

# ***e-Waste in New Zealand***

## **TAKING RESPONSIBILITY FOR END-OF-LIFE COMPUTERS AND TVS**

An investigation by the Computer Access NZ Trust (CANZ) with financial support from the Minister for the Environment's Sustainable Management Fund, which is administered by the Ministry for the Environment.

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CANZ is a not-for-profit trust, established with support from the Ministry of Education, to promote the recycling of computers for schools. John MacGibbon and Laurence Zwimpfer are CANZ trustees.

*The Ministry for the Environment does not endorse or support the contents of this publication in any way.*



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## 1.0 Executive summary

The average New Zealand household has two or more television sets and more than one computer, representing a total of over seven million electronic devices.<sup>1</sup> Their eventual disposal represents a potential toxic threat to our environment. Combine this with computers outside homes, and the e-waste challenge increases to 16 million devices, including 10 million cathode ray tubes (CRTs). In 2005, 830,000 new televisions and computers were sold. Many of the newer TV and computer products are less toxic to the environment, but few are benign and all will need to be disposed of when they too reach end-of-life.

This is a challenge and a threat that New Zealand cannot ignore. Most of the 10 million TVs and computers use a cathode ray tube (CRT) as the display device, and in this component alone there are numerous toxic materials, including lead, barium, beryllium, cadmium, hexavalent chromium, selenium, mercury and arsenic to name a few. Furthermore, the plastics used in equipment casings typically contain brominated flame retardants. All of these substances are dangerous for human beings and animals, if they are released into the atmosphere by burning or allowed to leach into the soil or waterways.

Like other developed countries, New Zealand's track record in minimising waste is not good. Though we have improved waste management in some sectors, the overall volume of waste that we generate continues to grow. This includes e-waste. New Zealand has not yet focused on solutions for e-waste, in contrast to the situation in some sectors, including paper, glass, paint, oil, car batteries and tyres, where efforts are being made to manage the safe disposal of waste products.

This report aims to kick-start an industry-led response to the e-waste problem.

New Zealand is not alone in addressing the safe disposal of e-waste. Overseas manufacturers are helping by designing new products that do not rely on the use of toxic materials. Lead-free soldering in some computers is a good example. The move to flat LCD (liquid crystal displays) and plasma screens, which within a few years are expected to almost completely replace CRTs, will help to reduce the overall impact of e-waste – though they are not free of toxic materials. Governments are also helping by implementing legislation to ensure that all producers conform to new standards. Recyclers are helping by recovering re-usable metals and directing waste materials to manufacturers of other products. Consumers are helping, albeit unknowingly, by storing old equipment in garages, basements and cupboards, pending the development of safe disposal methods. It is estimated that around half a million end-of-life TVs and computers are currently being stored in New Zealand homes.

While we can feel good that others are taking responsibility for reducing the problem for the future, this does not address New Zealand's current dilemma. What are we going to do about our stock of 16 million units – especially the 10 million CRTs – when they inevitably reach end-of-life?

This report explores options available to New Zealand and draws on experiences in other countries, especially Sweden, Ireland and Australia, as well as in other sectors in New Zealand, including the packaging, oil and agricultural container sectors.

We conclude that the way forward requires a 'whole-of-society' approach to e-waste responsibility from the producer to the consumer – what we have termed 'eResponsibility'. Some countries are seeking greater responsibility from the manufacturer, not only in terms of setting design standards but also in allocating responsibility for 'take-back' schemes. Such schemes are typically referred to as extended producer responsibility (EPR) schemes. We

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<sup>1</sup> Computer processor boxes and monitors are counted separately. Not all are being used – some are in storage.

found that representatives from the major computer and TV brands in New Zealand and Australia were open minded and accepting of the need to build in (or design out) the cost of disposal. As they pointed out, this was already happening on a global scale and in the future, New Zealand would get the same benefits. However they accepted that this did not deal with the 10 million historic and orphan<sup>2</sup> products already in use. They also expressed a willingness to share responsibility for these products but were concerned about how free-riders could distort a highly competitive market which has shrinking margins. They sought reassurance that Government would play its part and regulate to ensure fair contributions from all suppliers.

eResponsibility does not end with the producers or their New Zealand distributors. Retailers have a critically important role to play in both educating consumers and helping make it easy for them to return end-of-life equipment to appropriate collection points. Computer refurbishers, who sell second-hand equipment and currently bear an unfair share of the cost of eResponsibility, are also critical to the success of any e-waste scheme. Computer recycling currently operates with a strong community focus, often using voluntary or low cost labour. As the cost of new computer equipment has plummeted in recent years, resellers have faced an increasing challenge to cover the cost of collection, refurbishment and resale (or stripping and disposal) and still compete with new equipment. If New Zealand is to get serious about e-waste, a new business model is required for these resellers. Why are they any less important than others in the supply chain? Retailers, for example, are not expected to operate not-for-profit businesses with voluntary labour. Why do we expect this from resellers and refurbishers?

***Recommendation:*** that computer refurbishers and other organisations involved in managing e-waste be encouraged to evolve their businesses towards sustainable and profitable enterprises, employing qualified staff.<sup>3</sup>

However, the other side of the coin for refurbishers and recyclers is standards and accreditation. In order to achieve a standing similar to that enjoyed by other players in the electrical and electronic industries, recyclers will need to accept the need for training to industry-agreed standards. This suggests the need for a code of practice and some waste industry qualifications; these will become especially important if recyclers wish to compete for industry-funded contracts to manage e-waste. The funders of these schemes will require some reassurance that the recycling operators have a minimum level of competency in the handling of e-waste.

***Recommendation:*** that refurbishers and recyclers should collaborate with Government, through Standards New Zealand, to develop an industry code of practice for recycling computers and TVs.

***Recommendation:*** that the development of unit standards for e-waste be progressed with the Resource Recovery Sector Advisory Group and the Extractive Industries Training Organisation.

The other parties bearing an unfair share of the e-waste burden are local authorities. Society has allocated them responsibility for establishing and managing consumer waste, including e-waste. Effectively the only waste disposal option available to local authorities is the landfill

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<sup>2</sup> Historic and orphan products: we use 'historic' to refer to products that have already been sold to the consumer and 'orphan' to refer to mainly unbranded (but some branded) products where it would now be difficult to identify any responsible producer.

<sup>3</sup> This recommendation and the others included in this executive summary highlight the key proposals arising from this study. A more detailed schedule of recommendations is included in Section 12.

and while reported volumes of e-waste are relatively low compared to total landfill waste (2-3%), this could quickly increase if householders decided to empty their garages. The extent to which toxic materials in computers and TVs will leach into the environment from landfills is debated internationally. Some studies suggest no negative impacts, but then timescales of these studies are typically no more than 10 years. What will be the impact in 100 years or 200 years? Do we want to be remembered as the generation that destroyed the environment for our descendants? In some parts of the world, including California, governments are unwilling to take the risk; they are simply banning toxic substances, including TVs and computers from landfills. For New Zealand, this is not the answer, at least for today. A landfill ban would most likely drive consumers to dump their e-waste in even less secure ways. Our goal should be to develop incentives for consumers to dispose of their e-waste in an environmentally friendly way.

***Recommendation:*** that local authorities be encouraged to start developing plans for community-based drop-off points for unused computers and televisions.

Which brings us to how consumers can exercise eResponsibility. This will require a major education campaign. The Dell-supported community eDay, to be held in Wellington in September 2006, could provide a model for raising consumer consciousness. In the meantime the best advice we can give consumers is to continue to store old electronic equipment or take computers that still have life in them to a computer refurbisher, where they can be cleaned and resold to schools and not-for-profit community groups.

***Recommendation:*** that suppliers support initiatives such as eDay to help raise community consciousness about the safe disposal of e-waste.

New Zealand also has a responsibility to other countries in terms of exporting e-waste. The Basel Convention governs the global movement of hazardous waste and while shipment between countries is not prohibited, permits are required that ensure waste is not transferred to unsafe facilities that could pollute the environment and endanger the health of community, especially in less developed countries. We discovered New Zealand-based operators who are exporting container loads of CRTs, apparently without the necessary permits. This is an issue that the Ministry of Economic Development, as the government agency responsible for administering the Basel Convention, needs to address with some urgency.

***Recommendation:*** that Government, through the Ministry of Economic Development, should strengthen enforcement of the Basel Convention requirements on the export of hazardous waste (including e-waste).

The Government, through the Ministry for the Environment, has sent clear signals to all industries producing products that end up as problem waste, that solutions need to be developed (preferably by the industries most directly involved). Product stewardship (PS) is a preferred approach, with players in each industry sector working collaboratively to develop and implement industry-wide voluntary product stewardship schemes. Given their highly competitive and fast-moving nature, electronic industries, especially the computer industry, are a challenging environment in which to develop collaborative initiatives. Recognising this, we recommend that the largest suppliers (who have the greatest stake in any product stewardship scheme) be asked to negotiate a solution that works for them. The solution would include establishing a producer responsibility organisation (PRO), on a tight timeframe – we are

suggesting that a taskforce be established immediately, supported by a wider industry consultative group.

***Recommendation:*** *that the major television and computer suppliers establish a taskforce to develop a product stewardship scheme in collaboration with government.*

***Recommendation:*** *that an industry consultative group be formed with representatives from all stakeholder groups.*

In parallel, Government should develop the necessary regulatory framework to give teeth to the adopted solution and ensure all industry players buy-in. While this might seem somewhat heavy-handed, the alternative could be a ‘talk-fest’ that drags on for years with no real resolution. There is certainly evidence from other countries that until there is regulatory ‘bite’, it is too easy for some players to opt out, which reduces the motivation for others to engage. Government has already signalled to industry that it is committed to playing its part, but this must now be followed up with legislative action.

***Recommendation:*** *that Government develop free-rider legislation to ensure industry-wide compliance to a product stewardship scheme*

New Zealand has a slight advantage compared to other countries; other countries have taken the lead in addressing the e-waste problem and we can learn from these developments in choosing the best approach for New Zealand. In particular, we noted the close relationship between many New Zealand computer and television suppliers and their parent organisations in Australia. This was particularly evident with a number of local companies referring us to Australia, where they had centralised environmental management issues. We think this is a strength, and as a result we would encourage ongoing close collaboration with the Australians.

***Recommendation:*** *that the taskforce cooperate with Australia. This might include direct Australian representation on the taskforce and it could include information sharing with relevant Australian organisations.*

We are pleased to report that there are technical and commercial alternatives to landfills for TVs and computers. While these alternatives are somewhat limited in New Zealand today, we have concluded that with the right product stewardship scheme in place with effective local collection points, there are commercial recyclers who will respond to the opportunity with safe extraction processes and the recycling of component materials. One Australian operator claims to be recycling 95% of all the materials in computers and TVs including the CRTs; European operators are achieving 80%. In these countries the residual waste (mainly plastics) is typically burnt in high temperature incinerators for energy recovery.

The challenge is to be able to bring steady flows of e-waste to centralised physical locations for processing. One estimate suggested a flow of 60,000 units per annum was the minimum required to justify establishing a single recycling and CRT rendering plant. Fortunately, there are options available relatively close by (in Australia and Singapore) to provide New Zealand with an early-start option while the flow of e-waste builds up. Some local authorities have already established e-waste collection points, typically at existing landfills. The main costs that would need to be met from a product stewardship scheme would be the transport of e-waste from these local collection points to centralised processing facilities, whether these were located in New Zealand or (initially) offshore. The local authorities have stressed that they



cannot place any further burden on ratepayers. A key role for the taskforce would be to agree a mechanism and funding formula for covering these transport costs.

***Recommendation:*** *that the e-waste Task Force give priority to developing funding schemes for covering the cost of transport to overseas e-waste processing facilities as a quick-start option.*

We were also impressed with the innovative uses of e-waste in new products, such as the shipping pallets and fenceposts being manufactured by a Melbourne plastics recycler from co-mingled e-waste plastics. In Christchurch, TerraNova is trialling manufacture of decorative tiles from CRT glass. This led us to recognise the opportunity for research and development in both e-waste minimisation and in the re-use of e-waste materials. We would encourage investment in R&D in this area, as clearly this is an area of increasingly global concern. While New Zealand may not be able to directly influence the manufacturing processes for TVs and computers, our researchers could contribute to a better understanding of the development and use of environmental-friendly materials in the design of new products.

***Recommendation:*** *that the computer and television industries should collaborate with Government in encouraging investment in research into new markets and processing techniques for e-waste materials, and into more enviro-friendly materials for initial product manufacture*

## 2.0 Introduction

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### 2.1 e-waste in New Zealand

New Zealanders have enjoyed TV for some 50 years and computers for nearly 30 years. During this time we estimate that the number of TV sets and computers has accumulated to approximately 10 million representing a total of 16M separate electronic devices (a computer processor box and monitor are counted as two devices). The great majority of these devices include a cathode ray tube (CRT), which is used to display the picture in the case of a TV or the software application in the case of a computer. CRTs have been described as ‘toxic time bombs’ and many are now entering our landfills.

In New Zealand today, there are limited options available to consumers, recyclers and local authorities for the safe and economic disposal of computer and TV waste, especially the CRTs.

End-of-life computers and TVs, along with mobile phones and other consumer electronics, are often referred to as electronic waste or e-waste.

This report focuses on desktop computers and TV sets, not because other types of e-waste are unimportant, but because computers and TVs are a major source of a wide range of toxic e-waste materials and a significant recycling challenge for New Zealand.

We believe that if problems for desktop computers and TVs are highlighted, and product stewardship solutions found, there is a good chance that solutions for other sources of e-waste will follow. For instance, procedures and facilities established for handling end-of-life computers and TVs could well be adapted or used for other forms of e-waste. Trying to solve problems for all forms of e-waste at the same time could bog the process down for all e-waste.

Toxic materials in electronic waste include lead, barium, beryllium, cadmium, hexavalent chromium, selenium, mercury, arsenic, PCBs (Polychlorinated biphenyls), and plastics containing brominated flame retardants. All of these materials are dangerous for human beings and animals if they are released into the atmosphere by burning or allowed to leach into the soil or waterways. Internationally, governments and manufacturers have worked together to ban the use of many of these materials from the manufacture of new equipment. New Zealand is already benefiting from these developments with some brand owners starting to promote the compliance of their products to these new standards<sup>4</sup>.

However, this does not address much of the equipment that is already in New Zealand. As noted above, there are an estimated 10 million devices with CRTs in New Zealand, and although they are increasingly being replaced with flat screen technologies, they remain a formidable toxic threat. But even with reducing numbers, CRTs are still being manufactured, and the new flat screen display devices themselves are not contaminant-free. It is essential that society takes responsibility for the safe disposal of this e-waste. It is time for a new community responsibility – for eResponsibility.

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<sup>4</sup> The ‘European Directive on the Restrictions of the Use of Certain Hazardous Substances’ in electrical and electronic equipment (known as the RoHS Directive) came fully into effect on 1 July 2006 for all electronic or electrical equipment sold in Europe.

## 2.2 eResponsibility

The Government's *Waste Strategy for New Zealand*<sup>5</sup> provides a context for this by calling on the electronic industries – manufacturers, retailers, brand-owners, recyclers and consumers – to share responsibility (and costs) for minimising and managing e-waste.

Both the environment and business can benefit from the thoughtful recycling of waste electrical and electronic equipment. There is evidence to suggest that New Zealanders have a relatively high level of consumer awareness about the benefits to the environment of recycling and that most have a desire to do the 'right thing'. However, when it comes to e-waste, it appears that consumers are uncertain exactly what the right thing is. There are no weekly collections of e-waste, as there are for paper and glass, and as a result, unused computers and TVs are frequently stored in spare rooms and garages. Two major suppliers of computer equipment – Dell and Hewlett-Packard – have developed 'take-back' schemes associated with responsible e-waste disposal, although there can be costs involved with older equipment and collection from more remote areas. While these schemes meet the needs of the corporate market, there is little awareness of them in the consumer (home) market. No other computer or TV suppliers provide environmentally acceptable take-back schemes for either home or business.

The Ministry for the Environment is currently undertaking a 'product stewardship' policy review and has recognised e-waste as waste that could be managed by a product stewardship scheme. The Government has made it clear that its preferred approach for dealing with e-waste is for voluntary industry-led solutions with shared responsibility.

## 2.3 Computer Access NZ Trust

Within this context, the Computer Access NZ Trust (CANZ) applied to the Sustainable Management Fund for support to carry out an exploratory study into good-practice solutions to address computer and TV e-waste. This report is the result of this work.

CANZ is a not-for-profit trust, established with support from the Ministry of Education, to promote the recycling of computers for schools. The Trust has been looking at options for the safe and efficient disposal of computer equipment as part of its mission to ensure affordable equipment is available to schools, especially those in disadvantaged communities. Its work involves promoting the reuse of computers wherever possible but also the recycling and safe disposal of end-of-life equipment. The viability of companies which refurbish computers for the CANZ programme has come under increasing pressure from growing stockpiles of end-of-life equipment – notably computer monitors, for which there are no environmentally acceptable disposal avenues inside New Zealand.

## 2.4 Product stewardship

The Ministry for the Environment describes product stewardship as "a 'cradle to grave' tool that helps reduce the environmental impact of manufactured products."<sup>6</sup> Under product stewardship schemes, producers, brand owners, importers, retailers, consumers and other parties accept responsibility for the environmental effects of their products – from the time they are produced until they are disposed of.

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<sup>5</sup> Ministry for the Environment and Local Government New Zealand, *The New Zealand Waste Strategy: Towards zero waste and a sustainable New Zealand*, March 2002.

<sup>6</sup> [www.mfe.govt.nz/issues/sustainable-industry/initiatives/product-stewardship/index.html](http://www.mfe.govt.nz/issues/sustainable-industry/initiatives/product-stewardship/index.html) Viewed on 12 June 2006.

The Government's preferred approach to product stewardship is for industry groups to develop voluntary schemes that:

- Ensure products are disposed of with the least environmental impact.
- Support the development of recycling industries for certain products.
- Reduce the amount of resources needed to produce products.
- Facilitate the reuse, recycling or safe disposal of a product.

However, in a product stewardship discussion document released by the Ministry for the Environment in July 2005<sup>7</sup>, the Government made it clear that, while it preferred an industry-led voluntary approach, it was investigating 'backstop' legislation to ensure that *all* industry participants in priority sectors such as e-waste engage in product stewardship. The Ministry for the Environment has indicated that it is building a policy proposal to present to the Government in mid 2006. If this is approved, empowering legislation could be presented to the House of Representatives by the end of 2006.

## **2.5 Report scope**

The scope of this report includes documenting current practice in New Zealand for disposing of end-of-life computers and TVs, identifying good practice options for addressing the e-waste problem both from overseas as well as from other sectors in New Zealand, and making specific recommendations for an industry-led initiative.

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<sup>7</sup> Ministry for the Environment discussion document, *Product Stewardship and Water Efficiency Labelling*, July 2005.

## 3.0 New TV and computer market in New Zealand

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The focus of this report is on TV sets and desktop computers as major sources of a wide range of toxic e-waste materials. We examine the present infrastructure of the computer and TV industries in New Zealand, from sales and distribution of new equipment to end-of-life disposal. This information provides the context within which a product stewardship scheme would operate.

### 3.1 Television sets

The usual sales channel for new TVs is retail stores, especially large chains including Harvey Norman, Noel Leeming, Bond and Bond, The Farmers, Retravisión, 100% Your Electric Store, Smiths City and The Warehouse. A relatively small proportion of televisions are sold in brand-owners' own stores, such as Dick Smith Electronics and Sony Centres. The former is the only outlet for Dick Smith product, while the latter accounts for only about 3% of Sony TV sales in New Zealand.

None of the retail groups contacted operated a take-back or trade-in system for TVs, so second-hand or end-of-life disposal was not a current issue for them.

All TVs in New Zealand are imported. The top three brands, Philips, Panasonic and Sony, share about 75% of the market. Other commonly sold brands include Samsung, JVC, LG, Sharp, Hitachi, Dick Smith and Digitor. Industry figures<sup>8</sup> show that 294,000 television sets were sold into the New Zealand market in 2005.

While their presence is growing in small consumer electronic items categories, parallel import companies<sup>9</sup> are not selling TVs (except small in-car receivers) or computers.

### 3.2 Computers

The sales and distribution infrastructure for computers is considerably more complex. Whereas TVs are sold mainly to homes by retailers, the computer market is much wider and sales and distribution channels are many and varied.

#### 3.2.1 Home market (including some small business)

There are four main channels for new computers:

1. Retail shops – including the same chains selling TVs, except for The Farmers. A wide range of brands is available – especially Hewlett Packard (HP), Lenovo (the renamed IBM range), Acer, Dell, Apple and a variety of locally assembled 'whitebox',<sup>10</sup> models often bearing retailers' name badges. Some of the retailer chains sell only laptops.
2. Direct from 'whitebox' assemblers. Major assemblers include Insite, Arche, Cyclone and PB Technologies. Some of these assemblers produce desktop computers with retailers' brand names on them – for instance PB Technologies assembles computers for Dick Smith Electronics.

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<sup>8</sup> CTV Market Intelligence report prepared for New Zealand television companies.

<sup>9</sup> [www.ETOWN.CO.NZ](http://www.ETOWN.CO.NZ) and [www.PARALLELIMPORTED.CO.NZ](http://www.PARALLELIMPORTED.CO.NZ)

<sup>10</sup> 'Whitebox' computers are locally assembled from imported parts, most of which come from Taiwan or China. Almost all of them run the Windows operating system, which would normally be purchased in New Zealand.

3. Website/phone sales (these include smaller operators such as ComputerStore and the large Dell operation, through which most of the company's computers are sold (some Dell product is also retailed at The Warehouse and Warehouse Stationery.)
4. Auction through Trade Me (mostly locally assembled by small operators).

As with television sales, none of the large retail chains contacted operate take-back or trade-in systems for computers and they are not currently concerned with second-hand or end-of-life disposal. Dell and HP offer take-back or trade-in processes – but these schemes do not have a high profile in the consumer market.

Though common in the commercial sector, renting of computers by householders is rare. Only 1% of home market respondents in a recent UMR survey<sup>11</sup> rented a computer system. One company that offers rent and rent-to-buy options to home users is Flexirent, a subsidiary of retailer Harvey Norman.

### **3.2.2 Commercial market (corporates, government, education)**

Systems for distributing new computers into the commercial market are more complex and varied and they include a significant amount of leasing – around 20% for one market leader.

Corporates can purchase directly from resellers, but more often purchasing is done via intermediaries:

Outsourcers and systems integrators who set up and roll out computer systems on behalf of client organisations – examples include EDS, Gen-I, Divers Group, Fujitsu, Datacom, Unisys, Computerbrokers, LanTech, HCC Pacific and numerous local IT companies.

Lease and/or finance companies. Major-brand companies have their own finance/lease subsidiaries. Examples are Dell Financial, IBM Global Financing and HP Financial. A variety of brands is also financed or leased through independents including CIT Group, Equico, TeRenco Finance, UDC, Macquarie Finance.

### **3.2.3 Main computer suppliers to New Zealand**

In the first quarter of 2006, the top five suppliers of *all computers*, including laptops, were, according to IDC:

1. HP (including former Compaq) (29%)
2. Acer
3. Dell
4. Toshiba
5. Lenovo (formerly branded as IBM)

This quarter saw Acer move into second position for the first time. Percentage share is only supplied by IDC for the leading vendor.

The top five suppliers in quarter 1, 2006, for *desktop computers* only, were:

1. HP
2. Dell
3. Acer
4. Lenovo
5. NEC

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<sup>11</sup> This survey, carried out in January 2006, is described in section 6.1.

**Table 1. Computer shipments<sup>12</sup> in New Zealand, 2001-2005**

		2001	2002	2003	2004	2005
<b>Desktop</b>	Business	160,586	173,044	210,766	228,727	207,383
	Home	105,701	107,802	117,546	125,367	109,643
<b>Desktop total</b>		<b>266,287</b>	<b>280,846</b>	<b>328,312</b>	<b>354,094</b>	<b>317,026</b>
<b>Notebook</b>	Business	47,451	58,909	85,580	96,440	120,550
	Home	8,669	12,328	28,618	49,171	95,210
<b>Notebook total</b>		<b>56,120</b>	<b>71,237</b>	<b>114,198</b>	<b>145,611</b>	<b>215,760</b>
<b>Total units</b>		<b>322,407</b>	<b>352,083</b>	<b>442,510</b>	<b>499,705</b>	<b>532,786</b>

Source: IDC

Annual shipments of desktop and laptop computers increased steadily over the period, with total numbers in 2005 65% higher than five years earlier. Cumulative totals over the five year period were: desktops, 1.5 million; laptops, 600,000; total 2.1 million.

Notebook computers gained market share from desktops throughout the period, with the rise particularly marked in homes. By 2005, almost half computers sold into homes were laptops.

**Table 2. Increasing share of laptops**

<b>Notebook share of total computer shipments</b>	<b>2,001</b>	<b>2,002</b>	<b>2,003</b>	<b>2,004</b>	<b>2,005</b>
Home	8	10	20	28	46
Business	23	25	29	30	37

Source: IDC

**Whitebox share of the desktop market:** there is disagreement within the industry about the real size of the whitebox market, with estimates ranging from 16% to 50%. The 50% claim was made by a large local whitebox assembler. IDC<sup>13</sup> estimated the whitebox share in 2005 to have been 30%, down from 39% in 2001. Microsoft, which sells operating system licences to assemblers, believes the whitebox market share is much lower, at about 16%, down from 35% five years ago. Microsoft's original equipment manufacturer (OEM) register has 650 New Zealand purchasers of operating system software. Of these, only about 70 are businesses that regularly build PCs and sell 16 or more units a month. However, whether the whitebox market share is 16% or 50%, it is a sizeable component and cannot be ignored when developing any product stewardship scheme. Suppliers of branded equipment would not accept the competitive distortion that would be created if the whitebox sector did not participate in an extended producer responsibility scheme.

<sup>12</sup> IDC definition: shipments are counted as the number of units sold into the channel within the country of intended final use or those sold directly to end-users in a given period (also known as 'sales-in'). 'Sales-in' shipments may reach the channel or end-user directly by way of a local subsidiary or local representative. If a shipment is held in inventory by a local subsidiary, it is not included in 'sales-in' until it is sent into the channel or to the end-user in direct sale cases. Local subsidiaries are not considered part of the channel. In OEM situations, shipments are attributed to the company whose name appears on the final product. Shipments are counted once the system is sold into that company's channel or to an end-user.

<sup>13</sup> The IDC estimation techniques take a number of aspects into account including performance of the larger suppliers, shipments of processors into the market and sales of Windows operating systems. IDC is currently reviewing its estimation techniques.

### 3.3 Links with Australia

Sales and marketing in New Zealand for most major brands of both computers and TVs is a subsidiary operation, reporting to parent organisations in Australia. Decisions on policy matters, including environmental issues, tend to be made in Australia. Alignment with Australia is expected to be an important consideration when considering the development of production stewardship schemes for e-waste in New Zealand. This is discussed further in Section 10.2.5. Some companies have more direct links with Asian 'parents'.

### 3.4 Key points

TVs (all imported) are sold mainly to homes, usually by retail chains. Trade-ins are rare.

The top three TV brands make up 75% of the market.

Sales and distribution for computers is more complex, with different models for home and commercial outlets.

While most home computer sales are through retailers, a greater variety of sales and distribution channels exists for the commercial sector.

An increasing proportion of home computer sales are made through the Internet, either through mail order (Dell) or through Trade Me auction.

Most commercial computer purchases are made through intermediaries (outsourcers, systems integrators and lease companies), rather than direct from computer companies or from retail outlets.

Overall computer sales including laptops in New Zealand are growing (533,000 units in 2005), but the desktop share is declining. (83% in 2001; 60% in 2005.)

Whitebox computer sales made up 16%-50% of the local desktop market in 2005.

Sales and marketing for major TV and computer brands is largely controlled by Australian and Asian parent organisations.



## 4.0 Used TVs and computers

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Unlike many other types of waste, TV sets and computers are often still functioning when an end-user decides on upgrading or replacement. Home and small business users may try and find someone who can put the equipment to ongoing use but they are just as likely to store the equipment in a shed or garage. Commercial users are more likely to have a relationship with a supplier who can make arrangements for the used equipment to be refurbished or disposed of by auction.

### 4.1 Home/small business

Distribution channels for functioning second-hand home equipment are relatively few in number and mainly informal. They include:

Giving equipment away to *family and friends*.

Giving to *community recyclers*.

Giving equipment to *local authority recycling drop-off points* (limited, but such services are available free in Dunedin, Christchurch and Porirua). There are plans to introduce drop-off/recycling facilities in Auckland City and Waitakere City. Only a few hundred refurbished systems are sold through this channel each year throughout New Zealand. Porirua City sold about 100 computers last year through its 'Trash Palace' recycling centre. Some of these computers were assembled from recovered parts. In Christchurch computers are received by the Council's recycling contractor on condition they, or at least some of their components, can be sold. Similar facilities are in Dunedin and Invercargill. Computers given to these programmes (and to all smaller scale recyclers), tend to be older and less capable. They are increasingly hard to sell due to competition from cheap low-end new computers with much better performance.

Sale via *classified advertising and local auctions*.

Sale via **TradeMe** online auction.

Trading in via the **Dell recycling programme**, for rebate vouchers to be spent on Dell products. (See the separate boxed item on Dell.)

A very limited amount of *trade-in* by retailers.



TradeMe has become a significant outlet for sales of computers, computer components and television sets. Broad sales levels can be estimated from statistics available on the website itself, using techniques suggested by the company.\* Current annual sales extrapolated from sales in May 2006, are in the order of:

- Computer systems: 22,500
- CRT monitors: 13,000
- Desktop box components: 80,000
- Laptops: 32,000
- TVs – CRT type: 17,000.

The growing scale of TradeMe operations is clear from the company's rise in membership – March 2003: 167,000; March 2004: 395,000 March 2005: 900,000, March 2006: 1.2m. Listings have risen in proportion to the member base.

*\*Items are listed on TradeMe for an average of one week, so multiply current listings by 52. Then apply separately listed 'sell-through' proportions for individual categories. Sell-through means the proportion of listed items that actually sold over the previous month. Note that while this technique yields approximate figures for overall sales, it cannot divide those total sales between new and used. Listings numbers can be split between new and used, but not sell-through rates. New items comprised 31% of computer system listings and 54% of desktop box component listings.*

***Storage in a garage, shed or cupboard.*** Survey data suggests relatively large quantities of used TVs and computers are being stored in private garages, sheds and cupboards. In many cases, they clutter homes, because of users' reluctance to 'throw out' something of possible value or because they are unaware of how it can be disposed of safely.

## Local authority recycling ~ Christchurch

Recycling of municipal waste has been taken further in Christchurch than in any other city. Material is collected at three locations, some of it processed into new raw materials and many items given a new life by selling them through a huge 'SuperShed' at Aranui. SuperShed's products include electronic goods such as computers and all manner of computer peripherals including printers.

Computers can be dropped off free of charge at recycling facilities, if centre staff see a market for them. Items that don't pass this test are charged for and sent to the regional landfill at Kate Valley in North Canterbury. In practice, most computers and monitors are accepted because it is difficult to test them at the receival point. Anything that is accepted and found to be broken or unsellable ends up at Kate Valley, at the recycling facility's expense.

Items are tested and some repairs carried out, in an electronics workshop at the SuperShed.

In practice, the SuperShed keeps only a small proportion of Christchurch's older computers out of the landfill. Only about two working computers are sold each week. In common with other small-scale computer recyclers, the SuperShed tends to get older stock and finds it hard to compete with more capable new computers being sold at increasingly low prices.

Christchurch City Council subcontracts its recycling operations to TerraNova, a not-for-profit trust. Terranova has established an operating arm, Meta NZ Ltd, to run the EcoDepots.

TerraNova is experimenting with making decorative tiles from the leaded glass in computer monitors. (See Section 9.2 below.)



*Receival facility at the Sockburn EcoDepot.*



*Computers among household goods received at the depot.*



*Repair facility at the SuperShed.*



*Computers and printers on sale at the SuperShed.*



## 4.2 Commercial computer equipment

Computers installed in corporate and government organisations are usually replaced every three years, though most schools probably keep them for longer. A number of companies are involved with collecting and disposing of functioning commercial computers.

Following are the broad avenues of collection and disposal:

***Outsourcers/systems integrators/leasing companies/decommission agents.*** When these companies roll out new systems for clients, they usually take the old equipment away. They rarely on-sell to end-users, but pass on or sell (and sometimes donate) via intermediaries – auction houses and refurbishers.

***Auction houses:*** the major auction houses are Turners Auctions, Fitz-Gerald Auctions and Gray's Auctions. These auction houses sell at physical auctions and website auctions. Increasing numbers of computers are also sold through TradeMe. Auction houses sell direct to the public, to smaller dealers who may on-sell through TradeMe and to refurbishers, who mostly on-sell to the final user.

***Refurbishers:*** sometimes known as resellers or remarketers, these companies security-wipe hard drives, tidy up, test and on-sell large numbers of computers, mainly to individuals, small business and schools. They receive computers from decommissioning agents or may collect themselves. Some have direct links with computer companies. Larger refurbishing companies include RCN (linked with IBM/Lenovo), Remarkit Solutions (linked with Dell), HCC Pacific (linked with HP/Compaq), The Computer Broker, The Ark, NZ Computer Sales and Public Technology. Smaller scale community recyclers do similar work, often supplying refurbished equipment to local community organisations. Examples include Computer Recyclers New Zealand in Tauranga, Palmerston North PC Recycling, Molten Media in Christchurch and Jensen Technical Services in Invercargill. Local community recyclers often receive older equipment and their ability to re-sell it is under increasing pressure from cheap new low-end computers.



*Remarkit Solutions in Wellington refurbishes computers for resale after their first life in corporate organisations. Remarkit has links with Dell Computer.*



*Refurbishing computers at The Ark in Auckland. The Ark is accredited by CANZ to refurbish donated corporate and government equipment for use in schools.*

***Donation:*** local businesses, government organisations and tertiary education organisations sometimes donate equipment directly to schools and community groups. On a larger scale, corporate and government computers are donated to refurbishers accredited by Computer Access NZ Trust (CANZ), for refurbishment and on-sale to schools and not-for-profit

community groups. The accredited refurbishers are The Ark in Auckland and Remarkit Solutions in Wellington. This programme is supported by the Ministry of Education.

***Dell take-back operation:*** for computers (including non-Dell brands) to be refurbished and re-sold – operated in conjunction with Remarkit Solutions. Dell’s website says that in general, payment is only made for computers less than three years old.

### 4.3 Key points

Distribution channels for used home equipment are relatively few in number and mainly informal (largely give away to family and friends, give to small-scale recyclers, local authority recycling drop-off points, second-hand sale).

TradeMe has become a significant and fast-growing sales outlet for home sellers.

Significant quantities of used TVs and computers are being stored in domestic garages, sheds and cupboards, in the absence of readily available disposal channels

Commercial computer installations usually have a three-year life-cycle and a well-established, interlinked system of larger companies is involved with their collection, refurbishment and re-sale – at increasingly low prices.

Few refurbished computers are sold by local authorities and small recyclers, largely because their products are older and under price pressure from newer refurbished machines and the reducing cost of new equipment.

Some commercial computers are donated through the CANZ system for refurbishment and sale to schools and the community, but the numbers are relatively low.

## 5.0 End-of-life equipment disposal

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While the useful life of TV sets and computers can be extended by passing on used equipment to friends and family, or in the case of computers, by donating or selling equipment to a recycler or refurbisher, eventually the equipment will come to an end of life and have no further use. This is a challenge for every developed country, including New Zealand.

### 5.1 End-of-life TVs

The most common method of disposal of unwanted TV sets is by dumping them in a landfill. Home owners typically store old TVs until the local authority or a community group organises an inorganic waste collection day. Equipment is then left on the kerbside for collection. Households with suitable transport and a willingness to pay landfill charges may transport unwanted equipment to a landfill collection point, but the much larger monitors and TVs that have been popular during the last decade will create an increasing disposal challenge, as these require more than one person to carry them and will not fit in an average-sized car.

### 5.2 End-of-life desktop PCs and monitors

A variety of options are available to householders and to corporate/government users. However, most of these result in a cost to the user, which reduces the incentive to dispose of end-of-life equipment in an environmentally responsible manner, especially for home and small business users. Larger businesses and government departments have the incentive to ensure that hard disk drives are wiped clean but some find it less costly to physically destroy the drives with a drill and hammer than to dispose of equipment through recyclers.



*Unwanted computer gear sharing storage space with discarded bicycles at Massey University. The computer equipment is stored by Palmerston North PC Recycling, which is supported by the city council and the university. Old computers, particularly superseded council stock, are refurbished for schools and community groups in the city. The group's viability is being threatened by a build-up of unsaleable and faulty stock, especially monitors. The present storage facilities are probably only available for another 12 months.*



*Showroom at Molten Media Trust recyclers in Christchurch. Sales of equipment and components are declining due to increasing buyer resistance to older equipment while more capable new equipment is available cheaply through retailers like The Warehouse and online through TradeMe. Molten Media now concentrates on stripping computer boxes for raw materials, mostly with 'free' labour supplied by individuals doing court-ordered community work. Molten Media's surplus computer monitors are exported in containers by Ashburton company, Professional Business Systems.*



### 5.2.1 Home/small business:

Options for disposing of end-of-life computer equipment that are available to home users and small businesses include:

**Storage** This can be for a significant length of time – up to several years.

**Take to landfill** (at disposer's cost). The most common disposal method.

**Kerbside collection** by local authority, although this is rarely available. Auckland region councils are among the few authorities that provide this option for electronic goods.

**Drop-off** at recycling/refurbishing companies. Some companies and recycling trusts, including Jensen Technical Service, Molten Media, Palmerston North PC Recycling and Computer Recyclers New Zealand, accept equipment at no charge, though sometimes with caveats. These organisations will often charge for security wiping of data on hard drives. Computer Recyclers will not accept equipment older than Pentium 166s and Jensen Technical Service is reconsidering its no-charge policy.)

Some companies, such as The Ark, have storage problems and have begun to reject unusable equipment brought in by the public. Remarkit Solutions will accept all equipment but charge for uneconomic equipment to compensate for the cost of eventual disposal.

**Local authority recycling centres.** Most work in this area appears to be carried out in Porirua, Christchurch, Dunedin and Invercargill. While these local authorities may not insist on the equipment being fully functional, they expect at least some parts to be re-usable.

**Dell recycling scheme.** Under this scheme Dell will, for a fee, arrange pickup anywhere in New Zealand for any brand of computer. (See opposite)

**HP** effectively excludes home and small business from its 'Planet Partners Hardware

## DELL TAKE-BACK SERVICE FOR HOME AND SMALL BUSINESSES

Dell is the only computer company offering a recycling service for home and small business users in New Zealand that is not tied to purchase of additional company product. The service is not free, but is available for any make of computer.

For a fee, Dell will arrange pickup anywhere in New Zealand. Within 40 kilometres of the CBD in Wellington, Auckland and Christchurch there is a flat charge of \$10 and then a charge of \$13 per unit 'unit' (the desktop box and monitor are separate units). Outside the 40 kilometre radius restriction, the flat charge is \$15. Fees are lower (\$8.50 per unit) if equipment is dropped off at Dell agents in Auckland and Wellington.

People with functioning computers, generally under three years old, can apply to have computers picked up and receive rebate voucher payments toward purchase of new Dell equipment. The company's website's low suggested values would be unlikely to attract home users, who might prefer to pass equipment on to a friend or relative, or store it.

Dell recycling was announced in late 2004, but it has not been actively promoted to home users except through the website, where there is a small recycling link. In 2005, Dell collected about 7000 PCs, monitors and printers, but we believe the great majority came from larger commercial users.

Equipment is processed in Wellington by Dell's New Zealand collection agent, Remarkit Solutions Ltd. Computer boxes are dismantled by a local box stripper and contents sold to local agents who recycle components, granulate cables and wiring for copper and recyclable PVC plastic, and export motherboards and steel. Monitors are stored by Remarkit for shipment to MRI Australia in Melbourne, where they will be rendered to high environmental standards. Less than 5% of waste materials (mainly plastic) is landfilled locally.

In September 2006, Dell plans to run a free computer recycling community day in Wellington, based on similar events run in Sydney and Brisbane, where about 20 tonnes of equipment were collected and deflected from landfill.



Dell monitors in storage at Remarkit Solutions in Wellington. Some will be sent to the MRI recycling plant in Melbourne.

Return and Recycling Programme' because minimum collection volumes are one pallet or one cubic metre. In theory – if the owner pays freight and buys a new HP product – his or her old computer of any brand can be picked up by HP. But when we enquired about this service, the company's recycling department (in Australia) discouraged us, saying it wasn't worth doing with less than a pallet of equipment.

We are not aware of moves by other computer importers to establish such schemes. Acer has no recycling scheme. Apple Computer's New Zealand distributor, Renaissance, has yet to be advised if New Zealand will participate in a recycling scheme announced for the USA and Canada in May 2006. Under this scheme, purchasers of new Apple products will get free recycling of their old system, of any make, provided they package the items in cartons and deliver them to a FedEx depot.

### 5.2.2 Corporate/government

Corporate businesses and government departments are typically dealing with large quantities of computer equipment and this makes it somewhat easier to dispose of end-of-life equipment through properly managed channels. These include:

***Outsourcers/systems integrators/leasing companies/decommission agents:*** as part of their service, these organisations will pass non-functioning equipment on to final-stage components and waste processors (see below). Sometimes they will arrange for these final-stage recycling companies to do the pickups. Based on Australian experience, up to 20% of computers in commercial installations may not be suitable for re-sale as working computers.

***Refurbishing companies:*** inevitably some of the equipment collected by or delivered to these companies will include 'dead' stock to be disposed of.

***Local recycling companies and community organisations:*** smaller organisations such as Jensen Technical Services and Molten Media may accept equipment at no charge, except for security wiping of data on hard drives.

***Dell recycling scheme:*** Dell has a business recycling service which it charges for, on a flexible basis. Charges may reflect collection costs, wiping confidential information from hard drives, net costs of storage and waste disposal and the residual value of equipment.

***HP:*** this company operates a 'Planet Partners Hardware Return and Recycling Programme' under which end-of-life computer equipment is collected, consolidated and exported to specialist recycling companies in the Asia-Pacific region. These include plants in Australia and Singapore. By exporting the material, HP is able to claim nil impact on landfills in New Zealand. This is a significant benefit to New Zealand, given that HP is the dominant player in the commercial market.

***IBM:*** this company's disposal process for computers that can no longer be economically remarketed is simple: the equipment – including CRTs – is crushed and shredded by hammer mills at Sims Pacific Metals plants in Christchurch and Auckland. Steel is separated by magnets and the balance, known as 'flock', is sent to landfills. This flock includes all the lead in monitor glass, but Sims Pacific Metals advises that TCLP testing by the Canterbury (Kate Valley) and Auckland (Redvale) landfill operators has shown that any leachate is within acceptable levels.

### 5.3 Final disposal of e-waste

Computer recyclers currently have a limited number of options available to them for disposing of residual e-waste:

- Components recovery and sale
- Scrap materials recovery and sale
- Exporting
- Storage
- Landfilling

#### 5.3.1 Component recovery and sale

Components which are often recovered and sold include floppy drives, CD drives, power supplies, mice, keyboards and monitors. All of these items are increasingly difficult to sell on the local market – at any price. Consequently many items end up in landfill or remain in storage. Some are given to community groups. Organisations making components available include The Ark, Molten Media Trust, the Palmerston North and Tauranga community recycling operations, local computer stores such as Jensen Technical Service in Invercargill and local authority recycling shops in Porirua and Christchurch. Some of these organisations on-sell recovered items through TradeMe.

#### 5.3.2 Raw materials recovery inside New Zealand

Breaking down computer systems is labour-intensive and the least profitable stage of the recycling process. This sector is characterised by back-yard operators and organisations who pay little or nothing for their labour. Only the desktop box yields any profit from its contents. CRTs (and television sets) cannot be stripped profitably in New Zealand.

As a general rule, the initial strippers sell parts to larger companies who consolidate and often export, or who process locally (usually metals).

**Computer box stripping:** prices for parts stripped from computer boxes have fallen considerably in recent years. In addition, overseas companies (mainly Asian) have become much more prescriptive about what they receive. For instance, because of expectations from the Chinese market, Sims Pacific Metals facilities buy nothing but metal, which means that every scrap of plastic and circuit board needs to be removed from computer cases and from components such as hard drives, floppy drives, CD-ROM drives and power supplies. This is very time consuming.

Remarkit Solutions and The Ark formerly stripped computer boxes and supplied parts to scrap dealers. Both stopped because of the reduced value of recovered parts and materials. Remarkit Solutions estimated that a skilled operator could only disassemble an average of about four boxes an hour, and when they ceased the operation late in 2005, they were getting less than \$1.50 for each box and its contents. Both Remarkit and The Ark now give computer boxes away to backyard operators who do the initial stripping.

Some other organisations, including Porirua's Trash Palace, can strip boxes much faster than this, but they are not stripping down to the same extent and have to accept overall lower prices on overseas scrap markets.

Dunedin's Techno Industries once did stripping work, but stopped in 2005 because it was unprofitable. Invercargill's Jensen Technical Service still does some stripping, but only as an



occasional operation, with student labour. A Korean group in Auckland, headed by someone known as 'Harry', is reported to be doing initial stripping on a moderately large scale.

Christchurch's Molten Media Trust originally dealt with end-of-life scrap as part of its refurbishing business, but scrap is now its main business. Molten Media can survive because it is a not-for-profit trust and because most of its labour is 'free' – people doing court-ordered community work. (The downside to this solution is unreliable workers.)

Another stripper in Christchurch, Resource Recycling Technology, considers desktop box stripping a profitable activity – for metals (copper, steel and aluminium). This company has developed a market for minimally stripped boxes which are sold for their metal content – mainly to Taiwan but also to China and Vietnam. The company is fortunate that its markets do not expect boxes to be fully pre-stripped as does Sims Pacific Metals. Any monitors the company receives are landfilled intact – time costs and health and safety issues make recovery of metals within the monitors uneconomic.

Some box strippers consider wires and cables to be their most profitable materials. Power plugs are removed and the wires are onsold to other companies which use a 'granulation' process to separate the copper and plastic covering. There is strong worldwide demand for copper. Prices are currently at an historical peak – they have trebled in the last two years.

Most cable plastic is PVC and a smaller amount is polyethylene. Sims Pacific Metals facilities routinely export cable, but plastics and copper are recovered in New Zealand by a number of 'granulators'. The recovered PVC granules are up to 2mm thick and are sold to two companies in Otaki which make mats for a variety of uses including gym mats, playground mats and freezer mats. The larger of these companies, Matta Products Ltd, made 500 tonnes of mats in 2005. (The other company is very small.) There is little demand for polyethylene granules, but one local use is lining areas used for horse dressage.

**Circuit boards:** the main exporter of circuit boards (mostly motherboards) is New Age Materials of Seaview, Lower Hutt. This company buys circuit boards from first-stage disassemblers for about \$1.25 a kilo, removes metal attachments and exports the boards for \$3-4 a kilo to specialist recyclers in the USA and Belgium. These recyclers recover gold, silver, palladium and copper. New Age Materials exports about 20 tonnes of circuit boards a year. It is not considered very profitable but the circuit boards are useful for topping up shipping containers of the company's main recycled goods export product: automotive catalytic convertors.<sup>14</sup>

An example of the declining value of computer scrap (other than copper) was given by the owner of Wellington's former PC Recycling Channel, which went out of business in 2005. Two years ago, PCRC could get \$1000 for an apple-orchard crate of circuit boards. Over a period of 12-18 months the price went down to \$150.

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<sup>14</sup> New Age Materials originally specialised in mainframe computer wrecking – one of four companies who did this work. They are now the only mainframe wreckers, producing 75% less scrap than formerly.



*Computer motherboards at New Age Materials in Seaview, Lower Hutt. Most of these boards have been bought from first-stage box-strippers. They will be exported to an American recycling company which recovers precious metals. The value of printed circuit board scrap has plummeted in the last two years.*



*Computer cables collected by Trash Palace, at the Porirua City Council's landfill. Cables such as this are the most profitable recovered material for many first-stage box strippers. The cables are sold to larger companies which use 'granulators' to separate the vinyl insulation from the copper wire. The vinyl granules are sold to an Otaki company which recycles them into matting for a variety of applications including children's play areas. Copper has a ready international market and prices are at record highs.*

**Metals:** next to cables, the most valuable part of computer boxes is probably the metal case. This metal is sold by first-stage strippers to a variety of metal recyclers throughout New Zealand. The largest of these is Sims Pacific Metals, which has 10 branches spread though New Zealand. It is part of the international Sims Group Ltd. Although there is a strong worldwide demand for steel for recycling, steel scrap from computers does not attract premium prices because its thinness makes it relatively light in proportion to its bulk.

**Computer monitor and TV set stripping:** CRT monitors are the greatest problem for any organisation seeking to recycle or safely dispose of computer waste. End-of-life television sets – essentially the same technology – go straight into the 'too hard' basket – meaning almost all are landfilled.

The greatest volume in monitors and TVs comes from the glass CRT and the plastic housings – both are worthless in New Zealand. Other parts do have a small value. They include recyclable amounts of lead solder, copper wiring and plating, steel, aluminium, silver, palladium and a small amount of gold. Most valuable is the copper wire in the yoke and degaussing coil (about 500 grams).

Small-scale attempts have been made in New Zealand to recover these materials but almost all of the work has been given up as the value of the recovered materials has not compensated for labour costs, health and safety issues and the problems of dealing with the glass CRT once it has been removed from its plastic housing. One known exception is Porirua's Trash Palace facility, which removes saleable components from about 150 CRTs a week before landfilling them. Wellington City Council formerly did this also, but stopped on 2005 because of health and safety concerns. CRTs were then stockpiled by WCC for a short period before storage space limitations forced landfilling to resume.

**Glass:** Because of its lead content there is no demand for monitor glass in New Zealand. Most of it needs to remain in its plastic enclosure and be stored, exported or landfilled.

We are aware of at least four investigations made by industry players over the past two years, into setting up larger scale CRT rendering plants. Three of these companies decided against proceeding, while one investigation is continuing.

More details of the construction of, and materials, in CRTs is given in Appendix I.

**Plastics:** next to the glass in CRTs, plastic is the greatest problem for computer (and TV) recyclers in New Zealand. Companies spoken to for this study all said there was effectively nil demand and they either stored plastic or landfilled it.

There are no plastics recycling companies in New Zealand which can work with plastics of the types used in CRT cases.

The bulk of the plastic is in CRT monitors and TV sets. As soon as it is removed, recyclers are presented with the problem of how to deal with the glass, for which there is no demand. It is generally safer and easier to leave CRTs and TVs intact, unless the recycling plant is located at the landfill itself (in which case the CRT can be dumped immediately).

More information about monitor plastics and their problems and opportunities are given below in sections 8.3, 9.1 and Appendices 1 and 2.

### 5.3.3 Exporting

**Component parts:** some materials, particularly metals and circuit boards, are being exported.

**Intact CRTs:** very few if any TV sets are being exported intact, but computer monitors certainly are. Overseas markets for New Zealand computer monitors are mainly in China, South-east Asia, India and Pakistan. Purchasers include:

Companies which refurbish them for continued use as monitors

Companies which convert them to television sets

Companies which scrap them for raw materials

Under the Basel Agreement<sup>15</sup>, exporting raw materials to strippers in developing countries should only be permitted after rigorous assessment by the Ministry of Economic Development – in theory. In practice there has never been an application for a permit for exporting electronic waste.

Export permits are not required for export for the first two purposes. The difficulty is in determining and proving that receiving companies are what they say they are.

When PC Recycling Channel closed down, it sent five container loads of monitors via an Auckland exporter, David Wu. The PCRC manager understood these monitors were destined for refurbishing in Hong Kong and China. Though he could not be certain the companies were 'kosher', he was reassured by the fact that Wu was very fussy about how the monitors were loaded into the container. (It is possible, however, that careful loading might have been required to prevent breakage and contamination on the ship or in the destination port.)

It is not known if Wu is still exporting monitors. However the PCRC manager understands that China, and particularly Hong Kong, are now making importing of monitors for purposes other than refurbishment very difficult – that whole container loads have been rejected when found to contain as few as 2-3 faulty monitors. We understand from another potential exporter that

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<sup>15</sup> See Section 9.6

the bureaucratic process for obtaining import permits from China/Hong Kong has become extremely long-winded.

In spite of these alleged hurdles, the trade to China continues. In March 2006, an agent in Auckland was soliciting computer e-waste, including CRTs, for export to China in emails sent to The Ark, Terranova and Rotorua District Council.<sup>16</sup> We presume the email went to other recycling companies and local authorities. The agent has since advised the authors by email that he now (1 June 2006) has two container loads of computers and monitors ready for export to China. He sees a need for his services due to a belief that landfilling of CRTs will soon be banned in New Zealand, "...through other OECD Environment experiences." Earlier in 2006 he investigated exporting e-waste to the MRI facility in Melbourne<sup>17</sup>, but turned his attention to China after deciding MRI could not "...get economic-scale and offer us better prices."

The PCRC manager is aware of a continuing market in Hong Kong for mixed loads of PC boxes, mice, keyboards and printers – at a rate of one container per month.

**Exporting monitors – Professional Business Systems operation:** this continuing operation is run by Ashburton's Professional Business Systems (whose owner is also contract manager of Molten Media Trust). Quoting "commercial sensitivity", the owner would not say where he was sending his monitors, but said he had developed the market after long research which included investigating setting up a monitor rendering plant and exporting glass to Australia. He said his customers had assured him the monitors were being refurbished for continued use, and he was "95% sure" this was actually the case. As with PCRC, he said he was reassured by the high standard of container packing demanded, and by the purchaser's other requirements: only 14", 15" and 17" colour monitors with no screen burn, no deep scratches on the glass and no Sony Trinitron types.

The Professional Business Systems owner firmly believes that exporting surplus monitors can be profitable and is the only sensible option for New Zealand, given the lack of a local market for recovered monitor raw materials and the fact that a local plant would not have long term supplies of CRTs, due to the switch to LCD computer screens. He said the markets he had established for CRTs could take "...as many container loads as I could send them."

**Quantities in containers:** Large 40-foot containers carefully packed with monitors on pallets accommodate 500-600 monitors. Careful packing, but not on pallets, can fit up to 840 x17 inch monitors in this size of container. The same containers, which take a maximum weight of 29 tonnes, would accommodate about 1200 roughly-stowed 15 inch monitors (i.e. monitors fit only for stripping for raw materials).

Rendered glass would probably be shipped in smaller 20-foot containers which take 19 tonnes each. Glass from approximately 2000-2500 monitors could be accommodated in each container.

**HP export arrangements:** as mentioned earlier, HP is already exporting unsaleable/end-of-life systems, including monitors, to HP recycling centres elsewhere in Asia-Pacific. HP has declined to give details of this operation, but it is understood one plant used is Cimelia in Singapore.

#### 5.3.4 Storage

Final disposal options are being postponed by the large amount of storage being carried out, particularly of CRTs:

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<sup>16</sup> See Appendix VII

<sup>17</sup> The MRI company is described in Section 9.2

Households are already storing almost half a million monitors/TVs and a quarter of a million computer boxes, according to the UMR research.<sup>18</sup>

There is anecdotal evidence of significant quantities of ‘business’ computer gear in storage – especially outside the corporate sector.

Recyclers/refurbishers are known to be storing large quantities of unsaleable gear – mainly CRTs – while waiting for solutions. One example is Remarkit Solutions in Wellington, which is storing Dell monitors and other monitors received via the Dell recycling programme. Some of these monitors may be shipped to MRI in Melbourne for safe disposal. Another example, on a smaller scale, is Palmerton North PC Recycling. This trust is working on recycling solutions with Massey University’s Zero Waste Academy and presently has free storage space at the university. This storage space is only available for another 12-18 months.

### 5.3.5 Landfill

TVs, desktop computers and CRTs are not classified as hazardous waste and can be landfilled almost everywhere in New Zealand. Landfilling is the usual disposal method for TVs.

Computers and monitors are being landfilled either as complete units, as the unsaleable waste (mainly plastic) left over after saleable items have been recovered.

Effectively the only things limiting landfilling of computers and monitors are inertia (especially in homes), resistance to landfill charges and environmental conscience. The latter has certainly contributed to some industry players’ decision to store equipment in hope of an environmentally acceptable solution coming along. Every so often, even some of the more environmentally conscious recyclers are forced to landfill material they can no longer store. Refurbishers and recyclers who claim very low proportions of e-waste sent to landfills are only able to do so because they are storing or exporting most of the problem – especially the CRTs.

Local authorities also landfill material which their own recycling operations reject because it cannot be repaired or is considered unsaleable.

**Quantities:** Almost no figures are available for the quantities being landfilled of TVs, desktop computers and CRT monitors. Although some local authorities do periodic audits of what is being dumped, from the limited survey we carried out<sup>19</sup>, it appeared that most do not even separate out e-waste, let alone specific items within that e-waste.

Porirua City’s Trash Palace is removing electronic parts first and then landfilling about 7000 CRTs and TVs a year. The Trash Palace supervisor believes many more monitors and TVs are going direct to the landfill.

Wellington City Council surveys in 2005 suggested that between 2 and 3% of material going into its landfills was electronic. (3% in the now-closed Northern Landfill and 2% in the Southern Landfill). These figures included more than just computers, CRTs and TVs. The 3% level for e-waste mirrors landfill surveys done in Europe.

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<sup>18</sup> See Section 6.1

<sup>19</sup> Including Environment Southland, Invercargill City Council, Dunedin City Council, Christchurch City Council, Wellington City Council, Porirua City Council, Waste Management Wairarapa, Auckland City Council, Waitakere City Council.



*Monitors awaiting processing at Trash Palace. This may be the only place in New Zealand where monitors and TVs are disassembled to recover sellable components, especially copper. The glass and plastic are disposed of at the adjacent Porirua City Council landfill. Export possibilities for plastic waste are being investigated. Partly disassembled computer boxes are already exported.*



*Disassembly workshop for electronic goods dropped off for recycling at Trash Palace. The facility deals with about 7000 monitors and TVs a year. Many more are dumped directly in the landfill. There is no charge for equipment dropped off at Trash Palace, and there is also a free home pickup service for appliances in working condition. Free home pick-up is unusual – we heard of no other local authorities or recyclers offering it.*

**Landfill charges:** charges collected by Local Government New Zealand and our own survey varied considerably – between \$27 per tonne and \$196 per tonne. More typical charges are around \$80 per tonne.

Per computer or CRT, these charges are not substantial, but they can deter commercial dumping of larger quantities. For instance, when PC Recycling Channel was wound up, the proprietor preferred to give his monitor stockpile away to export agents.

**Collections:** few households in the local authorities surveyed had the opportunity of putting computers, TVs and monitors on kerbsides for pickup. There were no instances of special community pickup days, although Dell has recently announced plans for a community collection day in Wellington. Only Waitakere and Auckland city councils offered kerbside pickup – Waitakere once every 12 months and Auckland twice a year. Analyses in Auckland show consistently that 3% of inorganic materials collected are e-waste (of all types). The UMR research asked households what they perceived as being barriers to recycling, and the Auckland respondents were least likely to say there were no collection schemes near where they lived. At present, the main destination for equipment on kerbsides in Auckland and Waitakere is landfills, but both those councils are in the process of setting up 'resource recovery centres' which will both receive and sell equipment.

**Treatment of electronic waste before landfilling:** none of the local authorities surveyed undertook any special treatment of e-waste going into their landfills.

## 5.4 Key points

Home computers are often stored unused for several years.

The most common disposal method for home computers and TVs is landfill.

Very little kerbside collection is available for home computers and TVs (it happens mainly in Auckland).

Some home computers are dropped off at recycling and refurbishing companies and local authority recycling centres – sometimes for a fee; sometimes not. There is very little home pickup.

Dell is the only computer company offering pickup for home computers (for a fee).

Up to 20% of computers recovered from commercial installations after their first life-cycle are considered unsaleable as second-hand machines.

Three major computer companies offer end-of-life disposal services for their machines removed from commercial installations. HP sends all such material overseas to its international recycling partners. Dell recycles via a New Zealand partner, which recycles computer boxes locally and stores monitors for export to Australia. IBM has a local partner which crushes and shreds computer boxes and monitors, recovers the steel and landfills the balance.

None of the other large companies, including Acer, Apple and all local computer assemblers, have pickup and recycling systems in place and leave such activities to corporates or their agents, who in turn deal with or subcontract to local recyclers or landfill directly.

There is low demand for recovered working components such as floppy and CD drives, and even monitors. Many such components are landfilled.

Computer box stripping is only marginally profitable and has increasingly been taken over by backyard operators who on-sell to larger companies which are mainly interested in the metal content. Some metal is smelted locally but most exported.

Wires and cables are the most profitable products for small-scale box strippers, due to the current high price of copper.

Some box component parts, metal cases, copper from cables, and steel are exported.

Very little recycling of computer monitors and TV sets takes place because there are no markets in New Zealand for the major constituents: the glass with its high lead content, or the plastic cases.

Container loads of monitors are still being exported.

Some monitors are for refurbishment and reuse as monitors or as TV sets and therefore do not need Basel permits.

It is likely that some of the monitors, along with other computer e-waste, are being exported for recycling and should be accompanied by a Basel permit (but are not).

Recyclers and refurbishers are known to be storing large quantities of computer e-waste.

Large quantities of computer e-waste are being landfilled in New Zealand and effectively there are no barriers to this other than landfill charges and environmental conscience.

## 6.0 e-waste volumes and toxicity

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Essential to any understanding of the problem for end-of-life desktop computers and television sets is an appreciation of the quantities of materials that are poised for landfilling, recycling into parts and raw materials or sending overseas for other people to deal with. Such information is difficult to obtain and any figures can only be approximate.

Comparing figures of equipment sold with the life cycle of equipment cannot give the complete answer. One reason is that a good deal of equipment is in storage. We don't know how long it has been in storage or how long it will remain there. Some of this 'parked' equipment may be in working order, but is out of date. Some is 'dead' or effectively so, but may remain in storage for several years due to a variety of factors including inertia, lack of suitable or convenient disposal avenues, perceived value, sentiment etc.

### 6.1 Home situation

We know something of the extent of used and unused computers and TVs in private homes, through a survey carried out for the Ministry for the Environment by UMR Research<sup>20</sup>. This research, undertaken in January 2006, gives part of the answer for computers and much of the answer for television sets (the great majority of which are in homes).

UMR surveyed a nationally representative sample of 750 New Zealanders 18 years of age and over and claims a margin of error of plus or minus 3.58%.

The results were extrapolated into national totals. A broad summary:

**Table 3. Use of computers and TVs in New Zealand homes, January 2006**

Item	In use	Not in use	Total
Computer 'boxes' <sup>21</sup>	1,649,000	251,000 (13.7%)	1,900,000
Computer monitors	1,644,000	256,000 (13.5%)	1,900,000
Televisions	3,190,000	210,000 (6.1%)	3,400,000

Source: UMR Research, 2006

TVs were far more numerous than computer monitors, but a higher proportion of TVs were still being used. Nevertheless, at the time of the survey, nearly half a million television sets and CRTs in New Zealand households appear to be in storage. They are at 'end-of-life' or close to it, and so are potential candidates for landfilling. Assuming an average of 1.4kg lead per computer monitor and 3.2kg per TV<sup>22</sup>, that equates to 360 tonnes of lead in stored monitors and 670 tonnes in stored TVs

If we add the monitors and TVs currently being used in homes, the total lead that may eventually reach the waste stream is 2,660 tonnes from monitors and 10,880 tonnes from TVs.

The UMR research attempted to determine how long it might be before this equipment reached the waste stream. A high proportion of respondents (29%) had never replaced their computers. Eight per cent claimed to replace their computer in less than two years, 38% around every two

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<sup>20</sup> UMR Research Limited, *Electronic and Electrical Equipment Survey: A Quantitative Report*, January 2006.

<sup>21</sup> Defined for this study as desktop computer units containing the processor and data storage units, plus mouse and keyboard. Note, however, that most of the 'box' analyses in this document do not include the keyboard and mouse.

<sup>22</sup> These averages, which can only be approximate, are based on typical glass weights for 17 inch computer monitors and 26 inch TVs, from equipment weighed at the MRI rendering facility in Melbourne. The average proportion of lead in glass was assessed at 20%.



to less than five years, 20% five to less than ten years and 3% claimed to replace their computer after 10 years or more. But most (56%) of replaced equipment was still being used occasionally, passed on the family members and friends or stored. Only 10% had been dumped.

Two-thirds of respondents claimed to use their TVs for at least five years. After that they were given to friends or family (22%). Other answers included stored but no longer in use (12%), continued to use it (11%), sold (9%), used as trade-in (7%) and dumped (20%).

## 6.2 Commercial situation

According to separate IDC research<sup>23</sup>, almost twice as many new desktop computers and CRTs are sold outside the home to 'commercial' users (mainly corporates, government and educational institutions).

**Table 4. Desktop computer sales, 2003-2005**

Destination	2003	2004	2005	2003-2005
Commercial desktop	211,000	229,000	207,000	647,000 (65%)
Home desktop	117,000	125,000	110,000	352,000 (35%)
Total	328,000	354,000	317,000	999,000

Source: IDC

These figures were for the 'box' units, rather than the monitors. IDC figures show about 20% more monitors were shipped than boxes.

It is possible to roughly estimate the numbers of computers and computer monitors outside the home, extrapolating from numbers revealed in the UMR home research and making an assumption of the relative proportions of total sales sold over time. We have assumed an overall split of home 30% and business 70%.<sup>24</sup>

If homes have 30% of overall monitors currently installed or in storage, and these total 1.9 million (UMR figure), then, pro-rata, the number of CRT monitors currently in commercial installations or storage (not by recyclers) would be about 4.4 million. Assuming an average of 1.4kg of lead per CRT, that totals 6,160 tonnes of lead.

**Table 5. Summary of computer monitors/TVs and their lead content<sup>25</sup>**

Category	Numbers in use and storage	Lead content <sup>26</sup>
Home – computer monitor	1.9 million	2,660 tonnes
Home – TV	3.4 million	10,880 tonnes
Business – computer monitor	4.4 million	6,160 tonnes
Total	9.7 million	19,700 tonnes

<sup>23</sup> New Zealand installed base for PCs 2001-2005, provided by IDC

<sup>24</sup> The home/commercial split would not be 35:65, as in the IDC's sales statistics for the last three years, because going back in time, the boom in home sales began several years later than the boom in commercial sales. On the other hand, home users would probably store unused equipment for longer, and also, a higher proportion of home users is likely to be using CRT monitors rather than flat screens. Bearing these factors in mind, we assumed an overall split of home 30% and business 70%.

<sup>25</sup> Note that the CRT lead figures in this table are slightly inflated, because they do not take into account substitution by LCD monitors in recent years. IDC figures show that between 2001 and 2005, 685,000 of total monitor imports were LCD (only 14,000 in 2001). While these monitors do not contain lead, their overall impact, as far as lead reduction is concerned, is minimal in relation to the accumulated CRT overhang – less than 100 tonnes.

<sup>26</sup> Assuming 1.4 kg per CRT monitor and 3.2 kg per TV.

### 6.3 Quantities looking forward

Quantities of desktop computers, CRT monitors and CRT TVs cannot be projected into the future at the present rate, because:

1. **Flat screen monitors are rapidly taking over from CRTs for both TVs and computer monitors.** This trend has been particularly pronounced over the past 18 months and is accelerating. In 2001, 4.3% (13,500) of computer monitor imports were LCD, while in 2005, 80% (295,000) were LCD<sup>27</sup>. The move to flat screens is less pronounced for TVs<sup>28</sup>, but still significant. In 2002, only 2.7% (5036) of TV sales were flat screens or rear-projection<sup>29</sup>. By 2004 the proportion had risen to 9.2% (30,000). In 2005 the proportion more than doubled, to 21% (63,000). Among some market leaders, the trend away from CRT televisions has been faster. One brand leader, whose TV sales in 2004 were 85% CRTs, expects the proportion to drop to 20% in 2006. The proportion of flat TV screens will accelerate, as some brand owners intend to phase out CRT production over the next twelve months.
2. **Bulky desktop computer boxes are being steadily replaced by laptops**, especially outside the home. According to IDC figures, laptops' percentage share of commercial shipments rose by 26% in 2003. In 2004 this was 29%, while last year it had climbed to 40%.

It is clear that, particularly for CRT monitors and CRT TVs, most of the problems we need to worry about are here already, to emerge sooner or later – almost 10 million of them. Monitors and televisions are rapidly being displaced by flat screens. Flat screens do contain toxic substances such as the mercury in LCD backlights, but overall their whole of lifecycle environmental impact is much lower than CRTs. Environmentally, the biggest advantage of flat screens is lower energy use – less energy to make the screen in the first place, and less energy to operate it (50-70% less). They have a lower volume of materials – especially plastics.

But in spite of the rise of flat screens, the sheer size of the CRT overhang presents New Zealand with major logistics, infrastructure and cost challenges. While disposal costs in environmentally acceptable facilities that might be established in New Zealand are unknown, we do know that the present unit cost of processing CRTs in Australian facilities is about \$20 including freight<sup>30</sup>. Processing all New Zealand's current stock of ten million CRTs there would cost \$200 million.

**Plastics in monitors and TVs:** while glass, with its high lead content, is the major problem in New Zealand, a considerable problem also exists for plastic CRT cases. These contain mixed plastics which cannot easily be separated. There are no facilities in New Zealand to make products from co-mingled plastics. A very rough estimate of the weight of plastic represented by New Zealand's TV and computer CRTs in current use or storage, is 29,000 tonnes (based on 3 kg of plastic per 17 inch computer CRT).

**Desktop 'boxes':** these will need to be dealt with for some years to come, but their sales have leveled off and are on the decline, due to the growing preference for laptops.

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<sup>27</sup> IDC

<sup>28</sup> CTV Market Intelligence

<sup>29</sup> Most of these non-CRT screens in 2002 were rear-projection (91%). By 2005, the shares of non-CRT screens were rear-projection: 23%, LCD: 47%, plasma: 30%.

<sup>30</sup> Current average charge at the MRI facility – for details see Section 9.2

## 6.4 E-waste toxicity

There is debate within New Zealand and internationally about the environmental impacts of dumping e-waste in landfills. Groups such as the Zero Waste New Zealand Trust are outspoken in their opposition to dumping any waste in landfills. They argue that “...landfills and incinerators are outdated technologies that do not have a place in a sustainable society of the 21st century.”<sup>31</sup> In 2001, the California Department of Toxic Substance Control declared all wastes containing cathode ray tubes to be a toxic substance, which meant they were banned from landfill disposal. However some have argued that landfill bans are not the answer as the risk to the environment is low and users are driven to dispose of their e-waste in much less managed ways.<sup>32</sup> A 2004 paper for the EPA by T Townsend et al<sup>33</sup> takes issue with Akatiff.

Jessica North, an environmental scientist at Otago University, who is carrying out doctoral research into landfill leachates, concludes that it is simply not worth the risk. She suggests there is no such thing as a 100% safe landfill, even when they are lined to European standards (and New Zealand only has a small proportion of its landfills lined to this standard). Leachates will eventually find their way into surrounding land and waterways, even if it is 100 years after the landfill has closed. But is this the sort of heritage we want to leave for future generations, she argues.<sup>34</sup>

A literature review<sup>35</sup> of the environmental and health impacts of waste electrical and electronic equipment was carried out for the New Zealand Ministry for the Environment in June 2006. The review concluded that the risks relating to placing discarded electrical equipment in landfill are due to the variety of substances they contain. Because of this range of substances in WEEE, landfilling creates unpredictable potential toxic hazards. Co-disposal with municipal waste adds to the unpredictability and spreads the problem. The report stated that licensed, controlled landfills with liners did not eliminate the risks of pollution. However, potential amounts and concentrations – and resulting environmental impacts – were considerably higher for WEEE placed in uncontrolled landfills.

The study also highlighted the need for more research and recommended that until then, the following principles be drawn on to guide policy development in WEEE management:

Precautionary principle: in the absence of fuller evidence, where theory or circumstantial evidence suggests damage potential exists it is prudent to assume the worst case and legislate accordingly.

Prevention is better than cure – it is cheaper in the long run to prevent risks and impacts from occurring rather than to concentrate entirely on cleaning up problems. Therefore eco-design mechanisms to minimise WEEE generation are a logical approach.

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<sup>31</sup> Zero Waste New Zealand Trust, *Wasted Opportunity: A Closer Look at Landfilling and Incineration* (undated).

<sup>32</sup> Clark Akatiff, *Is this Ban Really Necessary? A Critical Investigation of the CRT Ban*, May 2002, [www.wrppn.org/hub/hub36/Is\\_this\\_ban\\_necessary\\_CRT\\_.pdf](http://www.wrppn.org/hub/hub36/Is_this_ban_necessary_CRT_.pdf)

<sup>33</sup> [www.epa.gov/reg5rcra/wptdiv/solidwaste/ecycling/UF-EWaste-Final.pdf](http://www.epa.gov/reg5rcra/wptdiv/solidwaste/ecycling/UF-EWaste-Final.pdf).

Other EPA reports of interest include a summary of a study on the life-cycle of desktop computer displays:

[www.epa.gov/oppt/dfe/pubs/comp-dic/lca-sum/](http://www.epa.gov/oppt/dfe/pubs/comp-dic/lca-sum/)

See also reports by the Californian Department of Toxic Substances Control (DTSC):

[www.dtsc.ca.gov/HazardousWaste/EWaste/upload/Consumer\\_Electronic\\_Products.pdf](http://www.dtsc.ca.gov/HazardousWaste/EWaste/upload/Consumer_Electronic_Products.pdf)

[www.dtsc.ca.gov/HazardousWaste/EWaste/upload/HWMP\\_REP\\_SB20\\_LCD.pdf](http://www.dtsc.ca.gov/HazardousWaste/EWaste/upload/HWMP_REP_SB20_LCD.pdf)

DTSC's main e-waste page is: [www.dtsc.ca.gov/HazardousWaste/EWaste/](http://www.dtsc.ca.gov/HazardousWaste/EWaste/)

<sup>34</sup> Jessica North, Interview with authors, May 2006.

<sup>35</sup> Horne, R E and J Gertsakis, J, *A Literature Review on the Environmental and Health Impacts of Waste Electrical and Electronic Equipment*, unpublished report prepared for the Ministry for the Environment, June 2006.

Polluter-pays principle – those who create the risks should incorporate the costs of dealing with them into their operating costs – for example through operating product stewardship programmes.

The negative environmental and health impacts of uncontained e-waste materials are summarised below:

**Table 6. Environmental impacts of selected materials used in computer production**<sup>36</sup>

Material	Main applications in computer production	Environmental/health Impacts
Plastics including PVC	Cabling, computer housings	Various cancers; endocrine system disruption (PVC emits highly toxic dioxins)
Lead	Soldering of printed circuit boards and other components; glass panels in CRT monitors	Significant amounts of lead ions are dissolved from broken lead containing glass, such as the cone glass of cathode ray tubes, when mixed with acid waters which commonly occur in landfills. Accumulates in environment and has high acute and toxic effects on plants, animals, and micro-organisms Damage to nervous system, blood
Barium	Vacuum tubes in CRT monitors	Short-term exposure to barium can lead to brain swelling, muscle weakness, damage to the heart, liver and spleen. Long-term effects of chronic exposure not yet known.
Beryllium	Used for thermal conductivity	Recently identified as human carcinogen. Exposure can cause lung cancer and skin diseases.
Cadmium	SMD chip resistors, infrared detectors, semiconductors, older models of CRTs; also used as plastic stabilizer	When plastics containing cadmium are landfilled, can leach into groundwater. Acute and chronic toxic compound which accumulates in human body, esp. in kidneys. Can be absorbed either through respiration or ingested through food.
Hexavalent Chromium	Mostly phased out, but still some limited use as corrosion protector and decorative or hardener for steel housings	Highly toxic material which can pass easily through cell membranes; causes strong allergic reactions (e.g. asthmatic bronchitis) even in small concentrations. May also cause DNA damage. Contaminated wastes can leach from landfills
Selenium	Used in rectifiers and printed wiring boards	Exposure to high concentrations of selenium compounds cause selenosis, the symptoms of which are hair loss, nail brittleness, and neurological abnormalities.
Mercury	Sensors and switches on printed circuit boards, batteries, switches/housing, printed wiring boards, tubes in flat panel screens	Mercury is released when electronic devices that contain it are destroyed – such as in, or on the way to, landfills. The vaporization of metallic mercury and dimethylene mercury is also a possibility. Both are highly toxic – methylated mercury causes chronic brain damage. Inorganic mercury is transformed into methylated mercury when introduced into natural water systems, where it concentrates in sediment. Easily accumulates in living organisms, especially fish.
Arsenic	'Doping' agents in transistors and printed wiring boards	Chronic exposure to arsenic can lead to various diseases of the skin and decrease nerve conduction velocity. It can also cause lung cancer and can often be fatal.

<sup>36</sup> Information in this table came from Environment Victoria, *Computer waste in Australia and the case for producer responsibility*, June 2005.

Material	Main applications in computer production	Environmental/health Impacts
PCBs (Poly-chlorinated biphenyls)	Used in capacitors and transformers (older equipment only)	PCBs affect the immune, hormone, nervous, and enzyme systems of the body and therefore have impacts on almost every organ. PCBs are considered by health agencies as a known carcinogen for animals and a probable carcinogen for humans.

## 7.0 Regulatory tools and e-waste

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The New Zealand Waste Strategy identifies electronic waste or e-waste as ‘special waste’ targeted for priority attention. There is a single target: *to establish pilot programmes for extended producer responsibility*. The Strategy suggests no specific guidelines, policies, legislation or regulations that might address e-waste problems. Studies of other ‘special waste’ streams have reviewed potential regulatory tools for waste<sup>37</sup> and have found small windows of opportunity.

### 7.1 Resource Management Act (1991)

New Zealand’s primary environmental legislation is the Resource Management Act (RMA) 1991. The RMA is an effects-based statute designed to promote sustainable management of natural and physical resources. Under the RMA, local and regional authorities are responsible for managing resources and avoiding or mitigating adverse effects on the environment.

The RMA provides for regulation of the environmental effects of land disposal of waste (e.g. by placing conditions on consents for landfills). However, the ability of the RMA to regulate waste as an ‘effect’ of land disposal is questionable because the inherent nature of a waste in itself, as well as the act of generating a waste, is not seen as an environmental “effect”.

#### 7.1.1 Landfill consent conditions

The Resource Management Act allows local or regional councils to place resource consent conditions on land uses such as landfills. Consent conditions could, in theory, be placed on a landfill to ban disposal of a particular product or material in that landfill. Such a ban would need to be backed up by a robust scientific case showing the environmental effects of disposal to landfill. Councils may also be reluctant to impose changes to conditions of existing resource consents.

Councils use consent conditions to set waste acceptance criteria at new landfills consented by Regional Councils. The Ministry for the Environment has published guidelines on landfill waste acceptance criteria with the aim of achieving national consistency for waste at landfills<sup>38</sup>. These criteria can be inserted as consent conditions on landfills, establishing what materials landfill operators can accept, and at what levels.

The landfill waste acceptance criteria set maximum concentrations for specific contaminants entering the landfill. These concentrations are measured by the ‘leachability’ of a substance in landfill conditions. The Toxic Characteristic Leaching Procedure (TCLP) is a laboratory test that simulates the conditions of a landfill in order to determine if toxic substances will leach from the waste. The limit for lead (Pb), for example, is set at 5mg/l. If TCLP results exceed this level then the waste should not be accepted at the landfill.

Some overseas studies have suggested that CRT glass fails the TCLP test for lead<sup>39</sup>. These findings have been questioned as to their applicability in real landfill conditions, when applied

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<sup>37</sup> Sinclair Knight Merz, *Inventory of Regulatory Tools: Construction & Demolition Reduction – SMF 4194*; May 2004.

<sup>38</sup> MfE, *Hazardous Waste Guidelines: Landfill Waste Acceptance Criteria and Landfill Classification*, 2004.

<sup>39</sup> Townsend, T.G. *et al Characterisation of Lead Leachability from Cathode Ray Tubes Using the Toxicity Characteristic Leaching Procedure*; Florida Centre for Solid and Hazardous Waste Management, University of Florida, 1999.

to a mixed waste load as opposed to an individual product<sup>40</sup>. Questions remain over the usefulness of the TCLP results on cathode ray tubes.

Using landfill waste acceptance criteria to ban a product such as cathode ray tubes from landfills could be a powerful regulatory tool. However, it has serious limitations because it can only be a localised measure, and would require a robust case to be made for such a ban. It would also be unrealistic to impose such a ban if no adequate alternative recycling solution was available. This would only transfer the problem elsewhere.

## **7.2 Local Government Act (2002)**

The Local Government Act (LGA) provides a framework and powers for local authorities to decide what activities they undertake and how they will undertake them. The LGA enables local authorities to undertake the function of waste management. Under the Act, local authorities are required to write a waste management plan that sets out how they will manage waste in their area. A waste management plan is not a regulatory tool but can be used to set out how a waste bylaw is intended to work.

The Local Government Act enables councils to establish bylaws in relation to the collection, transportation and disposal of waste. A local authority can implement a bylaw to regulate solid waste, but it must be for one of the following purposes:

- Protecting the public from nuisance

- Protecting, promoting, and maintaining public health and safety

- Minimising the potential for offensive behaviour in public places

Local authorities have tried to impose a levy on solid waste in order to increase disposal costs and shift the economics in favour of recycling. Christchurch City Council, for example, did this through the placement of a levy on construction waste being disposed of to cleanfill sites in the district. The \$9 per cubic metre levy was intended to encourage the diversion of construction waste for recycling. Some of these levy monies were used to fund recycling and waste minimisation initiatives.

Recent legal proceedings between local authorities and the waste management industry have ruled that local authorities do not have the power to impose bylaws to raise general waste levies in New Zealand<sup>41</sup>. This has resulted in Christchurch City Council removing its waste levies and the other local authorities not implementing the levy portion of their recently adopted waste bylaws. The High Court made it clear that the Local Government Act only allows a local authority to use a waste levy to collect monies needed to recover the costs of implementing a bylaw and its waste management plan. The use of a local waste levy to shift the economics of disposal in favour of recycling is not therefore an option.

Local authorities do have the ability to impose a fee to cover the costs of recycling a waste stream. Many already charge a fee for the disposal of refrigerators for example. Local authorities which want to offer an e-waste recycling service have the ability to impose a fee at the point of disposal by the consumer. UMR market research<sup>42</sup> suggests that many consumers may be willing to pay a fee for the safe disposal of their computer and TV waste at the time of disposal.

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<sup>40</sup> Akatiff, C, *Is This Ban Really Necessary? A Critical Investigation of the CRT Ban*; Solid Waste Association of North America (SWANA) Western Symposium, 2002.

<sup>41</sup> 31 March 2006, CHH vs. NSCC, Waitakere CC and Rodney DC and Waste Management Ltd vs. Rodney DC, Waitakere CC, NSCC, and CCC in the High Court.

<sup>42</sup> See Appendix III

### 7.3 Hazardous Substances and New Organisms Act 1996 (HSNO)

This act puts controls on the importation and manufacture of new hazardous substances as well as on the management and disposal of hazardous substances. However it cannot control wastes that do not meet HSNO thresholds as ‘hazardous substances’. Nor can it directly influence decisions about features and volumes of products that become waste (including product design) that do not involve ‘hazardous substances’.<sup>43</sup>

### 7.4 Litter Act (1979)

The Litter Act is designed to control litter and directs waste into waste management systems. It provides for local authority by-laws and local authority collection of litter. However it does not influence the nature and volume of products that become waste, resource recovery from used products, or product design. Furthermore, it does not shift the burden and responsibility for the environmental effects of waste so that this is shared among all product-cycle decision-makers.<sup>44</sup>

### 7.5 Regulating free-riders

A key concern raised by the major computer and television suppliers is the problem of free-riders. Their particular concern is with suppliers who might not contribute to the costs of a product stewardship scheme, thereby creating market distortion, but there could also be end-user free-riders. For example, consumers who disguise their e-waste with other household rubbish rather than take it to a local e-waste collection point, would effectively be free-riders. It is important that any effective scheme take the necessary steps to prevent both types of free-riders emerging.

As noted elsewhere in this report, in the computer industry some 16-50% of product is locally assembled by a number of small operators. One estimate suggests that there are at least 70 organisations producing 16 or more computers a month. In order to maintain a fair and competitive playing field, all suppliers must contribute to any form of extended producer responsibility. If only some contribute, this would give others an unfair advantage in the market. Since most of these machines are likely to be using Microsoft’s operating systems, Microsoft could potentially play a critical role in assisting with information on the number of operating system licences provided. Other mechanisms would be needed to identify suppliers installing other operating systems such as Linux.

But clearly the Government also has a critical role to play. It is not enough to just encourage them to take responsibility for their waste. Industries, such as the computer industry, require strong regulatory support from the government to ensure all suppliers contribute equally to agreed solutions. The Government must also address the end-user free-rider problem by ensuring appropriate incentives and/or penalties for the disposal of e-waste.

The experience from other countries, including Australia, suggests that, without the guarantee of government regulation, progress towards sustainable e-waste solutions is likely to be a slow, drawn-out process.

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<sup>43</sup> Ministry for the Environment, *Product Stewardship and Water Efficiency Labelling* Discussion Document, pg. 6

<sup>44</sup> Ibid., pg 6



## 7.6 Conclusions

There are few options for regulating e-waste in New Zealand under the current regulatory environment. The use of bylaws to raise levies on particular waste streams within local areas has been ruled out by a 2006 High Court judgement that such levies are ultra vires (beyond the scope).

As a result of the High Court ruling, central government is considering the issue of a national waste levy<sup>45</sup>. A national levy is likely to be imposed on the entire solid waste stream rather than be targeted at specific items such as e-waste. A national levy might help make e-waste recycling more viable as an alternative to landfill.

Local councils do have the ability to impose recycling fees on products they want to separate from the general waste stream. If councils wanted to develop a user-pays solution for the recycling of e-waste they could do so. A fee could be charged per item to cover the costs of shipping and recycling e-waste at available overseas recycling facilities.

Resource consent conditions can include bans on materials or products accepted at landfills, providing robust scientific cases are made. Landfill waste acceptance criteria have been established for landfills in New Zealand. These criteria can be used to restrict disposal of hazardous waste into landfills. However, it might be difficult to use TCLP lead leachate criteria to control disposal of cathode ray tubes, because of uncertainty over previously conducted TCLP tests and the fact that CRTs are usually mixed with a general municipal solid waste stream. Any move to ban CRTs from landfill must take place with adequate alternative recycling outlets available.

And finally, the Government must progress 'free-rider' legislation to ensure compliance by all players (including end-users) to any industry-developed product stewardship scheme.

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<sup>45</sup> See [www.mfe.govt.nz/publications/waste/levy-issues-mar06/index.html](http://www.mfe.govt.nz/publications/waste/levy-issues-mar06/index.html) (Issues Associated with a Levy on Solid Waste – A Review of Positions and Possibilities.)

## 8.0 Recycling of cathode ray tubes

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The single greatest e-waste challenge facing New Zealand is the safe disposal of the estimated 10 million cathode ray tubes (CRTs) in computers and television sets. The following information is derived from a desktop literature review together with the authors' direct contact with overseas CRT recycling systems.

The potential for lead oxide and other metal oxides to be removed from CRT glass in order to make the glass more recyclable has been studied in the UK<sup>46</sup>. This study found that metal oxides could not be removed to a suitably low level through smelting or electrolysis. The study recommended that efforts should be focused on applications for the CRT glass containing metal oxides.

There are two approaches to CRT recycling: splitting and crushing.

### 8.1 CRT splitting

To be economically viable, CRT splitting needs markets for the lead-free face glass.


The process is shown in the photographs on the following page, taken at a facility run by the waste authority in Vienna, Austria. This is a largely standard process, used in recycling facilities throughout the world.

Face glass, containing very small quantities (or none at all) of lead is separated from the leaded funnel glass. The leaded funnel glass can go to markets such as use in new CRT manufacture, lead smelters for lead extraction, other smelters for use as fluxing agent, or alternative glass use (tiles etc).

The lead-free face glass can be used in more typical recycled glass applications.

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<sup>46</sup> Industry Council for Electronics Recycling, *New Approach to CRT Recycling*; report to UK Dept Trade and Industry, 2003.

<p>1. Televisions and monitors (segregated) arrive in cages.</p>	 
<p>2. Housing removal and seal broken.</p> <ol style="list-style-type: none"> <li>Back housing is removed, dust vacuumed from outside of CRT, seal broken under pressure to avoid implosion.</li> <li>Remainder of housing removed with electric screwdriver.</li> </ol>	<p>a.</p>  <p>b.</p> 
<p>3. Components manually removed from CRT:</p> <ol style="list-style-type: none"> <li>Cable – sold for copper extraction.</li> <li>Further dismantling for copper parts – yokes and degaussing coils.</li> <li>Plastic housing from monitors (ABS) for recycling or incineration.</li> <li>Residual waste – goes for incineration or disposal.</li> </ol>	<p>a.</p>  <p>b.</p>  <p>c.</p>  <p>d.</p> 
<p>4. Steel anti-implosion band around CRT is removed using saw – time consuming part of process. The metal is recycled.</p>	

<p>5. Splitting of CRT glass:</p> <ol style="list-style-type: none"> <li>CRT automatically measured and then scored with blade. Heated wire splits front panel from cone glass.</li> <li>Cone glass removed manually.</li> <li>Fluorescent material (phosphorus) vacuumed manually from inside of panel glass. Stored for disposal as hazardous material.</li> </ol>	<p>a.</p>  <p>c.</p> 	<p>b.</p> 
<p>6. Recycling options for split glass.</p> <ol style="list-style-type: none"> <li>Front panel glass with low lead content, suitable for recycling.</li> <li>Cone glass with lead content for lead smelting, fluxing agent or disposal.</li> </ol>	<p>a.</p> 	<p>b.</p> 

## 8.2 CRT crushing

An alternative is to crush complete monitors/TVs, after which different materials are extracted, including the housing and other components, using a variety of separation techniques

Some preliminary dismantling of the monitor/TV can also take place to remove components such as the housing, wiring and circuit boards. The remaining glass CRT is then crushed or shredded with no separation of the face and funnel glasses. This mixed glass is used for manufacture of new CRT funnel sections or as flux replacement in smelters.

## 8.3 Plastics recycling

To be recycled for high-end uses, the different plastic types must be segregated before being mixed with virgin plastics of the same type for moulding new products. Segregation often relies on a brief visual inspection of either the markings or physical properties to determine the type of polymer used. This can result in misidentification of plastic types, reducing their suitability for recycling.

Also, plastics coming from e-waste are often contaminated by other plastic types, or by labels, lamination, metallic coatings, metal fastenings and paint. This contamination can make the plastic unsuitable for recycling into high quality end uses. One study in the United States found that only 35% of plastic from collected household e-waste was suitable for recycling into high quality end uses.<sup>47</sup>

<sup>47</sup> American Plastics Council (2000) *Plastics from Residential Electronics Recycling*, APC, April 2003.

The recyclability of plastics is also complicated by the addition of flame-retardants. Flame-retardants affect the flow properties of recovered plastics, making them more difficult to reprocess. It is extremely difficult to identify flame-retarded plastic from non-flame retarded.

**Table 7. Flame retardants in different types of EEE<sup>48</sup>**

Equipment	% of plastics treated with flame retardants
PCs and monitors	65%
Printers and copiers	20%
Televisions	55%

In many parts of the world, the difficulties in economically recycling plastic means plastic components are simply used as feedstock for waste incinerators. Plastic from e-waste has a good calorific value.

Markets for mixed plastic resins are limited, but several markets are used elsewhere in the world, including:

- Granulate mixed resins for use in asphalt paving products.

- Manufacture of low-end, large-piece or thick-walled products such as pallets or ‘timber’ with mixed resins.

Some e-waste recycling companies visually identify and sort plastic parts then grind the sorted plastics and process to remove metal contaminants. The resulting granulate resins are then sold on to brokers at variable market rates or reworked into other plastic products.

## 8.4 Key points

Safe disposal of CRTs is the greatest e-waste challenge facing New Zealand.

The technology is available and in use overseas to separate the lead-impregnated funnel glass from the lead-free face glass.

But there is no point in doing this unless there is a market for the re-use of glass.

The ability to recycle plastics is limited by the addition of flame-retardants and the most common solution overseas is to burn plastics in high temperature incinerators for energy recovery. Some of the plastics are also used for mixed-resin ‘timber’ products.

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<sup>48</sup> APME (2001), op. cit.

## 9.0 Potential e-waste recycling solutions in New Zealand

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### 9.1 Plastics

The most common solution overseas, burning of plastics in high temperature incinerators for energy recovery, is not available in New Zealand. This is unlikely to change, given current government policy.

One option is to identify and sort the plastics, either manually or using plastic separation and cleaning technologies. The biggest question is not whether it is technically feasible to sort this plastic, but whether it can be done economically.

Because the New Zealand materials market size is small and the identification of different plastic types is time consuming and costly, it is most likely that markets for only mixed-grade plastics from e-waste will be developed in New Zealand.

Low-grade markets for mixed ('co-mingled') plastics from e-waste have some potential in New Zealand. These include granulated plastics being used as an alternative aggregate in concrete, and being reprocessed to make plastic furniture, fence posts and similar products.

Potential markets for recycled plastics have been explored overseas and include an aggregate for an asphalt crack and pothole filler, roofing tiles, synthetic flooring core, roading base course aggregate and internal, non-visual components of products.

Innovative markets for reground mixed plastics should also be explored in New Zealand.

Overseas recycling solutions for mixed e-waste plastics already exist and could be used in New Zealand. Close The Loop Ltd (CTL)<sup>49</sup>, based in Melbourne, has developed a process for manufacturing plastic timber from styrenic plastics. The product is called 'e-wood'. E-wood is different from other plastic lumber because it has a much greater durability (equivalent to hardwood) and it can be painted, glued and varnished. Other types of plastic timber do not have these finishing properties. Markets for Close The Loop e-wood include retaining walls, furniture, fence posts and underground mine support beams.



*Potential uses for e-wood: Close the Loop's fencing and garden furniture*

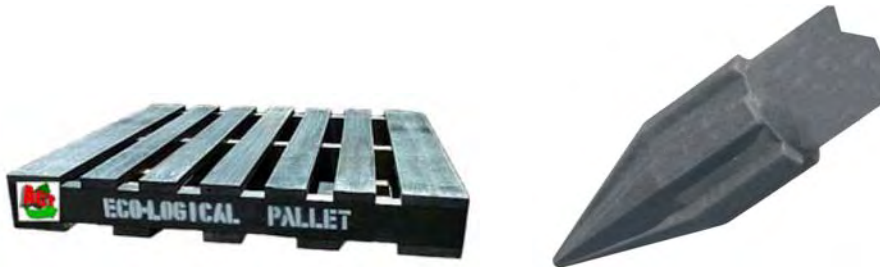
The company is interested in establishing a processing facility in New Zealand but needs an assured supply of material and potential local markets for e-wood products.

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<sup>49</sup> Close the Loop Ltd: [www.closeheloop.com.au](http://www.closeheloop.com.au)



There are other outlets for mixed e-waste plastic in Australia. MRI, an e-waste recycler located in Melbourne, sends mixed plastic to a neighbouring Melbourne plastics recycler, ACT. This company processes co-mingled plastics, including fire-retardant ABS types, into fence posts, and shipping pallets.



*ACT shipping pallet and fencepost made from co-mingled e-waste plastics.*

New Zealand e-waste recyclers have the option of exporting plastic to recyclers in Australia, or other countries. However, there is a significant transport cost involved in this export and this cost would need to be recovered through a recycling fee or similar paid to the New Zealand recycler.

Turnkey solutions for plastics recycling are available from overseas, including Australia. However, in order to make a New Zealand plastic recycling facility viable there needs to be a minimum volume domestic supply of plastic, as well as markets available for the end products (e.g. plastic lumber).

The challenge for New Zealand is to develop cost-efficient collection mechanisms to consolidate waste plastics in one or a few locations, after which the plastics are either processed locally or shipped to an off-shore plant. This is a simple question of economics that the recycling industry is well able to respond to.

## **9.2 CRTs**

There has been significant overseas research into the potential markets for CRT glass<sup>50</sup>. The struggle to find markets for the leaded glass from CRTs is global. Some uses have been identified, but to-date the most significant use has been remanufacture into new CRTs. This has become a dying market due to the switch to LCD screens and the recycling industry and other agencies have been forced to investigate more innovative uses for the leaded glass.

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<sup>50</sup> See, for example: ICER/WRAP, *Materials Recovery from Waste Cathode Ray Tubes*, UK, 2004

**Table 8. Markets for recycled CRT glass, and their potential in New Zealand**

Use category	Application	Equipment or glass type	Market in New Zealand
Reuse	Refurbish & resale	All	Exists
Closed loop glass-to-glass recycling	CRT glass manufacturing	Panel & funnel glass; lead & no-lead glass chemistries	Not available
Open loop glass-to-glass manufacturing	Decorative tile	Co-mingled CRT glass	Potential. Being trialed by Terra Nova in Christchurch
	Decorative glass products	Clean face panel glass only	Small potential
	General glass recycling	Clean face panel glass only	Not available, due to problems with glass recycling in NZ
Lead reutilisation	X ray shielding products	Co-mingled CRT glass	Unlikely
	Industrial glass panels	Co-mingled CRT glass	Unlikely
	Lead smelting	Co-mingled CRT glass	Not available. Secondary lead smelter in Wellington (Exide) not suited to use.
Glass aggregate	Flux agent for smelters: lead and copper	Co-mingled CRT glass or whole monitors (copper smelter only)	Not available.
Export	Refurbish and resale overseas	All	Available. Outlets in developing countries for reuse of CRTs both as computer monitors and as television sets.
	Fluxing agent in smelters	Funnel glass; or co-mingled CRT glass	Australia – MRI/Zinifex
	General glass recycling	Clean face panel glass only	Australia – MRI/Visy

Some potential uses for CRTs in New Zealand can be ruled out easily:

Closed loop CRT-to-CRT recycling. There are no CRT manufacturing facilities in New Zealand. Export may not be an option because CRT manufacturing overseas is declining.

X-ray shielding and industrial panel glass. Leaded glass can provide radiation protection for glass windows used in buildings, or x-ray shielding<sup>51</sup>. There is some use of these markets in the United States. There is not the same market available in New Zealand

Fluxing agents in lead and copper smelters. Glass can be used as an alternative fluxing agent in primary smelters. In some smelters lead can also be recovered from the resulting slag. There are no suitable smelters in New Zealand. The only lead smelter in New Zealand (Exide in Wellington) is a secondary, lead refining, smelter and therefore not suited to using leaded glass as a fluxing agent.

<sup>51</sup> Chelsea Centre for Recycling and Economic Development, *Potential Markets for CRTs and Plastics from Electronics Demanufacturing: An Initial Scoping Report*, University of Massachusetts, 1998.

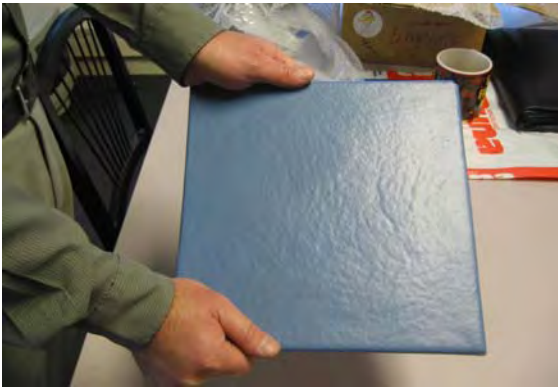


The following market options do exist, to varying extents for recycled CRTs within New Zealand.

Re-use. There is currently reuse occurring through local council facilities, ex-lease companies and charitable organisations.

Export for reuse. There is currently some export to developing countries for re-use occurring.

Decorative tile manufacture. The potential for CRT glass to be used as a raw material in making decorative tiles is currently being investigated by TerraNova in Christchurch<sup>52</sup>. This market use may provide a partial solution to CRT glass in the South Island but is unlikely to provide a comprehensive, nationwide solution.



*Decorative tile made from co-mingled CRT glass by TerraNova in Christchurch. The company is awaiting the results of laboratory testing for lead leachate in this product.*

Export for recycling. There is potential to use the recycling infrastructure in other countries. Given the lack of adequate local facilities, New Zealand needs to look overseas for solutions, initially at least. Two options – MRI and Cimelia – are described in the panel below. Exporters are required, under the Basel Agreement, to obtain licences through the Ministry of Economic Development, but this is not considered a barrier if e-waste is being exported to an appropriate recycling facility in a developed country.

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<sup>52</sup> TerraNova: [www.terranova.org.nz](http://www.terranova.org.nz)

## Asia-Pacific recycling companies



**MRI**, with facilities in Melbourne and Sydney, provides recycling services for a range of electronic equipment, including computers and televisions.

The company dismantles televisions and computers, recycles and diverts a high proportion of components and materials from landfill, distributing them to various end markets in Australia and offshore. MRI charges customers for the recycling of televisions and computers. The company is currently a recycling partner for wide range of electronics companies including Dell, managing computers taken back through Dell's 'takeback' programme in Australia.

MRI, refurbishes and offers for resale a range of products. Where this is not possible, the company dismantles the equipment and recovers reusable components and recycles a range of commodities including plastics, glass, metals and precious metal-bearing items and processes them through a facility approved by the Australian Environmental Protection Authority (EPA).

Other computer components are processed to recover copper, aluminium, and resaleable items such as cooling fans, CD-ROM drives, power supplies and TV set castors.

MRI has CRT demanufacturing facilities where CRT glass is split into its face and funnel glass sections, using the same basic technique described in section 8.1. Face glass is sent to Australian recycler Visy for recycling. Funnel glass goes to Zinifex Ltd's South Australian lead smelter where it is used as a flux replacement.

MRI offers this solution for end-of-life televisions and monitors to any company in New Zealand that can accumulate full container loads of monitors/televisions. The current charge, including freight, is about \$20 per CRT.

MRI is also interested in selling turnkey CRT processing solutions to New Zealand. Companies in Asia and Europe offer similar recycling services if CRTs are shipped to them.



One of the largest facilities in the Asia-Pacific region is **Cimelia** in Singapore. Cimelia acts as a south-east Asia recycling hub and has a 25,000 tonne feedstock capability. Manufacturers in the Asia-Pacific region already use Cimelia to manage surplus stock and customer take-back.

Cimelia disassembles CRTs and sends the glass to a nearby company for remanufacturing into CRTs. Cimelia also has a precious metal extraction and refining plant for processing printed circuit boards.

Cimelia has installed joint-venture turnkey solutions for e-waste in other countries and would be interested in a similar venture in New Zealand.

### 9.3 Box stripping

Stripping of computer boxes is presently a labour-intensive, low-profit operation, but it would be more viable if operated on a larger scale in a conveyor-belt process with specialist strippers working on different parts of the operation. (Analogous to the difference between a small abattoir where one or a few persons do all stages of the butchering work, and a freezing works 'chain' system.) There are no such facilities in New Zealand, but they could be associated with larger-scale monitor rendering plants that might be set up in the future. Alternatively, exporting of minimally stripped boxes to Asian plants for metal extraction may remain an option.

### 9.4 Capacity building and recycling skills

The group of industries involved with waste, recycling, resource recovery, zero waste and scrap metal, collectively known as the 'resource recovery' industry, has until recently felt educationally marginalised. Until 2004 there was no industry training organisation (ITO), nor was there any specific NZQA accredited industry training or qualifications. This started to change in March 2004 with the establishment of the Extractive Industries Training Organisation (EXITO).

While no specific unit standards have yet been developed for e-waste, EXITO does have a track record with the development of 238 unit standards in areas such as scrap metal, composting, solid waste, hazardous and special waste etc. At the April 2006 meeting of the Resource Recovery Sector Advisory Group (RRSAG), it was agreed that e-waste units would be developed "further down the track" and a special interest group would be established to look at e-waste issues.<sup>53</sup>

This is good news in building capability within the e-waste sector and in raising confidence in the community that computer recycling and the associated safe disposal of e-waste is a 'real job' and not just one left to not-for-profit community groups and volunteers. Standards for recycling operators also give confidence to manufacturers and producer responsibility organisations that their end-of-life equipment is being handled in an appropriate way.

A recent report in the UK drew specific attention to the need for skilled people to correctly differentiate and separate waste materials<sup>54</sup>. The same report revealed that one in ten recycling staff felt that a lack of training was not only damaging to their career prospects but also to the success of recycling schemes.

### 9.5 Research and development

It is evident to us that significant research and development opportunities could arise from the e-waste sector. This includes the design of new electronic equipment, the development of cost effective e-waste solutions and the re-use of e-waste materials. While participants in the industry meetings were quick to point out that New Zealand can not expect to have much impact in the manufacture of computers and TVs, there is nothing preventing New Zealand researchers exploring the development of more enviro-friendly materials that could potentially be used in the manufacturing process. Likewise, there are opportunities for innovation in e-waste processing and in the development of new materials from e-waste. The decorative tiles being developed by TerraNova from co-mingled CRT glass is a good example.

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<sup>53</sup> Communication from Jonathon Hannon, Coordinator of the Zero Waste Academy, Massey University

<sup>54</sup> [www.mrw.co.uk/homepagePBP\\_NADetail\\_UP.aspx?ID\\_Site=534&ID\\_Article=9874&mode=1&curpage=0](http://www.mrw.co.uk/homepagePBP_NADetail_UP.aspx?ID_Site=534&ID_Article=9874&mode=1&curpage=0), viewed on 30 June 2006

The challenge for New Zealand is more a matter of funding – how to persuade the significant funders of research and development that there are potential economic benefits for New Zealand.

## 9.6 The Basel Convention

The Basel Convention is an agreement between countries to control the international movement of hazardous waste. New Zealand ratified the Basel Convention in 1994. Exports of most of our electronic waste<sup>55</sup> is subject to the Basel Agreement, which applies under the umbrella authority of New Zealand's Imports and Exports (Restrictions) Order (No 2) 2004.

Electronic goods destined for disposal and recovery are classified as hazardous waste if they contain any of the hazardous materials contained in annexes of the Convention.

Some items of e-waste contain hazardous materials such as lead, chromium and mercury. E-waste items classed as hazardous include (but are not limited to):

- Mobile phones
- Computer monitors
- Televisions
- Printed circuit boards
- Photocopiers
- Fluorescent lamps

Companies or persons exporting electronic waste from New Zealand to Basel signatory countries must obtain a 'Basel Permit' from the Ministry of Economic Development.<sup>56</sup>

The Ministry of Economic Development must be satisfied that the e-waste is destined for an appropriate processing facility in the country of import. There is a differentiation between OECD and non-OECD countries under this permitting system, but both require the same information and verification to ensure that the waste is ending up in facilities which process in an environmentally sound manner.

Electronic products for re-use are not classified as a hazardous waste movement and therefore do not require a Basel Permit.<sup>57</sup> Customs in New Zealand and the receiving country must be satisfied that the equipment is destined for re-use rather than disposal.

A Basel Permit requires the company exporting from New Zealand to have the following:

- A written contract between the exporting company and the importing company
- Appropriate insurance for the shipment
- Details of the route the shipment will take

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<sup>55</sup> Most of New Zealand's known export destinations for e-waste are Basel signatories – including China, Hong Kong, Taiwan, Singapore, Vietnam, India and Pakistan.

<sup>56</sup> Further information on the Basel Convention and e-waste is available at [www.med.govt.nz/templates/Page\\_10556.aspx](http://www.med.govt.nz/templates/Page_10556.aspx)

<sup>57</sup> MED advises that electronic equipment is considered to be waste by Customs Department if it does not power up, or there is physical damage that impairs its functionality or safety or there is a faulty hard disk drive, RAM or video card or there are batteries containing lead, mercury or cadmium or liquid cathodes that are unable to be charged or to hold power or there is insufficient packaging to protect the goods from damage during transport. Direct re-use with minor upgrading or refurbishment that is packaged appropriately for transport would not require a permit.

Reasons that the waste cannot be disposed of in New Zealand

Details and information about the proposed receiving company and its processing facilities.

Basel permits have never been applied for, or issued, for computer or television e-waste export from New Zealand, yet we know that equipment is regularly shipped overseas for recycling.

Control can be exercised under separate agreements, for e-waste exports to countries that are not parties to the Basel Convention. For instance, the USA is not a party, but New Zealand companies wishing to export there can apply for a separate OECD permit. Export of waste to South Pacific countries requires permits under the Waigani Convention.

## **9.7 Key observations**

It is clear that recycling solutions for many types of e-waste, and in particular CRTs, are not currently available within New Zealand. This is because the recycling of CRTs and plastics from TVs and computers does not generate a profit for recycling operators.

Recycling solutions are available overseas and New Zealand can make use of these solutions by shipping waste to appropriate facilities in other countries, such as Australia or Singapore.

Export of e-waste from New Zealand to recycling facilities in most countries is not banned but is supposed to be controlled through hazardous waste permits from the Ministry for Economic Development. Levels of permitting are currently nil, even though New Zealand companies are known to be exporting e-waste for recycling. This suggests that illegal shipments are taking place.

There are costs associated with the export of e-waste (in particular CRTs and plastics) for recycling. It is therefore a question of how these recycling costs are going to be met.

With such an undeveloped recycling infrastructure in New Zealand, it is likely that any e-waste management system will need to export equipment whole for recycling. This is likely to change as the supply of equipment and financing through any product stewardship regime makes domestic recycling more viable. New Zealand will then have domestic and overseas options available for dealing with e-waste.

Turnkey solutions are also available to be imported into New Zealand. These solutions would only be viable if there is a system for financing and collection of e-waste that would give certainty of supply to recyclers and pay for the costs of the recycling.

There is a need for a code of practice and some waste industry qualifications; these will become especially important if recyclers wish to compete for industry-funded contracts to manage e-waste.

The computer and television industries should collaborate with Government in encouraging investment in research into new markets and processing techniques for e-waste materials, and into more enviro-friendly materials for initial product manufacture.

## 10.0 Product stewardship schemes

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There has been a global trend toward regulatory approaches to producer responsibility, or product stewardship. The trend has been led by Japan and the European Union.

The European Union's 'Directive on Waste Electrical and Electronic Equipment' (known as the WEEE Directive) has promoted the greatest change in the industry. Legislation is also under development in China, Australia and many individual states of the USA.

Several countries have promoted a more voluntary approach to product stewardship for e-waste. Key among these have been the USA, Canada, and New Zealand.

### 10.1 European Union schemes

The European Union (EU) has developed a regulatory approach to product stewardship for e-waste and its WEEE Directive became law in 2003. The legislation required EU member countries to provide a system for the free collection of equipment from consumers by August 2005. Many countries missed this deadline.

Under the WEEE Directive, producers are required to finance the collection and treatment of e-waste. European schemes are required to manage *all* types of electronic and electrical equipment including IT, consumer equipment, whiteware, lighting, tools, and medical equipment.

Each country in the EU has passed, or is in the process of passing, regulations to meet the requirements of the WEEE Directive.

It is early days in the implementation of many schemes that have been set up in Europe to meet the WEEE Directive.

There are some common characteristics of European national product stewardship schemes for e-waste and these are described below. Note, however, that due to the newness of Directive implementation, some of the information may be subject to change.

Observations on typical European producer schemes<sup>58</sup>:

- All are run by not-for-profit 'producer responsibility organisations' (PROs), typically set up and owned by one or more trade associations.

- Most use a combination of retail take-back (on an old-for-new basis, when a new item is being purchased) and local authority collection facilities for domestic sources of e-waste. Commercial e-waste is taken back directly by individual producers and fed into the system, or collected by the PRO for a fee.

Collection at local authority facilities is the most used channel for almost all schemes. In some systems, it is the only channel used (Table 9).

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<sup>58</sup> These observations on EU schemes are based on two sources: the European experiences of Simon Wilkinson, one of the authors of this report, and a report by Future Energy Solutions, *Study into European WEEE Schemes*, for the UK Dept of Trade and Industry.

**Table 9. European producer schemes**

Scheme	Retailer	Producer	Centres (municipal)	Centres (other)
Recupel (Belgium)	25%	-	60%	15%
ICT Milieu (Netherlands)	-	-	100%	-
NVMP (Netherlands)	10%	-	87%	3%
El Retur (Norway)	31%	-	51%	14%
El Kretsen (Sweden)	-	-	75%	25%
SWICO (Switzerland)	58%	18%	8%	16%

All schemes outsource most of their transport, recycling and treatment activities. Most use multiple contractors in order to avoid monopolistic behaviour.

Some schemes insist on separate contracts for transport and recycling service providers.

Schemes with competitive tendering for multiple service providers have managed to control and reduce costs.

**Table 10. Financing mechanisms used in European producer schemes**

Mechanism	Description	Scheme/country
Visible fee per product – future and historic waste	<p>Fee collected from producers for every product placed on market.</p> <p>This fee/levy is imposed on consumer at point of purchase.</p> <p>The fee covers cost of recycling the individual product sold, plus a component for the recycling of WEEE put on the market before the scheme (historic waste), plus a component for any WEEE from non-participating producers (orphan waste)</p> <p>A reserve fund is built up to cover future and historic waste liabilities</p> <p>As % of historic waste declines, so (in theory) will the level of fee decline</p>	NVMP/Netherlands Recupel/Belgium El Retur/Norway
Visible fee per product – current waste	<p>Fee collected from producers for every product placed on market.</p> <p>This fee/levy is imposed on consumer at point of purchase.</p> <p>All income raised is used to finance operating costs of dealing with current WEEE entering the system.</p> <p>Does not create a reserve fund for future and historic waste, but builds an operating reserve fund to underwrite activity for a period of months. After end of set period costs are reconciled against income.</p> <p>Any surplus is returned to producers and fee level adjusted.</p>	SWICO/Switzerland
Non-visible fee per product – no historic waste	<p>Fee collected from producers for every product placed on market.</p> <p>Fee is absorbed into producers costs and not visibly charged to consumers at point of purchase.</p> <p>All income raised is used to finance operating costs of dealing with current WEEE entering the system.</p> <p>Does not create a reserve fund for future and historic waste but builds an operating reserve fund to underwrite activity for a period of months. After end of set period costs are reconciled against income.</p> <p>Any surplus is returned to producers and fee level adjusted.</p>	El Kretsen/Sweden

Mechanism	Description	Scheme/country
Actual costs – current market share, in arrears	Products within a given category are recycled and total actual costs calculated. Costs apportioned to producers on the basis of current market share data that is provided to the scheme, or to a trusted third party. Costs of scheme are absorbed into the overall product price.	El Kretsen (ICT sector)/Sweden ICT Milieu/Belgium

Scheme fees for producers are calculated by different methods:

- Fixed fee per unit (variable by category)
- Fee per product weight
- Fee according to cost band
- Fee according to % of sales price

Fees are set based on:

- Return rate of the product category
- Weight of product and its associated transport costs
- Actual costs of treatment
- Materials content and value for recycle

Schemes recycle approximately 80% of e-waste collected, with the remainder being incinerated with energy recovery or landfilled.

All schemes have managed to significantly reduce their cost/kg over time. These reductions have been made through improved rationalisation of operations, economies of scale, and through better negotiated contracts with recyclers and logistics providers.

A balance must be struck between administrative efficiency and the desire to allocate real costs of recycling to a particular product category. It is sometimes more efficient to band products together for administrative efficiency – some schemes have reduced their product categories to just a handful. However, a more complicated system (such as El Kretsen in Sweden) gives a better reflection of actual recycling costs for each type of product but can be an administrative burden on producers that manufacture across multiple product categories.

***Irish and Swedish schemes:*** we have looked in more detail at schemes in Ireland and Sweden, two countries closer in size to New Zealand than some of the European countries.

While the WEEE Directive required that schemes be in place by August 2005, the Swedish *El Kretsen* scheme started earlier because of previous national legislation. But the earlier Swedish system needed to be adapted and has only been operating under the full WEEE Directive requirements for just over six months. The Irish scheme is in a similar state of infancy.

## 10.2 Sweden

Sweden is a good example of a European e-waste product stewardship scheme.

***Background:*** Legislation entitled ‘Producer Responsibility for Electrical and Electronic Products Ordinance’ came into force in 2001. This legislation was updated in 2005 to reflect the more stringent requirements of the EU WEEE Directive.



Consumers are given the right to return old products free of charge when buying a new product of a similar type. Local authorities are required to collect equipment not exchanged on a 1:1 basis.

As a solution to the 2001 legislation, producers in Sweden founded the company *El-Kretsen AB*. This company is owned by 21 trade associations, representing all the types of equipment concerned. To date more than 800 international and domestic producers have joined the El-Kretsen scheme. These producers are estimated to represent almost the total market for electronic and electrical equipment in Sweden<sup>59</sup>.

The board of directors of El Kretsen consists of nine members made up of producers and retailers. There are 15 full time staff running El Kretsen.

El Kretsen uses local authority waste/recycling depots as the main collection points for products from domestic consumers. Local authorities pay for the cost of the collection facilities, but El-Kretsen pays for the collection of equipment from these facilities and for their treatment/processing.

The whole system is called *elretur*.



*WEEE collection at local authority transfer station, Stockholm, Sweden, 2003*

**Operation:** There are 650 collection points for household WEEE and 300 for businesses – at least one in each of Sweden’s 289 municipalities. Some additional locally designed systems of collection, financed through municipal tax or fees also operate. These include kerbside, call systems and additional collection points.

Household consumers may return WEEE free-of-charge to any of 700 collection sites paid for and operated by the local authorities. Equipment can also be returned to producers on a like-for-like basis.

Business consumers have two options: they can ask their suppliers to take back goods that are being replaced or they can deposit the replaced goods at one of 350 business collection centres, free of charge.

Transport of waste from the collection centres to recycling organisations is organised and financed by El Kretsen. Twenty-one transport providers have been contracted using a competitive tendering process.

El Kretsen pays for treatment and recycling, using 28 service providers, including large waste management companies, small local operators and ‘social enterprises’ – community/not-for-profit recycling projects.

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<sup>59</sup> Membership has increased significantly since new legislation was implemented in 2005 bringing the Swedish legislation into line with the EU WEEE Directive (El Kretsen Annual Report 2005-06).



*WEEE dismantling facility contracted to El Kretsen, Uppsala, Sweden*

**Financing:** El Kretsen has a turnover of 300 million Swedish Kronor (€32 million, NZ\$63 million).

The actual costs of processing e-waste in each product category are recorded. Common costs such as management and communications are split among the categories. Fees from a specific sector are kept separate and used exclusively to cover the costs of that sector, meaning that no sector is cross-subsidised. Each sector decides how to split costs within that sector.

Each month the contributors declare their sales to El-Kretsen and their contribution is calculated on the basis of the number of units sold per category of equipment.

Collection service providers are remunerated per kilogram of waste collected for electronics and per unit for white goods and light sources. The industrial recycling firms are remunerated per tonne of waste received.

Producers pay an entry fee of €380 to join El-Kretsen, and an annual fee of €54.

In addition to annual fees, suppliers pay a variable fee, based on their sales of new products. The total fee is determined by a combination of the type of product and volume of sales. Some fees are calculated on a per-item basis, while others are on a per-kg basis. Some examples of fees are shown in the table below.

**Table 11. Examples of El-Kretsen 2006 fees per item<sup>60</sup>**

	2002	2006
Microwave oven	€4.90	€2.70
Washing machine, dishwasher, tumble dryer, cooker	€9.20	€4.85
Mobile phones	€0.02	€0.02
TV sets (>32")	€26.00	€19.00
TV sets (22-31")	€17.40	€13.00
TV sets (<22")	€8.70	€6.50

These scheme fees are based on the actual costs associated with the processing of the category of equipment. These costs vary according to the size and complexity of the item, as indicated in the calculation model below.

<sup>60</sup> From [www.el-kretsen.se](http://www.el-kretsen.se) and based on current exchange rate of Swedish Kronor to Euro.

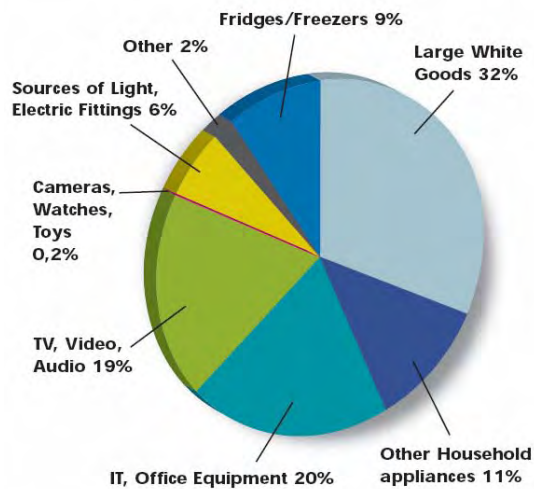
**Table 12. El Kretsen model for calculation of fees**

Item	TVs	Mobile phones
Weight	Heavy	Small
Return rate	High	Low
Treatment cost	High	Low
Material value/reuse	Low	High
FEE	€6-19 (NZ\$12-38)	€0.025 (NZ\$0.05)

These fees are fixed for the year. At year end, the accounts are settled for each product type. Any remaining surplus is credited to respective suppliers, either as a reduction on future fees or as a repayment. Table 11 also shows that fees have reduced between 2002 and 2006. Reductions in fees have been achieved through lower recycling and processing costs. These cost savings have come as a result of competitive tendering for recycling and transport contracts. Recycling and transport service providers have been able to reduce costs by rationalising their businesses through economies of scale.

A different debiting model has been implemented for ICT equipment. El-Kretsen calculates the real cost for collection and treatment of ICT products for each month and this is divided among the suppliers according to their market share. The market share is defined as each supplier's proportion of total sales in the preceding year.

**Data/results:** In 2005, El Kretsen collected 126 million kg of e-waste, equal to 14 kg/person in Sweden. In terms of collection quantities, this is the best performing e-waste collection scheme in the world.



*Composition of e-waste collected by El Kretsen in 2005<sup>61</sup>*

Plastics and wood are incinerated for energy recovery. Metals are recycled. Hazardous materials are treated through high temperature incineration or special disposal. Estimates of the treatment routes for e-waste in the El-Kretsen system<sup>62</sup>:

<sup>61</sup> Reproduced from the El Kretsen annual report, 2005-06.

Recycled and recovered:	70%
Energy recovery (incineration):	20%
Landfill	10%

### 10.3 Ireland<sup>63</sup>

**Background:** Irish regulations enacting the WEEE Directive has set out requirements for producers.

Consumers can drop off WEEE at local authority facilities and/or retailers (old-for-new). Producers finance transport and recycling beyond collection.

Producers must join a compliance scheme, or self-comply. Two not-for-profit producer responsibility organisations (PROs) have been set up and now operate in the country to manage e-waste on behalf of producers. Both PROs are open to membership from any producer.

One is a pan-European organisation set up in 2002 by four major electronics companies: Sony, HP, P&G (formerly Braun) and Electrolux. This is the European Recycling Platform (ERP). The ERP is designed to deliver a cost-effective solution on behalf of member companies.

ERP aims to develop and operate a common waste management procurement platform to:

- Meet the specific requirements of electrical and electronic producers.

- Promote cost-efficient and innovative recycling strategies, while actively embracing the concept of individual producer responsibility.

- Open up opportunities for pan-European recycling services and cross-border competition in the waste management service market.

The other PRO is WEEE Ireland, set up by producers' associations to meet member obligations. Members of WEEE Ireland are invoiced monthly, based on the amount of equipment they placed on the market in that previous month.

**Operation:** Geographical territory has been split between the two collection schemes, or PROs, in Ireland. Some larger retailers have aligned themselves with one or other of the collection schemes.

Both collection schemes use multiple transport providers and multiple recycling contractors. These contracts are awarded on a competitive basis.

**Financing:** Producers must register with the 'WEEE Register Society' and show a unique registration number on all invoices, dispatch dockets and credit notes.

Producers submit monthly sales figures to a 'black box' managed by Deloitte.

For all equipment except IT and telecommunications equipment, medical equipment and monitoring/control equipment, a visible fee, known as the Environmental Management Cost, is imposed on the consumer at the point of sale. The visible fee varies depending on the product and is based on estimated costs of recycling.

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<sup>62</sup> Future Energy Solutions (2003) *Study into European WEEE Schemes*; report for UK Department of Trade and Industry; 20 Nov 2003.

<sup>63</sup> The authors are grateful for the assistance of John Hayes from the European Recycling Platform in Ireland for information and assistance with this section.

**Table 23. Examples of visible fees in Ireland**

Item	Price (€1=NZ\$2 approx)
Refrigerators >250 litres	€20
Microwave	€5
TV 73cm+	€20
TV 52-72cm	€10
TV 0-51cm	€5
Fluorescent lamps	€0.50

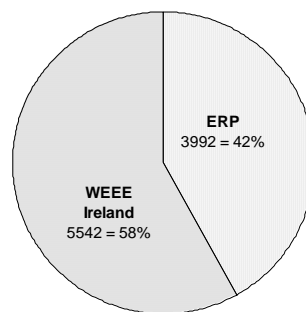
Visible fees are paid by a consumer to the retailer. Producers then invoice retailers for the fee, less 20% kept by the retailer to cover administrative costs, and less VAT (GST equivalent). The remainder of the fee is used by the PRO to pay for the transport and recycling of collected equipment

There is no visible fee for the IT and telecommunications sector. Instead, producers are invoiced for recycling costs by the PROs based on every tonne of product the producer has placed on the market in the previous month, as a percentage of the total market. This information is managed by the Deloitte's black box.

The Irish visible fee mechanism is currently being reviewed.

There is also considerable debate about the levels of contingency funding required by the PRO schemes to handle historical waste into the future. The ERP has decided on a 12 month contingency fund, and now has this in place. WEEE Ireland is considering a contingency fund that will take them through to 2020. There is concern among some producers that such fund-building is excessive and unnecessary. The WEEE Register (collector of visible fees) said this approach was not acceptable and WEEE Ireland has made a new submission for a contingency fund based on one year's operating costs. It is expected that a final decision on new fees will be arrived at, at the end of June with implementation on 1 September 2006.

**Data/results:** ERP represents approximately 20% of the Irish electronic and electrical equipment market. After the initial 5 months of operation, ERP was collecting 42% of WEEE in the country. This inequity is being redressed and the PROs are reallocating the territory so that WEEE Ireland has more territory.



Total: 9534

The combined Irish schemes are on target to collect approximately 6.7 kg/person/year e-waste. This far exceeds the 4kg/person/year target of the EU WEEE Directive.

Approximately 78% of e-waste in Ireland is collected at local authority collection sites, where consumers can dispose of e-waste free of charge. The remaining 22% is collected through

retailers who are obliged to offer a take-back system to customers purchasing replacement electronic and electrical goods.

The original business plan for both WEEE Ireland and ERP was to export 100% of equipment without pre-processing, due to the lack of infrastructure in the country. Irish recyclers have since invested in recycling plants and now 60% of equipment has some form of pre-processing in Ireland. Most materials are still exported for actual recycling.

## 10.4 USA

The United States has had a wide range of individual state responses to the e-waste issue. There have also been a large number of voluntary initiatives by individual manufacturers and electronics retailers. Some significant e-waste collection and recycling pilot projects have been run in the US over the last 10 years<sup>64</sup>.

**National initiatives:** Over the last five years there have been concerted efforts to develop a national product stewardship programme for e-waste in the USA. The National Electronics Product Stewardship Initiative (NEPSI) is a formal national discussion among electronics manufacturers, state and local government agencies, recyclers, and non-governmental organisations. The goal of the initiative is to develop a written agreement among stakeholders that will increase the collection, reuse, and recycling of used electronic products. The products being addressed in the dialogue are televisions, computer monitors, CPUs, laptops, and computer peripherals such as printers.

The NEPSI is coordinated by the University of Tennessee using funding from the US EPA.

**State legislation:** Growing numbers of states are implementing their own legislation for e-waste. There is a lack of legislative action at a federal level and approaches vary from state to state. Two examples are given below.

**California:** The Electronic Waste Recycling Act was introduced in California in 2003.

Since 1 January 2005, retailers collect fees on televisions and computer screens at the point of sale/lease. Fees are set according to cost of recycling. Products covered are – CRTs and LCDs (i.e. computers, laptops and televisions).

**Table 14. Recycling fees for CRTs in California, January 2005**

Viewable screen size	Electronic waste recycling fee
Between 4" and 15"	\$6
15" to 35"	\$8
35" +	\$10

The retailer keeps 3% of the fee to cover administration costs.

There are no fees on the resale of equipment.

Collected fees are deposited in an 'Electronic Waste Recovery and Recycling Account' managed by the State of California and used to pay authorised collectors and recyclers.

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<sup>64</sup> See, for example, US EPA, *Plug-in To eCycling: Voluntary Shared Responsibility Pilots for Electronics Recycling, 20003*; or Northeast Recycling Council, *Setting Up & Operating Electronics Recycling/Reuse Programs: A Manual for Municipalities & Counties, 2002*.

Approved collectors and recyclers are required to maintain records documenting costs and then submit annual reports to the CIWMB on the net costs of collecting and recycling covered electronic wastes (CEWs). Covered electronic wastes include televisions and computer monitors that contain a cathode ray tube (CRT), laptop computers, and liquid crystal display (LCD) computer monitors. Plasma and LCD televisions were added from July 1, 2005.

The annual report includes:

- An annualised summary of the net revenues, costs and net costs (costs less revenues) of covered electronic waste (CEW) recovery and/or CEW recycling.

- Total annualised revenues excluding recovery and recycling payments received from the CIWMB, plus a list of the types of revenues included.

- Total annualised costs, plus a list of the types of costs included.

- The net cost per pound of CEW recovery and the net cost per pound of CEW recycling.

Collectors/recyclers are reimbursed from the collected fees according to the quantities they have processed. They receive 20c per pound collected and 28c per pound recycled (48c total).

**Maine:** Legislation was passed in the state of Maine in 2004 and implemented in January 2006.

The approach is one of shared stewardship between local authorities and producers.

Local authorities collect e-waste from consumers for free. The local authorities then deliver this e-waste to consolidators.

Consolidators record quantity, and brand. The consolidators then invoice the producers for the costs of handling, transporting and recycling equipment.

## 10.5 Australia

**Legislation and policy:** The following outline chronology provides a sense of policy activity including studies, discussion papers and progress towards a 'National Environment Protection Measure for Product Stewardship', looking at co-regulatory action for TVs, tyres and potentially IT equipment:

- The policy process effectively commenced in 2001 with the publication of a Commonwealth Government discussion paper titled: Developing a Product Stewardship Strategy for Electrical and Electronic Appliances in Australia.

- 2001: Commonwealth Government commissions study – Major Appliances Materials Project.

- 2001: Commonwealth Government commissions study – Computer and Peripherals Material Project.

- 2001: The Waste Avoidance and Resource Recovery Act 2001 provides for the introduction of extended producer responsibility (EPR) schemes in NSW.

- 2002-2003: generally a significant period of inaction by both government and industry.

- 2004: increased activity, with a greater focus by governments on IT equipment and TVs.

- 2004: New South Wales Government launches the Extended Producer Responsibility Priority Statement. IT equipment and TVs are listed as priority waste for industry action.

2004: Commonwealth Government commissions study – Electrical and Electronic Products Infrastructure Facilitation.

2004: discussion paper called Co-regulatory Frameworks for Product Stewardship released by the Environment Protection and Heritage Council (EPHC) and the government.

2005: Western Australian Department of Environment releases policy statement on Extended Producer Responsibility.

2005: Commonwealth Department of the Environment and Heritage begins industry roundtable process on how Australia should or could act in harmony with the EU Directive on Restriction of Hazardous Substances with a view to eliminating dumping of non-compliant product in Australia.

2005: EPHC/Government commence drafting a National Environment Protection Measure on Product Stewardship.

2006: Draft National Environment Protection Measure (NEPM) for Product Stewardship scheduled for release and comment (June 2006).

***Industry-wide product stewardship initiatives:*** no collective industry-wide product stewardship initiatives (involving multiple producers and/or suppliers) are operating in Australia for computers or televisions. While industry-wide schemes exist for mobile/cell phones and imaging consumables such as toner and inkjet cartridges, this has not yet extended to similar initiatives for TVs and IT equipment.

Pilot collection and recycling projects have been conducted as a means of trialling methods, collecting data, economic and environmental assessment, as well as evaluating community awareness and participation. The first noteworthy pilot was conducted by the Consumer Electronics Suppliers Association (CESA) in partnership with MRI Pty Ltd and RMIT University. The TV pilot project was conducted across eastern metropolitan Melbourne, and co-funded by CESA member companies and EcoRecycle Victoria<sup>65</sup>.

The second significant e-waste related pilot project was developed and co-funded by the Australian Information Industry Association and New South Wales Department of Conservation and Environment. The project covered IT equipment and conducted across western metropolitan Sydney during 2003-2004<sup>66</sup>.

Current activity by both sectors (TVs and IT) is focused on developing collection, processing and education schemes or programs. Although this development work is being led by the companies and their respective industry associations, governments (federal, state and territory) are also playing a key role through the Environment Protection and Heritage Council (EPHC). The EPHC provides a national vehicle by which all federal, state and territory environment ministers can debate, assess and facilitate the development of nationally coherent and consistent environmental policies and associated legislation and regulation.

Two initiatives or schemes are currently being formulated, each one dealing with TVs and IT equipment respectively. These initiatives are being developed separately, however both sectors and their associations liaise with a view to cooperation where appropriate and beneficial.

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<sup>65</sup> *Beyond the Dead TV – Managing End-of-Life Consumer Electronics in Victoria*. May 2003. Available on-line at: [www.aeema.asn.au/Default.aspx?ArticleID=566](http://www.aeema.asn.au/Default.aspx?ArticleID=566).

<sup>66</sup> *Recycle IT! Computer Collection Pilot*. October 2004. Available on-line at: [www.aiia.com.au/i-cms.jsp?page=738](http://www.aiia.com.au/i-cms.jsp?page=738).



**Industry-wide product stewardship activity for TVs:** Current activity on TVs is industry-led and driven by Product Stewardship Australia Ltd (PSA)<sup>67</sup>. PSA was established by CESA in late 2004, chiefly in response to recommendations put forward in the TV pilot recycling project report. Also in 2004, CESA established a product stewardship working group which played a proactive role in developing a high-level working strategy on how to move forward on shared product responsibility, including organisational and financing options.<sup>68</sup>

PSA is a relatively new organisation with a focus on managing environmental issues in the consumer electronics sector in Australia. PSA is operational and has a board of directors and a part-time Executive Officer. The initial focus is on post-consumer TVs (CRT, LCD and plasma technologies). However, PSA is planning to expand its e-waste programmes to address other e-waste categories as determined by member companies and government/EPHC priorities.

In generic terms, PSA is often referred to as a 'Product Responsibility Organisation' (PRO) and is similar to organisations in Europe and Canada that manage industry-wide e-waste programs. PRO type organisations already exist in Australia for managing packaging and ozone depleting substances/refrigerants.

An essential aspect of PSA's scheme is the need for a uniform, national approach to regulating free-riders, including effective enforcement of the approach for TV suppliers who fail to participate in either an approved scheme (such as PSA is planning to achieve) or their own collection, recycling and education activities.

PSA is currently following a co-regulatory model for how its scheme would operate. Under the model, PSA would voluntarily develop, finance and deliver elements of a phased national TV collection and recycling scheme, subject to government effectively regulating free-riders. PSA expects that any safety regulation would effectively reduce the risk of competitive disadvantage by providing incentives for potentially indifferent TV suppliers to either join the PSA scheme or create their own program. This is consistent with current government/EPHC work on drafting a 'National Environment Protection Measure for Product Stewardship' (NEPM).

As part of the co-regulatory framework, PSA is currently drafting a 'Product Stewardship Agreement' complete with collection and recycling targets, key performance indicators and timeframe for national implementation. This agreement will be considered and assessed by government/EPHC as part of becoming an approved scheme.

A 'shared product responsibility' approach to managing end-of life TVs underpins the PSA model and as such they are investigating how other relevant stakeholders (e.g. consumers, retailers, local councils, waste management industry) can also play a productive role in any scheme.

PSA is also proposing that the Australian Customs Service play a key role by providing effective data on TV imports to enable efficient enforcement of any safety-net regulation or product stewardship NEPM.

PSA is forging ahead in the development of a phased, national TV collection and recycling scheme. PSA is also consulting with relevant government departments (eg. Environment, Customs, ACCC) to help facilitate the development and strong enforcement of national regulation to deal with free-riders.

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<sup>67</sup> For more detailed information about PSA and its activities refer to: [www.productstewardship.asn.au](http://www.productstewardship.asn.au).

<sup>68</sup> *A Collective Product Stewardship Approach for Electrical and Electronic Product in Australia: Strategy Plan – Working Document*. Available on-line at [www.productstewardship.asn.au](http://www.productstewardship.asn.au).

A key part of PSA's activities is to work cooperatively and collectively with other consumer electronics suppliers and retailers in developing a permanent and national solution to TV recovery and recycling, including effective consultation with government and the use of community education.

Membership of PSA is open to companies involved in the manufacture, supply, distribution and/or retailing of consumer electronics in Australia. Current PSA members (and/or their brands) include:

- BenQ
- Castel Electronics (Toshiba and Orion brands)
- Dick Smith Electronics
- Hagemeyer Brands (JVC)
- Hitachi Australia
- LG Electronics Australia
- NEC Australia
- Panasonic Australia
- Philips Electronics Australia
- Samsung Electronics
- Sanyo Oceania
- Sharp Corporation of Australia
- Sony Australia

These TV suppliers and their respective brands represent approximately 60-70 % of TVs imported into Australia during 2005.

PSA is proposing to commence its phased national take-back scheme once governments have enacted the NEPM across all states and territories. Current estimates indicate this to be late 2007 or early 2008.

***Industry-wide product stewardship activity for IT equipment:*** the Australian Information Industry Association (AIIA) is driving the only industry-wide initiative on IT equipment in Australia<sup>69</sup>. Its recent history and current activities reflect a relatively similar process to the CESA/PSA approach in terms of having undertaken a pilot project and now seeking to facilitate and develop a scheme or program that would meet the needs of its member companies while also delivering environmental benefits.

The AIIA has an Environment Interest Group representing key IT equipment producers and suppliers including:

- Apple
- Canon
- Epson
- Fujitsu
- Fuji Xerox
- HP
- IBM
- Lenovo
- Intel

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<sup>69</sup> For more detailed information about AIIA and its product stewardship activities, refer to: [www.aiia.com.au/i-cms.isp?page=139](http://www.aiia.com.au/i-cms.isp?page=139).

Kodak  
Lexmark  
Microsoft  
Sun Microsystems  
Dell

The AIIA Environment Special Interest Group has been very active over the last 18 months developing its principles and strategic process within the context of how the sector could deliver a national product stewardship scheme for post-consumer IT equipment. The AIIA's recent documents seek '*...to facilitate solution-oriented dialogue amongst industry and government stakeholders with an ultimate objective of establishing and initiating an industry driven take-back scheme for end-of-life computers, printers and associated hardware products*'.

Similar to PSA activity on TVs, the AIIA is working towards a product stewardship agreement featuring detail on collection, funding, processing and the role of regulation if/where required to deal with free-riders. The AIIA is also considering establishing a PRO (similar to the TV industry PSA) to manage its scheme.

Issues of orphaned and historical products, including how to finance their collection and processing, remains a critical area of discussion and negotiation with government/EPHC. This is a significant issue that is also relevant to ongoing scheme development by PSA.

The AIIA seeks flexibility for member companies to either join a collective or PRO based scheme, or operate their own individual take-back program '*subject to agreed minimum standards*'.

Like the TV sector, the Australian IT sector is concerned about the impact of free-riders. It believes the volume of un-branded or 'whitebox' IT products is even higher than that affecting the TV sector.

The AIIA has also undertaken an information and promotional project highlighting the importance of Design for Environment (DfE) measures as part of any product stewardship process.

In summary, both the AIIA and PSA are in a scheme development phase which includes ongoing discussion and negotiation with the Federal Government and the Environment Protection and Heritage Council.

***Product stewardship activity for TVs – individual companies:*** From a Design for Environment perspective, the major, well established TV producers (e.g. Sony, Philips, Panasonic, Samsung) are all actively addressing key environmental issues at the product development stage. Whether it is related to lead-free solder or dealing with other restricted and/or hazardous substances, noteworthy features are evident.

There is no evidence of any individual TV producer, supplier or retailer in Australia offering any form of product stewardship service to consumers which involves the collection and recycling of end-of-life TVs. While many of the major, well-established TV producers ensure that end-of-life warranty related and 'dead on arrival' TVs are processed in an environmentally sound manner, there are no consumer-oriented initiatives.

***Product stewardship activity for IT equipment – individual companies:*** Design for Environment (DfE) activities among the major, well established IT equipment producers is

significant and has evolved over several years. The AIIA has published a specific report (2002) on DfE and its environmental value<sup>70</sup>:

*'AIIA recognises that industry's greatest contribution to improving the environmental impact of its products is through the design phase. In recognition of our members' performance in this area AIIA has published, "Designing for the Environment" which illustrates a range of actions being taken by AIIA members both globally and in Australia. The aim of this report is to provide an introduction to Design for Environment (DFE) principles and strategies in the Information and Communication Technology (ICT) industry, illustrated and supported by examples of initiatives being taken by AIIA members.'*

At an enterprise or corporate and institutional level, the major IT equipment producers and suppliers provide some form of take-back and processing service as part of leasing and/or procurement agreements. Such services have been operating for several years and are not the focus for review or improvement in the eyes of environment policy makers in Australia.

In relation to take-back and recycling services for domestic consumers and small business, both Dell and HP run noteworthy schemes:

**Dell:** Dell Australia operates a similar take-back scheme to that operating in New Zealand (see sections 4.0 and 5.0 above).

**Hewlett-Packard:** With co-funding from Sustainability Victoria, HP is involved in a computer drop-off and recycling initiative operating out of a local council in metropolitan Melbourne. Known as 'Byteback', the pilot project is a collaborative approach among HP, Sustainability Victoria, City of Boroondara, KS Environmental and Sims E Recycling.

**Recycling services available:** the extent of e-waste processing service providers in Australia is relatively limited, although understandable, given the size of market in Australia and the absence of regulations and compliance drivers.

Companies involved in the disassembly and/or recycling of IT equipment and TVs include:

MRI Australia Pty Ltd [www.mri.com.au](http://www.mri.com.au)

SIMS Group (including their E-Recycling Solutions division) [www.sims-group.com](http://www.sims-group.com)

Zinifex Ltd (major mining and smelting company that processes CRT glass)  
[www.zinifex.com](http://www.zinifex.com)

The TIC Group (acquired the former HMR CRT crusher) [www.ticgroup.com.au](http://www.ticgroup.com.au)

Close the Loop<sup>71</sup> (mostly recycling imaging consumables)

While other smaller operators may also scrap and recycle IT equipment, their scale, services and technical capabilities are generally negligible.

Greater numbers of companies are active in relation to refurbishment and remarketing of used IT equipment. Sometimes also characterised by charitable objectives, these organisations (featured on the Australian Consumers' Association web site) also play a role in extending product life and deferring PCs from landfill<sup>72</sup>.

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<sup>70</sup> The AIIA's DfE report is available on-line at: [www.aiia.com.au/i-cms.isp?file=139/DFEReportNov02.pdf](http://www.aiia.com.au/i-cms.isp?file=139/DFEReportNov02.pdf).

<sup>71</sup> [www.closesthe-loop.com.au](http://www.closesthe-loop.com.au)

<sup>72</sup> For more information about the ACA table refer to:  
[www.choice.com.au/viewFullWidthPage2.aspx?id=105140&catId=100245&tid=100042&p=4](http://www.choice.com.au/viewFullWidthPage2.aspx?id=105140&catId=100245&tid=100042&p=4).

## 10.6 Agrecovery: a New Zealand example<sup>73</sup>

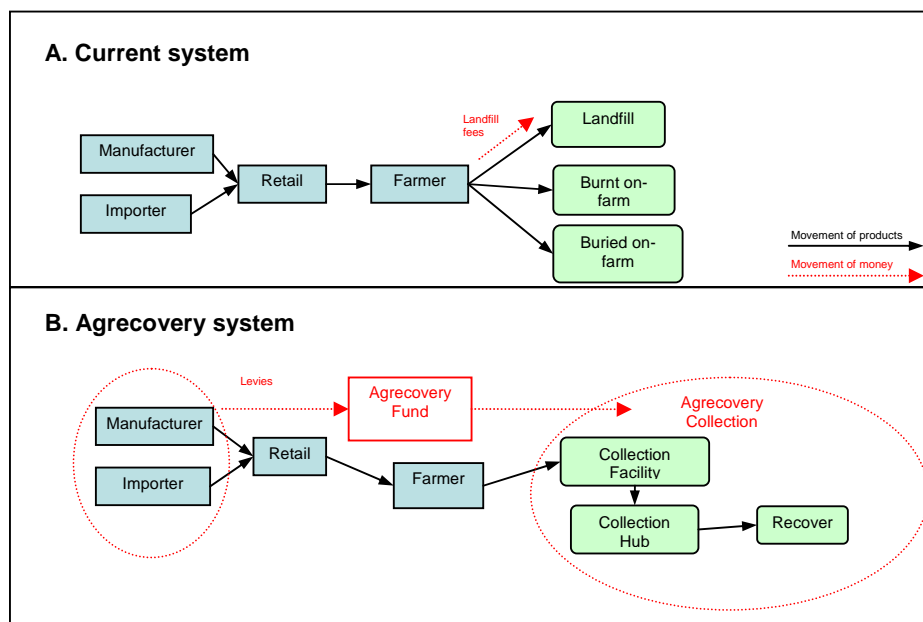
Other product sectors in New Zealand are developing product stewardship solutions. Examples include the packaging sector, which developed the voluntary Packaging Accord in 2004, and the oil industry, which has a voluntary collection and recovery system. The agrichemical industry has been working on a product stewardship system that has a planned implementation date of March 2007. The resulting *Agrecovery* programme shows how a sector can come together to develop an industry-driven solution. The model offers possibilities for the development of a product stewardship solution for the IT and TV industries.

Agrecovery is a product stewardship programme for the sustainable recovery of triple rinsed agriculture and forestry sector plastic containers throughout New Zealand. Under the Agrecovery system, the collection and processing of agriculture and forestry sector plastic containers in New Zealand will be financed by a levy, paid by supporting brand owners, on every litre or kg of eligible product that is placed into the market.

### 10.6.1 The problem

In New Zealand, growers and farmers currently have no solution for the sustainable recovery/disposal of plastic agrichemical containers. Common practice is to burn on farms (mostly illegal) and to dump (either on farms or in landfills). Farmers and growers are increasingly looking for practical solutions for managing farm wastes which are sustainable and environmentally acceptable.

The Agrecovery Foundation will manage all facets of the recovery scheme. Administration, promotion, management of contracted collectors, management of container inspection staff and collection compounds, sale of all products collected and reporting to brand owners, are tasks that will be contracted out. Any revenue recovered via the sale of the collected material will be returned to the programme to offset costs.



*Movement of products and finances (A) now and (B) in the proposed Agrecovery system*

<sup>73</sup> Programme designed by Responsible Resource Recovery Ltd. For more information, visit [www.agrecovery.co.nz](http://www.agrecovery.co.nz).

### 10.6.2 How the programme is structured

In December 2005 the Agrecovery Foundation was formed as a not-for-profit trust to own and govern the Agrecovery programme. The formation of the Foundation was the result of a number of years of work on an industry product stewardship scheme for used agrichemical containers.

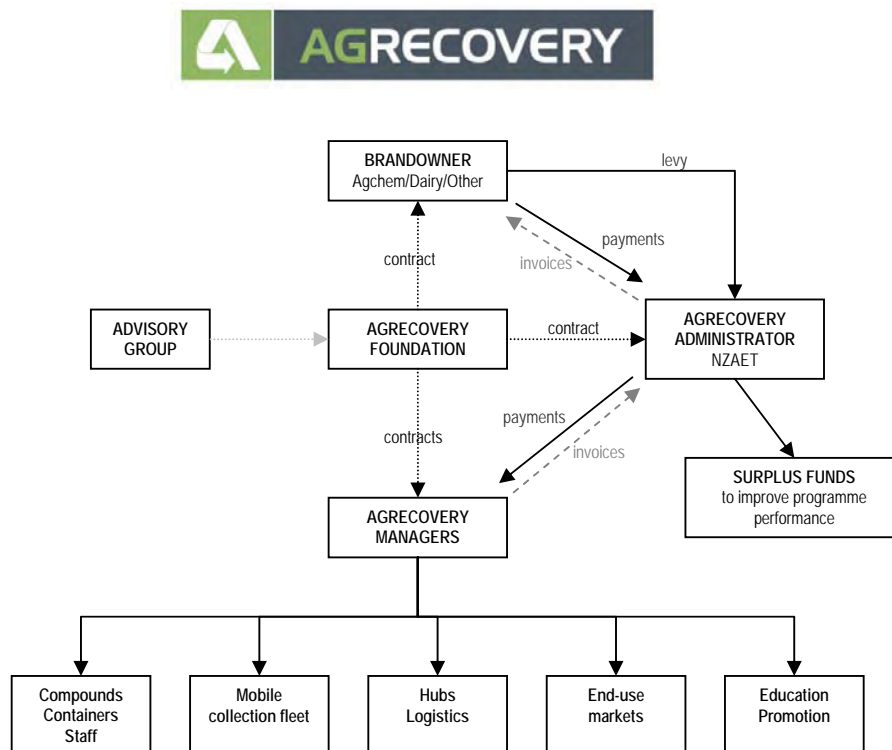
The legal entity that owns and governs the Agrecovery programme is the Agrecovery Foundation.

Founders and Trustees of the Agrecovery Foundation are:

- Agcarm Inc (representing producers)
- Federated Farmers of New Zealand Inc (representing farmers)
- Horticulture New Zealand Inc (representing growers)
- Environment Waikato (for Local Government New Zealand)
- Fonterra Cooperative Co Ltd

The New Zealand Agrichemical Education Trust (NZAET) is the administrator for the Agrecovery Foundation.

The Agrecovery Foundation will contract a programme manager to deliver an agreed programme on its behalf. The Agrecovery programme manager will manage infrastructure, logistics, administration, and communications. The programme manager will invoice the Foundation for these tasks. The Foundation will in turn invoice the Agrecovery Fund based on these costs.



*Structure of Agrecovery programme*

### **10.6.3 How Agrecovery will work**

Agrecovery collection sites will be sited at retail merchants (where appropriate) or local authority transfer stations. Collection facilities will be manned by staff who will be specially trained to inspect and accept triple-rinsed containers that belong to the Agrecovery programme. Specialist collection vehicles are proposed that will 'process' the material collected, using a mobile shredding unit. There will be five collection regions throughout New Zealand, each one serviced by a contracted collector who in turn will service the 75 collection sites proposed.

It is proposed that large scale applicators (commercial applicators, large farm units) will be serviced directly. They will be able to log their collection requirements via a managed website that will direct a contractor to the location when next in the area servicing the collection site for the district. This is likely to attract a user charge, yet to be determined.

Collected material will be transported to 'Approved Processors'. An Approved Processor will be required to meet specified minimum standards of processing. These standards will be in line with current international standards applied to other agrichemical container collection programmes worldwide.

The Agrecovery programme will work towards collection and recovery targets that will be set in consultation with key stakeholders. Performance against these targets and other criteria will be reported in an Annual Report.

There will be a significant investment in education and promotion to encourage farmer participation in Agrecovery. This communication will take place in close association with local and regional government.

### **10.6.4 Financing Agrecovery**

Agrecovery is a product stewardship programme underpinned by contributions by brand owners. Once up and running, the programme will be funded on an ongoing basis by levies on product put in the market by participating brand owners.

The Agrecovery programme has initial establishment funding requirements. These are costs associated with setting up systems and structures under which the programme will operate. These initial costs are being met by a mix of government and industry/stakeholder funding.

Additional start-up capital investment will also be required. These costs will be met by the programme manager and 'amortised' through the programme costs charged to the Agrecovery Foundation.

Following set-up of the programme, there will be ongoing costs associated with the collection and processing of product and the management of the scheme. These will be met by a levy.

The final levy will be determined by the quantity of product placed into the market by participating brand owners. This levy will fund ongoing collection and processing of collected product.

Based on estimated volumes of product to market in New Zealand the total cost of the programme will be between \$1.4 million and \$1.5 million per year.

## **10.7 Key observations for e-waste in New Zealand**

### **10.7.1 Governance**

Legislation and regulation have been the driving force behind the significant schemes established in most parts of the world

Close cooperation between local government and industry is essential from the earliest stage.

In Australia, progress is being made through communication and negotiation between industry and central and state governments.

A forum for dialogue could be a useful tool in an environment where national regulation does not exist. However, such a dialogue has been ongoing in the USA and has not resulted in a scheme being established. This highlights the importance of having a legislative driver to the process.

Given the experience of overseas e-waste schemes, and several existing voluntary schemes in New Zealand, including the Packaging Accord and the Agrecovery programme, the computer and television industries should be able to fast-track the development of an appropriate product stewardship scheme.

### **10.7.2 Structure**

Producer responsibility organisations (PROs) are generally made up of a board that represents producers and retailers.

Schemes that have worked hard on the relationship between PRO and local authorities from inception have been successful.

Despite the appearance of bureaucracy and administrative cost, fee levels in European schemes appear to be reasonable: for example, a maximum €16 (NZ\$32) fee for a large TV in Sweden.

There are advantages to the Swedish model of operating a single PRO with multiple categories/sectors and different fee structures and fee calculation methodologies. This model prevents cross-product subsidisation so that real recycling costs are associated with specific products.

Schemes set up by individual producers, or groups of producers, can successfully operate in parallel with each other, even in small countries with population of similar size to New Zealand. The ERP in Ireland is an example of this. Parallel schemes require clear performance standards in order to prevent competitive advantage being gained when companies set up substandard systems.

### **10.7.3 Delivery**

The majority of schemes in Europe have organised themselves primarily around local authority collection systems. This is an even more likely collection route for computers and TVs due to the 'lag' effect. People do not bring in an old item when they buy a new one – they pass it on, keep it 'just in case', or sell it.



Multiple service provider contracts have been found to reduce costs through competitive tendering processes.

A feature common to the overseas e-waste schemes and that of the proposed Agrecovery scheme is the establishment of a large number of collection points in collaboration with local authorities, reducing the barriers that consumers might face in disposing of unwanted computers and TVs.

#### **10.7.4 Outcomes**

In terms of quantities of equipment collected, the best-performing scheme in Europe is in Sweden. It is collecting 14kg/person/year across all categories. (The WEEE Directive set a target of 4kg/person/year). This level of collection sets a benchmark for the rest of the world.

Ireland is an example of a country that had little e-waste recycling infrastructure prior to producer responsibility regulation. After just five months of operation the schemes in Ireland are on course for exceeding the EU collection targets by more than 50% in the first year of operation. The development of producer responsibility schemes has also resulted in a dramatic increase in the domestic recycling infrastructure, to a level previously thought unlikely.

There is still a reliance on incineration and landfill in most countries for some of the more difficult to recycle products (up to 30% in some countries). High temperature incineration is not an option for New Zealand, highlighting the challenge faced in recycling e-waste in this country.

Schemes such as the Packaging Accord and Agrecovery provide useful examples for the computer and TV sectors to learn from.

## 11.0 A potential solution for New Zealand

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### 11.1 Recycling solutions available

This study has identified that there are already solutions available for recycling New Zealand's e-waste. Companies in Australia, Singapore and Europe, among others, can provide recycling services for export quantities of end-of-life televisions and computers coming from New Zealand. But these recycling services come at a cost – around \$20 per television or monitor. The key questions are: how do we efficiently collect and recycle waste equipment and how do we meet these collection and recycling costs?

### 11.2 Local authority collection solutions?

A UMR research survey in April 2006<sup>74</sup> revealed that as many as two-thirds of consumers were willing to pay for the safe disposal of their television or computer. The majority of respondents were prepared to pay between \$20 and \$50 for this disposal. There was a fairly even split on when they would like to pay a recycling fee, with 44% saying they would prefer it at the point of disposal and 49% preferring to pay at the time of purchasing the item.

While the survey suggests there could be some willingness among consumers to pay for recycling their televisions and computers *at the point of disposal*, there is scepticism within the industry that this would translate into actual behaviour and could even increase the risk of illegal dumping. Local authorities have also pointed out that they would face difficult logistical issues in collecting fees for special types of waste; current practices at landfills typically only distinguish between green waste and all other waste.

However, while some local authorities have indicated they would be willing to assist with the separation of e-waste at landfills, they would face the same dilemma as local recyclers in terms of how to cover the costs of transporting the e-waste to overseas recyclers. They might also be concerned that unless a proper industry-supported product stewardship scheme were put in place, these disposal costs could fall back on ratepayers.

The intention with product stewardship is to internalise the cost of the environmental impact from a product. This means that the physical and financial burden from the disposal of a product is shifted to those who supply the product. And of course suppliers have the opportunity to shift these costs to the end consumer by simply re-pricing the product. But perhaps of even greater importance, product stewardship schemes can send economic signals to manufacturers that give them an incentive to develop products that are easier to recycle, or that incorporate recycled materials.

The above discussion seems to rule out consideration of a local authority-administered disposal fee as an option for New Zealand. But as also noted above, this does not mean there is no ongoing role for local authorities; clearly their support will be critical in establishing e-waste collection points at local landfills and in local communities. They will also have an important role to play in helping to educate consumers about the responsible disposal of e-waste.

### 11.3 A product stewardship solution – how might it look?

The development of a product stewardship system for collecting and financing e-waste recycling will provide the most comprehensive and sustainable solution to the problem of e-waste. Product stewardship systems for e-waste are already successfully addressing the problem in countries including Ireland, Sweden, the European Union and parts of the USA.

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<sup>74</sup> See Appendix III

Product stewardship approaches are also being developed in Australia, China, Japan, Korea and Thailand

Under a product stewardship system, responsibility is shared by all groups involved in the lifecycle of a product. In many product stewardship systems overseas, local authorities and retailers take on some of the financial burden by providing free collection points for all e-waste, irrespective of brand or the need to purchase a new item. Producers then finance most transport and recycling costs beyond the point of collection.

Producers take the majority of the physical and/or financial responsibility for the collection and recycling of their end-of-life products under a product stewardship system. These responsibilities are typically met by joining a take-back scheme with other producers. Such schemes are run by producer responsibility organisations (PROs).

The flow chart on the next page illustrates in basic terms how product flows through the market for computers in New Zealand. Also shown is the flow of finance for a typical product stewardship scheme. The model for TVs would have similar finance flows, but the distribution flows would be much simpler.

There are four distinct phases in the product lifecycle. Each stakeholder in this lifecycle will play an important role in a product stewardship system.

**1. Producers** – product is placed onto the market by producers, who in many cases are importers and distributors as well as original equipment manufacturers (OEMs). Most TVs are distributed through retail chains to domestic consumers. For computers the distribution channels are more complicated because markets are more evenly split between domestic and commercial consumers. Channels for computers include lease companies, retail, direct sale, auction and outsourcing (see Section 3 of this report for more detail on sales channels).

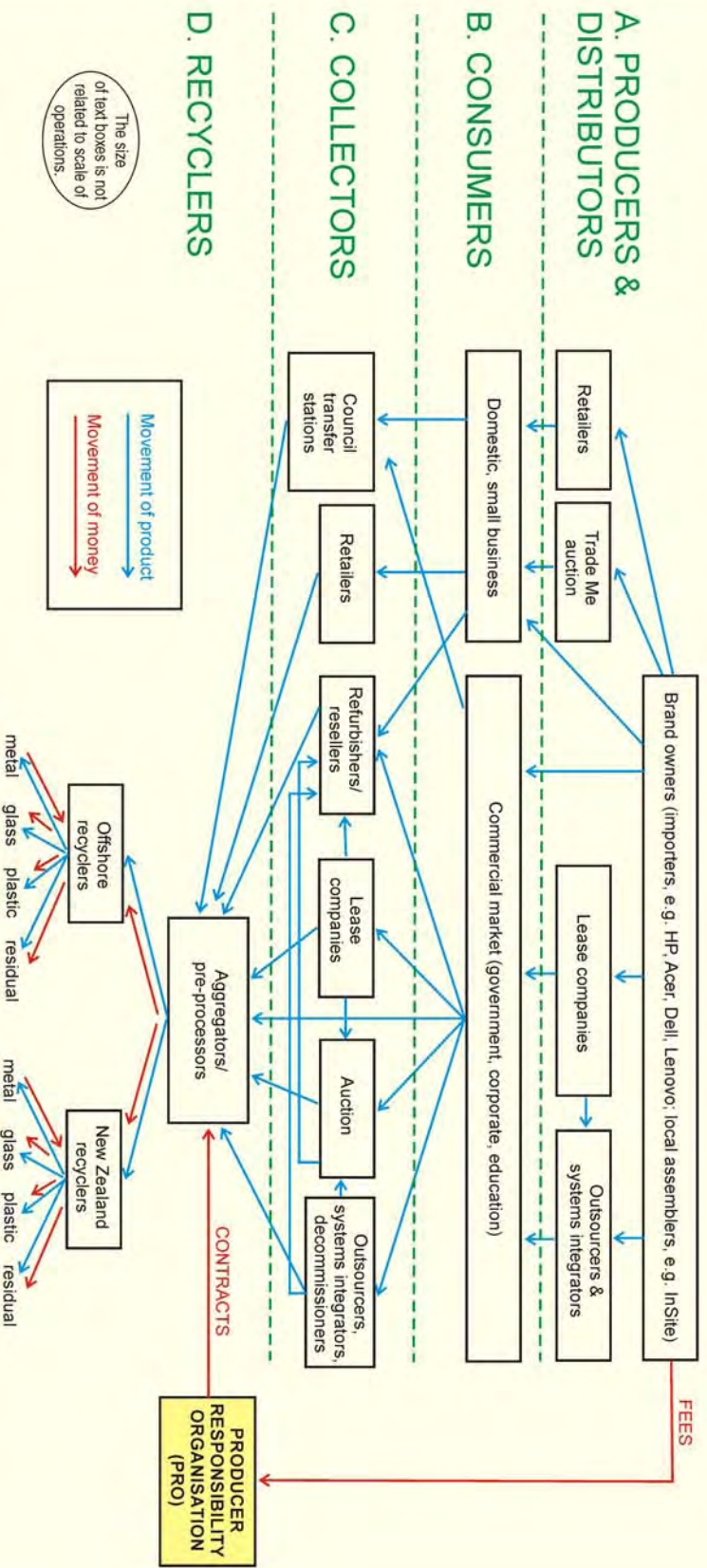
Under a product stewardship scheme producers would take most of the financial responsibility for managing end-of-life products. The way in which this responsibility would be managed is described below.

**2. Consumers** play a vital role in the product stewardship system. Unless they return old equipment, a system cannot succeed. Any product stewardship scheme must ensure there is sufficient information provided to make consumers aware of their role. There are both domestic and commercial consumers of televisions and computers. For televisions it is almost all domestic consumers, while for computers there is an approximate 60/40 split between commercial and domestic markets. These differences need to be considered when establishing take-back collection avenues.

**3. Collectors** – several collection channels are potentially available for end-of-life televisions and computers. Overseas product stewardship schemes often rely heavily on local authority collection facilities. Such facilities are logical first choices because they are already set up to deal with the collection of recyclables from the public. It is likely that local authorities in New Zealand will play an important role in the take-back of e-waste through their existing waste transfer facilities, although there may need to be some investment in facilities for separating e-waste and palletising and baling (of plastic) for transport to recycling plants.

Retailers have significant roles in overseas e-waste product stewardship schemes. Retailers provide a valuable interface with consumers when new products are being purchased informing them how to dispose of unwanted equipment including providing an opportunity for consumers to return old equipment when they purchase new items. Lease companies, outsourcers and systems integrators are also in direct contact with commercial consumers of computers. This means they are often replacing equipment on an old-for-new basis and are therefore perfectly

# FLOW OF COMPUTER EQUIPMENT AND FLOW OF FINANCING UNDER A PRODUCT STEWARDSHIP MODEL IN NEW ZEALAND



**Notes:**

1. Sections A, B and most of C show existing flow of computer products from brand owner to market. This would not change in a PRO environment.
2. Section C shows existing collection channels for end-of-life computer equipment, with the exception of retailers, who do almost no collecting at present.
3. Two of the channels in Section C (refurbishers and auction), resell functioning equipment to end-users. Some of their stock has no resale value and needs to be disposed of. Lease companies and outsourceers/systems integrators/decommissioners typically on-sell to refurbishers or through auction, but some of what they collect is faulty or has no value and needs to be disposed of. Very little of the equipment collected at transfer stations and landfills has resale value.
4. Section D includes aggregators/pre-processors, a few of which exist at present. In order to receive PRO contracts, companies in this sector would need to meet minimum standards and be accredited. They would collect end-of-life equipment, pre-process it and pass materials on to the final recyclers."

placed to be a main collection channel under a product stewardship system. The same applies for specialist decommissioning companies.

Companies that refurbish equipment for resale (often ex-lease) also have equipment that cannot be repaired and must be recycled. Refurbishers may also be a significant collection route for e-waste.

**4. Recyclers** – under a product stewardship scheme, recyclers would be contracted to the PRO and paid for their recycling services according to the terms of that contract. Product collected through the system would be aggregated and all or part of it may be directly exported overseas for processing where appropriate facilities are not available in New Zealand, or until such time that facilities are established in New Zealand.

E-waste exported would need to take place with the appropriate Basel permits in place. With the aggregation of larger quantities of e-waste under a single PRO system, it may become economically viable for recyclers to set up plants in New Zealand and begin processing e-waste.<sup>75</sup> Separated materials might be recycled in New Zealand or exported for recycling in other countries. A product stewardship system should be designed to ensure that there is open competition among recyclers (both NZ and overseas recyclers) so that market forces will ensure cost efficiency.

The flow chart also shows the financial flows under a typical product stewardship model. Under this model, producers pay fees into a producer responsibility organisation (PRO). The PRO is set up as a not-for-profit organisation to manage all aspects of e-waste on behalf of the producers.

A producer meets its responsibilities by paying fees into the PRO through a third party. The PRO finances transport and processing of e-waste beyond the point of initial collection from consumers. The PRO manages the contracts with transport operators for the transport of e-waste collected at designated collection sites (local authority transfer stations, retailers etc).

Any national approach to product stewardship should allow for individual product stewardship schemes to be set up by companies that do not wish to be a part of a collective approach. In Ireland, a small group of major brand-owners set up their own producer responsibility organisation alongside the collective scheme, in order to reduce costs and provide a tailor-made solution. The existence of two parallel schemes in Ireland has still resulted in the development of new recycling infrastructure through economies of scale benefits.

Key to the existence of product stewardship schemes overseas has been the existence of regulations to control the potential for companies to free-ride the system and gain competitive advantage. Regulation has been used to ensure that standards for product stewardship schemes are consistently applied and that an equitable approach is developed.

In Australia, for example, the television industry is ready to implement a take-back solution through a PRO established by the industry association. However, they will not implement their solution until the government has set up a system that requires potential free riders to meet the same standards.

## **11.4 A mechanism for moving forward**

There needs to be a mechanism through which a product stewardship solution for computer and television waste can be developed in New Zealand. Overseas, schemes have been

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<sup>75</sup> A small amount of e-waste is already recycled in New Zealand – for example vinyl plastic cable coverings and steel from computer boxes (the latter mainly in Auckland).

developed through industry associations. This is the case in Australia, where the AIIA (IT industry association) and CESA (television industry association) are very active in the development of product stewardship approaches.

New Zealand industry representation has been through a period of change for the last year, with the creation of the Information and Communications Technology NZ (ICT-NZ) to bring together several sector organisations and provide a multi-sector representative body for the ICT industry. ICT-NZ appears to still be in a state of flux and unlikely to be in a position to commit resource to the development of product stewardship.

This means producers need to set up a process through which they can develop a collective product stewardship approach. Setting up a special development group will provide an opportunity for producers to shape the solution themselves and take leadership in developing agreements with the Government.

Government also has a critically important role to play in ensuring the necessary regulations are in place to prevent free-riders. The evidence from overseas has demonstrated how critical this is in implementing product stewardship schemes in a timely manner.

New Zealand also has the opportunity to collaborate closely with Australia. Most of the major producers of both computers and TVs are the same in both countries, with New Zealand representatives typically reporting to Australia. The larger scale of operations in Australia also means that there are often staff dedicated to environmental issues – this has been evident throughout our study with the direct involvement of Australian representatives from nearly all the major computer and TV suppliers.

The New Zealand e-waste sector can also leverage on work carried out in other industries that have already taken a proactive approach to developing product stewardship solutions for their products. This report has highlighted the agrichemical industry as a successful example of a collaborative industry approach to product stewardship in New Zealand.

Producers from the computer and television industries need to come together in a similar way to map out a process through which they can negotiate and develop solutions in answer to the Government's developing product stewardship policy.

The starting point for this process should be a forum for producers and government where baseline principles can be established before developing any product stewardship solution. Agreement on such principles will ensure that future product stewardship solutions are developed in a transparent and consistent way.

Following from this, a legal entity, in the form of a trust, could be established to provide a more formal and more focused vehicle for developing an industry-led solution. This would eventually lead to the establishment of a producer responsibility organisation (PRO) to set up and manage a take-back system on behalf of producers. Some producers could participate in the initial processes and then create their own take-back programme or form a competing PRO (as has occurred in Ireland for example).

The forum for producers and government should involve other key stakeholders from local government and the retail sector at critical phases of the process and in the development of the solution. Both of these sectors will play important roles in an e-waste product stewardship scheme and their involvement from an early stage will be critical.

Alongside the producer and government taskforce a wider group of stakeholders should also be consulted. Wider consultation is needed to ensure that a system is workable and that the needs of stakeholders are addressed. This group should involve manufacturers, retailers, commercial

product distribution organisations, central government, local government, recyclers, refurbishers, consumer groups and non-governmental organisations.

## 12.0 Conclusions and recommendations

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### 12.1 Principles

We have accepted the following principles as a baseline for this study. These principles reflect existing international agreements and industry practice and/or current Government policy.

New Zealand takes responsibility for its own e-waste.

Responsibility for implementing a product stewardship (PS) scheme is shared – manufacturers, brand-importers, local assemblers, integrators/outsourcers (service providers), retailers, end-users, local government and central government.

Producers take financial responsibility for their end-of-life products (extended producer responsibility – EPR).

An e-waste PS scheme is transparent, fair and accountable, and provides for orphan and historic products as well as new products.

PS schemes do not restrict competition.

PS schemes achieve national coverage.

### 12.2 Conclusions

We have reached the following conclusions after examining the computer and television industries in New Zealand as well as e-waste product stewardship schemes overseas and in other sectors in New Zealand.

A co-operative pan-industry approach (producer responsibility organisation PRO) is the most efficient way to manage products from multiple producers on a national basis; however, this does not preclude the development of private schemes that meet agreed performance criteria.

Minimum compliance, reporting and governance standards should be agreed with the Ministry for the Environment; private schemes meeting these standards should be endorsed.

The PRO should develop and implement a funding model, noting that overseas schemes are typically funded on a market share basis.

New Zealand schemes should align as closely as practicable with similar schemes in Australia.

A collaborative PS scheme should be developed for the television and computer industries, with flexibility to accommodate key differences, e.g. funding and collection schemes could differ but both industries could share common back-end recycling processes.

Implementation of free-rider legislation is essential to the equity of a product stewardship approach.

A target date for a fully implemented PS scheme should be agreed between industry and Government.

The recycling of e-waste should be left to the competitive market, subject to an agreed code of practice.



## **12.3 Recommendations**

### **Industry**

1. Computer and television producers and distributors should take a leadership role in addressing e-waste issues.
2. Suppliers of television and computer equipment should form a small focused taskforce to develop a product stewardship scheme in collaboration with government. A suggested draft terms of reference is attached.
3. A wider consultative group should also be formed with representatives from all stakeholder groups. A suggested draft terms of reference is attached.
4. The computer and television industries should support the work of the Resource Recovery Sector Advisory Group within the Extractive Industries Training Organisation in developing unit standards for e-waste for training industry personnel.
5. Recyclers should collaborate with Government, through Standards New Zealand, to develop an industry code of practice for recycling computers and TVs. In the meantime, a voluntary code of practice should be established.
6. Computer resellers and others involved in managing e-waste should be encouraged to evolve their businesses towards sustainable and profitable enterprises, employing qualified staff.
7. The computer and television industries should support research into new markets and processing techniques for e-waste materials, and into more enviro-friendly materials for initial product manufacture.

### **Government**

8. Government should commit to a regulatory framework that has teeth, to ensure any industry-developed product stewardship schemes applies equitably to the whole industry and prevents any market advantage by free-riders; regulation is essential to prevent unfair competition in such highly competitive industries as television sets and computer equipment.
9. Government and industry should agree to a timeframe for action. We recommend a target implementation date of 1 July 2008, by which time there should be a firm plan for free-rider legislation, even if it can not be enacted on this timescale.
10. Government, through the Ministry of Economic Development, should strengthen enforcement of Basel Convention requirements on the export of hazardous waste (including e-waste); this is not intended to limit the export of e-waste, but to ensure that such materials are being sent to appropriate overseas recycling facilities.
11. Government should provide funding assistance with the start-up of product stewardship processes, e.g. through a contestable product stewardship funding pool (similar to the Sustainable Management Fund, managed by the Ministry for the Environment).
12. Government should consider adopting legislation equivalent to the European Union Restriction of Hazardous Substances (RoHS) Directive.
13. Government should evaluate the potential for 'green procurement' through its Govt<sup>3</sup> initiative to promote the demand-side incentive for incorporating sustainable design into the production of electronic goods.

14. Government should help fund industry efforts to promote research and development into new markets and processing techniques for e-waste materials, and into more enviro-friendly materials for initial product manufacture.

#### **e-waste supplier taskforce**

15. The taskforce should include brand-owners from the television and computer industries, a representative from the major electronic equipment retailers, as well as government representatives from the Ministry for the Environment and the Ministry of Economic Development. Suggested supplier representatives should include Renaissance, Hewlett Packard, Dell, IBM/Lenovo, Acer, Philips and Panasonic, as a minimum.
16. The taskforce should be formed by 1 July 2006 and report to a wider industry stakeholder group no later than 1 January 2007.
17. The taskforce should cooperate with Australia. This cooperation could come through direct industry representation on the taskforce and through information sharing with Product Stewardship Australia (PSA), the Information Industry Association Australia (AIIA) as well as the Federal and State governments, particularly New South Wales.
18. The core function of the taskforce is to develop a draft product stewardship scheme, including a funding model, as well as to establish a producer responsibility organisation (PRO) supported by the broader industry stakeholder group.
19. That the e-waste task force give priority to developing funding schemes for covering the cost of transport to overseas e-waste processing facilities as a quick-start option.
20. The taskforce should invite expressions of interest from individuals and organisations interested in facilitating their work; an initial budget of \$100,000 is recommended, to cover facilitator fees and expenses; it is expected that this would be funded mainly by industry, with some support from Government.

#### **e-waste industry consultative group**

21. The e-waste consultative group should include representatives from all stakeholder groups, including manufacturers, brand-importers, local assemblers, integrators/outsourcers (service providers), retailers, recyclers, end-users, local government and central government. This group could also include a consumer representative, possibly from the Consumers Institute and a representative from the government's Digital Strategy group.
22. The Consultative Group will have responsibility for reviewing the recommendations of the taskforce and securing pan-sector support.
23. The facilitator appointed by the taskforce would also be expected to provide secretariat support for the Consultative Group.

#### **Local authorities**

24. Local authorities should continue SWAP (Solid Waste Analysis Protocol) analyses with e-waste included as a category. The SWAP analyses should isolate cathode ray tubes in television monitors and computer screens.

25. Local authorities should be encouraged to start developing household drop-off schemes for e-waste, including industry and community supported e-days, such as the pilot programme being planned by Dell for Wellington.
26. Local authorities should collaborate with industry to promote the safe disposal of e-waste and educate local communities on their options.

## 13.0 Acknowledgements

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The authors wish to acknowledge the information, advice and feedback received from the following companies and individuals, either directly, or indirectly via the Ministry for the Environment:

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Dell  
Hewlett Packard  
IBM NZ Ltd  
Lenovo  
Microsoft NZ  
Panasonic New Zealand Ltd  
Philips  
Radiola  
Renaissance Corporation Ltd (Apple, Insite)  
Sharp Corporation of New Zealand Ltd  
Sony  
Toshiba  
Ultra Computer Company Ltd

### **Recyclers:**

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Jensen Technical Services  
Matta Products Limited  
Molten Media  
MRI  
New Age Materials  
Palmerston North PC Recycling  
Plastics New Zealand  
Resource Recycling Technology  
Sims Pacific Metals  
Wellington Scrap

### **Refurbishers**

Divers Group  
HCC Pacific Ltd  
RCN  
Remarkit Solutions  
Ark Recycling Ltd

### **Outsourcers/systems integrators:**

EDI  
Fujitsu  
Gen-i  
Lantech

### **Auction houses:**

Fitz-Gerald Auctions Ltd  
Gray's Auctions  
Trade Me  
Turners Auctions

### **Retailers:**

Appliance Connexion  
Dick Smith

Farmers Trading Co  
Harvey Norman  
LV Martin  
Noel Leeming  
NZ Retailers Association  
Progressive Enterprises Ltd  
Retravision  
The Warehouse

### **Local authorities and waste management organisations:**

Auckland City Council  
Auckland Regional Council  
Christchurch City Council  
Dunedin City Council  
Environment Southland  
Greater Wellington Regional Council  
Invercargill City Council  
Local Government (NZ)  
Mana Community Enterprises  
Porirua City Council  
Rotorua District Council  
TerraNova  
Trash Palace  
Waitakere City Council  
Waste Management Wairarapa  
Wellington City Council

### **Others:**

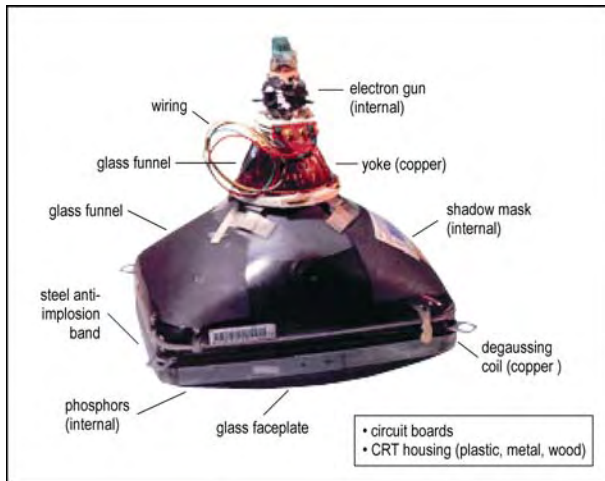
European Recycling Platform in Ireland  
IDC Research  
Manukau Institute of Technology  
Massey University  
Ministry for the Environment  
Ministry of Economic Development  
Otago University  
Product Ecology Pty Ltd  
Responsible Resource Recovery Limited  
Waste MINZ  
Zero Waste Academy

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**Helen Bolton** of the Ministry for the Environment's Sustainable Industry Group – our liaison point and supplier of data from her own investigations into e-waste issues.

## Appendix I – What's in a CRT?



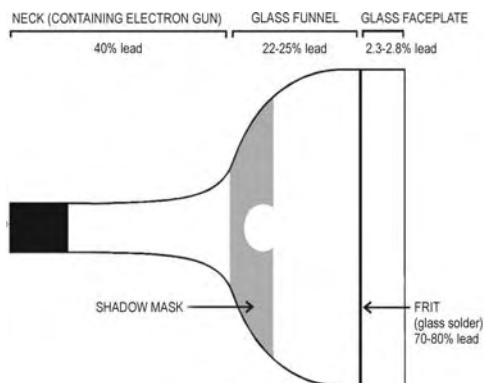
*Typical CRT, removed from housing*

Cathode ray tubes (CRTs) are made up of a mix of:

- glass
- phosphors
- steel
- copper
- aluminium
- electrodes
- wiring
- printed circuit boards
- plastic housing (wood or metal housing for older televisions).

This mix of materials makes CRT recycling challenging.

### Glass composition



*Sections of a CRT showing their average lead levels*

A CRT has three sections, made of two different types of glass:

The flat viewing section the flat viewing section (panel) - made of glass containing barium oxide (up to 14%) and strontium oxide (up to 12%)

The thinner conical section (funnel or cone) - contains up to 25% lead oxide

The gun section (neck) which has up to 40% lead oxide.

The panel and funnel sections are welded together with a glass solder, called a frit, containing about 70-80% lead.

There is considerable variation in the composition of glass, especially screen glass, made by different manufacturers.

Lead is used in CRTs to protect users from potentially harmful exposure to x-rays.

## Non-glass components

Other components of the CRT include:

A coating of phosphor powder on the inside of the viewing panel.

Shadow mask – a metal screen on the inside of the CRT that focuses electron beams

Electron gun – consists of a series of metal electrodes placed inside the glass cylinder with electrical connections extending through and sealed by the glass

Yoke – the coils of copper wire around the neck of the CRT are known as the yoke. The yoke is an electromagnet that acts as a deflector.

Degaussing coil – many strands of a single length of copper wire around the widest part of the CRT, to reduce unwanted magnetic fields.

Steel anti-implosion band around the outside of the CRT.

Printed circuit board, whose components may include a significant amount of aluminium.

## CRT housing

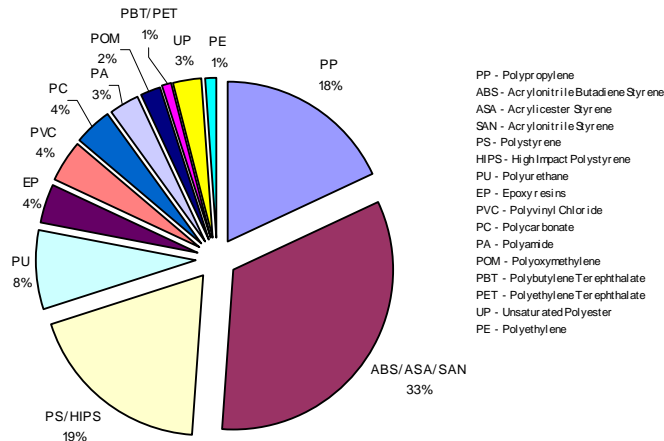
Modern cathode ray tube housings are mostly made of plastic which typically contains flame retardants. Different plastic types are used in housings, including blends of plastics and some housings have limited labelling of the plastic types. Some housings may also have metallic coating or a screen on the inside. These factors mean that the plastic housings are difficult to recycle into anything other than low-end uses such as plastic lumber.



Inside a CRT housing. Plastic labeling like this is sometimes absent, making a recyclers job more difficult. This housing is a blend of acrylonitrile butadiene styrene (ABS) and polycarbonate (PC).

## Appendix II – Plastic types

More than 16 different generic plastic resins are used in the manufacture of electrical and electronic equipment. The proportion and types of plastics used vary not only from one product to another, but also among products manufactured in different years.



Generally the plastics used are engineering thermoplastics such as acrylonitrile butadiene styrene (ABS), high impact polystyrene (HIPS), polycarbonate (PC), polyethylene (PE), and polyphenylene oxide blends (PPO). These plastics can be found as single polymers or as laminates/composites.

ABS is usually the only polymer used for computer monitors. Pure ABS can be recycled, but monitors sometimes have the inside painted, making them difficult to recycle.

TV casings are mostly made of HIPS, but modern, large TVs are increasingly made of ABS or PC/ABS blends.

Cables are usually insulated with polyvinyl plastic.

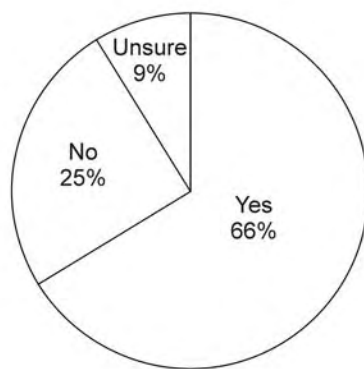
## Appendix III – Willingness to pay for disposal of computers and TVs

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In April 2006, UMR Research carried out a telephone survey for the Ministry for the Environment to assess attitudes towards paying for safe disposal of electronic and electrical items. UMR contacted a nationally representative sample of 750 New Zealanders 18 years of age and over, and claims a margin of error of plus or minus 3.58%. The survey showed a surprisingly high preparedness to pay, and it is quite possible that more resistance would be shown if people were faced with the actual situation – especially if equipment had to be dropped off at collection points, rather than be collected at the home address. (In Europe, householders usually have to take their own e-waste to collection points, but they are not charged for dropping it off.)

### Would you be willing to pay?

Respondents were first asked “Would you be willing to pay money for the safe disposal (i.e. the recycling) of your television or computer?” Two-thirds said they were.



### Why would you pay?

Of the two-thirds of the respondents who said they would pay, almost three-quarters (72.3%) said this was because of concern for the environment:

- Keep NZ green/protect the environment (30.8%)
- I'm happy to pay for ecologically sensitive disposal (16.6%)
- Landfills are bad/not sustainable (14.8%)
- Stop pollution (4.6%)
- Leave some environmental resources for the future (3.3%)
- Protect our water supply from pollution/ leaking landfills (1.7%)
- Conscious of environmental issues (0.5%)



A quarter of respondents said they would pay to ensure proper disposal and 16% said they would pay because of safety issues. Thirteen per cent said they preferred items to be recycled.

Small numbers of people gave other reasons for being prepared to pay for recycling:

There's a mountain of obsolete appliances to dispose of

More convenient to pay than do it yourself/ better than being fined for illegal dumping

The initial disposal charge provides a disincentive to buy products

It would help out New Zealand society

Because I don't want it in my backyard

I work in the recycling trade/ more business

You can no longer sell old ones, new ones are too cheap

Send recycled computers for use in the third world

### Why wouldn't you pay?

People who were not willing to pay for disposal of computers and TVs were asked why. The major reason was cost (24.4%), government/council should pay for disposal (24.1%), recycling facilities should be free (13.0%) and disposal should be dealt with by retailer (11.7%), I don't believe these appliances are dangerous (10.6%).

### What is the most you would pay?

Respondents were asked, "As you may be aware there are many costs involved in the safe recycling of computers and TV's, such as collection, storage, disassembly, transportation, freight and processing costs. If you were required to pay a fee for the safe recycling of your obsolete computer or TV, what is the maximum amount you would be willing to pay?"

One-third of respondents were unwilling to pay or unsure. Most answers fell in the \$20-50 area. (base=all respondents)

	%
Not willing to pay/ unsure	34
Less than \$5	3
\$5	2
\$10	5
\$20	12
\$30	11
\$40	2
\$50	20
\$60	4
\$70	2
More than \$70	5
<b>TOTAL</b>	<b>100</b>

### When would you prefer to pay?

Respondents were asked “If you had to pay a fee, would you prefer to pay the fee when you buy a new computer or television within the purchase price, or when you dispose of the item?”

A small majority preferred to pay at the time of purchase.

	%
Fee at disposal	44
Fee at purchase	49
Depends	2
Unsure	5
<b>TOTAL</b>	<b>100</b>

## Appendix IV – Draft terms of reference for an e-Waste supplier taskforce and an industry consultative group

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The New Zealand Government is pursuing a policy of product stewardship in a number of industry sectors. The TV and computer sectors are being targeted because of the absence of an effective recycling scheme for cathode ray tubes and other hazardous materials (e-waste) used in the manufacture of these appliances. A **taskforce** of major computer and television suppliers and an industry **consultative group** are to be established to provide a mechanism through which industry and government can collaborate in developing industry-led solutions for safe recycling of e-waste.

### 1.0 Supplier taskforce

#### 1.1 Objective

To develop a draft product stewardship solution for e-waste in New Zealand.

#### 1.2 Timeframe

The Taskforce is to be established by 1 July 2006 and should aim to develop a draft product stewardship scheme for industry consultation no later than 31 December 2006.

#### 1.3 Terms of reference

To consider the agreement of broad principles under which a product stewardship agreement between government and industry can be developed/negotiated.

To identify, evaluate and select options for a nationwide product stewardship scheme.

To develop a business plan for a product stewardship scheme for TV and computer waste (together or separate).

To establish timeframes for the establishment of a product stewardship agreement between government and industry.

To develop a structure for an e-waste producer responsibility organisation (PRO).

#### 1.4 Membership

Membership of the taskforce is to include, as a minimum, representatives from Renaissance, Hewlett Packard, Dell, IBM/Lenovo, Acer, Philips and Panasonic, as well as representatives from electronic equipment retailers, the Ministry for the Environment and the Ministry of Economic Development. The taskforce may choose to appoint its own chairperson, who could be an industry representative or someone who is independent. The work of the taskforce would be supported by an independent facilitator.

While it is recognised that stakeholders in e-waste industries extend well beyond the major hardware suppliers, the principle of producer responsibility calls for leadership from the suppliers. The inclusion of a representative from the retail sector is also recommended because of the significant interface that sector provides with end users. The size of the taskforce is to be kept small (no more than 10 people, including the chairperson), to ensure results can be achieved on a tight timeframe.

The taskforce would be expected to present its proposals initially for review by the e-waste Consultative Group and then to all interested parties.

## **1.5 Meetings**

The taskforce is expected to meet monthly over a six-month period, for half or full-day meetings.

## **2.0 Industry consultative group**

### **2.1 Objective**

To provide a forum for ongoing industry collaboration in addressing e-waste issues in New Zealand.

### **2.2 Timeframe**

An e-waste industry consultative group (e-ICG) is to be established no later than 1 January 2007 and is to remain in operation at least until an effective producer responsibility organisation (PRO) for the electrical and electronic industries is established; there could potentially be an ongoing role for a consultative/technical advisory group.

### **2.3 Terms of reference**

To review the recommendations of the taskforce and provide feedback on the implications for their respective sectors.

To identify all relevant stakeholders, and the best method for two-way communication between these stakeholders, the consultative group and the taskforce.

To promote agreed industry solutions to member organisations in stakeholder groups.

### **2.4 Membership**

The e-waste consultative group should include representatives from all stakeholder groups, including manufacturers, brand-importers, local assemblers, integrators/outsourcers (service providers), retailers, recyclers, end-users, local government and central government. This group could also include a consumer representative, possibly from the Consumers Institute and a representative from the government's Digital Strategy group. Experts with a special interest or knowledge of e-waste could also be invited to participate.

Each representative on the consultative group should ideally represent an identifiable stakeholder group. Their role would be to represent the interests of their constituency as well as encourage adoption by their constituency of a collaborative industry position.

## **2.5 Meetings**

The consultative group would be expected to communicate mainly by email, although there would be benefits in scheduling at least two in-person meetings each year.

## **3.0 e-waste secretariat**

### **3.1 Facilitator**

The taskforce and consultative group would be supported by a facilitator, who would undertake the substantive work of the taskforce and could potentially provide the necessary administrative support for meetings and collaborative communications.

### **3.2 Funding**

A budget of \$100,000 would be required to fund the work of the taskforce and consultative group for the 2006-07 financial year (July 06-June 07). It is expected that this would be primarily funded by the industry players forming the taskforce, with some government assistance through the Ministry for the Environment.

Taskforce and consultative group members would not receive fees for their participation, but all meeting costs would be covered. An independent chair would receive a daily fee for support provided to the two groups.

The main costs would be for the facilitator, who would be expected to work on a full-time (or nearly full-time) basis to develop the draft product stewardship scheme and assist with communications among all industry stakeholders.

A preliminary budget could be:

Task force facilitator	\$60,000
Meeting expenses (incl travel)	\$25,000
Task force chair	\$10,000
Printing and communications	\$5,000
<b>TOTAL</b>	<b>\$100,000</b>

## Appendix V – European RoHS Directive<sup>76</sup>

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The *European Directive on the Restriction of the Use of Certain Hazardous Substances* in electrical and electronic equipment (known as the RoHS Directive) was passed in 2003. The RoHS Directive requires that, from 1 July 2006, electronic or electrical equipment sold in Europe must not contain:

Lead

Cadmium

Mercury

Hexavalent chromium

Two types of flame retardant: polybrominated biphenyl (PBB); polybrominated diphenyl ether (PBDE)

There are some major exclusions from these requirements, including (but not limited to) lead in CRT glass and mercury up to a specified level in fluorescent lamps. These exclusions, and others, have been made because no viable alternative material or technologies exist.

Other countries are imposing similar material restriction legislation on electronic products. China and South Korea, for example, are in the process of passing laws based very closely on the European RoHS Directive. The State of California in the USA also has a RoHS-style law that will enter into effect on January 2007. Australia is considering developing legislation similar to the RoHS Directive.

The proliferation of RoHS-type legislation throughout the world is having an impact on the way electronic products are manufactured. Most major manufacturers have now phased out the banned substances in all of their products put on the global market. Component suppliers have also had to adapt to the needs of the large OEMs.

### **Could the RoHS Directive lead to dumping of hazardous products in New Zealand?**

The first point to make is that equipment being put on the New Zealand market after 1 July 2006 (RoHS compliance date) will not contain substances more hazardous than that which is already entering the New Zealand market.

The question is whether New Zealand needs to adopt a similar stance to hazardous substances in electronic products because those substances pose an environmental, health and safety risk.

Many electronic products have already had their hazardous substances removed completely. Multinational manufacturers have already phased out banned substances and have publicly stated goals of producing all products for all markets in compliance with the RoHS Directive.

*HP's goal is to exceed compliance obligations by meeting the requirements of the RoHS Directive on a worldwide basis. By July 1, 2006, RoHS substances will be eliminated (to levels below legal limits) for virtually all HP electronic products subject to the RoHS Directive, except where it is widely recognized that there is no technically feasible alternative (as indicated by an exemption under the EU RoHS Directive). (HP RoHS Position Statement; from www.hp.com)*

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<sup>76</sup> The authors wish to thank Roland Sommers, RoHS and WEEE Specialists Ltd, for his peer review of this section.

*All Fujitsu-brand products to be made free of specified hazardous substances by the Group by the end of fiscal 2005. (Fujitsu Environmental Target; from [www.fujitsu.com](http://www.fujitsu.com))*

*Dell's goal is to comply with the RoHS Directive requirements prior to the July 1, 2006 EU implementation deadline and continue to incorporate these changes over our global product lines. Dell has prohibited the use of cadmium, hexavalent chromium, mercury, PBBs and PBDEs in Dell branded products. Dell has also established public goals to phase-out the use of lead and other non-regulated brominated flame retardants in our products, in advance of legal requirements. (Dell Global RoHS Position Statement; from [www.dell.com](http://www.dell.com))*

This commitment to the requirements of the RoHS Directive by global manufacturers means that a large part of the market will have phased out hazardous substances in New Zealand electronic products by default.

However, there does remain a risk that imports of 'whitebox' computer systems and parallel imports of lesser-known brands will still contain hazardous substances. This whitebox section of the market is thought to be significant.<sup>77</sup> New Zealand (and other countries without RoHS-style legislation) runs the risk of becoming an easy market for companies that produce electronics that fail to meet the RoHS criteria.

If the significance of this whitebox market is high enough, and the potential environmental, health and safety impacts are significant enough, then the New Zealand Government should seriously consider implementing legislation that parallels the European RoHS Directive.

There are also concerns that countries that do not adopt RoHS style legislation will become dumping grounds for cheap 'hazardous' components as well as finished products. This may have economic implications as well as environmental implications.

If the New Zealand domestic market does not require RoHS compliance then it is unlikely that a start-up ICT company would design to the RoHS standard as non-compliant parts are likely to be cheaper (due to the shrinking global market for non compliant parts) and RoHS-style legislation in major NZ markets (Australia, China, USA and Europe) could become a non-tariff trade barrier to export growth.

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<sup>77</sup> See Section 3.2.3 above.

## Appendix VI – Glossary of acronyms

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ABS	Acrylonitrile butadiene styrene
AEEMA	Australian Electrical and Electronic Manufacturers Association
AELA	Australian Environmental Labelling Association
AIIA	Australian Information Industry Association
BAN	Basel Action Network
CANZ	Computer Access NZ Trust
CD	Compact disk
CESA	Consumer Electronics Suppliers Association (Australia)
CEW	Covered electronic waste (California)
CIWMB	California Integrated Waste Management Board
CPU	Central processing unit
CRT	Cathode ray tube
DfE	Design for environment
EEE	Electrical and electronic equipment
EPHC	Environment Protection and Heritage Council (Australia)
EPR	Extended producer responsibility (Australia and Europe )
ERP	European Recycling Platform
EU	European Union
EXITO	Extractive Industries Training Organisation
HIPS	High impact polystyrene
HP	Hewlett Packard
ICT-NZ	Information and Communications Technology NZ
IT	Information technology
ITO	Industry training organisation
LCD	Liquid crystal display
LGA	Local Government Act
MED	Ministry of Economic Development
MfE	Ministry for the Environment
NEC	Nippon Electrical Co Ltd
NEPM	National Environment Protection Measure (Australia)
NEPSI	National Electronics Product Stewardship Initiative (USA)
NZQA	New Zealand Qualifications Authority
OECD	Organisation for Cooperation and Development
PBB	Polybrominated biphenyl – type of brominated flame retardant
PBDE	Polybrominated diphenylethers – type of brominated flame retardant
PC	Polycarbonate
PCB	Polychlorinated biphenyl
PCB	Printed circuit board
PE	Polyethylene
PPO	Polyphenylene oxide
PRO	Producer responsibility organisation
PSA	Product Stewardship Australia Ltd
PU	Polyurethane
PVC	Polyvinyl chloride
RoHS	Restriction of use of certain Hazardous Substances (EU)
RMA	Resource Management Act
RRSAG	Resource Recovery Sector Advisory Group
TCLP	Toxic characteristic leaching procedure
EPA	Environmental Protection Agency (USA)
WEEE	Waste electrical and electronic equipment



## Appendix VII – Approach by company seeking EEE for export to China

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The following email was sent by an Auckland entrepreneur to several recyclers and local authorities in March 2006:

Dear .....

Glad to give you some advices on Auckland computers and electronic recycle. Because of rapid growing e-waste stream throughout the whole nations, we sincerely recommend you may export those wastes to the other country, where our recycle manufactures and processional workshops will be able to dismantle, reuse, and recover metal and plastics etc, in North China, around Tianjin City. We have a great deal of well-trained labor and systemic waste management, and can guarantee the "e-waste" recycling major stages remains almost regulated and well protected.

Expansion of the global market for electrical and electronic products continues to accelerate, resulting in a corresponding explosion in computer scrap. While tens of thousands of PCs are discarded per year in Auckland alone. However, this rapid growing "e-waste" stream presents additional difficulties because of insufficiently dealing with end-of-life products and electronic devices, and these subsequently create substantial problems with regard to handing, recycling and disposal of obsolete PC products.

Due to low labor cost, our well trained workers are able to manually dismantle those electrical and electronic products at lower costs than New Zealand local workers do. Then mechanical shredding and component recovery will be in progress, through separation, further dismantling, glass recovery and/or few high-temperature burning in our professional workshop. Furthermore, those hardly recycled material will be sent to the high-scale recycle manufactures. There are over one hundred workers, who have been professionally trained and have sufficient skills to deal with most types of electrical and electronic products. And, our coordinated partners have high-scale manufactures and can help us recycle the rest of products on less hazardous ways.

In short, all above are just some frank advices and suggestions, after all, we are all deserved to keep the City of sail clean and beautiful. By exporting electrical and electronic products to China, relying upon low cost but well trained labor, and high-tech recycle manufactures, most of e-wastes can be reused and recycled more efficiently but much cheaper. Meanwhile, due to the special relationship with port customs and local recycling manufacturers, we are able to trade those wastes quickly and safely. For us, in an attempt to overcome the waste disposal problem, recycling schemes are well being set up to recover some of the metals and plastics in the waste.

I am looking forward to hearing you. If interested, we may provide further and clearer explanations and business plans.

Kind regards,

(Name withheld)