


e-Waste Assessment South Africa

e-Waste Association of South Africa (eWASA)

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1 Executive Summary

This assessment considers three primary e-waste streams: white goods, consumer electronics, and information technology (IT). By focusing on several tracer products in these categories – namely, fridges, washing machines, microwaves, TVs, PCs, printers, and mobile phones – it outlines the current e-waste situation in South Africa. It also briefly considers the status of fluorescent discharge lamps, and rechargeable batteries used in electronic products.

It suggests that white goods are likely to become a major feature of e-waste volumes in the future – even surpassing IT as a tonnage percentage of the waste stream. For example, it is likely that microwaves will rival printers in the number of units entering the waste stream in the next five years. But despite e-waste initiatives elsewhere in the world, white goods vendors have so far not actively engaged in attempts to develop an industry-led e-waste solution in the country.

The assessment estimates that white goods, consumer electronics and IT in South African homes amount to anything between one million and two million tons, most of which is likely to enter the waste stream in the next 5-10 years. While storage of e-waste in institutions such as government departments and universities is reported to be high, the domestic storage of e-waste is also substantial – the amount of e-waste in storage in 358 middle-class households that participated in a survey conducted as part of this study could be packed into two-thirds of a 20-foot shipping container.

South Africa faces a number of recycling challenges when it comes to e-waste. These include dealing with hazardous fraction, such as Cathode Ray Tube (CRT) glass, and finding markets for flame-retardant plastics. Liquid Crystal Display (LCD) monitors are also likely to present a key challenge in the future, while the technology does not currently exist in the country for the environmentally friendly recycling of rechargeable batteries used in electronics and fridges. At the same time, basic environmental precautions are absent at some recyclers, and health and safety regulations are loosely enforced. Most refurbishers and recyclers interviewed for this assessment were not ISO compliant.

While the cost of logistics (i.e. transport) is a major cost challenge faced by recyclers, preventing the fluid flow of waste volumes in the country and in the region, grassroots e-waste projects currently piloted demonstrate that at least a minimum wage is possible through the manual dismantling of discarded technology. The assessment suggests that more new PCs are sold into the market each year than are recycled, which illustrates the opportunity for job creation and economic development presented by e-waste.

Finally, it shows that informal e-waste recycling includes mostly the early stages of recycling - collection, crude dismantling and sorting. Informal recyclers are vulnerable, often deal with e-waste in a hazardous way, and are open to exploitation.

Amongst other things, the assessment recommends the scaling up of public awareness campaigns that spell out the hazards of e-waste, the active engagement of all stakeholders in the current drive by eWASA to establish an e-waste management system, the support of small business start-ups and informal recyclers, and support for the investment in new recycling technology through incentives.

2 Introduction

2.1 Background to study

Electrical and electronic waste (e-waste) – which includes white goods, consumer electronics, and IT – is classified by international convention as a hazardous waste, and is a growing global concern. Many developed countries, most notably in the European Union, have taken steps to develop policy guidelines and legislation for developing e-waste management systems, and some of the most successful examples of these systems can be found in countries like Switzerland and the Netherlands.

Most countries in Africa have yet to develop practical solutions to e-waste management, and have yet to practically recognize it as a hazardous waste stream. Until recently, South Africa was no exception, and most of the e-waste processing was done by the private sector, which responded instinctively to the profit potential in recycling discarded technology. Scrap metal recycling – including white goods such as fridges and washing machines – has been a going concern in the country for some time, as has the refurbishment of PCs for use in social projects, including in schools or in disadvantaged communities. At the same time, printer cartridges have been recycled, and ad hoc take-back schemes tried out. However, most of these initiatives have been fragmented.

In 2004 South Africa, together with India and China, became part of a global e-waste knowledge-sharing programme initiated by the Swiss State Secretariat for Economic Affairs (SECO) and implemented by the Federal Laboratories for Materials Testing and Research (Empa). This support catalysed the formation of the e-Waste Association of South Africa (eWASA), which was registered as a Section 21 company in 2008. This assessment forms part of that programme, and follows a pilot study conducted by Rolf Widmer and Ray Lombard in 2004 (Widmer & Lombard 2005).

2.2 Problem definition

E-waste volumes are expected to increase significantly in South Africa in the near future. Yet the country faces challenges at the level of consumer awareness, collection, recycling processes, and the disposal of e-waste, amongst others. These concerns call for collective action in dealing with the e-waste challenge in South Africa, including developing appropriate policy and legislation, and a practical e-waste management solution which has the buy-in of all stakeholders. To achieve this, a baseline assessment of the extent of the e-waste challenge faced in South Africa is necessary.

2.3 Objective of the assessment

This assessment aims to:

- Develop a baseline assessment of current e-waste quantities and challenges in South Africa
- Expand our knowledge of the IT, white goods, and consumer electronics sectors, as well as, at a secondary level, the lighting, and battery sectors
- Serve as a basis for all stakeholders to understand current e-waste challenges, and to plan future interventions.

2.4 Acknowledgements

This assessment would not have been possible without the direct support of SECO and Empa, as well as all those who have been involved in and supported eWASA over the years. In this sense, the assessment is very much the result of a collective learning experience. The authors would also like to thank the interviewees who gave generously of their time and information.

3 Methodology

3.1 Methodological framework

This assessment is based on a methodology developed by Empa for country e-waste assessments. To find out more about this methodology, please visit: http://ewasteguide.info.

3.2 Geographic scope

The scope of the assessment is national. However, the primary research process took place in Gauteng, KwaZuluNatal and the Western Cape. In KwaZuluNatal and the Western Cape, the researchers were assisted by regional eWASA co-ordinators Mbaweni Manqele and Susan Dittke.

3.3 Product scope

In order to make general assumptions about e-waste in South Africa, this assessment focuses on seven primary tracer products, as shown in Table 1.

Sector	Tracer products
White goods	Fridges, washing machines, microwaves
Consumer electronics	TVs
IT[1]	Desktop PCs, printers, mobile phones

Table 1: Tracer products

Laptops were also partially considered for comparative purposes. In addition, the status regarding fluorescent discharge lamps, and rechargeable batteries is considered.

The following data assumptions about our tracer products were made:

Tracer product	Average weight (kg)	Average age when discarded (years)*
Fridges	45	10
Washing machines	65	8
Microwaves	10	7
TVs	20	10
Desktop PCs (with monitor)	27	4

[1] Although we could use Information and Communications Technologies (ICTs) as the product category, we have used the narrower definition of IT to keep in mind that we are referring to a limited range of ICT products typically found in the home or office.

Printers	8	5
Mobile phones	0.15	1.5
Laptops	3.5	4

Source: Empa and Furniture Re-use Network (undated)

* Once discarded, the products might disposed or reused after being repaired or refurbished.

Table 2: Average weight and age of tracer products when discarded

3.4 Data acquisition

The research was both quantitative and qualitative and included:

- Document review (including prior research conducted by eWASA, or aligned to the eWASA initiative)
- Querying the South African Revenue Service (SARS) database
- Face-to-face interviews with key stakeholders in government and the private sector
- Site visits to recyclers, refurbishers, municipal landfills and other collection points
- Online survey

The research process also involved a presentation of the preliminary research results to stakeholders for comment.

3.4.1 Document review

Previous studies by Empa and eWASA have considered the legislative environment governing e-waste management in South Africa in detail. The key documents in this regard are:

- Widmer, R. and Lombard, R. (2005) *e-Waste Assessment in South Africa*: A case study of the Gauteng province, Empa/SECO, St.Gallen
- Dittke, M. (2005) *A Review of South African Environmental and General Legislation Governing e-waste*, eWASA, Johannesburg

These documents can be downloaded from: www.e-waste.org.za. The overview of the National Environmental Management Waste Bill has been informed by Iris Cloete, the Senior Environmental Advisor (Corporate Sustainability) at Eskom, who provided a presentation on the Bill for the eWASA Policy and Legislative Task Team.

3.4.2 Constructing totals for units distributed

The total units distributed for each tracer product was calculated from the available data, including SARS import totals and sales figures and other data provided by the interviews. The working totals ("Total units distributed") are presented in the main body of the report, while the primary data is included in Annex B.

3.4.3 Interviews

50 interviews and consultations were conducted for this study, as shown in Table 3.

Stakeholder	No. of interviews
National government	3
Local government and municipalities	7
Industry associations	5
Importers and manufacturers	9
Distributors	5
Refurbishers	7
Recyclers	8
Collector	4
Academic	2

Table 3: No. of interviews conducted

3.4.4 Site visits

16 site visits were conducted, as shown by Table 4.

	No. of site visits
Landfill or municipal collection point	4
Refurbisher	6
Recycler	6

Table 4: No. of site visits conducted

3.4.5 Online survey

An online survey was conducted in order to determine household e-waste quantities and e-waste storage and disposal patterns. The survey details were distributed to stakeholder e-mail lists, students and colleagues, amongst others. The online questionnaire is included in Annex D. A total of 358 responses were received, and these results are analysed in Section 7.

3.5 Limitations

The following limitations to this research apply:

- In the case of data not being accurate, available or reliable, estimates needed to be made. Wherever possible, we have tried to keep these transparent (e.g. through the inclusion of original data in Annexes)

- Not all stakeholders were available for interviews or forthcoming with data, and representative data or information needed to be constructed from other sources
- The results of the online survey could not be verified and should be taken to be illustrative.

4 Country Context

4.1 Overview and institutional framework[2]

South Africa is a multiparty parliamentary democracy, and has a population of 47.59 million. With a Gross Domestic Product (GDP) of some US$277.58-billion (2007), it is considered a middle-income country, and is one of the global emerging markets. The country is rich in natural resources, such as gold, chromium, coal, iron ore, manganese, nickel, phosphates, tin, uranium, diamonds, platinum, copper, salt and natural gas. It has developed mining, manufacturing, retail, legal, financial and media sectors, amongst others.

However, wealth is spread unevenly across the different population groups. About 79% of the population are black, 9.6% white and 8.9% 'coloured', while the Indian and Asian population groups account for about 2% of the total population (2001 Census). Yet more than 90% of the unemployed are black people, and the poorest 10% of households account for less than 2% of national consumption. In contrast, the richest 10% have a 46% share of national consumption.

The country has a three-tier governing structure: national government, provincial government and local government, each with its own legislative and executive authority. Its nine provinces – Gauteng, North West, Limpopo, Mpumalanga, KwaZuluNatal, Eastern Cape, Free State, Western Cape and Northern Cape – are divided into nine metropolitan municipalities and 46 district municipalities. The 46 district municipalities are further subdivided into 231 local municipalities.

The nine metropolitan municipalities (or 'metros') are:

- Buffalo City (East London)
- City of Cape Town (Western Cape)
- Ekurhuleni Metropolitan Municipality (East Rand, Gauteng)
- City of eThekwini (Durban)
- City of Johannesburg (Gauteng)
- Mangaung Municipality (Bloemfontein)
- Msunduzi Municipality (Pietermaritzburg)
- Nelson Mandela Metropolitan Municipality (Port Elizabeth)
- City of Tshwane (Pretoria, Gauteng)

Gauteng, the Western Cape and KwaZuluNatal are the provincial economic powerhouses of the country.[3]

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[2] Various sources have been used in compiling this overview, including: SouthAfrica.info (www.southafrica.info), South African Government Information (www. http://www.info.gov.za/), Statistics South Africa (www.statssa.gov.za), Wikipedia (http://en.wikipedia.org/wiki/South_Africa), and James, Finlay, Jensen (2008).

[3] Gauteng includes the economic capital Johannesburg, Midrand and the administrative capital Pretoria, the Western Cape the legislative capital Cape Town and its port, and KwaZuluNatal Durban port.

The Constitution, which contains a Bill of Rights, is the supreme law of the country. The Bill of Rights contains a clause on the Environment, which reads:

> *Everyone has the right –*
>
> *a. to an environment that is not harmful to their health or well-being; and*
> *b. to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –*
> *I. prevent pollution and ecological degradation;*
> *II. promote conservation; and*
> *III. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. (Constitution, Chapter 2, Bill of Rights, 25).*

Citizens of South Africa vote for particular political parties, rather than individuals. Parties are awarded seats in the National Assembly proportional to the outcome of the elections. The Cabinet is made up of the President, the Deputy President and 25 Ministers.[4]

The ministries govern the work of their respective departments, which implement policy and legislation. Key departments in the context of e-waste management are:

- Department of Environmental Affairs and Tourism (DEAT)
- Department of Trade and Industry (*dti*)

DEAT has led the recent development of the National Environmental Management Waste Bill, while *dti* has commissioned a scoping study to assess the economic potential of the recycling sector, including e-waste. However, e-waste is a cross-sectoral concern, and several other departments are likely to have a keen interest in the development of an e-waste management system in South Africa, including the Department of Water Affairs and Forestry (DWAF), Department of Communications, Department of Science and Technology, the Departments of Health, Labour, and Minerals and Energy, and National Treasury.

Only Cabinet members, Deputy Ministers, or a member of a National Assembly committee may introduce legislation in the National Assembly.[5] Bills are typically put before the public for public and industry comment before being passed.

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[4] The National Assembly is made up of no fewer than 350 and no more than 400 members elected every five years in the country's national democratic elections. A National Council of Provinces (NCOP) is made up of 54 permanent members and 36 special delegates. Each of the country's nine provinces has 10 representatives on the NCOP, which includes permanent members and special delegates. Through the NCOP, the provinces participate in the legislative process. Parliament is vested with final legislative authority, and is bound by the Constitution. The President of South Africa is elected by the National Assembly from among its members. He or she may not serve more than two five-year terms in office, is the executive Head of State and leads the Cabinet.

[5] Bills passed in the National Assembly must be referred to the NCOP, who in turn may propose amendments or reject the Bill. The National Assembly must consider the NCOP's proposals, but may pass a Bill without or without amendments.

4.2 Development indicators[6]

4.2.1 People

Total population	47.59 million (2007)
Population growth (annual %)	0.828 (2008 est.)
Number of households	13,261,000 (Stats SA, 2007/8)
Literacy rate	82.4 (2006)
Unemployment rate	22.7% (2007, Stats SA)
Population below poverty line	50% (2000 est.)
Gini index	65 (2005)
Prevalence of HIV (% of population ages 15-49)	18.1 (2007)

4.2.2 Environment

Surface area (sq. km) (thousands)	1,219.1
Improved water source (% of population with access)	93 (2006)
Energy use (kg of oil equivalent per capita)	2,722 (2005)
CO emissions (metric tons per capita)	9.0 (2000)
Electric power consumption (kWh per capita)	4,847 (2005)

4.2.3 Economy

GDP (current US$) (billions)	277.58 (2007)
GDP growth (annual %)	4.8 (2007)
Inflation rate (consumer prices)	6.5% (2007 est.)
Exports of goods and services (% of GDP)	30 (2007)
Imports of goods and services (% of GDP)	34 (2007)
Labour force by sector	Agriculture: 9% Industry: 26% Services: 65% (2007 est.)

4.2.4 Communications

Households with TV (%)	59 (2005)

[6] Information compiled from World Bank Developmental Indicators (www.worldbank.org/data) and associated institutional databases, the CIA World Factbook (www.cia.gov) Africa Policy Monitor (http://africa.rights.apc.org/) and Statistics South Africa (www.statssa.gov.za)

Radios per 1000 people	324.7 (1997)
Telephone mainlines per 100 people	9.97 (2006)
Mobile telephones (million)	42.3 (2007)
Personal computers per 1000 people	82 (2004)
Internet subscribers per 100 people	9.02 (2006)

5 E-Waste Policy & Legislation

5.1 Key international conventions

South Africa has ratified the Basel Convention (1989),[7] which seeks to restrict the movement of hazardous waste between countries, specifically from developed to developing countries. The convention is also concerned with waste minimization and the environmentally sound management of waste. However, it has not ratified the Bamako Convention (1991), which bans the import of hazardous wastes into Africa, and minimises and controls the trans-boundary movement of hazardous waste on the continent. According to DEAT, the Bamako Convention has not been ratified due to its potential impact on trade in waste. South Africa, and countries like Nigeria, have an interest in importing waste for recycling in the future.[8] (www.pmg.org.za)

5.2 Key legislation impacting on e-waste

5.2.1 National Environmental Management Waste Bill

There is currently no specific legislation that deals with e-waste in South Africa. However, the new National Environmental Management Waste Bill ([2007]) has come before parliament, and has implications for e-waste management. The Bill aims to reform waste management legislation in South Africa in order to protect public health and the environment. This includes providing reasonable measures for the prevention of pollution, securing "ecologically sustainable development", to develop norms and standards for the management of waste, and to provide specific waste management measures such as licensing and controls, for the remediation of contaminated land, and to deal with compliance and enforcement. A national waste information system is also envisaged.

It provides several definitions which can be read to have an impact on e-waste, such as what constitutes "acceptable exposure" (i.e. the maximum permissible concentration of a substance, which is relevant when collecting or recycling e-waste in volume), "best practicable environmental option" (relevant to a context when the latest technology for recycling e-waste may not be available), "hazardous waste" and "inert waste" (which includes waste that does not undergo significant transformation after disposal, and which may have relevance to some e-waste fraction), and "extended producer responsibility measures" (which is likely to impact on the responsibility of vendors and others after the sale of a product). (Chapter 1, pp6-9)

The Bill is considered historic in that it is the first time that legislation has been used to drive a waste minimization approach. It is limited only to waste streams that are not dealt with by other pieces of legislation, in order to avoid duplication and to compliment existing legislation. Industry-led waste management plans are encouraged. In order not to over regulate, only industries that are

[7] South Africa has also effectively ratified the Rotterdam Convention, which monitors and controls the trade of certain hazardous chemicals (www.pic.int) and has ratified the Stockholm Convention, which deals with persistent organic pollutants (POPS).

[8] The Africa Institute for the Environmentally Sound Management of Hazardous and Other Waste was to be established in South Africa following the ratification of the Basel Convention. This would replace the Basel Convention Regional Centre, which was formally hosted in the country. (ibid.)

identified as large waste generators will be required to develop and implement waste management plans. Other industries will be encouraged to develop plans on a voluntary basis. (Cloete, 2008)

5.2.2 Second-hand Goods Bill

The Second-hand Goods Bill ([2008]) aims to regulate the trade of second-hand goods, limit the trade of stolen goods, and promote ethical standards in the second-hand sector. Under the legislation second-hand goods are defined as "goods which have been in use by a person other than the manufacturer or producer", excluding goods worth less than R100. (Chapter 1)

A "dealer" is defined as "a person who carries on a business of dealing in second-hand goods, and includes a scrap metal dealer and a pawnbroker" (ibid.), while "scrap metal" is defined as:

> *[A]ny used, broken, worn out, defaced or partly manufactured goods made wholly or partly of non-ferrous or ferrous metal, lead or zinc or any substance of metallic waste or dye made of any of the materials commonly known as hard metals or of cemented or sintered metallic carbides (ibid.)*

In particular, Chapter 7, dealing with communication equipment, states that:

> *26 (1) Subject to section 21 and any other applicable law, a dealer dealing in second-hand communication equipment must also record in the prescribed register the particulars regarding every acquisition or disposal of communication equipment contemplated in subsection (2).*
> *(2) The particulars contemplated in subsection (1) are*
> *a) a description of the communication equipment, including the make and model;*
> *b) the communication equipment's IMEI number, where applicable; and*
> *c) any other distinguishing mark or feature, including any serial number.*
> *(3) A person acquiring communication equipment from or disposing of communication equipment to a dealer, must furnish such dealer, with his or her*
> *a) full name;*
> *b) physical address; and*
> *c) original identity document or passport as proof of his or her identity.*
> *(4) A dealer must obtain and keep a copy of the identity document or passport contemplated in subsection (3).*
> *(5) A dealer must retain copies contemplated in subsection (4) for a period of not less than five years, calculated from the date of the relevant transaction.*

Critical for industry associations like eWASA is the clause that dealers who are members of accredited associations may be exempt from the Bill's provisions if they are effectively addressed through self-regulation. (Bill, p21)

5.2.3 Other legislation

Various other legislation can be read to impact on e-waste. These are summarized in the table below.[9]

Legislation	Summary
Constitution	Deals with basic environmental rights. Sets out the allocation of powers for different levels of government. While provinces set the standards of environ-

[9] In addition, various municipal by-laws can be read to impact on e-waste management. For an analysis of these, please see Dittke (2007).

	mental control within a national framework, local authorities are expected to administer the legislation, supplementing it with by-laws where necessary.
The National Environmental Management Act, 107 of 1998 (NEMA)	Amongst other things, NEMA lays out principles for waste management. These include avoidance or minimization, and the remediation of pollution. Waste reduction, re-use, recycling and proper disposal, as well as the 'polluter pays' and 'cradle to grave' principles are emphasized.
The Municipal Services Act, 32 of 2000	Includes principles for effective local governance.
The Occupational Health and Safety Act, 85 of 1993	Deals with health and safety in the workplace.
The Environment Conservation Act	Deals with the protection and controlled utilization of the environment. The Environment Conservation Act makes provision for an Environmental Impact Assessment (EIA) which is needed for any waste disposal activities. An amendment delegates the administration of waste disposal to DEAT. The permitting of waste disposal sites is guided by a series of documents dealing with minimum requirements.
The White Paper on Integrated Pollution and Waste Management (2000)	Deals with the allocation of environment and waste management functions and powers. Has also included the development of the National Waste Management Strategy, a joint venture between the DEAT and DWAF. The emphasis is on holistic waste and pollution management. The following waste management hierarchy is laid down for policy and legislative development: a) Waste avoidance, minimisation and prevention; b) recycling and reuse c) Treatment and handling d) Storage and final disposal. Recycling is one of the short-term priority areas identified.
The Health Act, 63 of 1977 and National Health Act, 61 of 2003	Promotes healthy living and working conditions. Relevant to the potential health risk implications of e-waste. Also deal with disposal of waste, and, amongst other health issues, the "accumulation of refuse…or other matter… injurious or dangerous to health" (Health Act, 63 of 1977, Section 1).
The Hazardous Substances Act	Regulates the management of hazardous substances and hazardous waste.
DWAF Minimum Requirements	In 1998 DWAF published detailed minimum requirements dealing with waste disposal by landfill, handling, classification and disposal of hazardous waste, water monitoring at waste management facilities. Also deals with storage of hazardous waste.
National Water Act, 36 of 1998	Act includes a reference to "Disposing of waste in a manner which may detrimentally impact on a water resource" (section 21(g)), which could have implications for e-waste management.
Atmospheric Pollution Prevention Act, 45 of 1965	Requires a registration certificate for certain processes, including lead, copper, waste incineration, cadmium, metal recovery, mercury, and glass processes.
Air Quality Act, 39 of 2004	This Act is only partially in force. It aims to improve

	air quality, although standards and control were still being formulated. Smelters, in particular, are likely to be affected. Once the licensing provisions enter into force they will replace the registration certificates currently issued in terms of the Atmospheric Pollution Prevention Act.
Hazardous Substances Act, 15 of 1973	Deals with the handling, selling, and use of hazardous substances.
Occupational Health and Safety Act, 85 of 1993, and Regulations	Regulates the health and safety of employees and the public in general. Amongst other things, employers are obliged to carry out risk and hazard assessments on a regular basis to determine any dangers posed by the work or materials used.
Precious Metals legislation	Legislation was considered in a state of flux. Governs gold, silver, platinum and other platinum group metals, namely palladium, rhodium, iridium, ruthenium and osmium.

Table 5: Relevant legislation

6 Stakeholder Overview

6.1 Importers and manufacturers

6.1.1 White goods and consumer electronics

The white goods and consumer electronics sectors are considered one of the most competitive in South Africa (PMS, 2006). Several well-known global brands are represented locally (e.g. LG, Bosch, Samsung, Sony), and locally manufactured products command strong market share (e.g. Defy). Most white goods and consumer electronics are imported into the country or locally assembled. For example, Electrolux and Panasonic are assembled by RC&C Manufacturing (owned by Reunert) in Cape Town. The main source of imports include Germany, China, United States, United Kingdom, Japan and the Republic of Korea. In March 2007, Defy alone had recorded sales of over R2.3-billion. As *the* major local manufacturer in the white goods industry, it employs more than 3,000 people (Media release, 2007).

Table 6 shows the key stakeholders in the white goods and consumer electronics sectors when considering our tracer products. As can be seen, market leaders such as LG and Samsung have a footprint in both sectors, and are therefore key stakeholders when considering domestic appliances more generally. At the same time, there is some degree of conglomeration in the sectors, with several brands being owned or distributed by a single parent company (e.g. Bosch and Siemens is owned by B/S/H). Defy, once a proudly South African-owned concern, was recently bought by the Swiss company Franke. This effectively means that the sectors are dominated by foreign brands and interests, which has implications for developing a local e-waste management system.

	Fridges	Washing machines	Microwaves	TVs
LG				
Samsung				
AEG				
Bosch				
Defy				
Siemens				
Miele				
KIC/Whirlpool				
Panasonic				
Philips				
Telefunken				
Kelvinator				
Tedelex				
Sony				

Table 6: Key stakeholders: White goods and consumer electronics

Table 7 shows the market share of key players in the white goods sector when considering our tracer products. As can been seen, the major stakeholders are LG, Samsung, KIC/Whirlpool and

Defy. LG has a dominant market position, while KIC/Whirlpool and Defy command a strong market share when it comes to fridges.

		Fridges (%)	Washing Machines (%)	Microwaves (%)
Major stakeholders (90% of white goods market)				
Importers	LG	15-20	25-30	30-40
	Samsung	5>	25-30	15-20
	KIC/Whirlpool	20-35	5>	5>
Local manufacture	Defy	25-35	20-30	5>
Smaller stakeholders (10% of white goods market)				
Importers	Siemens	5>	5>	5>
	AEG	5>	5>	5>
	Bosch	5>	5>	No product
	Miele	5>	5>	5>

Source: Interview

Table 7: Market share: White goods

Table 8 below shows the market share of both white goods and consumer electronics together. Again, LG is the market leader, with Panasonic in a relatively strong second position.

	Market share (%)
LG	18-20
Panasonic	10-12
Philips	6-8
Telefunken	6-8
Samsung	6-8
Kelvinator	6-8
Tedelex	4-6
Sony	4-6

Source: PMS (2005)

Table 8: Market share: White goods and consumer electronics

Table 9 shows the estimated total units distributed locally in 2007. Both the white goods and consumer electronics sectors show strong growth forecasts. Of particular interest in this context is the relatively high number of microwaves distributed locally. Microwaves have an average age[10] of seven years, compared to the average age of 10 years for TVs. Unlike TVs, microwaves cannot be easily refurbished, and are therefore likely to be readily disposed. In this way they are comparable to printers in that they are more easily replaced than repaired.

Product	Est. total units distributed locally	Estimated total weight (tons)	Year	Expected annual growth (%)

[10] This represents the number of years before a new product typically needs to be substantially repaired, refurbished or is disposed.

Fridges	636,000	28,620	2007	10-20
Washing machines	564,000	36,660	2007	10-20
Microwaves	885,000	8,850	2007	10-20
TV	1,155,000	23,100	2007	(10-20+)

Table 9: Estimated units distributed: White goods and consumer electronics

Industry associations do not appear to be strong in these sectors – for instance, attempts to get a White Goods Association off the ground have floundered. The sectors are also not currently engaged in visible e-waste recycling and take-back activities, despite companies like LG, Panasonic and Sony having launched recycling and take-back initiatives in other parts of the world such as Korea and the United States.

6.1.2 IT

The IT sector in South Africa is robust, with major global vendors such as Hewlett-Packard (HP) and Dell with a strong local presence. There is no local manufacture of IT equipment, which can be considered 100% imported.[11] There is, however, local assembly of several brands, such as Mecer (produced by the distributor Mustek), Sahara and Proline (produced by Pinnacle Micro), as well as global brands such as HP. Estimates put the sector's value at R30-billion for hardware sales alone, around R100-billion including software, services and consulting, and some R300-billion annually when including the mobile market. The PC market, in particular, is said to have crossed the "million PC" threshold, making it a viable and attractive market for global vendors. While the white goods and consumer electronics sectors are mostly accounted for by domestic (household) spending, the IT sector is supported primarily by business and government spending.

Market	Value
Direct or channel IT hardware sales	R30-billion
With software, service provision and consulting	R100-billion
With mobile market	R150-200-billion

Table 10: Estimated IT market value

Table 11 shows what are considered the primary markets for IT products in South Africa (although this will vary from vendor to vendor):

Sector	Market size (%)
Public	60
Private	30
Domestic	10

Source: Interview

Table 11: IT Market breakdown

The key stakeholders in the IT sector when considering out tracer products are shown in Table 12.

[11] Despite experiments in, for example, memory manufacture.

	PCs	Printers	Mobiles
HP			
Dell			
IBM/Lenovo			
Fujitsu-Siemens			
Acer			
Sahara*			
Mustek/Mecer*			
Pinnacle Micro/Proline*			
Lexmark			
Epson			
Cannon			
Nokia			
Samsung			
Motorola			
Sony Ericsson			
LG			
Siemens			

* Local brands

Table 12: Key stakeholders: IT (new)

Tables 13, 14, and 15 show the estimated market shares of the key stakeholders in our three IT tracer product categories. As can be seen, HP is a strong player in both the PC and printer market, while Dell has a strong presence as a PC brand. Nokia holds a dominant position in the mobile handset sector.

	Market share (%)
HP	20-25
Dell	10-15
Acer	10-15
Mecer	5-10
IBM/Lenovo	5-10
Other	40

Source: Interview

Table 13: Market share: PCs

	Market share (%)
HP	45
Xerox	55
Konica Minolta	
Lexmark	
Samsung	
Canon	
Ricoh	

Source: Interview

Table 14: Market share: Printers

	Market share (%)

Nokia	51
Samsung	20
Motorola	10
Sony Ericsson	10
LG	2
Other	7

Source: Interview

Table 15: Market share: Mobile handsets

Industry associations and bodies appear stronger in the IT sector than the white goods sector. They include the IT Association (ITA) and the Black IT Forum. The IT sector has also been more responsive to the issue of e-waste generally in South Africa – vendors such as HP have for several years been involved in refurbishment projects, and recently supported e-waste studies in Africa, as well as a pilot e-waste refurbishment and recycling initiative in Cape Town. Other IT vendors to launch pilot initiatives include Fujitsu-Siemens, and, most recently, Nokia (see Annex C for a list of these initiatives). HP and Fujitsu-Siemens have also supported the local drive to develop an industry-led solution to e-waste, currently being initiated by eWASA.

PC refurbishers currently import anything from 20,000-100,000 units a year into South Africa. Some 60,000 second-hand mobile phones (or 6% of the total) are said to be imported into the country each month. Currently the second-hand IT market is relatively unregulated. For instance, the importation of new and second-hand PCs and mobile phones is not distinguished by SARS. Key importers of second-hand PCs are Device Global, Xperien, and Bridgeport Technical Services. Pactel is considered the largest importer of second-hand mobile phones.

The table below shows the different quantities of second-hand PCs imported into the country each year by refurbishers interviewed.

	Product	Units import	Total weight (tons)
Refurbisher 1	PCs (with monitor)	10,500	283.5
Refurbisher 2	PCs	6,000	162
Refurbisher 3	PCs	5,000	135
Estimate of total annual second-hand imports	PCs	(100,000)	2,700

Table 16: Second-hand imports (sample)

Table 17 shows the estimated total units of our IT tracer products distributed locally in 2007. As the table shows, the growth forecast for PCs is flat. This reflects both a saturated market, and a trend away from desktop computing to mobile computing, including laptops and handhelds. At the same time, there is strong growth predicted for the second-hand PC sector. Refurbishers report that businesses are opting to refurbish their office IT rather than purchase new, and are also starting to take up leasing schemes with refurbishers. The total for laptops is included here for comparative purposes.

Product	Est. total units distributed locally	Total weight (tons)	Year	Expected annual growth (%)
New PCs (with monitor)	1,020,000[12]	27,540	2007	(0 to -15)
Printers	844,600	6,756	2007	5-10
Mobiles (new and used)	12,500,000	1,875	2007	2-5
Laptops	650,000	2,275	2007	20

Table 17: Estimated units distributed: IT

6.1.3 Lighting

There is no manufacture of light bulbs in South Africa. Philips is, however, setting up a production facility for Compact Fluorescent Lamps (CFLs) in Lesotho, in partnership with the Central Energy Fund and Karebo Systems, a company working in the energy sector. It facility is expected to produce up to 15-million CFLs a year.

Table 18 shows the key stakeholders in this sector. There is some degree of cross-ownership and global vendors holding stakes in all four of the white goods, consumer electronics, IT, and lighting sectors. For example, Osram and Sylvania are the same company, owned by Siemens. Eskom is listed as a 'small supplier' given its mass distribution of CFLs to disadvantaged areas, amongst others (some 19-million CFLs were distributed from 2004-2007). Retailers such as Pick n Pay, who offer a self-branded product, also import directly, or through major stakeholders if their order is large enough. Eveready (not included in the table) have also entered the local market with a range of energy-saving and standard lamps.

Stakeholder	Market share (%)
Major stakeholders	
Osram	80
Philips	
Eurolux	
Lohuis	
Smaller stakeholders	
General Electric	20
Sylvania	
(Eskom)	
Direct imports (self-branded)	
Pick n Pay	
Clicks	
Spar	

Source: Interview

Table 18: Market share: Lighting

[12] This total is based on the number of CRT and LCD monitors imported in 2007 (see Annex B). The monitor count could include 20,000 or more second-hand monitors imported for use with refurbished PCs. However, this is difficult to tell, and for convenience we have taken the total to be a reasonable indication of the distribution of *new* PCs in one year.

The lighting sector has an industry association: the Illumination Engineering Society of South Africa (IESSA). It also shows a relatively strong degree of self-organisation in that a working group has been formed to deal with the challenge of fluorescent discharge lamps, which are of primary concern when considering e-waste. This group includes major role-players such as Eskom, which is also participating in eWASA's efforts to establish a local e-waste management system.[13]

Table 19 shows the number of units of different lamp types imported in 2005/6. High Intensity Discharge (HID) lamps, linear fluorescent and CFLs are all fluorescent discharge lamps, and relevant to our e-waste concerns.

Type of lamp	Units imported*
Incandescent	92,421,000
Tungsten halogen	3,321,000
Dichroic	4,821,000
High Intensity Discharge (HID)	1,869,000
Linear fluorescent	16,330,000
CFLs	19,095,000
Total	**137,857,000**

Source: Eskom (2008), Lombard & Webb (2008)

* 2005/2006

Table 19: Units imported: Lightbulbs

6.1.4 Rechargeable batteries

About 50-million batteries are said to be consumed in South Africa annually, 95% of them non-rechargeable, throw-away batteries (Uniross, 2008). Non-rechargeable batteries are distributed by Eveready and Duracell, with the locally-owned Eveready the only manufacturer of dry cell batteries in South Africa. Of particular concern for e-waste are rechargeable batteries distributed by the likes of Eveready, Duracell and Uniross – which has a battery assembly facility in Midrand – but are also found in products such as mobile phones, computers, tools and various consumer electronics.

	Non-rechargeable	Rechargeable
Eveready		
Duracell		
Uniross		
Energizer		

Table 20: Key stakeholders: Batteries

The battery industry clearly takes the hazardous content of its product seriously. Eveready, for instances, makes a point of mentioning on its website that it has eliminated the use of mercury and cadmium in its batteries, and reduced the amount of waste to hazardous landfills by 40% since 1999. It has also shown interest in energy-saving technology, such as wind power. However Uniross is one of the few sector stakeholders who is engaged in a pilot e-waste initiative, which in-

[13] Eskom is currently conducting a study on the responsible disposal of fluorescent discharge lamps. To find out more on Eskom's roll-out programme, visit: www.eskomdsm.co.za.

volves battery collection at Pick n Pay outlets. Both non-rechargeable and rechargeable batteries are collected in this initiative.

6.2 Distributors

6.2.1 White goods and consumer electronics

The retail sector in South Africa is dominated by monopoly owners such as MassMart or the JD Group who own several well-known chain brand names such as Makro and Game (in the case of MassMart) and Hi-Fi Corporation, Incredible Connection, and Russells and Bradlows (in the case of the JD Group). White goods and consumer electronics retailers such as Hirsch's, and food chain Pick n Pay are considered 'smaller' stakeholders in the white goods, consumer electronics and IT sectors. Independent stores collectively offer some competition to the main chain brand names. The turnover for one major retail group for white goods, consumer electronic and IT brands was around R6.7 billion/annum (June 2007).[14]

The distribution models of the major white goods and consumer electronics vendors are similar. For example, in the case of LG, products are stored at LG warehouses in Johannesburg and Cape Town. From there they are delivered to warehouses of the major retailers (e.g. Game, Hi-Fi Corporation, and House and Home). LG delivers directly to the smaller independents (e.g. Hirsch's), which it considers an important part of its business. Often independents are serviced by a buyer. Independents also typically carry a vendor's premium products, because it can price products higher.

Table 21 below lists key stakeholders in the retail sector, and the product categories they deal in.

	White goods	Consumer electronics	IT
Large stakeholders			
Makro			
Game			
DionWired			
Hi-fi Corp			
Incredible Connection			
Stax			
Smaller stakeholders			
Hirsch's			
Pick n Pay			
Other independents/furniture (about 8000 stores)			
Bears, Morkels, Russells, Bradlows etc.			

Table 21: Key stakeholders: Retailers

[14] These brands were LG, Defy, Whirlpool, Kenwood, Electrolux, Eurolux, Samsung, Sony, Panasonic, Canon, Sharp, Kodak, Fujitsu-Siemens, HP, Dell, Elies, Philips, Osram. Together with power tools, turnover stood at R7-billion.

Challenges for retailers when it comes to e-waste include floor space (which is valuable) and security. Nevertheless, some retail groups such as MassMart (through its Makro stores, in partnership with Fujitsu-Siemens) have begun to participate in e-waste pilot collection initiatives, as have Pick n Pay and Woolworths. In the past Incredible Connection made a trade-in offer for old equipment.

6.2.2 IT

IT vendors follow different distribution channels depending on their business model. Channels include selling direct to the public (government) and private sectors, and through retailers or resellers. The table below shows the channels preferred by the major vendors.

Vendor	Direct to private and public sectors	Resellers
HP		
Dell		
IBM/Lenova		
Fujitsu Siemens		
Sahara		
Mustek/Mecer		
Lexmark		
Epson		

Table 22: Distributor channels: Vendors

A number of distributors, such as Axiz and Tarsus, also operate in the sector, commanding turnover of some R1-2 billion or more annually. Axiz and Tarsus distribute mostly multinational brands, while Rectron (see Table 23) distributes mostly components.

Distributor	Direct*	Reseller	Est. market share (of hardware sales) (%)
Axiz			10
Tarsus			15-20
Pinnacle Micro			Portion of 70-75%, which includes vendor direct sales (see Table 5)
Rectron			

* Direct distribution involves sales directly to businesses, government or other customers. The reseller model (or "pure" channel) involves selling to retailers, or to services providers.

Table 23: Market share: Distributors

In addition, a so-called "grey zone" exists, with budget IT retailers like Hi-Fi Corporation and Computer Corporation by-passing vendors and distributors and importing directly.

Second-hand PCs are typically supplied directly from the refurbisher or importer to the client. Refurbishment centres often serve as the shop front for products, and online promotions (e.g. sending out pricelists via e-mail) are prominent.

6.2.3 Lighting and rechargeable batteries

The distribution of lamps happens in several ways, such as:

- Importation and delivery directly to the warehouses of major retailers like Pick n Pay (much the same as the LG model);
- Delivery from a wholesaler to regional or central warehouses;
- Delivery directly to stores.

CFLs are typically distributed to the domestic market, while the larger linear fluorescent lights are found in the government sector (e.g. public works departments). HIDs are used for street lights and factory lights.

As mentioned, besides being sold through retailers, rechargeable batteries used for IT and consumer electronics enter the market in a variety of ways, including as a component of a product. This makes the actual number of rechargeable batteries in circulation difficult to quantify.

6.3 Collectors

The collection of e-waste is both formal and informal. Informally e-waste has been sorted in an ad hoc way from mainstream waste for years (e.g. on the curb-side, and at landfills and Garden Sites or other municipal collection points). While ferrous metals have been traded with the numerous scrap metal dealers found in urban areas, informal collection often involves basic recycling such as burning cables for their copper, and smashing monitors to get at the same. Informal collectors are found at municipal collection points such as landfills, or comb the streets on waste disposal day with trolleys, sorting through domestic waste. They have become a permanent feature of the waste disposal landscape, and their informal entrepreneurship appears to offer a sustainable means of generating income.

Various initiatives have attempted to structure or formalize the collection and sorting processes that happen at municipal collection sites. For instance, the Johannesburg waste company Pikitup allows ‘site entrepreneurs’ to operate at its Garden Sites. These entrepreneurs collect different kinds of recyclables, such as plastics, cardboard, and more recently, e-waste. However, as far as e-waste is concerned, this has had mixed results in limiting informal collection and recycling activities at the sites. At the same time, it is important to point out that while the metros may lead the way in local government recycling initiatives and practices, there is little or no e-waste recycling happening in smaller municipalities due to financial and human resource constraints.

Historically, the formal ‘collection’ of e-waste has been done by recyclers such as Desco or Universal Recycling, who have been processing e-waste since the early 1990s, and even before. These recyclers are not, however, interested in domestic e-waste, and have worked mostly through contract with businesses and government, or responded to tenders for e-waste removal from sites. Smaller recyclers, or ‘feeders’, work alongside these bigger recyclers, collecting from places like municipal landfills or small businesses, and even from homes. These ‘feeders’ tend to be on call, work a cash trade, and continually have their feelers out to spot a good deal, big or small. They ‘feed’ the bigger recyclers and scrap dealers after performing some basic value-add dismantling and sorting. Like most recyclers, they guard their networks, sources and contacts jealously, as well as their trading prices. Some of these recycler-collectors have established sizable businesses.

Whether or not a recycler pays a client for the e-waste that is collected varies from recycler to recycler and deal to deal. Strictly speaking, under current recycling conditions, e-waste should be paid for. However, sometimes the cost of collection is deducted from the potential value of the e-waste collected, and the disposer is more than happy just to have his or her e-waste finally taken away.

In the past few years there have been several government and private sector initiatives to explore the systematic collection of e-waste, such as IT, batteries and lamps. Typically these have involved creating a public ‘drop off’ point for e-waste, and have been aimed at the domestic market, which is

economically unviable for big recyclers to service. The collection initiatives have so far steered away from white goods, in part because the white goods industry has yet to show an active concern for e-waste in South Africa. Moreover, the scrap metal value of white goods means that it has always been a going concern for recyclers, while the sheer bulk of white goods compared to other forms of e-waste means that it is more difficult to secure space for collection initiatives (e.g. at shopping centres).

Sites for collection have included Garden Sites, shopping centres, retailers, refurbishment centres, and e-waste projects, amongst them. Industry names that have been involved in these initiatives include Pick n Pay, Makro, Woolworths, Nokia, Fujitsu-Siemens, and Uniross. Typically these collection initiatives involve a contract or arrangement with a recycler or waste disposal company to periodically collect the e-waste for recycling. Recyclers engaged for these purposes include Desco, Darkling Industrial Metals, and Wasteplan. As in the case of Fujitsu-Siemens, they may also involve sending recovered PCs to a selected refurbisher. A full list of these collection initiatives can be found in Annex C.

For many of these initiatives it is too early to assess how successful they have been. However, Fujitsu-Siemens reports that 4.7 tons of assorted IT e-waste was collected over an eight-week period at one drop-off site situated at a Marko store. A collection container at a municipal drop-off site in Wynberg in Cape Town collected an estimated six tons of e-waste in four months soon after being set up. In comparison, Table 24 shows IT e-waste quantities recorded by a recycler at four Pikitup Garden Sites, also over an eight-week period. According to the recycler, it is financially viable to collect from a site if 400kg of material can be collected in one visit. The recycler also claims that as much as 20 tons of e-waste (including scrap metal) was lost to informal collection and recycling at the sites over the period.

Site	Total IT e-waste (kg)	Total other/ scrap metals (kgs)	e-waste (%)
Site 1	103.3	2,194	4.5
Site 2	190.3	2,152	8.1
Site 3	1,193	7	99.4
Site 4	1,575	0	100

Table 24: e-Waste quantities: Pikitup Garden Sites

6.4 Refurbishers

The repair of whites goods, consumer electronics such as TVs, and IT also happens both formally and informally. However, the organised mass refurbishment of second-hand equipment, when considering our tracer products, is most notably in the IT sector, where the refurbishment sector has been described as an “industry”.

Several large IT refurbishers are operating in South Africa. One of the largest in terms of floor space is Device Global, a foreign-owned operation based in Midrand. Other stakeholders include Bridgeport Technical Services, Sylvara Technologies, Xperien, and non-profit organisations such as Community Education Computer Society (CECS) and NetDay.

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

Refurbished PCs for sale at Just PCs in Cape Town

As Table 25 shows, PCs, monitors, notebooks, printers, scanners, amongst other IT equipment, is refurbished by the industry. Most refurbishers, however, deal primarily in refurbished PCs. Sources of second-hand IT equipment include institutions such as banks and businesses, and importation mainly from Europe and the United States.

Refurbishers	Products refurbished	Total quantities/annum	Key stakeholders
Refurbisher 1	PCs (70%); Monitors (10%); Notebooks (20%); Printers (marginal)	24,000-30,000	Bridgeport Technical Services, Device Global, Xperion, Sylvara Technologies, Bias, Computers Unlimted, Just PCs, NetDay, CECs, Freecom etc.
Refurbisher 2	PCs (with monitor) (100%)	10,000-12,000	
Refurbisher 3	PCs (80-90%; 40-50% of this is servers); notebooks (10-20%); monitors (10%-20%)	18,000-36,000	
Refurbisher 4	Touchscreens, LCDs (26%), CRTs, Printers (POS, Laser, Injet), PCs (13%), Laptops (5%), Card Encoders, Banking Equipment (ATMs), Scanners	3,600	
Refurbisher 5	PCs & Monitors (60%), Laptops (30%), Servers (10%), Computer peripherals	18,000-24,000	
Refurbisher 6	PCs (80%), Laptops, Monitors, LCDs	600	
Refurbisher 7	PCs, Laptops, Monitors, LCDs, Components, Servers, Consumer electronics (small scale)	5,600	
Mobile refurbishers	Mobiles (sold and refurbished)	(720,000)	Pactel (largest)

Table 25: Unit turnover for IT refurbishers

Refurbished products are, in turn, sold back to the private sector, or to individuals, and are used in non-profit projects run at schools or in disadvantaged communities, amongst them. Table 26 below shows the different markets for three refurbishers.

Refurbisher 1	Private sector: 40% Individuals: 25% IT dealers/resellers: 35%

Refurbisher 2	Private sector (small business) and individuals: 70% Export (to Namibia) and informal resellers: 30% (about 20% of the equipment is sold over webpage)
Refurbisher 3	Individuals: 50% IT dealers/resellers: 25% Private and non-profit sectors (business and NGOs): 25% Donations: 2%

Table 26: Market for refurbished products

White goods vendors typically have contracted repairers who deal with warranties. A sample survey of independent white goods repairers in the Johannesburg area gave the following results:

	Products	Sources	Units turnover/ annum	Processes
Repairer 1	Fridges, washing machines, stoves, microwaves, TVs	Private consumers	1800-2400	Repair
Repairer 2	fridges, washing machines, tumble driers stoves	Private consumer	1200>	Repair
Repairer 3	Fridges	Businesses (No private consumers)	360	Repair, partial dismantling

Table 27: Units turnover of sample repairers

6.5 Recyclers

Recyclers processing non-ferrous and ferrous metals have been operating in South Africa for decades, as have e-waste recyclers such as Desco. Recently, however, new e-waste recyclers, such as Global e-Waste Solutions and Reclite SA, have emerged. There is also some degree of specialisation, with Reclite SA importing technology into the country to deal with fluorescent discharge lamps (see: www.reclite.co.za).

Mechanised e-waste recycling at NF Shred in Gauteng

The recycling processes amongst the current operators are not uniform, and include manual dismantling and mechanised shredding. Manual dismantling is a value-add process that allows different markets to be found for the separated fraction. In the case of Universal Recycling, which can deal with ferrous and non-ferrous metals, the recycling process includes a combination of conveyor belts, shredding, water separation, rotary magnets, extractors, granulation, shears and balers.

Desco uses machinery it designed and built to process PC boards, which it then transports to a refinery for smelting. However, unlike Universal Recycling, it relies heavily on hand-sorting and dismantling – and even removes some parts for resale. Local and international markets are found for dismantled fraction, while some fraction is sent to Universal Recycling for shredding.

A key concern is the potential threat of backyard electrochemical processes being set up, similar to India and China. Electrochemical processes allow for precious metals to be easily extracted. However, if the process is unregulated, dangerous toxic chemicals which are casually disposed can become a health hazard. The recyclers interviewed for this assessment indicated that they used no electrochemical processes.

Table 28 shows the tonnage of e-waste recycled by the recyclers interviewed for this study. As can be seen, only one recycler can be considered a major recycler of both ferrous and non-ferrous scrap. The estimated total annual processing of IT e-waste is 11,000 tons or more.

	Tonnage/year	IT and consumer electronics (tons)	White goods	Stakeholders
Recycler 1	90000+	2,000-5,000	10,000-15,000	NF Shred, Desco, Universal Recycling, Global e-Waste Solutions, Recover e-Alliance, Re-ethical, Darkling Industrial Metals
Recycler 2	2,500	2,500		
Recycler 3	9,000	5580*	Small percentage	
Recycler 4	12,000	12		
Recycler 5	480	480		
Recycler 6	72-96	72-96	Small percentage.	
Estimated total/annum		**10,500+**	**10,000+**	

* Includes small percentage of white goods.

Table 28: Recyclers: tonnage (samples)

Different recyclers receive different kinds of e-waste loads, in part because the recyclers pass on fraction to each other after dismantling and sorting (e.g. a small recycler might sell PC boards to Desco, and scrap metal elsewhere). Recyclers report receiving PCs, fax machines, photocopiers, scanners, monitors (including LCD panels), mobile phones, and other telecommunications equipment, medical and radio equipment, the occasional TV, fridges and irons. The kinds of e-waste processed by Recover e Alliance in Cape Town is show in Table 29.

E-waste	%
CRTs	60
Printers	15
PC towers	10
Photocopiers / fax machines	5
Notebooks	2-3
White goods	1-2
Communication equipment (mainly phones)	5

Table 29: Recover e Alliance: Kinds of e-waste processed

A fraction composition for IT e-waste typically processed by two recyclers is shown in the table below.

Recycled materials	Recycler 1 (%)	Recycler 2 (%)
Plastics	23	16
Monitors (CRTs + LCDs)	15	20
Ferrous metals	32	42
Non-ferrous metals	18	4
PC boards	Small amount	6
Batteries (storage)	Do not accept	2
Batteries (lead)	Do not accept	2
Fraction to landfill	n/a	2

Sources: Interviews

Table 30: Sample e-waste fraction composition (excluding white goods)

Un-recyclable fraction includes plastics, batteries (which are stored, or removed before accepting e-waste loads), and CRTs. In some instances these are responsibly disposed. For instance, Gerry Newson from Recover e Alliance previously charged clients R6 for the disposal of monitors.[15] The CRT glass was then sent to a hazardous landfill at the recycler's expense. Rand Refinery also accepts crushed CRT glass at its smelter as a value-add service to a client. However, a number of recyclers do not remove CRTs before crushing or shredding, stockpile hazardous fraction such as batteries, or cannot find a market for plastics.

Table 31 shows the extent to which e-waste fraction is passed from one recycler to another, in part to achieve the volumes necessary for profitable trading. For instance, Desco receives e-waste from

[15] When running a similar project at Footprints in Cape Town.

several other recyclers, such as PC boards, and even monitors, which it then on-sells to a local smelter. Hazardous fraction, such as CRTs, is also offloaded in this way.

	Recycler 1	Recycler 2	Recycler 3
Metals	SA Metals	Local refineries	Local refineries
PC boards	Desco (and then to a local smelter)	Shipped to Europe	Desco (and then to a local smelter)
CRT glass	Hazardous landfill	n/a	Desco (and then to a local smelter)
Plastics	Sold to recycler/ converter	Sold to recycler/ converter	Non-recyclable plastics landfilled
Cables	To recycler (Cable Utilities)	n/a	Plastics from cables sold locally
Batteries	n/a	n/a	Stockpiled

Table 31: Market for recycled fraction

Because of the diversity of scrap metal dealers, and the difficulty in accessing the sector, it is almost impossible to properly trace the extent to which our tracer products are processed by them. Reclam is the largest processor of ferrous and non-ferrous scrap in the country. Its processing equipment can process some 200 tons an hour. According to the recent scoping study by the *dti* (BKS, 2008), Reclam recovers approximately three million tons per annum of ferrous metals and 93,000 tons per annum of non-ferrous metal.

The following table gives the provincial breakdown of the estimated number of formal scrap dealers:

	MRA members	Reclam branches*
Limpopo	2	
Mpumalanga	2	4
Gauteng	44	13
KZN	14	18
Free State	2	1
North West	0	1
Northern Cape	0	
Eastern Cape	1	4
Western Cape	7	2
Total	**72**	**43**

Source: Metal Recyclers Association/ Reclam

* Reclam also processes paper, glass, rubber, and plastics.

Table 32: Metal scrap dealers (sample)

In total, 170,000 tons of all kinds of plastics are recycled each year in South Africa. However, only a fraction of the flame-retardant ABS plastics, PVCs (used for cabling), and hard polystyrene used in e-waste are properly recycled. Plastics that are recycled are shredded, melted down and pellet-

ized, so that they can be used by converters[16] in manufacturing. Table 33, shows the number of importers of plastics, raw material manufacturers, recyclers and converters in South Africa.

Sub-sector	
Importers	30-40
Raw materials manufacturers	3*
Plastic recyclers	162**
Converters	1200

* (e.g. Sasol, Safripol) ** Members of Plastics Federation

Source: Plastics Federation

Table 23: Stakeholders: Plastics

Industry associations and bodies are active in the recycling sector. These include the Plastics Federation of South Africa, the Metal Recyclers Association, the South African Iron and Steel Institute, and eWASA. E-waste recyclers interviewed for this study employ anything from 6-125 or more people.

6.6 Downstream vendors

The downstream market for e-waste ranges from high-end refineries and smelters, to plastics converters, and grassroots waste-to-art projects. The potential of gold in e-waste (e.g. from PC boards) has meant that Rand Refinery is considering it as a viable resource for smelting and refining. It expects 5% growth in its e-waste throughput annually – compared to a 5% annual reduction in gold-bearing ore throughput also anticipated. Its smelter's capacity will be increased from 2,000 tons a year to 6,000 tons a year.

The Department of Minerals and Energy lists a number of smelters in South Africa with the capacity to process non-ferrous and ferrous metals, including lead (see: Department of Minerals and Energy (2007)).

Process	
Rand refinery	Rand Refinery moving aggressively into e-waste. Expects 5% growth in e-waste tonnage a year.
Smelters	Various ferrous and non-ferrous, including lead (e.g. Brass Extruders SA, Non-ferrous Metal Works (SA), Zimco Aluminium Company).

Table 34: Refineries and smelters

[16] 'Converters' refers to the manufacture of goods out of plastics (here recycled plastics).

In 2000 the battery industry claimed that 84% of the smelter output from secondary lead smelters went back into the battery industry, while 7% was said to go to the cable industry (Joseph & Verwey (2000)). However these figures could not be confirmed. Table 35 lists key lead smelters. Currently no non-rechargeable batteries are recycled in South Africa. Batteries collected by Uniross in its collection pilot are to be shipped back to Europe for recycling.

Smelter	
Fry's Metals	Combined output estimated over 46,000 tons (2000).
First National Batteries	
Lead Processing	
Dixon Batteries	

Source: Joseph & Verwey (2000)

Table 35: Secondary lead smelters

As Table 23 shows, there are an estimated 1,200 plastics converters who deal with all sorts of plastics in South Africa. Products made from recycled e-waste plastics include: plastic floorboards, benches, plumbing, roof tiles, garden tools, poles for fences, and even soles for shoes. IT e-waste has also been used successfully in waste-to-art projects, where clocks, jewellery and other arts and crafts have been made. The most noteworthy instances of this have been the Footprints waste-to-art project, and Recover e Alliance in Cape Town. However, Footprints has recently had to close down after its premises was re-appropriate by the owner for another purpose.

6.7 Final disposers

Few accurate statistics exist regarding how much e-waste ends up in municipal landfill, although figures of 5% of waste volumes being e-waste have been quoted by Tshwane metro. The 2004 study by Widmer and Lombard also quotes a figure of 2.2 tons of e-waste a month at one landfill in Ekhuruleni (also in Gauteng). However the systematic monitoring of e-waste quantities is not happening, given that it is a relatively new waste stream.

Estimates of nearly 220,000 tons of recyclable metal reaching landfill annually have been made (BKS, proposal, 2008). At the same time, the e-waste and scrap metal quantities recorded at the four Pikitup Garden Sites over the two-month period are indicative (See Table 24). On the other hand, waste activists working in some metros, such as eThekwini, offer anecdotal evidence of e-waste put out on the curb-side, but little or none of it reaching landfills.

Much of the e-waste of value is likely to be formally and informally collected before it is landfilled. E-waste that does end up at landfills includes IT scrap, TVs, telecommunications equipment and white goods. At the same time, fraction from recyclers that cannot find a market (e.g. shredded plastics) are disposed at landfill. Our consumer survey indicates that batteries and lamps are typically disposed in domestic waste and are unlikely to be detected. Similarly, old mobile phones, or smaller consumer electronics are unlikely to be visible in ordinary domestic loads.

Recent moves by local government, such as the City of Johannesburg, to benchmark waste reduction volumes because of a shortage of landfill space suggests that all recyclable waste streams will be more closely monitored by local government in the future. Moreover, as e-waste's status as a hazardous waste is recognized, it should be governed by legislation that requires the tracking and recording of hazardous waste volumes.

Currently only a small and even negligible fraction of e-waste is properly disposed at hazardous waste landfills such as Holfontein in Gauteng. Hazardous waste disposal costs money, and most recyclers have yet to build this imperative into their business plans.

No mass incineration of e-waste occurs in South Africa, although the on-site incineration of e-scrap was found at one recycler.

6.8 Most affected communities

The e-waste sector provides formal employment and informal entrepreneurial opportunities to previously disadvantaged communities and people. There are an estimated 40,000 – 50,000 informal recyclers in South Africa dealing with all sorts of waste streams, one of them being e-waste. However, while informal recycling has its positive spin-offs, it also has its hazards and can impact negatively on communities. The informal recycling of e-waste includes burning wires for copper, and smashing CRT screens. As a side effect, homeless people are also reported to burn plastics for warmth. These dangerous activities often occur near Garden Sites or landfills, or near the premises of recyclers, including on the curb-side.

Informal recyclers at a landfill in Tshwane, Gauteng

Besides this, most formal recycling activities occur in relatively controlled environments, such as industrial zones. This tends to minimize the impact on surrounding communities, and little immediately detrimental impact on potentially affected communities was visible during our site visits.

6.9 Other stakeholders

Table 36 below lists key stakeholders not mentioned above who form part of the e-waste sector in South Africa.

Stakeholder	Field	Example organisations
ICT for development non-profit organisations	ICTs for development, ICTs in education, refurbishment	SANGONeT, Women'sNet, SchoolNet South Africa, CECS, NetDay
ICT and environmental donors and other funders	Donors and funders working in the field of ICTs for development and environment	Open Society Foundation, International Development Research Centre (IDRC), Mott Foundation, Ford Foundation, Heinrich Boll Foundation, Shuttleworth Foundation, Hivos, and private sector sponsors like Pick n Pay and Nedbank
Environmental non-profit organisations	Environmental groups	Wildlife and Environment Society of South Africa (WESSA), Groundwork, Earthlife Africa
Parastatals or government agencies	Materials testing and development, quality control, ICT strategies, trade and industry	Council for Scientific and Industrial Research (CSIR), South African Bureau of Standards (SABS), National Cleaner Production Centre, Trade and Investment South Africa (TISA), State Information Technology Agency (SITA), Centre for Public Service Innovation (CPSI)
Quasi government aligned projects, partnerships and programmes	Business and R&D development, support and incubation	Innovation Hub, South African Technology Vanguard (Savant)
ICT and waste consultants, specialists, academics and scientists	Specialists in these fields	Various independent consultants and academics in universities

Table 36: Other stakeholders

7 Household Survey

Consumers are a key stakeholder in any e-waste system: they buy the products in the first place, and store, exchange, repair, refurbish or dispose of the products after use. In this way they are a key link in any waste management system, in which consumer education aimed at changing or directing consumer behaviour is paramount.

Basic assumptions about consumer demand when considering our tracer products can be made. For instance, the majority of CFLs are likely to be sold into the domestic sector, while HID will be used for public services, such as streetlights.

Similarly, the majority of (household) fridges, microwaves, and washing machines are likely to be sold into the domestic sector, even while there will be some demand for fridges and microwaves from the private and public sectors. In contract, most IT is sold to the private and public sectors.

As far as the household consumption of our tracer products goes, some data are suggestive. For example, the 2001 Census, although conducted seven years ago, offers the following breakdown of household white goods, consumer electronics, and IT:

Product	Percentage households (%)
Radio	73
TV	53.8
PC	8.6
Fridge	51.2
Telephone	24.4
Mobile phone	32.3

Source: Stats SA (2001)

Table 37: Household products: Census 2001

According to the census results, only 2% of black-headed households had a PC, compared to 46% of white-headed households.

In comparison, a survey in Kannaland, one of the most poverty stricken areas in the Western Cape, found that 70% of respondents owned a TV, 60% a radio, 47% a mobile phone, and 23% a landline phone. None of the interviewees owned a PC or fax machine. (Fourie, 2007)

2007 data from the South Africa Advertising Research Foundation (SAARF) shows the following:

- More than 56% of households have electric stoves
- 45.9% of households have microwave ovens (except for the Western Cape and North West)
- 80.1% of households have TV sets
- 44.9% of homes have DVD players (except for the North West)
- 72.5% of homes have a fridge, while 20.6% have a deep freeze

- 14.9% have top-loading washing machines

With these figures serving as a backdrop, our online survey aimed to flesh out the picture of household white goods, consumer electronics and IT, with a particular emphasis on our tracer products.

7.1 Survey results: general

A total of 358 households participated in the online survey. The respondents can be broken down into the following income categories:

Household income (ZAR/month)	No. of respon-dents
Less than 2,000	2
2,000 - 4,999	4
5,000 - 9,999	23
10,000 - 19,999	86
20,000 - 39,999	141
Over 40,000	82
Not defined	20
Total	**358**

Table 38: Household income of respondents

As can be seen, respondents were primarily from the upper-income categories, with over 90% falling into the top 10% household income group. This suggests that the quantities for some white goods, such as microwaves and washing machines, is likely to be higher than the average household, that spend on luxury consumer electronics will be higher, and that IT quantities will be high. Of all the income groups, the top 10% is likely to account for the highest level of domestic IT spend.[17]

The survey suggests that the total amount of e-waste (considering all product categories) generated by the top 10% of households by income is nearly 84,000 tons a year.[18] This can be broken down into the following categories:

Category	Tonnage of e-waste generated/annum	%
White goods	54,229	64
Consumer electronics	14,296	17
IT	16,379	19
Total	84,904	

Table 39: Estimated e-waste generated by top 10% of households overall

[17] Moreover, only people with a PC and internet access could fill out the online survey.

[18] To calculate this we divided the total tonnage of a product by the product's average age when it is discarded, suggesting an annual disposal tonnage.

In terms of tonnage generated per annum, as expected, white goods account for nearly 65%. This includes large household appliances such as fridges and freezers, washing machines, dish washers and tumble driers, as well as small household appliances, such as microwaves, toasters, kettles, vacuum cleaners, irons and hair dryers.

Interestingly, in tonnage terms, the amount of domestic IT e-waste in this income bracket is roughly the equivalent of consumer electronics discarded. IT e-waste products include PCs, laptops, photocopiers, printers, scanners and mobile phones, and consumer electronics include TVs, DVD players, Hi-fis, cameras and MP3 players.

Over 50% of respondents disposed of e-waste in municipal waste. However, over 33% of the respondents also show pro-active e-waste management by delivering discarded products to refurbishers or recyclers, or extending their lifespan in other ways, such as donating them. 8% of respondents said they put some e-waste out on the curb-side for informal collection, while the same number said they store e-waste.

E-waste disposal	% (of total)
Dispose in domestic waste	51
Donate	36
Take to refurbisher or recycling initiative	33
Deliver to local municipal collection point	15
Sell	13
Put on street (for informal collector)	8
Store	8

Table 40: E-waste disposal habits

The survey also suggests that 77% of the consumers dispose old batteries in domestic waste and 12% store them. Only 11% hand them back to retailers.

7.2 Survey results: tracer products

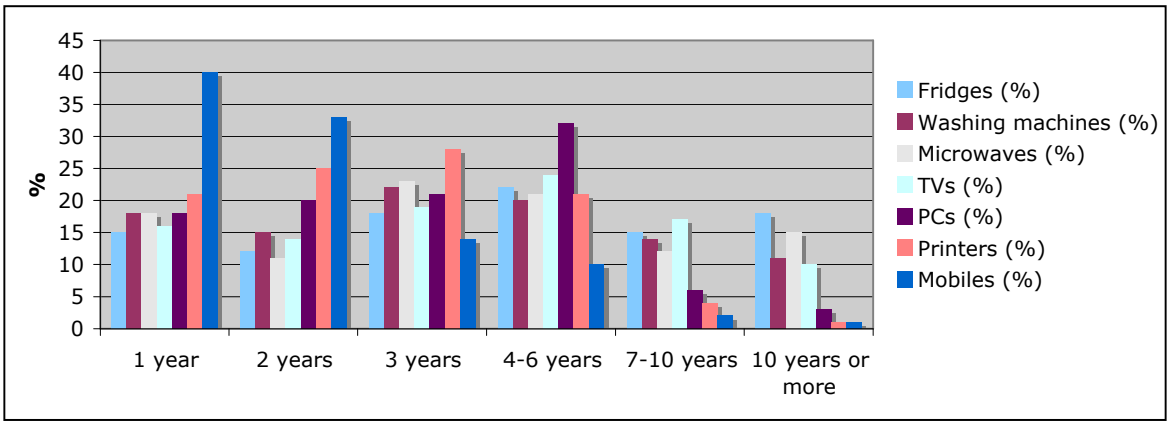
The table below gives a breakdown of the number of tracer products in use and in storage recorded in the survey (a total of 2,898 units). As can be seen, on average each household has more than two mobile phones, and at least one fridge, TV and PC.

	Fridges	Washing machines	Microwaves	TVs	PCs	Printers	Mobiles
Total	406	286	300	475	364	257	810
Units per household	1.13	0.8	0.8	1.3	1	0.7	2.3

Table 41: Units per household

Graph 1 shows the age of our tracer products. It suggests that of the three e-waste categories, IT has the shortest lifespan[19] in the domestic households. Fridges, washing machines, microwaves and TVs all have a comparatively longer domestic lifespan.

Mobile phones have the shortest lifespan of the tracer products, and few are older than six years. Similarly, few printers in the households are over six years. After six years, the number of PCs tapers off rapidly, with a spike at 4-6 years of age. In comparison, fridges, washing machines, microwaves, and TVs all appear to have a more 'stable' domestic lifespan with the number of products roughly balanced out over the different age categories.



Graph 1: Age of household tracer products

As Table 42 suggests, while IT equipment reaches it's the end of its lifespan in domestic households sooner than white goods, or even consumer electronics, there is a higher percentage of storage of IT products compared to the other tracer product categories. Nearly all of the fridges, washing machines, microwaves and TVs recorded in our survey are in use, while around 15% of the IT tracer products survey were in storage.

	Fridges (%)	Washing machines (%)	Microwaves (%)	TVs (%)	PCs (%)	Printers (%)	Mobiles (%)
In use	96	96	94	93	84	86	85
Storage	4	4	6	7	16	14	15

Table 42: Use versus storage

When we consider unit numbers, the extent of the domestic storage patterns becomes apparent. Amongst the 358 households participating in the survey, as many as 120 mobile phones, and 60 PCs were in storage.[20] In graphic volume terms, the amount of e-waste in storage in these households could be packed into two-thirds of a 20-foot shipping container.

[19] The term "lifespan" is used here to indicate the life of a product in a specific domestic setting, and not its overall lifespan (which includes refurbishment etc.).

[20] In comparison, 19 laptops (6%) were recorded as being in storage.

	Fridges	Washing machines	Microwaves	TVs	PCs	Printers	Mobiles
In use	389	275	283	440	304	221	690
Storage	17	11	17	35	60	36	120

Table 43: Units in storage

Table 44 below, gives the percentage breakdown of the tracer products that were purchased new and second-hand. As can be seen, nearly 20% of PCs were bought second-hand,[21] while most mobile phones tend to be bought new.

	Fridges (%)	Washing machines (%)	Microwaves (%)	TVs (%)	PCs (%)	Printers (%)	Mobiles (%)
New	86	89	92	88	81	90	93
Second hand	14	11	8	12	19	10	7

Table 44: New versus second-hand

Finally, Table 45 shows the breakdown of the different categories of lamps in households. As it suggests, on average the number of standard lamps is roughly the same as the number of CFLs in households falling in the top income brackets. Fluorescent tubes are more than likely used in some kitchens and bathrooms, and garages.

	Min. No.	Max No.	Average	Av. %
Standard lamps	6.5	11.6	9.05	44
CFLs	6.4	11.5	8.95	43
Fluorescent tubes	1.9	3.4	2.65	13
Total	**14.8**	**26.5**	**20.65**	

Table 45: Household lamps

7.2.1 Total household potential e-waste tonnage

It is possible to develop a 'guesstimate' of the total potential e-waste in households in South Africa – i.e. the total tonnage of white goods, consumer electronics and IT sitting in our homes.

If we take the number of households in South Africa to be 13,261,000, and adapt some of the data offered by Statistics SA, SAARF, amongst others, we can suggest the percentages of households with our tracer products (as in Table 46). From this, tonnage total for each tracer product can be arrived at.

	Households with product (%)	Total units	Average weight of product (kg)	Total weight of products (tons)
Fridges	72.5	9,614,225	45	432,640
Washing machines	14.9	1,975,889	65	128,432

[21] 58 (16%) of laptops were bought second-hand.

Microwaves	45.9	6,086,799	10	60,867
TVs	80.1	10,622,061	20	212,441
PCs (with monitor)	8.6	1,140,446	27	30,792
Printers	8.6	1,140,446	8	9,123
Mobile phones	70	9,282,700	0.15	1,392

Table 46: Percentage of households with tracer products

We can then offer low-end and high-end estimates of the percentage our tracer products make up of the total when considering the tonnage of the entire product category. For example, our household survey suggests that our tracer products make up 44% of the entire white goods category, 35% of the consumer equipment category, and 47% of the IT category. The high-end estimates can be seen in Table 47, largely accounting for poor households which have few household products.

	Tonnage of tracer products	Estimate % of total tonnage of household goods in each category (low-end and high-end)	
White goods	621,940	44	85
Consumer equipment	212,441	35	60
IT	41,308	47	95

Table 47: Tracer products as percentage of category

From these assumptions we can calculate the total domestic tonnage estimates, as in Table 48.

	Total tonnage (low)	Total tonnage (high)
White goods	731,695	1,413,502
Consumer equipment	354,068	606,974
IT	43,482	87,889
Total	**1,129,245**	**2,108,366**

Table 48: Total household tonnage estimates (minimum and maximum)

7.2.2 Country comparison

It is difficult to offer a direct domestic comparison to developed countries, because of the absence of comparable data. Table 49 compares the distribution of fridges and washing machines in South Africa in 2007 to the sale of those tracer products in several European union countries in 2005. This rough snapshot suggests that South Africa lags considerably behind in its purchase of washing machines compared to developed countries of a similar population size, but that the tonnage distributed for some e-waste categories, such as fridges, could be comparable.

	Population	Fridges	Units per capita	Washing machines	Units per capita
South Africa (2007)	47.59-million	636,000	0.013	564,000	0.011
Switzerland	7.36-million	258,000	0.035	161,000	0.021

United Kingdom	59.67-million	967,000	0.016	3,092,000	0.051
Spain	42.35-million	378,000	0.008	1,863,000	0.043

Source: http://ewasteguide.info; World Bank (Eurostat 2005)

Table 49: Comparative units distributed

8 Massflow Assessment

8.1 e-Waste flow diagram

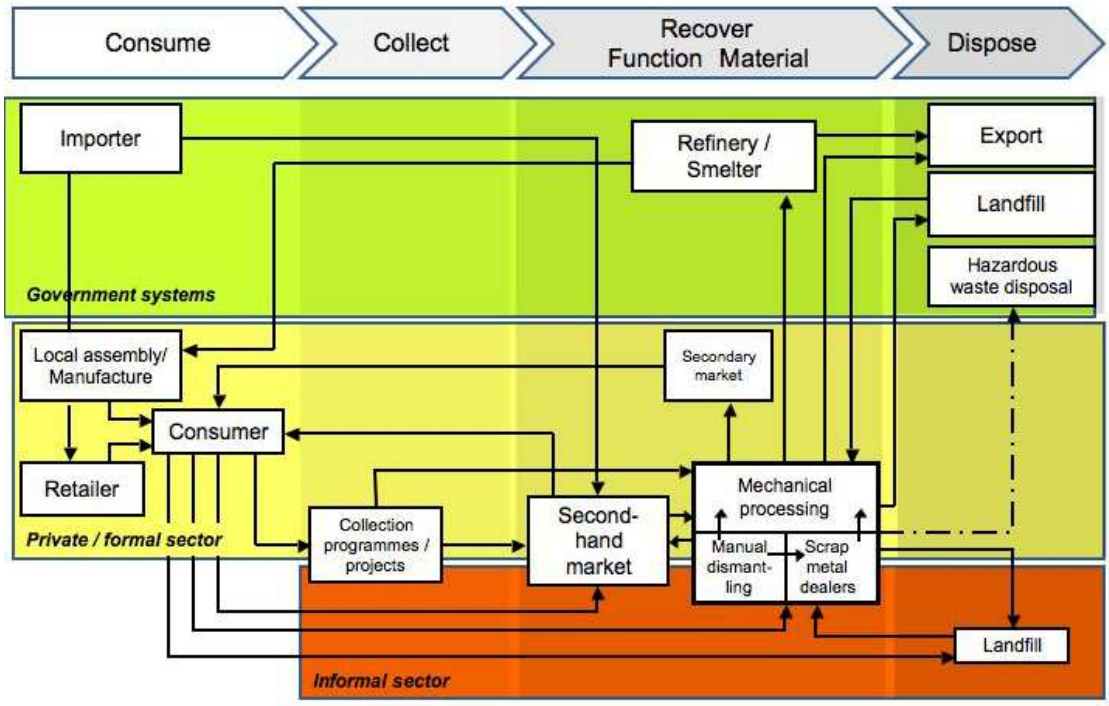


Diagram 1: e-Waste flow diagram

Diagram 1 graphically shows how e-waste flows circulate between the different stakeholders. The diagram represents the flow of all e-waste categories for our tracer products.

The green zone ("Government systems") represents part of the e-waste system that is closely monitored and controlled by the government. This includes importing, refineries and smelters, which require specific permits and are monitored and regulated, exporting, municipal landfills, which are mostly closely managed and monitored by local government, and hazardous waste facilities, which requires very specific permitting and controls. Products are imported by local assemblers and manufacturers, as well as directly by some retailers (e.g. IT and lamps). In Switzerland, which has an organised e-waste recycling system, all of the stakeholders fall into a green zone – even while the 'system' in the Swiss case is industry-led.

The yellow zone ("Private/formal sector") is mostly self-organising, and partly regulated in line with standard business controls. This zone includes vendors and manufacturers, retailers, consumers, second-hand and recycling businesses, and private sector formal collection initiatives.

The orange zone represents the informal sector. The informal sector is active in collection, in the second-hand market, manual dismantling, engaging with recyclers and scrap dealers, and on landfills.

As can be seen from the diagram, e-waste flows from the consumer – here the public, private and domestic sectors – in essentially four ways: to pilot e-waste collection initiatives, to landfill (via municipal waste) to the second-hand market, or directly to a recycler.[22]

From collection programmes and projects, it moves to the second-hand market for repair or refurbishment, or straight to recyclers. The collection programmes box is smaller, because either collection initiatives are stand-alone initiatives, or they are mostly trial e-waste collection programmes, some of which, such as the Makro/Fujitsu-Siemens partnership, having only started to consider mass roll-out.

From the second-hand market, the refurbished 'e-waste' is sold back to the consumer, or some fraction from the refurbishment process (about 5-15% for IT) ends up at recyclers. There is also direct importation into the second-hand market, as in the case of second-hand PCs and mobile phones.

Recyclers include manual dismantlers, scrap metal dealers and recyclers with mechanised processes. As suggested, there is some movement of e-waste between the recyclers. Some stock received by recyclers finds its way back into the second-hand market (such as PCs that are still usable).

Some fraction from recyclers enters the secondary market, in the form of waste to art, or plastics that are in turn recycled by plastics recyclers, and used for the manufacture of various products. Fraction, such as PCs boards, are also sent to smelters and refineries for precious metal extraction. Some e-waste fraction is exported by recyclers, including PC boards, non-ferrous metals, and plastics. Destinations include Europe (e.g. Umicore in Belgium for smelting) and Asia (e.g. China, for further manual separation of plastics and copper, or Singapore for processing PC boards through wet chemical refining). Fraction for which no market can be found is either stockpiled (e.g. batteries, plastics and CRTs), or sent to landfill.[23] Only some hazardous fraction is sent to hazardous waste sites.

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[22] A fourth option not marked here also exists in the case of PCs on lease (e.g. by IBM) being exported back to Europe for refurbishment. Similarly, refurbishers export PCs out of South Africa to the African market.

[23] Both 'landfill' boxes refer to government controlled landfill (i.e. including the landfill box in the "informal sector"). The boxes have been visually split here to simplify the diagram.

8.2 Current massflows

8.2.1 Massflow: PCs

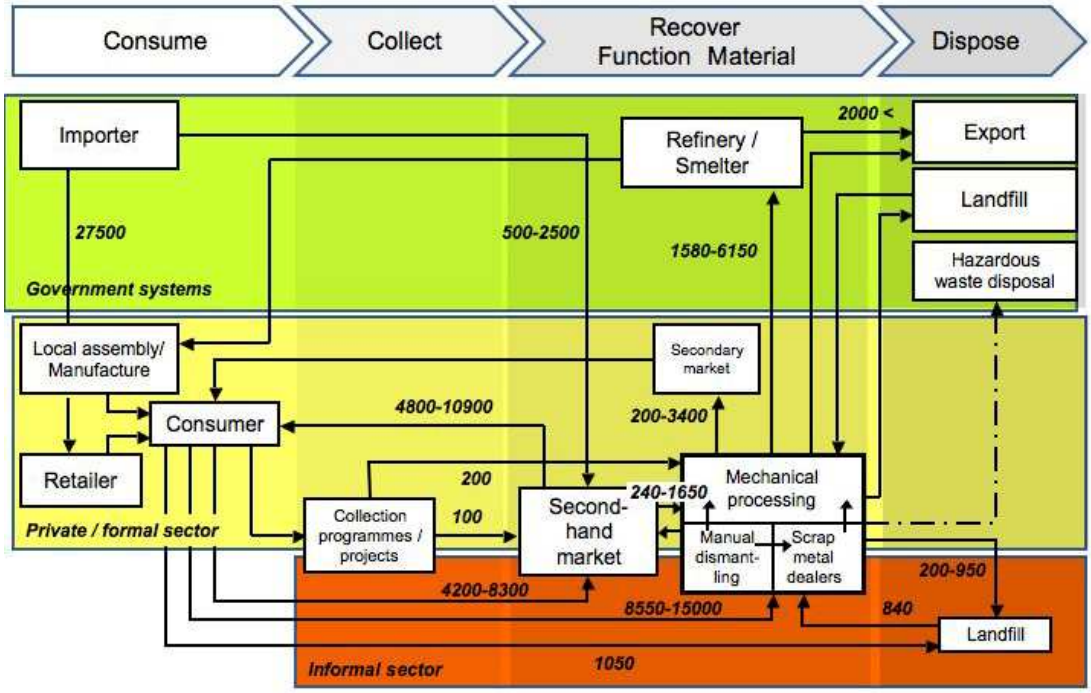


Diagram 2: Massflow: PCs (tonnage)

The PC massflow shows tonnage estimates for PC units and e-waste made up of PC parts and fraction. These estimates have been rounded off, and should be taken as illustrative. To get the unit equivalent of PCs, the tonnage estimate should be divided by 0.027 (i.e. 27kg). For example, the massflow suggests that between about 15,000 and nearly 43,000 PC unit equivalents currently end up in landfills across the country as a whole. It is important to stress that it is not the case that this number of PCs enter the landfill. The actual fraction that is landfilled is, for example, a mixture of discarded PC casings, some old monitors and keyboards, mice, a good few loads of shredded plastic, batteries, and other PC scrap of little value.

The tonnages figures are informed estimates, and cannot be scientifically exact. They are, however, in line with our site visit observations and data collected in our interviews, and through previous research conducted. The massflow diagram can be considered a snapshot that captures a bird's eye view of the life cycle of a PC based on currently available knowledge and assumptions.

The PC tonnage totals illustrate that:

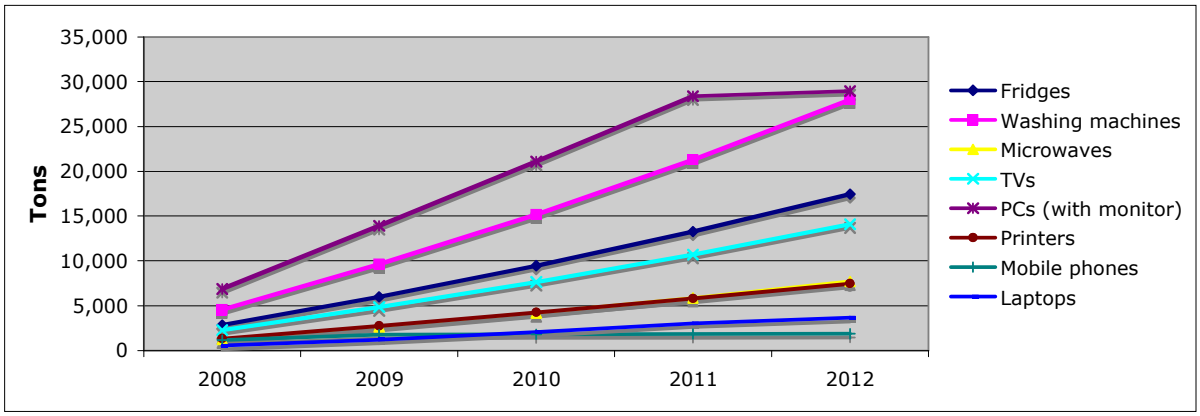
- The total number of PCs refurbished each year is between around 180,000 and 400,000 PCs.
- About 315,000 - 555,000 PCs are delivered directly from consumers to recyclers annually.

- The total number of PC equivalents recycled by recyclers is about 364,000 - 655,000 PCs annually. (Or, stated differently, more new PCs are sold into the market each year than are currently recycled).
- About 15,000 - 43,000 PC equivalents end up in landfill.
- It is possible that there is currently a balance between the number of second-hand PCs imported into the country, and the PC-equivalent of fraction exported to destinations in Europe and Asia. Any imbalance is likely to be in the favour of exports. This may go some way to allaying concern about the import of second-hand PCs into the country, or e-waste dumping as far as PCs are concerned. However, while flame-retardant plastics are exported, there is little evidence of the export of hazardous fraction such as CRTs and batteries by recyclers.

8.3 Future massflow trends

Using the data for units distributed for our tracer products, it is possible to project baseline e-waste volumes for the next five years (See Annex E). This projection is for 2008-2012, and includes all new units sold into the market of our tracer products. In order to account for the anticipated decline in new desktop PC sales,[24] laptop volumes are included here.

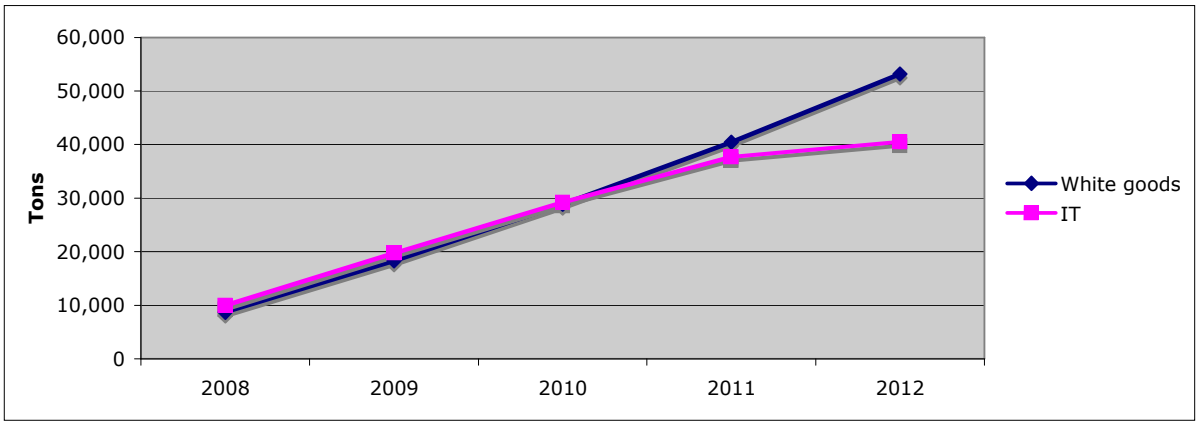
Based on current sector growth forecasts (See Section 6), Graph 2 shows that washing machines are likely to overtake desktop PCs as a tonnage percentage of the waste stream over the next 5-10 years. This means that they will enter the waste stream and either end up on landfills, at recyclers, or at repairers or refurbishers. It is also noteworthy that as commodity products, the tonnage percentage of the e-waste stream for microwaves and printers is similar.



Graph 2: E-waste projections (tracer products)

As Graph 3 suggests, while IT currently accounts for a significant percentage of the e-waste stream in tonnage terms, over time it is possible that white goods will become a primary driver of e-waste volumes (even with the inclusion of laptops in our waste stream projection). In terms of products sold into the market from 2007 onwards, this transition is likely to happen from about 2010 onwards.

[24] A token 2% growth for desktop PCs is used.



Graph 3: White goods and IT e-waste projections (tracer products)

It is important to emphasize that these projections do not take legacy e-waste into account (i.e. waste that is in storage, or that is the result of units distributed prior to 2007). Secondly, it may be the case that a higher proportion of white goods will be refurbished or repaired compared to IT. This will impact on the tonnage of white goods received by recyclers and at landfill. Finally, it is also important to bear in mind that even if white goods become the primary driver of e-waste volumes, this does not mean that they will be the most valuable part of the e-waste stream, or the most environmentally hazardous. However, these projections do suggest that we are likely to see more and more white goods entering the waste stream in the near future, including the second-hand market, at recyclers, and on landfills.

9 Impacts

9.1 Overview

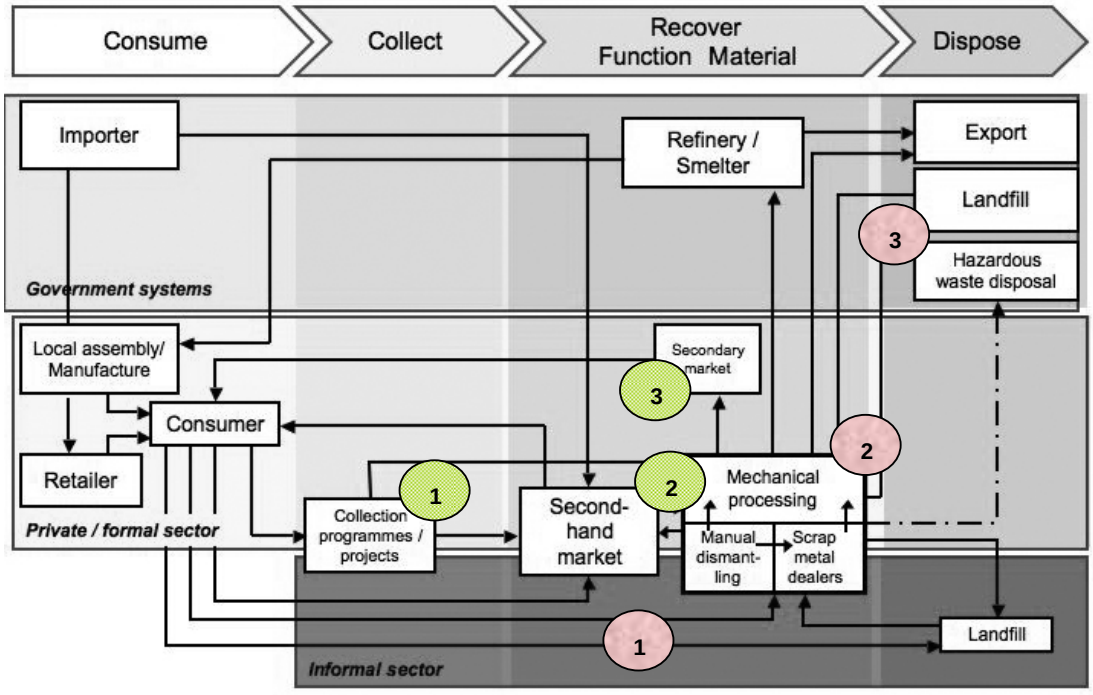


Diagram 3: e-Waste hotspots

Key 'hotspots' – both challenges and opportunities – of the current system in terms of the impact of e-waste in South Africa are shown in the diagram above:

Challenges: *Health and the environment*

1. Informal collectors are open to a range of threats, including health hazards, exploitation and violent crime. Environmentally unfriendly recycling also occurs.
2. Environmentally unfriendly recycling activities are found. Health and safety precautions for workers are also not always adhered to.
3. Hazardous disposal of e-waste fraction is minimal. Potentially hazardous e-waste is disposed in landfills.

Opportunities: *Business development*

1. The scaling up of collection programmes, including logistics, is a business opportunity. Informal collectors can be organized.
2. There are numerous business opportunities in the refurbishment and recycling sectors. New technology is needed. E-waste also has potential for small and micro-business development.

3. Opportunities for business development exist in the secondary market (e.g. recycling plastics to produce a range of products).

9.2 Social

As outlined, the collection, refurbishment/repair and recycling of e-waste occurs in both the formal and informal sectors. Each of these sectors offer different views of the social impact of e-waste in the country.

9.2.1 Formal sector

There was a mix of formal and casual employment of workers at the recyclers and refurbishers visited for this study. Most employers claimed a better-than-minimum wage for employees that were formally employed. Benefits were not standardized, but included incentive bonuses, and a provide fund. One new recycler aimed to offer workers shares in the company. At one recycler, workers, who are considered semi-skilled, were offered a course in English, and received on-site training for processes. Only some of the workers – typically at the bigger recyclers, such as Universal Recycling – were unionized.

Worker wages across the refurbishers and recyclers varied, ranging from R1,400 to R6,000 a month. However, hours were long, and ranged from 8.5-10 hour shifts. Two recyclers operated overnight shifts.

Table 50 gives a breakdown of the employment categories for one refurbisher:

Number of employees	50
Number in management	10
Permanent staff	35
Casual employment (paid on hourly basis at different rates)	15

Table 50: Categories of employment at a refurbisher

The number of women employed mostly ranged from 10-30% of staff, with some reports of a 50/50 split between the employment of males and females. Many women were employed for less technical or physical tasks, including administrative or cleaning duties, and for activities that required repetitive labour, including cleaning of equipment and sorting waste on conveyor belts. This general stereotyping was explained in positive terms by one recycler who said that men do not have the concentration spans to work methodically and carefully when sorting waste on conveyor belts, whereas he felt that women do. As a result the recycler only employs women for the task.

While health and safety regulations are followed at most of the sites visited – including, for instance, dust extractors on grinders – strict enforcement of the use of Personal Protective Equipment (PPE) sometimes appeared to be lax. The following instances of hazardous e-waste management for workers were observed:

- A lack of protection against noise (e.g. wearing ear-muffs on sites where large quantities of e-waste are shifted with heavy machinery regularly)

- A lack of protection for eyes (e.g. wearing goggles where e-waste is moved in large quantities, is smashed, and can easily cause harm)
- Potential problems with ventilation (in refurbishment processes)
- The unprotected use of cleaning agents (in refurbishment processes)

9.2.2 Informal sector

e-Waste is unlikely to be a primary waste stream for informal collectors and recyclers, who will typically work with a range of recyclables (e.g. cardboard, glass, any kinds of scrap metal, as well as old electronics). The more formalized informal collection activities become,[25] the more specialized informal collection is likely to become in terms of waste streams. Of the 40,000 plus informal recyclers estimated to be working in South Africa, it is likely that most of them, at some time or another, have dealt with e-waste.

In our household survey, we asked respondents to ask informal collectors who collected waste from their curb-side on municipal collection days what quantities of e-waste were collected. While most respondents were not able to, the following results were provided:

Amount	Number of respondents
No e-waste	15
1 - 10 kg/ month	3
20 - 50 kg / month	3
100 - 200 kg / month	4

Table 51: E-waste curb-side collection (informal collectors)

While these totals should only be taken as suggestive, when compared to a central collection point such as a Pikitup Garden site, where electronic e-waste quantities of 1.5 tons over two months have been recorded – or 750kgs a month – the possibility of one person collecting 200kg per month informally from curb-sides feels substantial.

While the informal sector in South Africa offers critical income generating opportunities for people, when it comes to e-waste, negative social impacts include:

- Open burning of plastics, both to extract value from metals such as copper, and for warmth
- Smashing of monitors to extract copper
- Exposure to hazardous substances generally
- A lack of basic safety equipment
- A lack of basic safety information about e-waste
- Vulnerability to e-waste traders (e.g. collectors do not have much leverage or bargaining power when negotiating with scrap metal merchants on prices)

[25] For example, through various programmes set up at landfills or municipal collection points.

- Other vulnerabilities associated with the informal sector, such as no guaranteed income, or other worker benefits
- Vulnerability to other informal traders (e.g. in protecting turf, or other power struggles over sources of e-waste)
- Exposure to violence and crime
- Illegal trading (e.g. with Telkom cabling)

Regarding the general vulnerability of informal collectors and recyclers, it needs to be noted that even in semi-organised settings, such as the Pikitup Garden Sites, power struggles between site entrepreneurs, informal collectors and recyclers, and even Pikitup staff have been reported.

9.2.3 Crime

In the South African context, a significant social impact of e-waste is crime. Crime ranges from petty yet inconvenient and costly theft such as stealing recycling bins,[26] to more serious and dangerous crime such as stealing cellphones or IT for re-sale, and the mass theft of copper cable, which is then sold to recyclers or even exported. A small recycler ('feeder') who collects e-waste from a range of sources and locations, including from Garden Sites, and who operates a cash trade, has reported several muggings and robberies, and has been shot on more than one occasion during the course of his work.

Copper cable theft is estimated to cost South Africa R500-million a year in direct costs. Annual losses to overall copper theft in Cape Town alone have been as high as R22-million, while recent crime-prevention measures have resulted in almost 200 arrests. Those arrested included a minor, a pastor and council officials, suggesting the widespread social impact of serious crime in the sector (Venter, 2008).

9.3 Environment

A number of recyclers interviewed take some level of care regarding the environmental impact of their recycling processes. For instance, Universal Recycling has developed an environmental management system to monitor the environmental impact of its business. Its environmental policy is laid out on its website, and quoted here in full:

Air	[Universal Recycling's (UR)] non-ferrous shredder is equipped with a liquicell multi-stage in-line scrubbing system to ensure that air pollution from the shredder is kept well within the standards for ambient air quality regulations.
Soil	[Its] facilities are concreted ensuring no release of oils, lubricants, coolants, or other soluble materials which could contaminate the soil and underground water.
Water	Water run-off including rainwater and processed water is diverted into various underground sumps and dams which are built all around the facility. [UR's] various processes which use water principally utilise the water collected in

[26] In one instance, it was thought that bins produced by the Johannesburg-based Resolution Recycling for its domestic recycling initiative, which includes collecting scrap metal, batteries and printer cartridges, were being stolen and sold to a buy-back centre.

	these sumps. This ensures that fresh water use is kept to an absolute minimum, and no contaminated water can leave our facilities.
Waste	[UR's] waste material is analysed on an ongoing basis and the company is continually looking at alternative solutions to its waste products.
General monitoring	All material arriving and leaving any of [UR] facilities must pass through [its] portal radiation detection equipment, ensuring the protection of [UR] employees, [UR] equipment, the environment and [UR] clients. Any contaminated material identified, is handled according to regulations and this material is taken out of the recycling loop.

Source: www.urc.co.za

Table 52: Universal Recycling's environmental management system

However, of 10 refurbishers and recyclers interviewed, only one was ISO 14001[27] compliant.

	No.
No	7
Yes	1
Busy with it	1
Partial fulfillment	1

Table 53: ISO compliance

Some environmentally problematic practices by the recyclers generally include:

- The mechanical shredding of monitors and white goods such as fridges (with the subsequent release of ozone-depleting and greenhouse gases)
- The stockpiling of hazardous fraction
- Passing hazardous fraction on to other recyclers, without proper knowledge of how it gets disposed
- Landfilling potentially harmful plastics for which no market can be found
- While one recycler insists that batteries are removed from IT e-waste before recycling, it does not know what happens to the batteries that are removed
- Premises that are not properly contained to prevent run-off of contaminated water
- E-waste exposed to rain
- Many recyclers do not treat effluents/leaching or water, or test landfilled fraction for toxicity
- While no recyclers report using hazardous substances like chemicals in any of their recycling processes, the on-site incineration of e-scrap was reported

[27] ISO 14001 is the international specification for an environmental management system: "It specifies requirements for establishing an environmental policy, determining environmental aspects and impacts of products/activities/services, planning environmental objectives and measurable targets, implementation and operation of programs to meet objectives and targets, checking and corrective action, and management review." (http://en.wikipedia.org/wiki/ISO_14000)

e-Waste is exposed to the elements at a recycler

The negative environmental impact of e-waste is obviously also found outside of the formal recycling sector. For example, the impact of the domestic disposal of CFLs, rechargeable batteries, and mobile phones on municipal landfills has not been quantified – and there is some disagreement in the waste sector regarding whether or not properly built and maintained landfills are suitable for containing the potential hazards from leaching. Collectors also face challenges. One interviewee suggested that a potential problem with CFL collection initiatives is that they increase the risk of exposure to mercury in concentrated form. At the same time, some e-waste dumping does occur in South Africa,[28] highlighting the need for a systematic approach to e-waste management and processes. The large-scale burning of cables was also photographed in Alexandra township, Gauteng, during the course of this assessment.

[28] E-waste dumping in Pretoria North was discovered by Tshwane officials.

Burning cables in Alexandra township, Gauteng

9.4 Economy

The recycling sector is now actively being recognized by government for its employment-generating potential. The recent scoping study commissioned by the *dti* is a case in point.

At face value, the business case for investing in e-waste recycling has probably never been as good. There exist numerous opportunities for large-scale investment in the e-waste sector, including investing in technology for the environmentally-sound recycling of white goods and batteries. There is also currently a level of public awareness and government encouragement that has perhaps been unprecedented in the country. This includes the local authority level, where municipal landfill managers are under pressure to reduce waste-to-landfill quantities and have, as a result, shown themselves willing to engage entrepreneurs who have viable and sustainable ways to help them do that. The potential for creative solutions, such as what to do with flame-retardant plastics, are already being explored by entrepreneurs. The gaps in the e-waste management chain, such as transport logistics, are also clear.

It is at the small or even micro-business level where an important impact of the e-waste sector is likely to be felt. For example, a small recycler based in Johannesburg has reported rapid business growth over the past year or so, in no small part simply through awareness-raising activities by eWASA, and by referrals from the likes of eWASA and Pikitup. In the space of six months he reported increasing his labour force from three to eight, and buying a 13-ton truck. Different business models are possible. Rather than pay workers a wage, a Gauteng-based recycler has opted for a model where the ‘employees’ “work for themselves”, and their take-home pay depends on the volume of e-waste processed (generally in the region of R850/week). This allows a flexible negotiation of the challenges faced by small-scale recyclers, such as finding sufficient sources of waste volumes, and fluctuating prices.

The Recover E-Alliance project in Cape Town has concretely demonstrated the small-business potential of e-waste recovery and recycling, including activities such as waste-to-art production. It has shown that at least a basic or minimum wage is possible through the manual environmentally sound recycling of e-waste. It is a business model that the project is hoping to blueprint and roll out across the country.

The project, started with seed funding from HP and the Digital Solidarity Fund, and support from EMPA and eWASA, has three core activities: testing/refurbishing; dismantling; and waste-to-art production. Fully operational, it is estimated the project will process some 100-150 tons of e-waste a year, and employ a total of 10 people. In about two months of initial start-up operations, the dismantling component of the project managed to generate about R25,000.

Even in recycling monitors alone, a business case is possible. The project offered the following figures paid for the fraction collected by dismantling a monitor:

Fraction	Price
Copper	R12/250g
Plastics	R0.60
Electronics	R1

Wiring	R0.50

Table 54: Prices of dismantling a monitor

Because the project has found that one worker can strip 10 monitors a day, provided the proper disposal of hazardous CRT glass was covered, this would mean that the worker could generate about R140 a day, or over R2,800 a month. The cost of floor space and tools would need to be covered by this, but it does suggest that a basic wage is possible through the manual recycling of monitors alone.[29]

CRT dismantling at Recover E-Alliance in Cape Town

The prices paid for e-waste fraction vary from deal to deal, and recyclers are typically reluctant to share their data. Some prices were collected during the course of this assessment, such as R8/kg paid for cables, and R48/kg paid for copper. One recycler was paid R50/ton for monitors by another recycler, while one smelter paid R850/ton for PC boards.

In comparison, one refurbisher said that if it bought a three-year old PC (2GHz) for R750, it would sell it to an end-user for R1,150 or to a dealer for R900. However the price margins in this transaction appear small, and it is likely that minimal refurbishment would be done on the PC. (The same refurbisher charged R350 for labour for laptop repairs, and R250 to fix PCs). In general, the prices for refurbished PCs are higher. For instance, Xperien's prices for refurbished PCs ranged from R2,999 for a Dell 2.4GHz, to R6,749 for a Dell 3.2GHz.

As far as disposal costs go, one recycler quoted a price of R850/ ton for sending CRT glass to a hazardous waste facility, while a collector quoted landfilling costs as R106/ton for general waste.

[29] Similarly, a small Gauteng recycler reported that monitors are economically viable, even when hazardous fraction is properly disposed.

The costs of disposing hazardous waste, as well as transport, are cited as key concerns for current large-scale recycling business models. One recycler suggested that it was not viable to transport e-waste from other African countries for recycling – and that it did not even make economic sense to transport e-waste from Cape Town to Johannesburg. With added pressure from government for businesses to comply with environmental protection and other measures, some businesses might be in jeopardy, or simply stop dealing in e-waste all together. The fate of the African Sky, the Gauteng-based e-waste recycler which recently closed down after only a few years of business, is suggestive. Any e-waste management system will need to take these challenges into consideration, as they do in other parts of the world through mechanisms such as an Advanced Recycler Fee paid by consumers.

10 Conclusion

10.1 Key findings

The following are the key findings of this assessment:

- The new National Environmental Management Waste Bill has direct implications for e-waste management, and effectively places the onus on industry to develop an e-waste management system.
- In tonnage terms, white goods are likely to become a key component of e-waste volumes in South Africa in the near future. However, the white goods sector is behind the IT sector in addressing the e-waste challenge in South Africa. This despite active engagement in e-waste concerns elsewhere in the world.
- The major challenges facing e-waste recycling include recycling CRT glass and LCD monitors, the disposal of rechargeable batteries, and markets for flame-retardant plastics. There is currently no technology in South Africa to recycle fridges in an environmentally positive way. While fluorescent discharge lamps are hazardous, they are receiving some industry attention.
- Many e-waste recyclers and refurbishers are not yet ISO compliant. While environmental management programmes are in place, challenges exist, including on-site incineration, exposed e-waste, and the insufficient containment of potential site run-off.
- Between 1,129,000 and 2,108,000 tons of potential e-waste is estimated to be in South African households. This includes white goods, consumer electronics and IT.
- In graphic volume terms, the amount of e-waste in storage in 358 middle-class households could be packed into two-thirds of a 20-foot shipping container.
- More new PCs are sold into the market each year than are currently recycled. At most about 30% of all PC sales in South Africa are estimated to be refurbished PCs.
- It is possible that there is a balance between the number of second-hand PCs imported into the country, and the equivalent of PC fraction (PC boards, plastics, metals) exported to destinations in Europe and Asia.
- Logistics, especially transport costs, is a key challenge to a sustainable e-waste management system. For white goods, storage costs and floor space are key cost drivers.
- At least a basic or minimum wage is possible through the manual environmentally sound recycling of e-waste.
- Basic worker health and safety precautions were not always adhered to at some refurbishers and recyclers, putting workers at risk.
- Informal recycling includes mostly the early stages of recycling – collection, crude dismantling and sorting. However, there is substantial burning of cables and other components, and the hazardous recycling of monitors.
- Crime has an impact on e-waste management in South Africa.

10.2 Strengths, opportunities and threats of the current situation

Strengths	Opportunities	Threats
Government is preparing regulations on e-waste.	South Africa is at the forefront of e-waste management in Africa, and is likely to be one of the first countries to develop an e-waste management system on the continent.	Some key sectors, such as the white goods sector, are not currently involved in local e-waste initiatives. At the same time, some IT vendors have not participated. This has the potential to weaken the emerging e-waste management system.
eWASA is developing an e-waste management system.	e-Waste offers an important opportunity for job creation and economic development.	Current recycling processes do not on the whole deal effectively with hazardous waste.
Key industry stakeholders are actively participating in the development of the management system.	There is an opportunity for the scaling up of recycling technology, including for processing white goods, lamps and batteries.	The holistic environmentally sound processing of e-waste has the potential to disrupt current recycling business models.
Current recycling processes are relatively sophisticated, and in some instances are in line with international standards.	South Africa has the potential to become a regional e-waste recycling hub.	Health and safety precautions are not uniformly enforced or adhered to in some recycling activities.
		Crime and recycling industry corruption.

Table 55: Strengths, opportunities and threats of current system

10.3 Recommendations

Industry participation: eWASA is currently in the process of setting up an industry-led e-waste management system. The government has now taken an active interest in e-waste, and specific regulations are in the pipeline. The environmentally sound recycling of e-waste is a necessity, and will impact on the sectors discussed in this report. It is incumbent on all stakeholders, including vendors, retailers, collectors, and recyclers to get proactively involved to help shape the emerging system. In particular, there is a need for the white goods sector to engage the current processes.

Public education: Awareness-raising around the proper disposal of e-waste is necessary. Specifically, a grassroots public education programme needs to be launched by government to educate informal collectors and recyclers and others as to the hazards of working with e-waste. This includes the implications of burning plastics, the smashing of monitors, and mercury in CFLs.

Technological investment: There is a need for technological investment in the recycling sector. This includes technology for the environmentally-sound recycling of fridges, rechargeable batteries, and fluorescent discharge lamps. This investment could be supported through state incentives.

Small business development: The potential for small business development in the e-waste sector is high. Pilot projects such as Recover E-Alliance that aim to share their business model with others need to be actively supported, as do start-up collection and recycling businesses. The kind of support needed is business training, funding and access to networks.

Recycling impact assessment: A study that scientifically measures the impact of current e-waste recycling processes on the environment may be necessary.

Health and safety: The on-site health and safety of workers dealing with e-waste needs to be properly monitored. This may need to include training and awareness-raising amongst some recyclers.

Informal collection and recycling: Informal collectors and recyclers should be supported through things like training, providing suitable equipment, and even brokerage when negotiating prices with recyclers. A specific study focusing on informal collection and recycling in South Africa may be necessary.

Monitoring and information-sharing: The systematic monitoring of e-waste quantities as a waste stream would be useful to the industry. This could include recording e-waste quantities at landfill, in collection initiatives, and by recyclers. This information could be shared through an organisation such as eWASA.

Import of second-hand products: Separate import codes for second-hand IT, white goods, and consumer electronics would assist in developing a credible e-waste management system in South Africa, and better our understanding of e-waste flows.

11 Annexes

Annex A: References

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Key websites

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CIA World Factbook: www.cia.gov
eWASA (info): www.e-waste.org.za
eWASA (home): www.ewasa.org
ITWeb: www.itweb.co.za
Parliamentary Monitoring Group: www.pmg.org.za
Plastics Federation of South Africa: www.plasfed.co.za/
South Africa Advertising Research Foundation (SAARF): www.saarf.co.za
SouthAfrica.info: www.southafrica.info
South African Government Information: www.info.gov.za/
Statistics South Africa: www.statssa.gov.za)
Swiss e-waste guide: http://ewasteguide.info
Wikipedia: http://en.wikipedia.org/wiki/South_Africa
World Bank Developmental Indicators: www.worldbank.org/data

Annex B: Primary data totals

Product	Units import	Units export	Units difference	Av. weight/unit	Total weight (tons)	Year	Source
Fridges	544,427	139,130	405,297	45	18,238	2007	SARS
Washing machines	(177,216)*	(7,099)	(170,117)	65	(11057)	2007	SARS
Microwaves	930,053	44,899	885,154	10	8,851	2007	SARS
TVs	1,248,043	93,086	1,154,957	20	23,099	2007	SARS

* Data in brackets could not be verified.

Units imported: White goods and consumer electronics (2007)

Product	Estimated units produced*	% of total	Total weight (tons)	Year	Source
Fridges	135,099	25	6,079	2007	Interview
Washing machines	(42,529)	20	(2,764)	2007	Interview

* Based on import data

Local manufacture: White goods (2007)

Product	Sales	Year	Source
Fridges	540,396	2007	SARS + est.
	732,000	2007	Interview
Washing machines	540,000	2005	Doc 1.
	564,000	2007	Interview
Microwaves	538,000	2004	Doc 1.
	660,000	2007	Interview
TV (HD only)	(300,000)	2007	Radio interview, 702

Sales and other data: White goods and consumer electronics

Product	Units import	Units export	Units difference	Av. weight/unit (kgs)	Total weight (tons)	Year*	Source
New							
PCs	115,092	11,694	100,398	12	1,204	2007	SARS
Monitors (CRT)	623,422	10,779	612,643	14	8,577	2007	SARS
Monitors (LCD)	435,115	28,288	406,827	5.7	2,318	2007	SARS
Laptops	633,703	41,024	592,679	3.5	2,074	2007	SARS
Printers	542,412	70,129	472,283	8	3,778	2007	SARS
Mobiles	13,256,667	796,327	12,460,340	0.15	1,869	2007	SARS
(Second-hand)*							
Mobiles	720,000			0.15	108		Interview

* Second-hand totals should be included in total import figures.

Units imported: IT

Product	Sales	Year	Source
PCs	1,000,000	2007	Interview
Printers	844,565	2007	Interview
Laptops	650,000	2007	Interview

Sales: IT

Annex C: e-Waste collection initiatives

National	
Fujitsu-Siemens MassMart	Fujitsu-Siemens and MassMart have partnered with recyclers to provide e-waste collection points for IT e-waste at Makro stores. Pilot project at Woodmead Makro, Gauteng.

Nokia	Nokia has established a take-back system for mobile phones. At the moment there exist 34 take back points, mostly at service outlets. All makes of mobile phones are accepted. It plans to expand the system and add take-back points at retailers. At the moment the discarded phones are destroyed and recycled in Europe.
Uniross Philips Pick n Pay	Uniross has partnered with Pick n Pay in a battery collection initiative at its stores nationwide. Batteries collected by Uniross. Pick n Pay is also collecting CFL lamps in partnership with Philips Lighting.
NOVA Woolworths	NOVA Lighting and Woolworths have launched a CFL take-back initiative at 46 stores nationwide.
Wildlife & Environment Society of South Africa (Wessa)	Wessa collects CFLs and rechargeable batteries are various points across the country.
Gauteng	
Resolution Recycling	Resolution Recycling provides households with bins for the collection of various recyclables, including metal, cartridges, and batteries.
Pikitup	Residents of Johannesburg can dispose of e-waste at 25 Pikitup Garden Sites across the city. (see: www.pikitup.co.za for details)
City of Tshwane	City of Tshwane offers e-waste collection at some of its landfills, although the initiative is in its early stages.
University of South Africa (UNISA)	UNISA has set up an e-waste collection point on campus in Pretoria.
Western Cape	
Wasteman	General waste services. Has started to collect e-waste separately.
Municipal drop-offs	Wynberg Municipal Drop-off Rosmead avenue Wynberg
	Atlantis Municipal Drop-off Dassenberg Road Atlantis
	Hout Bay Municipal Drop-off Main Road Hout Bay

NOVA	Nova Lightning collects linear fluorescent lamps and CFLs from customers for free. The linear lamps are crushed, processed and disposed by Enviroserve. There is no recycling or recovery of materials involved.
HP Recover E-Alliance Wasteplan	The Recover E-Alliance facility in Cape Town receives its e-waste through different channels. Discarded equipment of companies is collected by Wasteplan, a company which is specialized in collecting and sorting recyclables.
Wessa	31 The Sanctuary, Off Pollsmoor Road, Kirstenhof, Cape Town
KwaZulu-Natal	
Re-Ethical	Re-Ethical is a waste collection and recycling company in Durban. They collect recyclables (paper, glass, plas-tic, cardboards, metals) mostly from companies. E-waste is collected separately and is dismantled and sorted manually.
Wessa	1 Karkloof Road, Howick
Other	Pavillion Shopping Centre
Eastern Cape	
Mustek	Mustek – Eastern Cape Division 39 Pickering Street Newton Park Port Elizabeth
Wessa	2B Lawrence Street, Central Port Elizabeth

Annex D: Consumer Survey: e-Waste Assessment South Africa

Region

Gauteng KwazuluNatal Western Cape Eastern Cape Free State Limpopo Mpumalanga Northern Cape North-West	

Suburb

Household Equipment

Mark how many items you have in your household for each product.

IT Equipment

Number of Items	0 1 2 3 4 5 more
Photocopiers Fax machines Laptops LCD screens (e.g. flat screen TVs; LCD computer monitors) Mobiles Standard computer monitors (CRTs) Modems PCs Phones (other than mobile) Printers Scanners	

Consumer Equipment

Number of items	0 1 2 3 4 5 more
Electric/battery-run alarm clocks Cameras	

DVD players Electrical musical instruments Game consoles MP3 players Projectors Radios Hi-fis TVs Video players	

Large Household Appliances

Number of Items	0	1	2	3	4	5 more
Freezers Dish washers Tumble dryers Electric heaters Fridges Grillers (separate from stove or oven) Hobs (separate from stove) Ovens (separate from stove) Steam ovens Stoves Washing machines						

Small Household Appliances

Number of Items	0	1	2	3	4	5 more
Blenders Coffee machines Electric lawn-mowers Electric toothbrushes Electric fans Hair dryers Irons Kettles Microwaves						

Mixers Pool cleaners (e.g. Kreepy Krauly) Pop-corn makers Toasters Vacuum cleaners	

Tracer Products

In our study we want to have a closer look at certain tracer products for each of the product categories.

Please specify for every item you have the following things:

- If you bought it new or second-hand
- How old it is
- If it is in use or in storage
- If it is working, broken (but fixable) or totally broken

	Purchase	Age [years]	State of Equipment
	new/ second-hand	1 2 3 4-6 7-10 more	in use/ in storage/ working/ fixable/ broken
PC 1 PC 2 PC 3 PC 4 PC 5			
Laptop 1 Laptop 2			
Printer 1 Printer 2 Printer 3			
Mobile 1 Mobile 2 Mobile 3 Mobile 4 Mobile 5			
TV 1 TV 2			

TV 3			
Fridge 1 Fridge 2 Fridge 3			
Washing machine 1 Washing machine 2			
Microwave 1 Microwave 2			

Lightning Equipment

	0	1-2	3-5	6-10	11-20	21-40	more
Fluorescent tubes Light bulbs Long-life light bulbs							

How do you get rid off old batteries?

Domestic waste Store them Hand them back to the retailer	

How many people live in the household?

1 2 3 4-6 more	

What is the income of the whole household?

less than 2'000 R/month	
2'000 - 3'999 R/month	
4'000 - 4'999 R/month	
5'000 - 9'999 R/month	
10'000 - 19'999 R/month	
20'000 - 39'999 R/month	
over 40'000 R/month	

How do you dispose of your e-waste?

Bin/municipal street waste	
Take it to local municipal collection point	
Take it to refurbisher/ recycler	
Donate	
Sell	
Street (informal collector)	
Recycling initiative	
Everything in storage	

Can you name or describe the refurbisher/recycler or the recycling initiative of the question above?

Can you interview your local informal waste collector and ask how much e-waste she/he collects? If you do not want to do this, check 'no answer'.

No answer	
No e-waste	
1 - 10 kg/ month	
20 - 50 kg / month	
50 - 100 kg / month	
100 - 200 kg / month	
more	

Annex E: E-waste projections (tracer products)

Year	2008
TVs	**2310**
PCs (with monitor)	**6885**
Printers	**1351.4**

Mobile phones	**1178**
Fridges	**2862**
Washing machines	**4582.5**
Microwaves	**1264.3**
Laptops	**568.6**
	21001.8

Year	2009		Total
TVs	2310	2541	**4851**
PCs (with monitor)	**6885**	7022.7	**13907.7**
Printers	1351.4	1418.97	**2770.37**
Mobile phones	**589**	1201.56	**1790.56**
Fridges	**2862**	3148.2	**6010.2**
Washing machines	4582.5	5040.75	**9623.25**
Microwaves	1264.3	1390.73	**2655.03**
Laptops	**568.6**	682.32	**1250.92**
	20412.8	22446.23	**42859.03**

Year	2010			Total
TVs	2310	2541	2795.1	**7646.1**
PCs (with monitor)	**6885**	7022.7	7163.154	**21070.854**
Printers	1351.4	1418.97	1489.9185	**4260.2885**
Mobile phones		600.78	1225.5912	**1826.3712**
Fridges	**2862**	3148.2	3463.02	**9473.22**
Washing machines	4582.5	5040.75	5544.825	**15168.075**
Microwaves	1264.3	1390.73	1529.803	**4184.833**
Laptops	**568.6**	682.32	818.784	**2069.704**
	19823.8	21845.45	24030.1957	**65699.4457**

Year	2011				Total
TVs	2310	2541	2795.1	3074.61	**10720.71**
PCs (with monitor)	**6885**	7022.7	7163.154	7306.41708	**28377.27108**
Printers	1351.4	1418.97	1489.9185	1564.414425	**5824.702925**
Mobile phones			612.7956	1250.103024	**1862.898624**
Fridges	**2862**	3148.2	3463.02	3809.322	**13282.542**
Washing machines	4582.5	5040.75	5544.825	6099.3075	**21267.3825**
Microwaves	1264.3	1390.73	1529.803	1682.7833	**5867.6163**
Laptops	**568.6**	682.32	818.784	982.5408	**3052.2448**
	19823.8	21244.67	23417.4001	25769.49813	**90255.36823**

Year	2012					Total
TVs	2310	2541	2795.1	3074.61	3382.071	**14102.781**
PCs (with monitor)		7022.7	7163.154	7306.41708	7452.545422	**28944.8165**
Printers	1351.4	1418.97	1489.9185	1564.414425	1642.635146	**7467.338071**
Mobile phones				625.051512	1275.105084	**1900.156596**
Fridges	**2862**	3148.2	3463.02	3809.322	4190.2542	**17472.7962**
Washing machines	4582.5	5040.75	5544.825	6099.3075	6709.23825	**27976.62075**
Microwaves	1264.3	1390.73	1529.803	1682.7833	1851.06163	**7718.67793**
Laptops		682.32	818.784	982.5408	1179.04896	**3662.69376**
	12370.2	21244.67	22804.6045	25144.44662	27681.95969	**109245.8808**