco-Design Requirements Of Eups Lot 14: Domestic Washing Machines And and Dishwashers, Part I – Present Situation, Task 2: Economic And Market Analysis, Isis: Eito 2007: European Information Technology Observatory 2007: Silicon.Com 2007: Pc Sales: Europe Outstrips The Us, Http://Hardware.Silicon.Com/Desktops/0,39024645,39155741,00.Ht

156 Jonbrink 2007

157 Deviations from 3.5 to 7 years

158 Jönbrinck 2007: Preparatory Studies For Eco-Design Requirements Of Eups, Lot 3, Personal Computers (Desktops And Laptops) And Computer Monitors, Draft Final Report (Task 1-7), March 28, 2007, Ivf Industrial Research And Development Corporation

159 Nissen 2007, Faberi 2007, Faberi 2007a, EITO 2007, silicon.com 2007, op.cit.

TV

In 2005 31.8 million TVs were sold.

Table 24: Sales and stock data for TV in EU25[160]

	Sales per year (million)	Lifetime (years)	Stock (million)					
			2005		2010		2020	
			CRT	Non CRT	CRT	Non CRT	CRT	Non CRT
TV	31.1 in 2004 31.8 in 2005		261.3	15	251,5	140	?	?

The sales figures for TVs show that cathode ray tube monitors are being replaced by flat screen technologies, a trend that is predicted to continue.

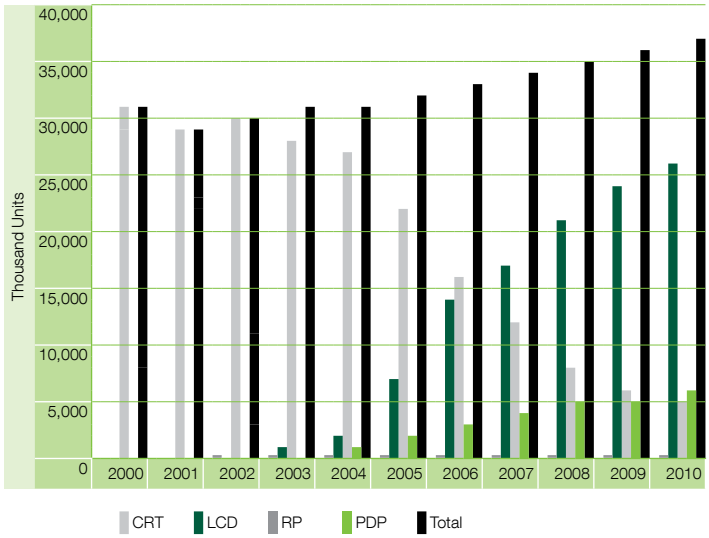


Figure 34: Sales of TV differentiated (in thousands of units)[161]

White goods

34 million white goods appliances of three product types (washing machines, refrigerators, dish washers) were sold in EU 25 in 2004.

Table 25: Sales and stock data for selected white goods in EU25 [162]

	Sales per year (million)	Lifetime (years)	Stock (million)		
			2005	2010	2020
Washing machines	12 (2002) 14 (2004)	14	184,6	189,4	195,5
Refrigerators	13 (2002) 14 (2004)	14	150		
Dishwashers	5 (2002) 6 (2004)				

For white goods there are four companies with market shares of 10% or above (BSH 17%, Electrolux 15%, Indesit Company 11%, Whirlpool 10%)[163].

160 Nissen 2007, Faberi 2007, Faberi 2007a, EITO 2007, silicon.com 2007, op.cit.

161 Stobbe (2007), op.cit.

162 Nissen 2007, Faberi 2007, Faberi 2007a, EITO 2007, silicon.com 2007, op.cit.

163 Presutto 2007: Preparatory Studies For Eco-Design Requirements Of Eups, Lot 13: Domestic Refrigerators and Freezers, Lot 14: Domestic Dishwashers and Washing Machines, Part I – Present Situation, A Portrait Of The Household Appliance Industry And Market In Europe, V3.0: March 2007

End-of-life

Amounts

The United Nations University[164] has estimated the total WEEE arising in 2005 for the EU27 at 8.3 – 9.1 million tonnes a year, for all e-waste. The forecast household WEEE arisings are 7.2 million in 2005; an annual growth rate of between 2.5% and 2.7% is predicted, leading to a total WEEE arising of about 10.6 million tonnes by 2020 from household sources. If business to business WEEE is included this could rise to 12.3 million tonnes, which is equivalent to about 24 kg per inhabitant.

UNU also estimates the typical life of the various types of appliances, ranging from 3 to 20 years. Okopol[165] has estimated the average typical life of electrical and electronic appliances, based on UNU, as nine years.

The European Environmental Agency published data on the total amount of waste electric and electronic equipment for four types of appliances including forecasts until 2010.

Table 26: Projected total waste potential for four appliances: refrigerators, TV sets, personal computers and photocopiers (in tonnes) for 14 Member States[166].

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Austria	3,46	3,58	3,73	3,89	3,73	3,88	4,03	4,17	4,32	4,47	4,63
Germany	4,25	4,01	3,95	3,89	3,35	3,3	3,24	3,17	3,11	3,05	3,01
Ireland	6,41	6,91	7,65	8,39	8,53	8,95	9,65	10,35	11,05	11,75	12,21
Spain	4,69	4,78	4,98	5,19	5,22	5,4	5,6	5,81	6,01	6,22	6,41
Greece	1,94	2	2,08	2,16	2,09	2,15	2,23	2,3	2,37	2,45	2,51
France	4,09	4,03	4,11	4,18	3,9	3,89	3,96	4,03	4,1	4,17	4,16
Italy	3,65	3,78	3,88	3,98	3,71	3,81	3,89	3,98	4,06	4,14	4,29
Luxembourg	1,94	1,91	1,88	1,85	1,82	1,77	1,74	1,72	1,69	1,66	1,62
Netherlands	0,76	0,58	0,59	0,61	0	0	0	0	0	0	0
Belgium	2,47	2,44	2,55	2,67	2,37	2,46	2,56	2,66	2,76	2,86	2,95
Portugal	2,75	2,75	2,83	2,9	2,78	2,82	2,88	2,95	3,01	3,08	3,12
Finland	3,74	3,73	3,92	4,1	3,72	3,85	4,01	4,17	4,33	4,49	4,61
Sweden	4,32	4,44	5,11	5,78	6,07	6,68	7,33	7,99	8,65	9,3	9,88
UK	3,15	2,97	3,03	3,09	2,82	2,84	2,89	2,94	2,99	3,04	3,05
EU14	**3,91**	**3,87**	**3,98**	**4,08**	**3,81**	**3,88**	**3,98**	**4,07**	**4,17**	**4,26**	**4,34**

164 Huisman, J., et al (2007), op.cit.

165 Sander, K., et.al., (2007), op.cit

166 EEA 2003: Crowe, M., E.A.: Waste From Electrical And Electronic Equipment, Eea, Copenhagen, 2003, p.27

Table 27: Projected waste potential per inhabitant for 2000-10 for four appliances: refrigerators, TV sets, personal computers and photocopiers (kg per inhabitant)[167].

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Austria	27954	28915	30176	31441	30131	31316	32502	33687	34872	36058	37243
Germany	349200	329142	324442	320039	275287	270053	264820	259586	254353	249119	243886
Ireland	24399	26328	29142	31961	32484	35239	37994	40749	43504	46259	49014
Spain	184988	188504	196723	204903	206059	214212	222365	230518	238672	246825	254978
Greece	20534	21092	21921	22754	22115	22891	23667	24442	25218	25994	26770
France	242918	239363	244134	248635	231524	235742	239960	244178	248396	252615	256833
Italy	212231	220062	225806	231381	215918	220764	225610	230456	235303	240149	244995
Luxembourg	763	752	741	729	718	707	696	685	673	662	651
Netherlands	12073	9138	9422	9701							
Belgium	25288	24914	26097	27312	24258	25288	26317	27346	28375	29405	30434
Portugal	27520	27602	28339	29065	27849	28505	29161	29818	30474	31130	31786
Finland	19384	19322	20287	21245	19271	20102	20932	21763	22594	23425	24256
Sweden	38270	39391	45318	51243	53812	59683	65554	71424	77295	83166	89036
UK	187369	176467	180029	183606	167583	170590	173597	176604	179611	182618	185625
EU14	**1475127**	**1460133**	**1499663**	**1539022**	**1437058**	**1472992**	**1508927**	**1544861**	**1580796**	**1616730**	**1652665**

167 EEA (2003) op.cit. p.26

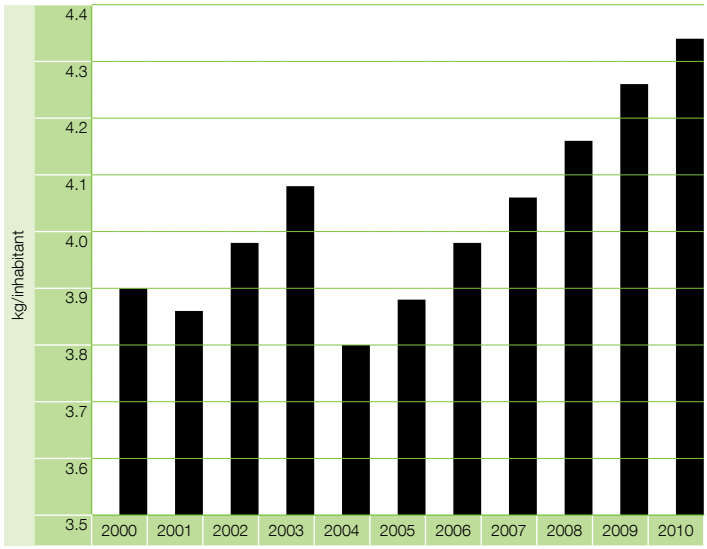


Figure 35: Projected waste potential per inhabitant for 2000-10 for four appliances: refrigerators, TV sets, personal computers and photocopiers (kg per inhabitant)[168]

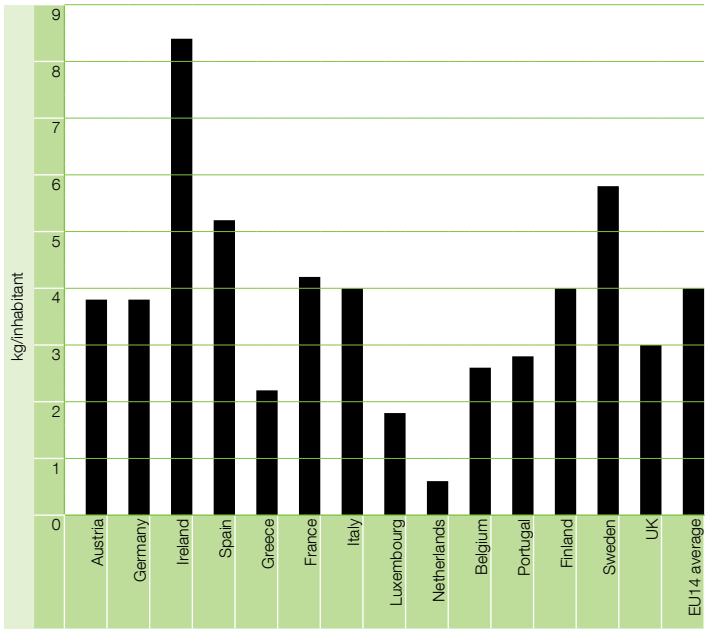


Figure 36: Waste potential per inhabitant for 2003 for four appliances: refrigerators, TV sets, personal computers and photocopiers, by country[169].

However, it has to be taken into account that the calculation of WEEE amounts given in these tables is often hindered by the fact that categorisation of sales figures do not fit well with the categorisation of WEEE collection approaches and that there is a great deal of uncertainty in determining the weight of WEEE per appliance. The collection rates for WEEE achieved in 2006 in some European countries (e.g. more than 11kg per inhabitant per year in Sweden) show that the amounts given in this study represent the lower end of the range of possible estimates.

According to the European Commission, the total amount of WEEE will increase in Europe at an expected rate of at least 3% to 5% per year[170].

168 EEA (2003) op.cit.

169 EEA (2003); op.cit.

170 DG ENV (1997); Recovery of Waste from Electrical and Electronic Equipment: Economic and Environmental Impacts.
AEA Technology for the European Commission DG Environment.

Destinations

Information on actual mass flows of e-waste in EU as a whole is not (yet) available. The implementation of the WEEE Directive in the European Member States and the reporting requirements resulting from this Directive will improve this situation in the coming years.

UNU[171] has estimated the amount of WEEE collected in the EU27 at 2.1 million tonnes, equivalent to about 5 kg per inhabitant. The percentage of large sized appliances collected is roughly 40%, and medium appliances roughly 25%. This is projected to rise to 53 million tonnes in 2011 (assuming full implementation of the WEEE Directive and an increase in collection), which would be about 11 kg per inhabitant. The percentage of large sized appliances collected would be roughly 75% and medium and small sized appliances would be 60%.

Information on specific amounts of collected WEEE is also published for some compliance schemes as shown in the table below.

Table 28: WEEE collected by some compliance schemes[172]

WEEE collected (kg / inh.a) DATA 2004		Range		
		Min.	Max.	#
1a	Large household appliances	1,2	5,0	5
1b	Cooling & freezing appliances	1,1	2,7	5
2	Small household appliances	0,4	1,5	5
3a	IT & T equipment (excl. CRT's)	0,4	3,0	5
3b	IT & T screens – CRT's	0,3	0,8	5
4a	Consumer equipment (excl. CRT's)	0,3	1,2	5
4b	TV sets – CRT's	0,6	1,4	5
5	Lighting equipment	0,06	0,7	2
6	Electrical and electronic tools	0,07	0,4	4
7	Toys,….	0,004	0,06	3
8	Medical devices	0,02	0,05	2
9	M&C instruments	-	-	0
10	Automatic dispensers	0,06		1

Presently the producers of electrical and electronic products organise their responsibilities for end-of-life products with the support of compliance schemes, which fulfil these responsibilities on behalf of the producers. They can be regional schemes or European schemes (see also below in the Member States' chapters). Presently around 150 different schemes or Producer Responsibility Organisations are operating in Europe.

171 Huisman, J., et al (2007), op.cit.

172 WEEE Forum 2007: Key Figures, http://www.weee-forum.org/projects_benchmarks.htm#amounts_collected, ACCESSED AUGUST 2007

France

Put on the market

PCs

EITO[173] publishes data about the sales of IT equipment, which shows that sales of most products will continue to rise slowly, with sales of laptops increasing faster.

Table 29: IT hardware shipment[174]

	2004	2005	2006	2007	2008	2005/04 %	2006/05 %	2007/06 %	2008/07 %
Servers	227791	257334	262014	263536	275445	13	1.8	0.6	4.5
Workstations	9384	9181	7029	5375	6213	-2.2	-23.4	-23.5	15.6
PCs	6736971	8103535	8748054	9699658	10589047	20.3	8	10.9	9.2
Portable	2301876	3025305	3685779	4397380	5044920	31.4	21.8	19.3	14.7
Desktops	4435095	5078230	5062275	5302278	5544127	14.5	-0.3	4.7	4.6
Totals	**13711117**	**16473585**	**17765151**	**19668227**	**21459752**	**15.4**	**1.58**	**2.4**	**9.72**

White goods

The sales data for washing machines and dryers are shown in the table below[175].

Table 30 Sales data selected white goods (million units)[176]

	2004	2005	2006
Washing machines	2,29	2,35	2,446
Dryer	0,57	0,58	0,631
Refrigerator	2,31	2,33	2,428
Freezers	0,785	0,77	0,775

Presutto[177] states that the "major five companies, representing 21 brands, account for about 80% of the global turnover".

The French producers register for the national implementation of the WEEE Directive describes the amount of appliances marketed in 2006 as 1.2 million tonnes

End-of-life

ADEME[178] estimates the total amount of WEEE in France at between 1.7 and 2 million tonnes per year (household + business) representing around 16kg per inhabitant per year. This fits quite well with the figures presented by APCM[179] showing a total amount of WEEE of 1.5 million tonnes per year, of which 650 000 tonnes comes from households. ADEME also calculates a specific amount of WEEE from private households of 16kg per inhabitant per year, with another source estimating that 14 kg per inhabitant per year comes from households[180].

It has been calculated that the amount of waste white goods is at around 1.1 million tonnes in 2006, for TVs at around 0.16 million tonnes, for mobile phones at around 6 000 tonnes and for PCs at around 71 000 tonnes[181].

A survey by ADEME[182] identified 253 registered treatment sites in France.

Information about recovery rates is not yet available.

It is not possible to calculate the 'hidden flow' of e-waste, as sales data doesn't go back far enough to estimate what percentage might be coming back and how this may increase in the future. Furthermore the sales data is in units and the e-waste data in weight.

173 EITO (2007), op.cit.

174 EITO (2007, op.cit.

175 GIFAM 2006: http://www.gifam.fr/pages/lemarche/chiffrescles/gam-2006.htm

176 GIFAM (2006) op.cit

177 Presutto (2007) op.cit.

178 ADEME 2007: Dechets D'equipements Electriques Et Electroniques (DEEE) - Chiffres Clefs

179 APCM (2006) : Réponse APCM à la consultation de la DG Environnement relative révision de la directive DEEE

180 ACTU Environnement 2007 : http://www.actu-environnement.com/ae/news/1896.php4

181 These figures represent conservative estimations based on relative figures as found in Germany.

182 ADEME (2007) op.cit.

Germany

Put on the market

PCs

EITO[183] published the following data for Germany on the total shipment of IT hardware, which overall show slower growth than the data for France, although sales of notebook PCs are still growing faster than other PC products.

Table 31: IT hardware shipments[184]

	2004	2005	2006	2007	2008	2005/04 %	2006/05 %	2007/06 %	2008/07 %
Servers	343435	368364	375546	398121	411204	7.3	1.9	6	3.3
Workstations	16024	12228	8798	7223	6265	-23.7	-28.1	-17.9	-13.3
PCs	8352413	9091467	9236588	9995558	11016752	8.8	1.6	8.2	10.2
Portable	3271431	3893841	4380815	5041478	5843147	19	12.5	15.1	15.9
Desktops	5080982	5197626	4855773	4954080	5173605	2.3	-6.6	2	4.4
Totals	**17064285**	**18563526**	**18857520**	**20396460**	**22450973**	**2.74**	**-3.74**	**2.68**	**4.1**

GFU[185] reports shipment to private consumers of 1.656 million Desktop PCs in 2005 and 1.450 million Desktop PC in 2006 (average prices 669 EUR and 648 EUR). For notebooks 1.945 units in 2005 and 2.280 units in 2006 have been reported (average prices 1.053 EUR and 958 EUR). **However, these figures are not consistent with the data provided by EITO**

TV

The total sales of TVs to private consumers in 2005 was 5.758 million units and in 2006 5.950 units[186]. The average price was 615 EUR in 2005 and 715 EUR in 2006.

Mobile phones

GFU[187] reports shipment to private consumers of 20 million mobile phones in 2005 and 20.740 million mobile phones in 2006. The average price was 195 EUR per unit in 2005 and 186 EUR per unit in 2006.

White goods

Germany is the largest white goods market in Europe. However, sales data have not been found to be available in the course of the investigations for this study. The German market is a saturated market (refrigerators 99% saturation in 2005 and washing machines 95%) where new appliances replace old ones. However, it shows a stable development regarding market values [188].

183 EITO (2007) op.cit.

184 EITO (2007) op.cit.

185 GFU 2007: GFU: Consumer Electronics Marktindex Deutschland (Cemix)

186 GFU (2007) op.cit.

187 GFU (2007) op.cit.

188 Presutto (2007) op.cit.

End-of-life

For Germany several different figures exist on the amounts of e-waste arising. Taking into account the respective data backgrounds and newly available data on mass flows an amount of between 1.3 and 1.5 million tonnes per year from households can be assumed.

Table 32: Amount of WEEE in Germany according to different sources[189]

Source	Year	Amount [t/a]	Amount [kg/E*a]
VDMA	1992	1,3 Mio.	
VDMA	1998	1,9 Mio.	23
ZVEI	1996	370.000	4,5
ZVEI	2004	1,1 Mio.	13
bvse	1997	1,8 Mio.	22,5
NU	2000	1,1 Mio.	13,4
UBA	2000	2,1 Mio.	26
Miele	2003	0,6 Mio.	7,5
OECD			12
EP			16
Tecpol	2005	1 Mio	

ZVEI calculates the quantity per person as 13.41 k/g in 2005, based on its data for 2005 (total amount of WEEE 1.1 million tonnes)[190].

Table 33: Amount of WEEE in Germany per product category[191]

Equipment	Weight (tonnes)	% of Total
Large Household Appliances	610'500	56%
Refrigeratoring Appliances	203'500	19%
Small Household Appliances	27'500	3%
Vacuum Cleaners only	27'500	3%
IT and Office Equipment	110'000	10%
Audio and Video Electronics	27'500	3%
TVs	82'500	8%
Total	**1'089'000**	**100%**

The (calculated) amounts per type of appliance that are the focus of this study are: waste TVs 110,000 tonnes; waste mobile phones[192] 4 235 tonnes; and for PCs[193] 48 500 tonnes.

Destinations

The collection of WEEE in Germany is undertaken by municipalities; to date no aggregated collected quantities have been published.

It can be expected that producers with a high share of the market will be registered according to the German implementation of the WEEE Directive and have contracted a compliance scheme that fulfils the requirements of the implementation of the WEEE Directive.

Quantified data about the recovery of WEEE in Germany are not yet available.

189 Ökopol 2005 amended, Sander, K. et al.Ermittlung von Verwertungskoeffizienten für die Fraktionen und Bauteile zur Dokumentation von Quoten auf der Basis von Artikel 7 der EU-Richtlinie zur Verwertung von Elektroaltgeräten (WEEE). [Recovery key factors for material fractions in view of the documentation of the recovery targets of article 7 of the WEEE Directive] (Ökopol and Cyclos) for Umweltbundesamt UBA.

190 ZVEI 2005: ZVEI - Deutscher Zentralverband Elektrotechnik Und Elektroindustrie (German Electrical And Electronic Manufacturers' Association), www.zvei.de, accessed August 2008

191 ZVEI (2005) op.cit.

192 estimated 3,5% of product category 3 according to the WEEE Directive

193 estimated 40% of product category 3 according to the WEEE Directive

Poland

Put on the market

PCs

For Poland[194] EITO published the following data about the shipment of IT hardware, which shows a levelling off of sales in 2007/8:

Table 34: IT hardware shipments [195]

	2004	2005	2006	2007	2008	2005/04 %	2006/05 %	2007/06 %	2008/07 %
Servers	33542	44935	49731	46133	47246	34	10.7	-7.2	2.4
Workstations	201	328	312	215	192	63.2	-4.9	-31.1	-10.7
PCs	1306369	1779875	2191074	2248635	2400947	36.2	23.1	2.6	6.8
Totals	**1340112**	**1825138**	**2241117**	**2294983**	**2448385**	**44.47**	**9.63**	**-11.9**	**-0.5**

White goods

Sales data for white goods shows that the market is not yet at saturation point for many products including freezers, washing machines, dryers and dishwashers, only refrigerators have a high market penetration at 98%.

Table 35: Sales and penetration of selected white goods [196]

Sales	2001	2003	Penetration (%)
Refrigerators	950 000	1.120 000	98
Freezers	210 000	305 000	39
Washing machines	850 000	802 000	76
Dishwashers	100 000	80 000	4
Dryers	150 000	280 000	41

End-of-life

Little data about the quantities of e-waste arising is available in Poland. The Polish association of household appliances[197] estimates the amount for 2006 at around 321,333 tonnes or 8 kg per inhabitant per year. However, the basis for these figures is not clear and it is therefore uncertain which types of appliances are included or excluded from these figures.

A rough estimation based on the relation of appliances as found in other European Member States results in an amount of about 200,000 tonnes of waste white goods, about 32,000 tonnes of waste TVs, about 1,200 tonnes of mobile phones and about 10,000 tonnes of PCs for 2006.

According to a recent press notice Poland will miss the collection target of the WEEE Directive of 4kg per inhabitant per year for 2008 and will not achieve this amount before 2008. The amount of WEEE collected in 2006 was 13,000 tonnes and the amount will drop to 1,000 tonnes in 2007 due to lack of implementation of the WEEE Directive[198].

No other more detailed figures have been found quantifying the actual amount of recovered WEEE.

194 EITO (2007) op.cit.

195 EITO (2007) op.cit.

196 Presutto (2007) op.cit.

197 CECED Polska 2006: CECED Polska: Re: The Review Of Directive 2002/96/Ec (Weee). Waste Streams. Collection Targets, 2006

198 ENDS Europe Daily Issue 2242 17/01/07.

The Netherlands

Put on the market

PCs

For the Netherlands EITO[199] published the following data about the shipment of IT hardware:

Table 36: IT hardware shipment[200].

	2004	2005	2006	2007	2008	2005/04 %	2006/05 %	2007/06 %	2008/07 %
Servers	87189	97041	103764	112311	115521	11.3	6.9	8.2	2.9
Workstations	2269	1793	654	479	309	-21	-63.5	-26.8	-35.5
PCs	2050745	2423716	2599929	2772828	3301636	18.2	7.3	6.7	19.1
Portable	678466	947801	1202560	1394401	1742321	39.7	26.9	16	25
Desktops	1372279	1475915	1397369	1378427	1559315	7.6	-5.3	-1.4	13.1
Totals	**4190948**	**4946266**	**5304276**	**5658446**	**6719102**	**11.16**	**-5.44**	**0.54**	**4.92**

According to Vlehan [201][2005] the Dutch market for white goods shows relatively stable sales figures.

Table 37: Sales of selected white goods [Presutto 2007]

Product	2001	2002	2003	2005
Refrigerators	620000	647000	614000	642000
Freezers	240000	231000	222000	231000
Washing machines	610000	595000	n.a	601000
Dishwashers	215000	270000	n.a	324000
Dryers	305000	320000	n.a	322000

End-of-life

The data situation on the actual amounts of e-waste collected and treated in the Netherlands is very good compared to other countries, mainly because two collection systems have been in place for several years that generate data on a homogeneous basis, one system for IT equipment and one for WEEE other than ICT.

In 2002, ICT Milieu collected a total of 9,900 tonnes of IT equipment (e.g. computers, screens, mobile phones). According to ICT Milieu this was 80%-90% of the available amount of this type of e-waste[202]. However, it has been stated by Greenpeace Netherlands that a rate of 40% is more realistic. NVMP, the Dutch take-back system for WEEE other than ICT, collected approximately 65,000 tonnes of WEEE in 2002[203].

The following table shows the volumes of WEEE collected per capita since the programme of extended producers' responsibility began in 1999.

199 EITO (2007) op.cit.

200 EITO (2007) op.cit.

201 Vlehan 2005: Vlehan Vereniging Leveranciers Van Huishoudelijke Apparaten In Nederland: De Nederlandse Markt Voor Grote En Kleine Elektrische Huishoudelijke Apparaten, Zoetermeer, 2006

202 USDC 2006: US Department of Commerce Technology Administration Office of Technology Policy: Recycling Technology Products An Overview of E-Waste Policy Issues, July 2006

203 USDC (2006) op.cit.

Table 38: Waste Electronic and Electrical Equipment Collected for Recycling in the Netherlands, per capita[204]

Year	Average WEEE collected per inhabitant (in kg)
1999	2,26
2000	3,94
2001	4,66
2002	4,82
2003	4,69

According to GP Netherlands the Dutch Environmental Inspection states a specific amount of e-waste of 15kg per inhabitant a year, while a recyclers organisation states an amount of 18 to 20kg/inh/y.

Exports of e-Waste

The Dutch Inspectorate VROM[205] investigated illegal exports of WEEE in 2004 and found that offences were frequently being committed with the result that large quantities of waste equipment were circumventing the take-back system set up by producers and importers. Unregistered collectors were illegally exporting equipment, much of which was faulty, to developing countries. In 2006 the Inspectorate initiated enforcement actions and as a result the percentage of contraventions has fallen. More than 60% of retailers were contravening the rules in 2004, compared with 11% in 2006. Inspections of a carefully chosen selection of businesses in 2005 revealed that 40% had contravened the rules, compared with 28% in 2006.

Fifty-seven contraventions of WEEE export regulations were uncovered by Police and Customs during these enforcement actions; almost two thirds of these contraventions related to consignments which had originated in other countries and were being exported from the EU via the Netherlands; Germany was the largest source of these illegal shipments, followed by the Netherlands, the UK and then France. The Inspectorate notes that: 'This number could in fact increase, because take-back systems that are open to abuse by the illegal trade are being set up all over Europe'. However, currently the number of contraventions that are being identified is on the decrease, whereas in the past many consignments of old lorries and cars full of e-waste destined for Africa were uncovered.

204 OECD, 2006. EPR Policies and Product Design: Economic Theory and Selected Case Studies. Prepared by the Working Group on Waste Prevention and Recycling. 28-Feb-2006. Available via http://www.olis.oecd.org/olis/2005doc.nsf/LinkTo/NT00005AA6/$FILE/JT03204660.PDF

205 VROM Inspectorate (2007), The clearer picture, Enforcement action in 2006 on exports of waste electrical and electronic equipment, Inspectorate of the Ministry of Housing, Spatial Planning and the Environment, Article code 7348, 8 March 2007.

United Kingdom

Put on the market

PCs

The PC market in the UK shows significant increases in sales figures which result mostly from increases in laptop sales.

Table 39: IT hardware shipment [206]

	2004	2005	2006	2007	2008	2005/04 %	2006/05 %	2007/06 %	2008/07 %
Servers	333937	356707	348021	359467	368969	6.8	-2.4	3.3	2.6
Workstations	7466	4685	2187	1782	1819	-37.2	-53.3	-18.5	2.1
PCs	8471000	9606775	10157945	11566047	12595259	13.4	5.7	13.9	8.9
Portable	2877699	3795826	4561211	5610683	6397429	31.9	20.2	23	14
Desktops	5593301	5810949	5596734	5955364	6197830	3.9	-3.7	6.4	4.1
Totals	**17283403**	**19574942**	**20666098**	**23493343**	**25561306**	**3.76**	**-6.7**	**5.62**	**6.34**

TV

The UK TV market still shows an increase in the overall sales. However, the change of technology from cathode ray tube (CRT) to flat screens is driving the market more significantly, as is the move to digital TV.

Table 40: Apparent EU-consumption of CRT and flat panel TVs[207]

CRT TUBE colour TVs			FLAT PANEL colour TVs		
1995	2000	2004	1995	2000	2004
3193000	4827000	5032000	11000	69000	755000

White goods

The UK market for white goods shows small increases of sales figures in the years from 2001 to 2005. These increases result mainly from replacement sales of refrigerators.

Table 41: :Sales of selected white goods[208]

	2001	2002	2003	2004	2005
Refrigerators	2.390 000	2.340 000	2.580 000	2.562 000	2.881 000
Freezers	890 000	915 000	965 000	925 000	810 000
Washing machines	2.320 000	2.330 000	2.260 000	2.118 000	2.220 000
Dishwashers	830 000	865 000	820 000	897 000	965 000
Dryers	1.405 000	1.390 000	1.145 000	1.106 000	1.040 000

206 EITO (2007) op.cit.

207 Stobbe 2007: Eup Preparatory Studies "Televisions" (Lot 5), Report on Task 2 "Economic and Market Analysis, Brussels, 2007

208 Presutto (2007) op.cit.

End-of-life

The following table shows the amounts of WEEE in the UK in 2000 by weight and percentage of total[209].

Table 42: WEEE arisings in the UK in 2000

Equipment	Weight (tonnes)	Wt% of Total
Large Household Appliances	392,000	43%
IT Equipment	357,000	39%
Radio, TV and Audio	72,000	8%
Small Household Appliances	30,000	3%
Electronic and Electrical Tools	28,000	3%
Lamps	12,000	1%
Telecoms	8,000	1%
Monitoring and Control	8,000	1%
Toys	8,000	1%
Total	**915,000**	**100%**

In another reference it is estimated that 939,000 tonnes of domestic equipment were discarded in the UK in 2003. The starting point for WEEE estimations was sales data for 2003. This amounts to 16 kg per person and four items per household,

Table 43: Domestic WEEE arisings in the UK in 2003[210]

Categories of domestic WEEE	Tonnage discarded ('000 tonnes)	%	Units discarded (millions)	%
Large household appliances	644	69%	14	16%
Small household appliances	80	8%	30	31%
IT/telecoms equipment	68	7%	21	23%
Consumer equipment	120	13%	12	13%
Tools	23	2%	5	5%
Toys, leisure and sports equipment	2	<1	2	2%
*Lighting	2	<1	9	10%
Monitoring and control equipment	<1	<1	<1	<1
Total domestic WEEE	**939**	**100%**	**93**	**100%**

No quantified figures have been found about the actual amount of recovered WEEE.

Exports of e-Waste

A study done by ICER for the Environment Agency[211] estimated that 160,000 tonnes of waste equipment were exported from the UK in 2004, representing between 10% to 15% of WEEE arisings in the UK. 130,000 tonnes were IT/telecoms equipment, largely from businesses, of which 110,000 were declared exports to permitted destinations; 23,000 were undeclared or 'grey market' exports to non-OECD destinations. The remaining 30,000 tonnes were large household appliances and TVs, sourced from civic amenity sites and retailer take-back.

The ultimate destinations of the e-waste include Eastern Europe, the Far East, the Indian subcontinent, African and China. Transhipment destinations include Rotterdam, Gibraltar and the Middle East. Details of over 20 operators involved in exporting WEEE were found and it was estimated that there could 100 to 200 of these operators; the value of the trade is estimated to be worth tens of millions of pounds.

There is no information on what the exact situation is currently, now that the EU WEEE Directive has been implemented, however, this study shows that there was a large and established trade in the export of e-waste in 2003.

209 DEFRA (2006) AEA Technology: WEEE and Hazardous Waste, Part 2, DEFRA, UK, 2006

210 ICER, 2005. Status report on waste electrical and electronic equipment in the UK. Interim report: January 2005. Available via http://circa.europa.eu/Public/irc/env/weee_2008/library?l=/characteristics/interimstatusreport2005f/_EN_1.0_&a=d

211 ICER 2004, WEEE – Green List Waste Study, Report prepared by ICER for the Environment Agency (UK), April 2004, (c) ICER 2004.

Spain

Put on the market

The following data on all electric and electronic equipment put on the market in 2006 has been published:

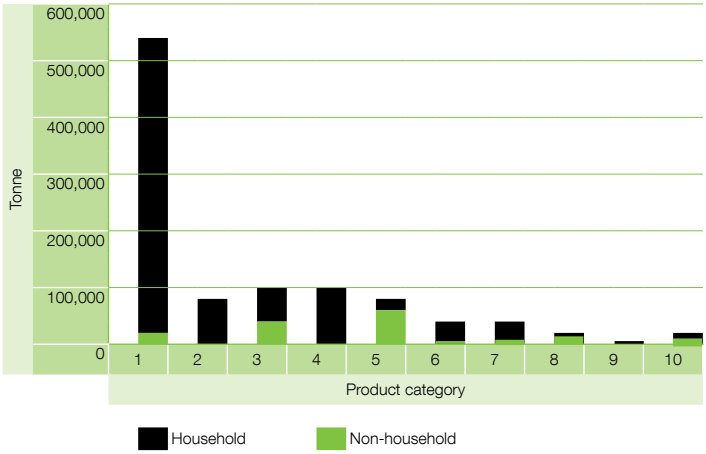


Figure 37: Electric and electronic equipment put on the market in 2006 source: [212] Product categories are equivalent to those listed in the WEEE Directive – see Annex 1.

PCs and mobile phones

The 2006 sales of mobile phones, laptops and personal computers are shown in the table below.

Table 44: Amount of mobile phones put on the market in 2006[213]

	t (2006)
Mobile phones	3.616
Laptops	6.372
Personal computers (including central unit, mouse, screen and keyboard)	34.129
Total	**44.117**

Three multinational companies dominate the market for PCs, HP at 24%, Acer at 17% and Dell at 10%, as shown in the table below.

Table 45: Market shares for PC shipments

Vendor	2005 Market Share (%) Q2[214]	2005 Market Share (%)[215]	2006 Market Share (%) Q2[216]	2006 Market Share (%) Q3[217]
HP	21.0	20.7	23	24.4
Acer	14.9	16.9	19	17.5
Dell	9.8	8.8	13.4	10.5
Fujitsu Siemens	6.4	5.8		
Airis Computers	5.2	5.4		
Toshiba				9.6
NEC				5.7

TV

The Spanish market is, like all other markets of the "old" European Member States, a saturated market. However, the trend to replace CRT with flat screens began earlier and was stronger than in other European Member States such as the UK, for example.

Table 46: Apparent consumption of CRT and flat panel TVs [218]

CRT TUBE colour TVs			FLAT PANEL colour TVs		
1995	2000	2004	1995	2000	2004
2100000	3441000	3966000	21000	315000	No data

212 Ministerio De Industria, Turismo Y Comercio, Spain, 2007 –'Registro Nacional de Productores de Aparatos Eléctricos y Electrónicos (REI-RAEE)' National Register of WEEE producers http://www.mityc.es/RAEE/,

213 Ministerio De Industria, Turismo Y Comercio, Spain, 2007, op.cit.

214 IDC Spain, Press Release, August 18, 2005, El mercado español de PC's mantiene su excelente momento a medida que los precios continúan descendiendo, http://www.idc.com/spain/about/mercadopc_2005.jsp;jsessionid=BUWJRLRHODRTQCQJAFICFGAKBEAUMIWD

215 Gartner, Computing Espana, pdf Lideris, pg.50, http://www.alhambra-eidos.com/web2005/documentos/prensa/PDF%20L%C3%ADderes.pdf

216 AC Nielsen, December 9, 2006, Los europeos prefieren HP y los estadounidenses, Dell, http://www.cincodias.com/articulo/empresas/europeos/prefieren/HP/estadounidenses/Dell/cdssec/20060912cdscdiemp_25/Tes/

217 Vnunet, El portal de Tecnologias de la Informacion, December 12, 2006, Repunta la venta de PC en el mercado español en el tercer trimester, http://www.vnunet.es/Actualidad/An%E1lisis/Inform%E1tica_profesional/Infomercado/20061220010/4

218 Stobbe (2007), op.cit.

White goods

The sales figures for white goods show relatively big increases for some appliances, for example washing machines.

Table 47: Market for white goods (units)[219]

	2003	2004	2005	2006
Total washing machines	1.654.300	1.829.400	1.907.500	2.106.300
Washing machines	749.000	834.600	900.000	929.500
Dryer	410.600	431.000	440.200	447.700
Total refrigerators	1.680.500	1.804.900	1.841.200	1.986.100
Freezers	340.400	383.800	378.900	378.900

End-of-life

Amounts

Less information is available for the end-of-life phase of electrical and electronic equipment, and no forecast of future WEEE quantities is published by the Spanish authorities. Data about the amount of WEEE collected must be reported this year but have not yet been published by the authorities or by the different take back schemes, which fulfil the producers' responsibilities on behalf of the producers.

The European Environmental Agency published appraisals of the quantity of waste for five appliances for the past years and a forecast for four appliances[220] (see figure below).

Table 48: Generation of WEEE in 2004 (t)[221]

		From consumers	From business	TOTAL
1	Large household appliances	126.982	31.746	158.728
2+4	Small household appliances and consumer electronics	25.314	1.332	26.646
3	IT Equipment	11.520	606	12.126
6	Electric tools	2.830	708	3.538
10	Automatic dispenser	0	6.336	6.336
TOTAL		**166.646**	**40.728**	**207.374**

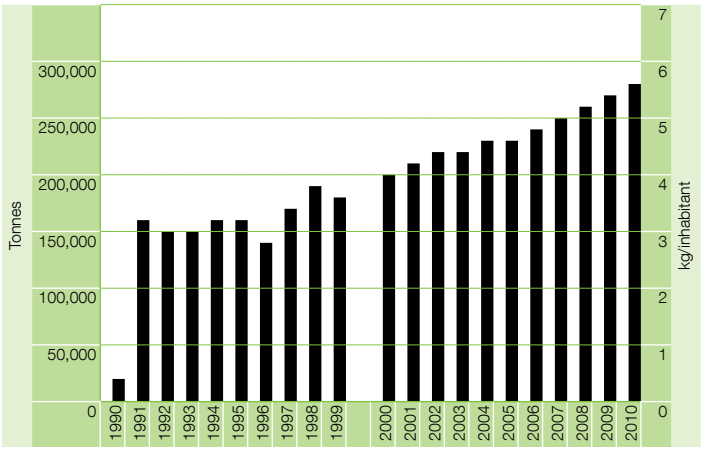


Figure 38: Amount of WEEE for selected appliances; source: Waste from electrical and electronic equipment, [222]

219 ANFEL 2007: Mercado De Electrodomésticos De Linea Blanca, http://www.anfel.org/05.cfm?anual=1, Accessed August 2007

220 1990 – 2000 refrigerators, PC, TV, photocopiers, toasters; 2000 – 2010 refrigerators, PC, TV, photocopiers

221 ECOLEC: Data Provided By Greenpeace Spain

222 EEA (2003) op.cit.

Destinations

The WEEE compliance schemes partly run their own collection points or cooperate with collection points; their total number is not yet[223] known. No information is available yet regarding the amounts of WEEE collected or its destination.

The costs[224] for collection and recovery of IT equipment are at around 5 Cent per kg of sold equipment[225]. Per unit of equipment this equates to the following costs:

Table 49: Examples of take back and recycling costs, Euro cents per kg, HP 2006[226]

	Handheld	Digital Camera	Laptop Computer	Desktop Computer	Consumer Inkjet Printer	Laser Jet Printer	Flat Screen Monitor
Cost of Take Back in Spain (ERP system)	0.01	0.01	0.20	0.5	0.18	0.75	0.81

223 The report of the Spanish authorities about the implementation of the WEEE Directive in 2006 is not yet available.

224 To be precise the figures shown might not really represent costs but probably prices.

225 ERP: European Commission Information Gathering Exercise to Provide Information for the Review of Directive 2002/96/EC of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (WEEE); Input from the European Recycling Platform (ERP), Brussels, 2006

226 ERP reported cost per kilo multiplied by average weight of unit sold; Based on HP specific conditions e.g. product weight Source: Real Consumer Costs for Electronic Equipment Recycling as Low as 1 Euro Cent, Hewlett Packard News release 03/2006

Summary of results for the EU

The data situation regarding sales of EEE in the EU is relatively good even when accessibility is partly restricted by high costs. The data shows a diverse picture, where markets are relatively saturated in some countries, such as Germany and the Netherlands, and still growing in others, like Poland.

The implementation of the WEEE Directive means that collection and recovery of end-of-life appliances within the EU is much more developed than in the US. The available information is set to improve over the coming years. Nevertheless, overall figures for the quantities of e-waste generated are now available, which show that current collection rates are about 5 kg per inhabitant, equivalent to 2.2 million tonnes a year; this is about 25% of the estimated waste arising of 8.3-9.1 million tonnes in 2005. Total e-waste arising, including business to business, could rise to 12.3 million tonnes by 2020, the equivalent of 24 kg per inhabitant.

Significant differences can be observed between the Member States: where nationwide systems for the collection and treatment of e-waste have been established for several years (e.g. the Netherlands) a much better data situation can be observed than in countries without such a comprehensive system or where data collection has just been started under the requirements of the European WEEE Directive. Information on the destinations of the e-waste collected is not always available; for example, it is not shown whether any e-waste collected in Europe is exported. However, studies done in the UK and the Netherlands show that an established trade in e-waste exports existed in 2003 and that this trade continues in 2006, albeit at a reduced level.

So far, only countries like the Netherlands have information on recovery rates, which are high for the collected amounts (>60%) but low compared to Japanese brands reporting under the Japanese Household Appliance Recycling Law. More and more data on collection rates are now published by European Member States in response to the WEEE Directive. The highest collection rates per inhabitant per year (inh/y) in the EU are in Sweden at 12 kg/inh/y. Outside the EU, the collection rate in Norway is higher at 28kg/inh/y. The WEEE Directive's requirement to collect 4kg/inh/y was already achieved in some Member States such as the Netherlands and Sweden five years ago.

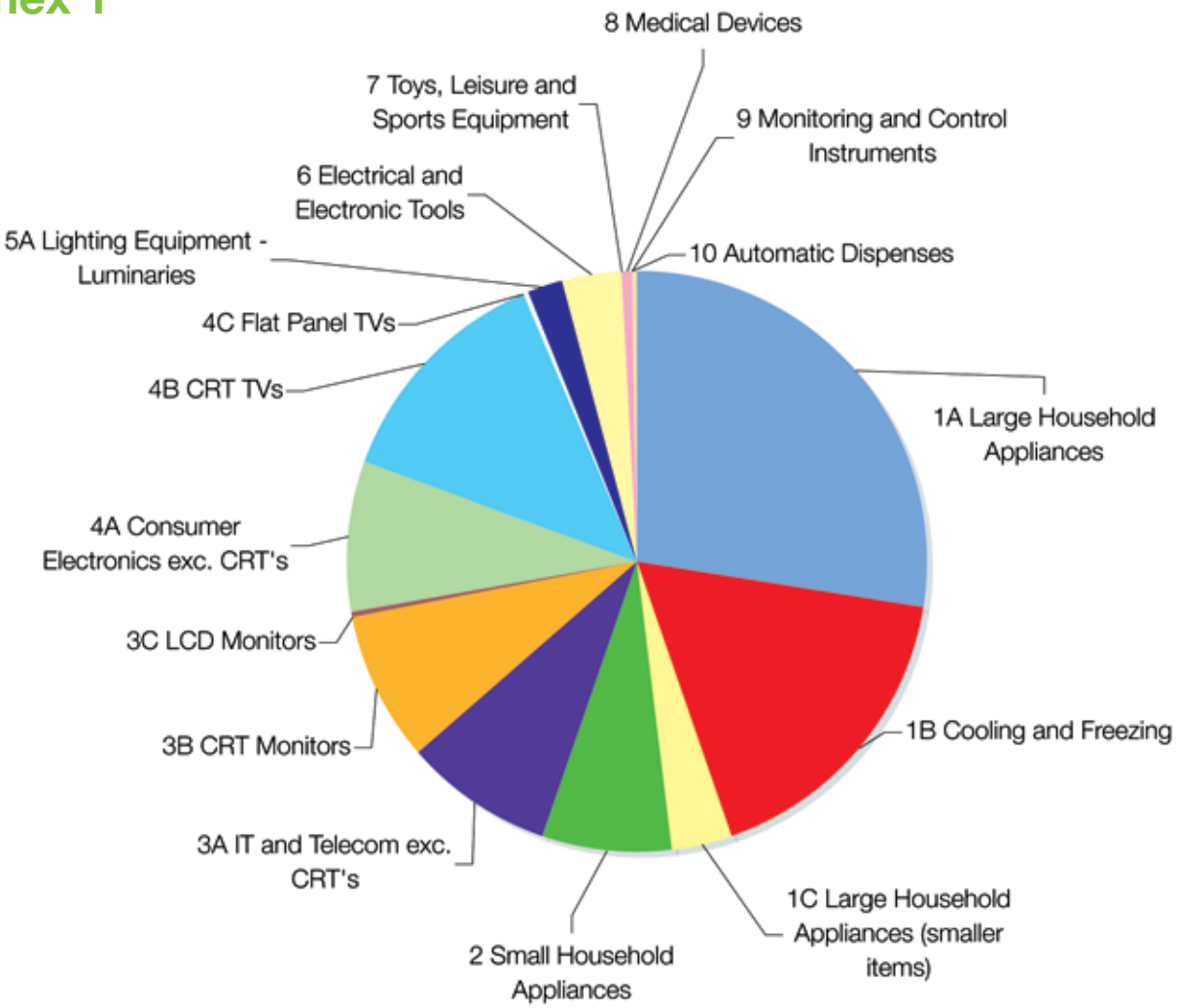
2006 was the first year where the WEEE Directive was implemented in several Member States in practice. It is expected that the data situation will improve significantly with the finalisation of the first round of reporting at the end of 2007. However, comparison of data across Member States is hampered by the lack of harmonisation of WEEE product categories. Overall, the EU represents a market which is relatively saturated, where serious efforts are being made by governments and companies combined to collect and recover e-waste.

Acid-soaked rags are used to clean out Cathode Ray Tubes ▶ before they are reprocessed in this workshop in Delhi. © Greenpeace. Hatvalne

Annexes

7

Annex 1


8 Medical Devices
7 Toys, Leisure and Sports Equipment
9 Monitoring and Control Instruments
6 Electrical and Electronic Tools
5A Lighting Equipment - Luminaries
10 Automatic Dispenses
4C Flat Panel TVs
4B CRT TVs
1A Large Household Appliances
4A Consumer Electronics exc. CRT's
3C LCD Monitors
1B Cooling and Freezing
3B CRT Monitors
3A IT and Telecom exc. CRT's
1C Large Household Appliances (smaller items)
2 Small Household Appliances

Annex 2

Weight of WEEE generated in a typical EU15 household

Item	Number in Household	Wt of item (kg)	Wt in household (kg)	Typical life (years)	No. of	Wt of waste in 20 years (kg)
Washing machine	0.9	65	58.5	8	2.3	146
Tumble drier	0.4	35	14	10	2.0	28
Dish washer	0.4	50	20	10	2.0	40
Refrigerator	0.5	35	17.5	10	2.0	35
Fridge/Freezer	0.7	35	24.5	10	2.0	49
Freezer	0.6	35	21	10	2.0	42
Microwave	0.9	15	13.5	7	2.9	39
Electric cooker	0.5	60	30	10	2.0	60
Vacuum cleaner	1	10	10	10	2.0	20
Iron	1	1	1	10	2.0	2
Kettle	1	1	1	3	6.7	7
Toaster	0.9	1	0.9	5	4.0	4
Food mixer	0.8	1	0.8	5	4.0	3
Television	1.8	30	54	10	2.0	108
Video recorder and DVD player	2	5	10	5	4.0	40
Hi-Fi system	2	10	20	10	2.0	40
Radio	1	2	2	10	2.0	4
Computer	1.5	25	37.5	4	5.0	188
Other electronic games	1.5	3	4.5	5	4.0	18
Hair dryer	0.5	1	0.5	10	2.0	1
Electric heaters	0.2	5	1	20	1.0	1
Telephone	2	1	2	5	4.0	8
Electric Drill	0.8	2	1.6	10	2.0	3
Power Saw	0.2	2	0.4	10	2.0	1
Other DIY (do it yourself) tools	0.2	2	0.4	10	2.0	1
Lawn mower	0.8	15	12	10	2.0	24
Other garden tools	0.3	10	3	10	2.0	6
TOTAL			**362**			**917**

Index of Figures and Tables

◀ *Piles of discarded computer parts in a godown in Delhi.*
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Glossary

Basel Ban - an amendment to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. At the Second Meeting of the Conference of the Parties (COP – 2) in March 1994, Parties agreed to an immediate ban on the export from OECD to non-OECD countries of hazardous wastes intended for final disposal. They also agreed to ban, by 31 December 1997, the export of wastes intended for recovery and recycling (Decision II/12). The Ban was formally incorporated in the Basel Convention as an amendment (Decision III/1).

BFRs – brominated flame retardants, chemicals added to plastics and other components of electrical and electronic equipment.

CRT – Cathode Ray Tubes, used in TV monitors, which contain lead

EEE – Electrical and electronic equipment

e-waste - Waste from electrical and electronic equipment, also known as WEEE

EU27 – refers to the 27 Member States of the European Union

OECD – Organisation for Economic Co-operation and Development, a group of thirty countries that accept the principles of representative democracy and a free market economy. Member countries include European countries, Turkey, the United States, Canada, Mexico Australia, New Zealand, Japan and Korea.

PVC – polyvinyl chloride plastic, commonly used in components for computers, especially plastic coating for cables.

RoHS – Restriction of Hazardous Substances, refers to the EU Directive 2002/95/EC of the European Parliament and of the Council on the restriction of the use of certain hazardous substance in electrical and electronic equipment (RoHS Directive).

US EPA – United States Environmental Protection Agency.

WEEE - Waste from electrical and electronic equipment (WEEE) – also known as e-waste

WEEE Directive - Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE). Japan, Korea and Taiwan are other countries with producer responsibility legislation embracing four large home appliances and PCs, but are not included in this report.

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