The Economist Intelligence Unit

Global e-waste systems

Insights for Australia from other developed countries

A report for ANZRP by the Economist Intelligence Unit

February 2015

Sponsored by

ANZRP
Australia and New Zealand Recycling Platform Limited

Contents

Executive Summary

Electrical and electronic waste, or e-waste, is growing rapidly in many countries as the technological revolution deepens and expands. Indeed, growth in e-waste is set to accelerate as technologies, especially those geared to consumer communications, extend into new areas and prices continue to fall. At the same time, stakeholders along the value chain increasingly recognise that e-waste that ends up in landfills, or is improperly treated, is both toxic for the environment and to people. Many countries, as a result, have been developing policies and systems to confront the problem, some of which are becoming ever-more sophisticated.

European countries, in particular, have developed e-waste systems that rely heavily on the principle of Extended Producer Responsibility (EPR). Essentially, EPR stipulates that the manufacturer of an electrical or electronic device bears responsibility for that product beyond the initial sale. This is a core principle of the European Union's Waste Electronic and Electrical Equipment (WEEE) Directive, which outlines the producer's responsibility to manage the collection and recycling of these products. Crucially, this principle requires the producer to assume the cost of the recycling. Thus, producers of electrical and electronic devices in Europe have a financial interest in the life cycle of these products. Other countries, however, use different approaches. Japan, for example, places the majority of the cost on the consumer, who pays a fee when recycling.

Compared with these countries, Australia's e-waste system is in its infancy. It is guided by the National Waste plan and has at its core the Product Stewardship Act. Like the EU's WEEE directive, producers and importers of electrical and electronic devices in Australia bear a financial responsibility for the life cycle of their products. But coverage under Australia's e-waste system, outside of voluntary schemes, is limited to personal computers, computer accessories and televisions, whereas the EU directive applies to a much broader range of electrical and electronic equipment. A lesson for Australia, therefore, is to expand the scope of the products that are covered by the e-waste system.

As e-waste programmes evolve, a number of the countries covered in this report are considering ways to encourage greater participation of households and consumers. Some countries, including Japan and Finland, are also making a special effort to encourage the collection and recycling of smaller devices. Another lesson for Australia, then, is to entice and encourage consumers to become more active players in the management and recycling of their electronic waste, especially smaller e-waste.

While EPR has put producers at the heart of e-waste systems, it is becoming increasingly important to promote the "shared responsibility" of all participants. The e-waste system being developed in Europe, in particular, involves not only national governments, producers and recyclers, but also consumers, retailers and municipalities. For Australia, a final lesson refers to a greater role for both local governments, who can incentivise the e-waste recycling of households, and retailers, who can provide collection points as the volume of e-waste grows in coming years.

Introduction

E-waste is a global problem that shows no sign of abating. This report is intended to research the e-waste systems of a select group of advanced economies to develop insights that can be applied to the Australian market. Other than the focus on Australia, the scope of this research is limited to three other advanced economies e-waste: Germany, Finland and Japan. Each is regarded as a leader in developing effective e-waste solutions. [1]

> *Scandinavian and northern European countries have exhibited good cases of policies and initiatives to tackle the problem. Japan is also strong on recycling and re-use (of recycled materials). These countries could be seen as benchmarks so far but a number of other countries also have pilot initiatives to showcase*.
>
> Stefanos Fotiou, Asia-Pacific Regional Coordinator,
> United Nations Environment Program.

This analysis also focuses on the e-waste system as a whole, rather than solely on e-waste regulation. Although legislation is an integral part of addressing the e-waste problem, an effective solution must include consumers, standards, incentives and technology.

What is e-waste?

Different countries define e-waste in different ways. According to the Australian Bureau of Statistics (ABS)[2], e-waste is associated with electrical and electronic equipment that is dependent on electric currents or electromagnetic fields in order to function (including all components, subassemblies and consumables which are part of the original equipment at the time of discarding). This includes:

1. Consumer/entertainment electronics (e.g. televisions, DVD players and tuners)
2. Office, information and communications technology products (e.g. computers, telephones and mobile phones)
3. Household appliances (e.g. refrigerators, washing machines and microwaves)
4. Lighting devices (e.g. desk lamps)
5. Power tools (e.g. power drills) excluding stationary industrial devices
6. Devices used for sport and leisure, including toys (e.g. fitness machines and remote control cars).

In discussing the future of the Australian e-waste system, this is the definition that will be used.

How much e-waste is being generated by the countries studied in this report?

As e-waste has garnered more attention globally, it has become increasingly important to understand the scale of the problem. That, inevitably, means a better process for collecting accurate, comprehensive data. This task has been led by a global initiative known as StEP, or Solving the e-waste Problem, which has created a world map that illustrates the scope of the problem and allows comparison among countries.[3] The data presented in Table 1, which is derived from StEP, shows the total and per-capita e-waste that is generated in the four developed countries in this report. While Australia's total e-waste is small compared with that of Japan and Germany it is actually the highest in this sample on a per-capita basis.

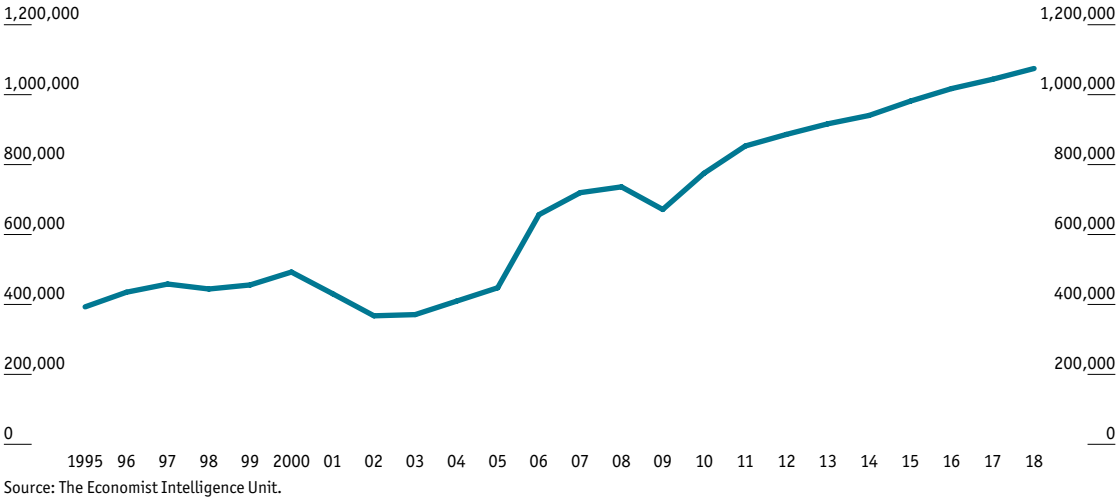
	Japan	Germany	Finland	Australia	Global
Total (in metric kilo tonnes)	2122	1402	106	447	48,894
Kg per inhabitant	16.6	17.23	19.52	19.71	

Source: Jaco Huisman, United Nations University/StEP Initiative [4]

What is the outlook for electrical and electronic products?

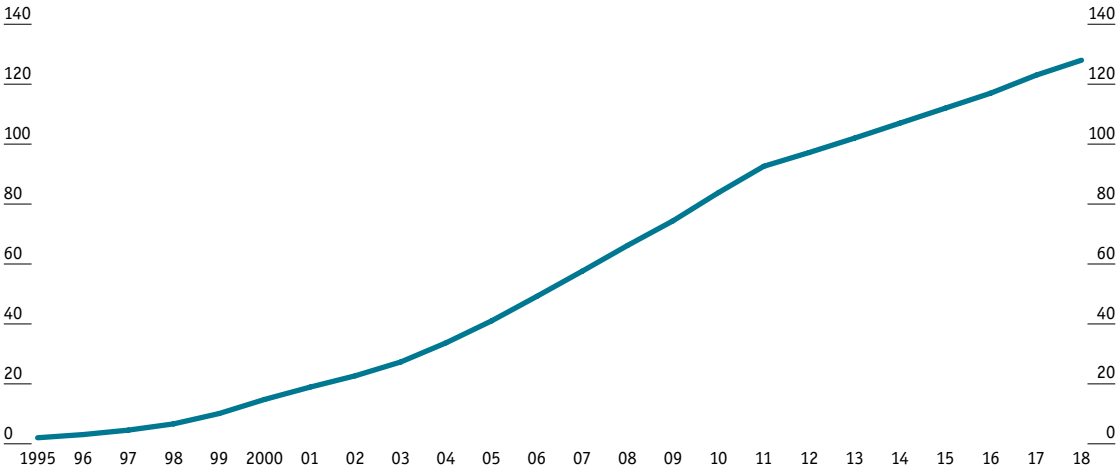
E-waste shows every sign of growing, and at a rapid rate. Consider, first, that as developing economies catch up with those in the rich world, the quantity of electrical and electronic equipment consumed will also climb. It is not only the domestic economic growth of these developing countries that will drive this demand, but the increasing need to be connected to other offices, cities and locations around the world.

World: IT hardware spending
(US$ m)



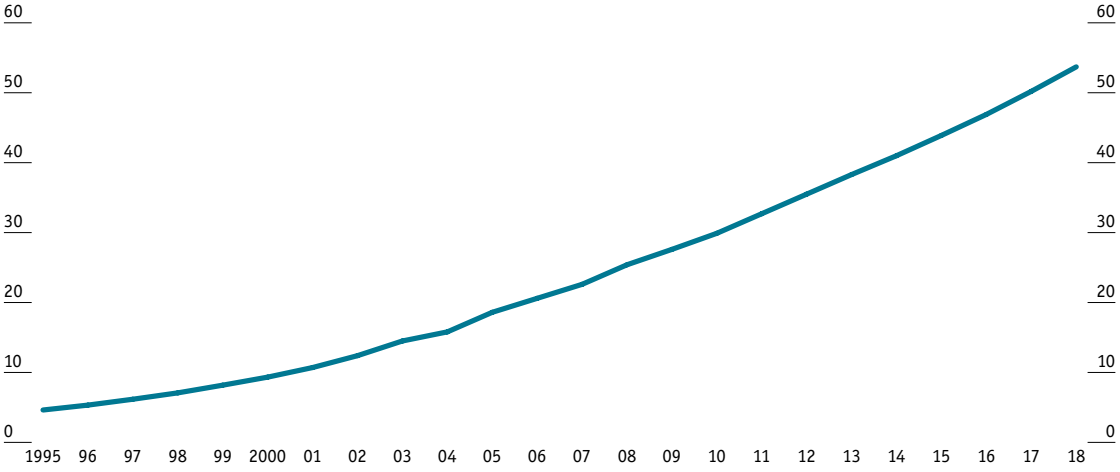
Source: The Economist Intelligence Unit.

World: mobile subscribers
(per 100 people)



Source: The Economist Intelligence Unit.

World: personal computers
(stock per 100 population)



Source: The Economist Intelligence Unit.

Second, across both developed and developing countries, consumer preferences regarding these technologies are constantly evolving. As the processing power of mobile phones and computers continues to grow, the enhanced capabilities and functionality of consumer electronics accelerates demand for the next new model and translates into shorter product lifespans.

Third, rapid technological change will not only increase demand for current electronics and equipment but also result in products that do not currently exist. Some of the consumer electronics in use today—smart phones and tablets, for example—had not been invented when the first electronic recyclers were set-up two or three decades ago, and these devices will not be the last in this technological evolution.

These trends are evident in the Economist Intelligence Unit's Market Indicators and Forecasts database. IT hardware spending and use of mobile phones and personal computers is expected to continue growing globally. Indeed, IT hardware spending alone is forecast to rise by around 60% between 2009 and 2018. The need, then, for better policy assessments—which will inevitably require national and international standards that are better aligned—will be an ongoing process.

Whether it is through legislation and standards or education and public awareness campaigns, efforts to address e-waste are vital. Materials contained in electrical and electronic equipment can become hazardous to both the environment and people when they end up in landfills. The production of electronic equipment also has an important sustainability dimension: the manufacturing process uses a range of resources, from precious metals to rare earths. The responsible use and recovery of these materials is a key focus of e-waste systems around the world, both from a resource management perspective—these materials are sometimes in short supply—and because they can be toxic. Consequently, an effective e-waste system must address every aspect of the electronics value chain.

Country summaries

Japan

Three laws address e-waste in Japan: the *Specific Household Appliance Act* (1998), the *Promotion of Recycling of Small Waste Electrical and Electronic Equipment Act* (2013) and the *Law for the Promotion of Effective Utilisation of Resources* (2001). Set alongside these regulations are public awareness campaigns and eco-town efforts (eco-towns are focused on reducing carbon emissions and utilizing waste generated to be used as raw materials in other industries[5]) that result in a broad and advanced e-waste system in Japan.

The *Specific Household Appliance Act*, also known as the Home Appliance Recycling Law, requires consumers to pay recycling fees and dispose of waste at collection points, such as retailers. From there, the waste is transported to designated sites specified by domestic manufacturers or importers, who recycle it at home appliance recycling plants. The law covers larger items such as television sets, refrigerators, air conditioners and washing machines. In Japan's 2013 financial year (April-March), approximately 12.7m units of these four types of home appliances were collected.[6]

The *Promotion of Recycling of Small Waste Electrical and Electronic Equipment Act*, meanwhile, expanded the list of covered devices beyond the four categories mentioned in the earlier law. The new items include digital cameras, mobile phones, game consoles, computers and printers. Unlike with larger household appliances, consumers do not pay a fee to recycle these smaller items, as the materials recovered from these devices are expected to be more valuable for the recycler.[7]

Japan's *Law for the Promotion of Effective Utilisation of Resources*, also known as the Recycling Promotion Law, encouraged manufacturers to help recycle goods voluntarily and reduce the generation of waste. One of its main goals was to promote product design that facilitates waste reduction, recycling and reuse. While this law does cover a wide range of products, including personal computers, it is not mandatory.[8]

The consumer plays an important role in Japan's e-waste system. Households are obliged to recycle their e-waste, and in the case of larger home appliances, to pay a fee for doing so. Efforts to improve consumer participation are supported by public education campaigns and collaborative initiatives between government and industry. October, for example, is designated "3Rs promotion month" in Japan (3R refers to reduce, reuse and recycle). Coordinated by eight government ministries, the campaign involves national promotion and events aimed at public understanding and cooperation.[9] There are also efforts to advance the so-called eco-town concept, with the aim of bringing government, industry and consumers together to explore environmentally friendly systems at the city and community level.[10]

Finland

Recycling programmes in Finland are largely based on the guidelines set out in the *EU's Directive on Waste Electrical and Electronic Equipment (WEEE)*.[11] As an EU member, Finland added these provisions to its waste legislation in 2004, via its *Government Decree on Waste Electrical and Electronic Equipment*. The legislation requires producers of electrical and electronic equipment to participate in recycling these products and makes them liable for the cost of waste management.[12]

In line with their WEEE obligations, Finnish producers have established organisations that are responsible for managing recycling on their behalf, and to which the producers pay a fee. Finland has five such organisations: SERTY, ICT Producers Co-operative, Flip ry, SELT ry, and ERP Finland ry.[13] All are not-for-profit and are supervised by the government to ensure they are meeting their requirements, which include reducing the amount of waste and the resulting harm caused by electrical and electronic equipment, enhancing material re-use and recovery, and promoting the recycling of all electrical and electronic waste.

Since 2005, these producer-funded organisations have maintained more than 400 collection points for households to dispose of equipment for free. They are also responsible for the transportation of this e-waste to processing plants and for the recycling of materials. Recent changes to national legislation also provide for the collection of e-waste by retailers; this has increased the number of collection points for households to more than 3,000. Consumers can take small, used electrical and electronic items to retailers for recycling without the obligation to buy a replacement product. Returning large used items for recycling would, however, require the consumer to purchase a replacement from that retailer.[14]

Despite the growing network of recycling points, Finnish consumers have not warmed to the notion of recycling their smaller used electronics. Small devices account for just 10% of recycled electronics in Finland, despite the new models, falling prices and high incomes that allow Finns to regularly invest in new gear.[15]

Germany

Germany is one of the EU's top recyclers overall, and its e-waste system is regarded as both "comprehensive and forward thinking."[16] Almost 780,000 tonnes of electrical and electronic waste was collected in 2010, of which 723,000 tonnes was from households and the rest from businesses.[17] This is equivalent to 8.8 kilograms of recycled electronic waste per person, which exceeds the 4 kilograms per person recycling rate stipulated in the EU's WEEE directive.

The WEEE directive was added to German law in 2005 in the form of the *Electrical Products Act (Elektro-und-Elektronikgeräte-Gesetz)*, also known as ElektroG. The law is currently being amended to reflect recent changes in the WEEE directive that were approved in July 2012. [18]

At the heart of ElektroG is the principle of "divided product responsibility" between the public sector and device manufacturers. The government is required to establish free recycling collection points

for all electrical and electronic waste, while manufacturers are responsible for properly disposing of and recycling this waste. In order for a producer to sell electronic products in Germany, it must register with the Federal Environmental Agency (FEA), agree to cover the transportation costs from the collection centres, and oversee appropriate disposal of the waste. Consumers are required by law to take their e-waste to these municipal collection and recycling points, of which there are around 1,500 in Germany.

The German e-waste system includes a designated clearing house, known as the Old Electric Appliances Register Foundation.[19] Once a collection centre is filled to capacity, notification is made to the clearing house, which supervises transport of the waste to the treatment facility. The quantity of electronic waste a producer must recycle is determined by its market share of the products it sells in Germany. The clearing house contacts the producer, which in turn contracts out the transport and recycling services to independent organisations.

Australia

The introduction of the National Waste Policy in 2009 was designed to set the direction of Australia's waste management and resource recovery for the ten years from 2010 to 2020. The policy has several goals, including adherence to international obligations such as the Basel and Stockholm Conventions[20]; reducing the generation of waste, and ensuring that waste treatment, disposal, recovery and re-use is safe and environmentally sound. Shortly after, the Product Stewardship Act of 2011 established the framework by which the environmental, health and safety impacts of products, and in particular those associated with their disposal, are managed. The law included voluntary, co-regulatory, and mandatory product stewardship, depending on the circumstances.[21] A co-regulatory arrangement, according to the National Waste Policy, is an arrangement that is designed to achieve regulated outcomes on behalf of liable parties.[22]

The first co-regulatory product stewardship scheme established under the law was the National Television and Computer Recycling Scheme (NTCRS). The scheme provides Australian consumers and small businesses with access to free recycling services for televisions, computers, printers and computer products (e.g. keyboards, mice and hard drives) regardless of brand or age. It requires television and computer manufacturers and importers to fund the collection and recycling of a percentage of their products that are disposed of each year.[23] Under the scheme, the technology industry was expected to pay for recycling 30% of televisions and computers in 2012-13, rising to 80% by 2021-22.The recycling target will increase gradually over time until the 80% level is achieved.

Under the law, manufacturers and importers of televisions and computers must join and fund co-regulatory arrangements. In turn, these approved co-regulatory arrangements administer the scheme and are charged with achieving results on behalf of their members. Initially, three co-regulatory arrangements were approved in 2012, and with a further two approved to start operations in 2013, five organisations are now able to deliver services under the NTCRS.[24] In 2012-13, its first year of operation, the scheme collected approximately 41,000 tonnes of material, more than doubling the estimated volume that was collected the preceding year, before the programme was launched.

In addition, the Product Stewardship (Televisions and Computers) Regulations of 2011 require that as of 1 July 2014, approved co-regulatory arrangements operating under the NTCRS recover 90% of materials used in the products. This figure is the proportion of television and computer by-products that must be recycled and reprocessed into useable materials.

Insights for the Australian e-waste system from other advanced economies

Compared with Japan and the northern European countries, Australia's e-waste system is in its infancy. Progress has been made, certainly, since the introduction of the National Waste Plan and the Product Stewardship Act. But with e-waste in Australia growing three times faster than other waste streams,[25] the capacity and sophistication of the country's systems will have to grow and adapt. Based on our analysis of programmes in Japan, Finland and Germany, Australia could consider three steps to move its e-waste system forward:

- a greater focus on consumer electronics and small devices
- more expansive coverage
- shared responsibility among all stakeholders

Consumer e-waste and small devices

National and sub-national governments, in countries such as Japan and the Netherlands, have implemented policies that focus on consumers and small waste. Although the consumer is central to these schemes, there are differences in the fees and incentives that the consumer faces, as well as the point at which the consumer engages with the e-waste system. Successful e-waste recycling systems in Japan and Finland pay special attention to small electronics waste, which is especially relevant to consumers. They do, however, differ in the way that they incentivise consumers to recycle these devices. In Finland, the government encourages the recycling of smaller devices by treating them differently from larger items, in particular by relieving consumers of the obligation to purchase a replacement product when returning these smaller products to retailers. In Japan consumers do not have to pay a fee when recycling smaller e-waste, as they do for larger items. Meanwhile, in the US state of California, consumers incur an advance recovery fee, which is a fee that is paid at the point of purchase for devices such as televisions and laptop computers.

While the schemes of Japan, Finland and California focus on the consumer interacting with retailers and collection points, local initiatives in some Dutch municipalities address consumers within the household. A recent study of e-waste flows in the Netherlands, conducted by the United Nations University Institute for Sustainability and Peace, highlighted the potential impact of different waste policies on the household disposal of electronics.[26] The study examined the difference in household flows between two distinct forms of local waste policy: a flat tax, through which a fixed price is paid for waste services, regardless of the amount thrown away, and a "pay-as-you-throw", or PAYT system, in which households pay higher taxes as they throw away more waste. For Dutch households in a PAYT municipality, there is a strong incentive to dispose of electronics in the appropriate channels, and not as part of their household waste. Indeed, this is what the analysis showed: the amount of e-waste

What the world's leading experts are saying about the role of consumers in an e-waste system.

"To motivate consumers, we need to educate them from an early age. They must understand that it is normal to pay for the waste they create". Jaco Huisman, Scientific Adviser, United Nations University

"There needs to be both a carrot and stick approach to consumers and e-waste. Sticks may include fees or fines for dumping electronic devices in the garbage bin; stronger regulation is needed here. Carrots could involve public and private programmes that create incentives to re-use products." Stefanos Fotiou, Asia-Pacific Regional Coordinator, UNEP.

"Increasingly, more metals of the periodic table are being used to increase the functionality of consumer products. Many of these metals are not as abundant in nature as copper, for example, or easy to extract and primarily process due to their low concentration. If we want to keep enabling this increasing functionality of these products, then we need to do more to address these rare and precious elements and make sure they are recovered and kept in the global resource loop. Consumers who keep old electronics as back-ups are not helping in this respect". Federico Magalini, Industrial Engineer & e-waste expert, United Nations University.

"Regarding the role of the consumer, a shared responsibility model that includes consumer financial responsibility is worth investigating. This may include elements similar to the advanced recovery fee used in California." Jeremy Gregory, Research Scientist, Massachusetts Institute of Technology.

"Producer take-back has been a successful strategy. So have local collection points for consumers. Public information and education is also important. The Swedish system, el-kretsen, which uses all of these elements, is a good example of how a system can work." Karin Lundgren, former consultant at the International Labour Organisation.

in general household waste was 50% lower in the PAYT households than in those who paid a flat tax. The fact that around 1kg per inhabitant of e-waste – a large amount when summed across the Dutch population – was found in household waste in PAYT households emphasises the point that consumers and small WEEE are a vital part of the e-waste system. [27]

Consumer based incentives for small e-waste is not the only challenge to formalising the role of the consumer. The interaction of consumers and smaller devices also raises the question of the systemic goals and incentives that relate to these devices.[28] A single recycling target that encompasses all products in the e-waste system can provide clarity for all stakeholders. However, as noted in a recent

StEP White Paper, when assessing the Recast of the EU WEEE Directive, a weight based approach may have unintended consequences for some appliances, such as small devices. Under a weight based approach, where the recycling target is based on the tonnes of electrical and electronics products produced, there is a much greater incentive to recycle larger items like washing machines and air-conditioners, rather than consumer electronics. For these products, a unit based target or accounting may be more appropriate as a measure to incorporate into e-waste systems.

Scope of e-waste systems

A significant difference between the e-waste systems of the northern European countries and Australia is the overall scope: the EU's WEEE directive is much more comprehensive than the programme now in place in Australia. The original EU WEEE Directive covered a range of products, including small and large household appliances, IT and telecommunications equipment and consumer equipment.[29] The WEEE Recast, while refining the number of categories, broadened the scope to include all electrical and electronic equipment, which enables new products and technologies to be included in the future.[30]

Compared with the product coverage of the EU WEEE Directive, the Australian e-waste system is smaller in scope. By construction, the NTCRS is limited to televisions and computers, although there are voluntary product stewardship schemes that broaden the product coverage. Complementing the NTCRS, Mobile Muster was established in 1998 as a voluntary scheme and is the only not-for-profit government accredited mobile phone recycling programme in Australia. It is the mobile phone industry's programme to take responsibility for its products at the end of their useful life.[31] Voluntary product stewardship schemes can be an important aspect of an e-waste approach, but a broader scope of the Australian system may help to achieve the objectives set out in the National Waste Policy.

The product coverage of the Australian e-waste system could be expanded in regards to both small and large devices, as well as the categories of products that are covered. The EU WEEE directive covers large household appliances such as dish washing machines, washing machines and cookers, as well as small household appliances such as vacuum cleaners, toasters and fryers. Other categories of the directive, like those that refer to consumer equipment and leisure devices, also show the extent of small devices beyond mobile phones. Such products include hand held video game consoles, radio sets and video cameras. As seen in the definition of e-waste from the ABS, the Australian Government recognises the broad scope of e-waste, and as indicated by a recent report examining the end of life of refrigerators and air conditioners, the Australian Government may be considering extensions to their e-waste system.[32]

For a country like Australia, with a smaller population than Japan and some EU countries, bringing more products into the e-waste system will bring additional benefits to the system apart from the collection of more electronic and electrical waste. Firstly, a greater volume of e-waste will encourage greater efficiency in the recycling and material recovery process, and will likely result in a lower cost per unit recycled. Secondly, with the targets and goals of the Australian Waste Policy, greater e-waste volumes will incentivise the investment in advanced technologies for the dismantling of products

and recovery of materials. The additional benefits of a broader e-waste system will complement the schemes already in place and increase the probability of the system's longer-term goals being achieved.

Shared responsibility and a systemic approach

> *Many countries have an e-waste policy. The key is implementation, and the willingness of all stakeholders to contribute to it. In the past, all of the focus has been on producers. Instead, having a functioning triangle of producers, government and recyclers is key.*
>
> Jaco Huisman, Scientific Adviser, United Nations University.

Extended producer responsibility, or EPR, is a consistent theme that informs the e-waste policies of all of the countries considered here. As Stefanos Fotiou, Asia-Pacific Regional Coordinator for UNEP, notes, "EPR is the right framework to address these issues." There is, however, a growing recognition that EPR alone cannot achieve the desired goals of an effective and comprehensive recycling framework.[33] As Mr Fotiou suggests, "Shared responsibility is what is needed in addition to ERP. In other words, ERP is a necessary but not sufficient condition."

Certainly, governments are already working with producers in the countries analysed in this report, though in different ways and to different degrees. In countries such as Japan and Finland, the retail sector also plays a role in managing e-waste. The most important link, however, is the consumer, who is the ultimate user of these products. Encouraging consumers and households to participate more fully in e-waste systems will be crucial to accommodating the big increase in waste volume in the coming decades. For Australia, both the retail and government sectors can play a role in enticing the consumer into the e-waste system.

While the NTCRS was responsible for recycling 30% of televisions and computers in 2012-13, Australian states, territories and local governments were responsible for the remaining 70%. With the NTCRS target rising incrementally to 80% by 2021-22, the interaction of local governments with the national government e-waste scheme will be crucial. Local governments will continue to manage general household waste, and with this proximity to the consumer, their importance to the e-waste system should not be underestimated.

The policies of local governments, therefore, could complement the national e-waste system and encourage greater recycling of electronic and electrical devices, especially smaller ones. As seen in some Dutch regions, such policies as PAYT can incentivise the household to reduce the e-waste that is thrown in the general waste bin. When policies like PAYT are combined with public awareness campaigns, the household will then have the incentive and the information required to deposit e-waste into the appropriate waste channel. Other examples of shared responsibility may exist between different levels of government, but such cooperation and complementarity of policy will only help the Australian e-waste system meets its mandated targets.

If Australia does embark on a broadening of the scope of its e-waste system, increasing the number of collection points will be necessary to accommodate the volume of recycled products. Consequently, it is worth considering the role of the retail sector as another collection point in the system. This may be especially relevant to smaller devices given the relative ease with which they can be transported when compared to larger items. At present, there is some involvement of the retail sector with the targeted recycling of products. Aldi supermarkets in Australia, for example, offer free battery recycling at their stores. However, if the broader retail sector was to be encouraged to participate in the e-waste system, a consumer education campaign would be advisable to help inform new consumer habits of recycling while shopping.

Conclusions

Managing e-waste is a multi-faceted challenge, and the associated recycling systems are inherently complex. As technology constantly evolves, e-waste systems will have to adapt. This point is embedded in the EU WEEE directive, in which specific dates are set for a review of the programme's elements, such as the scope of products covered. As an example of best practice, this is a feature that other countries should consider. Indeed, each country has its own challenges to confront as it designs e-waste programmes – from the vast geographical spread of Australia to the concern over rare-earths in Japan.[34] The need to review, monitor and critique e-waste systems, then, is universal.

Although extended producer responsibility is a necessary part of any e-waste environment, much more needs to be done. This is best captured by the term "shared responsibility", in which not only producers but governments, recyclers, retailers, households and consumers play a vital role. This is easy to say but difficult to implement. Policymakers globally must balance a number of factors as they consider a shared responsibility system, some of which may be in conflict. This example, covering the life cycle of a car, is a case in point.

> *"The goal is to keep cars out of landfills, which is admirable. But we need to be careful: there is also a need to focus on the total environmental impact of the car, including its use of fuel and its greenhouse gas footprint. Carbon fibre vehicles would reduce fuel use, but are difficult to recycle, so goals can be in conflict at times."*
>
> Jeremy Gregory, Research Scientist, Massachusetts Institute of Technology.

Australia, certainly, can do more to advance the idea of shared responsibility. Consistent with that theme, the consumer needs to be brought more fully into the e-waste system. European countries have experimented with different schemes to incentivise the recycling behaviour of consumers. The PAYT system in some Dutch municipalities has led to a reduction in the proportion of e-waste in overall household waste. Local governments in Australia should consider similar policies that incentivise household behaviour to separate e-waste, especially smaller devices, from the general waste stream. The cooperation of all levels of Australian government will be necessary as the e-waste system transitions to one that is dominated by the national scheme over the coming decade.

In a related area, countries such as Finland and Japan have designed e-waste systems that distinguish the recycling of small devices from larger ones. They have done this by differentiating how a consumer interacts with the retail sector when recycling small versus larger items. Consistent with this theme, Australia should consider the role of the retail sector as a collection point in the e-waste system. This may be especially beneficial for the collection of smaller electrical and electronic devices. As these systems are monitored and evaluated, valuable insights into consumer behaviour and their willingness to recycle small electronics will become apparent.

For Australia in particular, expanding the scope of products covered by e-waste systems—from mainly televisions and computers to more sophisticated IT devices—deserves serious attention, and could pay dividends by reducing toxic waste, efficiently reusing valuable resources and ultimately reducing costs for businesses and consumers.

Managing—and improving—recycling systems for electronics involves a complex interplay of economic and social factors, and a sometimes tense relationship between governments, businesses and consumers. An environment in which responsibilities are more evenly shared, incentives are clearly laid out, roles are more carefully defined and coverage of products is expanded offers the best hope for a more effective and adaptable system.

Appendix

EPR and Product Design

EPR has been portrayed as having two broad roles. Firstly, it was designed to bring the responsibilities of the producers to the entire life cycle of their products, not simply the initial sale. Secondly, by establishing EPR as the central theme of an e-waste system, it was thought that this would incentivise producers to design more recycle-friendly products. Despite some efforts from producers, there is little evidence that EPR has encouraged the changes in product design that were envisioned.[35] However, when compared to policy areas such as the scope of the e-waste system and the role of consumers, the interaction of EPR and eco-design is less relevant for the Australian e-waste system. Primarily, this is due to the relative lack of technology manufacturing that occurs within Australian when compared to other countries. Nevertheless, it is still an important debate for all e-waste systems to consider.

One of the world's leading experts in this field is Jaco Huisman, Scientific Adviser at the United Nations University, who has examined the issue of EPR and product design very closely. According to Mr Huisman, the eco-design of electrical and electronic products should be embedded much more in the design process than it currently is. While this is something that will take time, Mr Huisman did have suggestions on the ways that eco-design could be incentivised or encouraged in firms:

> "*There are prevention elements built in various e-waste legislation. However, the waste phase and design stage are too far apart to enable any feedback loops. There are attempts like the eco-design directive in the EU to give more guidance. Personally, I believe eco-design requirements should get much more a 'process' related attention rather than old-fashioned too late product requirements. When companies are directed to have sustainability criteria incorporated in their bonus system for instance, it may trigger much more creativity in product development compared to restricting compliance efforts.*"

In the EU WEEE Recast of 2012, Article 4 addresses the notion of product design in the WEEE Directive[36] (emphasis ours):

> Member States shall, without prejudice to the requirements of Union legislation on the proper functioning of the internal market and on product design, including Directive 2009/125/EC, **encourage cooperation between producers and recyclers and measures to promote the design and production of EEE, notably in view of facilitating re-use, dismantling and recovery of WEEE, its components and**

> **materials. In this context, Member States shall take appropriate measures so that the eco-design requirements facilitating re-use and treatment of WEEE established in the framework of Directive 2009/125/EC are applied** and producers do not prevent, through specific design features or manufacturing processes, WEEE from being re-used, unless such specific design features or manufacturing processes present overriding advantages, for example, with regard to the protection of the environment and/or safety requirements.

The effectiveness of eco-design requirements in incentivising product design is an ongoing debate at present. It is, however, an important consideration for all e-waste systems as they move to become more sophisticated and better equipped to meet their goals.

The international trade in e-waste

Another theme that was highlighted by the interviewees of this report was that of the international trade in e-waste. As noted in a research paper from the INSEAD Social Innovation Centre, a substantial amount of e-waste is being exported to China and Africa where they are either re-sold or recycled at standards below that of the exporting country.[37] For a detailed discussion of the complexity of the issues that surround the exporting of e-waste, see the 2013 StEP Green Paper on the transboundary movements of e-waste.[38]

While this is an issue that e-waste systems will continually face over the coming years, it is worth noting that the EU WEEE Directive (recast) has changed the focus of the responsibility for proving the functionality of used equipment from the relevant Authority to the exporter. This is addressed in Annex VI of the WEEE recast, as shown here (emphasis ours):

MINIMUM REQUIREMENTS FOR SHIPMENTS

1. In order to distinguish between EEE and WEEE, where the holder of the object claims that he intends to ship or is shipping used EEE and not WEEE, Member States shall require the holder to have available the following to substantiate this claim:

(a) a copy of the invoice and contract relating to the sale and/or transfer of ownership of the EEE which states that the equipment is destined for direct re-use and that it is fully functional;

(b) evidence of evaluation or testing in the form of a copy of the records (certificate of testing, proof of functionality) on every item within the consignment and a protocol containing all record information according to point 3;

(c) a declaration made by the holder who arranges the transport of the EEE that none of the material or equipment within the consignment is waste as defined by Article 3(1) of Directive 2008/98/EC; and

(d) appropriate protection against damage during transportation, loading and unloading in particular through sufficient packaging and appropriate stacking of the load.

Notes

[1] In a number of interviews conducted for this research, these countries were most often cited as having advanced policies and thus were considered leaders in the field.

[2] http://www.abs.gov.au/ausstats/abs@.nsf/Products/4602.0.55.005~2013~Main+Features~Electronic+and+Electrical+Waste?OpenDocument

[3] http://step-initiative.org/index.php/WorldMap.html

[4] Notes from the StEP Initiative on data and definition: Data refers to domestic generation only, thus excluding import and export of EEE, WEEE, components and fractions. The definitions of EEE and WEEE include all EU WEEE Directive categories and products, including ALL professional, ALL B2B and ALL small appliances.

[5] http://www.unido.org/news/press/japans-was.html

[6] http://www.meti.go.jp/english/press/2014/0624_02.html

[7] http://www.japantimes.co.jp/opinion/2013/04/27/editorials/recycling-of-useful-metals/#.VDdS2fm1Z9V

[8] A comparative study of E-waste recycling systems in Japan, South Korea and Taiwan from the EPR perspective: Lessons for developing countries. 2008. Sung-Woo Chung & Rie Murakami-Suzuki. See also http://www.meti.go.jp/policy/recycle/main/english/law/promotion.html

[9] http://www.meti.go.jp/english/press/2014/0930_01.html

[10] http://www.unido.org/news/press/japans-was.html

[11] http://ec.europa.eu/environment/waste/weee/index_en.htm

[12] http://www.elker.fi/en/tuottajayhteisot_en/tuottajavastuu_en

[13] http://www.serty.fi/en/toiminta-ja-jaesenet/membership-in-serty

[14] Ministry of Environment, Waste Act, amendments, 4th of July, 2012.

[15] http://yle.fi/uutiset/few_finns_recycle_small_electronics_hoarding_rules/7150707

[16] Fixing the e-waste problem: An exploration of the sociomateriality of e-waste, Mary Lawhon and Djahane Salehabadi. 2013. In Solving the e-waste problem: An interdisciplinary compilation of international e-waste research, Edited by Deepali Sinha Khetriwal, Claudia Luepschen. and Ruediger Kuehr.

[17] http://www.umweltbundesamt.de/en/topics/waste-resources/product-stewardship-waste-management/electrical-electronic-waste

[18] ibid.

[19] Solving the E-Waste Problem (StEP) White Paper E-waste Take-Back System Design and Policy Approaches (2009).

[20] The Basel Convention on the Control of Transboundary movements of Hazardous Waste and their Disposal places obligations on Australia to ensure that generation of waste, including hazardous waste, is kept to a minimum. It also requires environmentally sound disposal facilities to exist and that waste managers take steps to prevent, and minimise the consequences of, pollution from waste. The Stockholm Convention on Persistent Organic Pollutants further requires the restriction and ultimate elimination of dangerous long-lasting chemicals. The context of Australia's National Waste Policy, in relation to these international obligations, among other aspects, can be seen in National Waste Policy: Less Waste, More Resources November 2009.

[21] http://www.environment.gov.au/protection/national-waste-policy/product-stewardship

[22] National Waste Policy Fact Sheet, National Television and Computer Recycling Scheme: Co-regulatory Arrangements, Australian Government, Department of Sustainability, Environment, Water, Population and Communities.

[23] Department of Environment, National Television and Computer Recycling Scheme, Outcomes 2012-2013. February, 2014.

[24] The three initially approved were DHL Supply Chain (Australia) Pty Limited, Australian & New Zealand Recycling Platform Limited (ANZRP), and E-Cycle Solutions Pty Ltd. A further two co-regulatory arrangements were approved in early 2013 to commence operation in 2013–14: Electronics Product Stewardship Australasia and Reverse E-Waste. TechCollect is a not-for-profit service provided by ANZRP.

[25] Electronics Factsheet, Planet Ark.

[26] Huisman, J., van der Maesen, M., Eijsbouts, R.J.J., Wang., F., Baldé, C.P., Wielenga, C.A., (2012), The Dutch WEEE Flows. United Nations University, ISP – SCYCLE, Bonn, Germany, March 15, 2012.

[27] http://www.theguardian.com/environment/2011/mar/18/recycling-waste This is an example of a similar scheme in Neustadt an der Weinstrasse whose recycling rates are the best in Germany. Here, the town's citizens are not charged for any waste left out for recycling and the less household waste left out for incineration the less the household pays.

[28] Solving the E-Waste Problem (StEP) White Paper, On the Revision on EU's WEEE Directive - COM(2008)810 final.

[29] Other areas included lighting equipment; electrical and electronic tools (with the exception of large-scale stationary industrial tools); toys, leisure and sports equipment; medical devices (with the exception of implanted and infected products); monitoring and control instruments; automatic dispensers

[30] Extended Producer Responsibility: Stakeholder Concerns and Future Developments, INSEAD Social Innovation Centre, written by Nathan Kunz, Atalay Atasu, Kieren Mayers & Luk Van Wassenhove.

[31] See Plant Ark 'Product Stewardship' Factsheet. Another voluntary product stewardship scheme in Australia is Apple's "Reuse and Recycle" programme that gives customers the opportunity to be rewarded with up to $250 of store credit for their old iPhones and iPads.

[32] This is a recent release of a product list that outlines products that are under consideration for regulation, http://www.environment.gov.au/protection/national-waste-policy/product-stewardship/legislation/product-list-2014-15. A recent report also focused on the end-of-life of refrigerators and air-conditioners, http://www.environment.gov.au/protection/national-waste-policy/publications/end-of-life-domestic-rac-equipment-australia

[33] For a discussion of the limitations of EPR, see the Special Feature on Extended Producer Responsibility, Too Big to Fail, Too Academic to Function: Producer Responsibility in the Global Financial and E-Waste Crises, by Jaco Huisman.

[34] Japan is highly dependent on exports of rare earth element from China. For a discussion on the 'urban mining' of rare earth elements, see the Research Paper, Urban Mining of Rare Earth Elements in the United States: A Win-Win Proposition, By Victoria Loewengart, 2011 American Military University.

[35] Again, see the Special Feature on Extended Producer Responsibility, Too Big to Fail, Too Academic to Function: Producer Responsibility in the Global Financial and E-Waste Crises, by Jaco Huisman.

[36] Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012, on waste electrical and electronic equipment WEEE. (recast).

[37] Extended Producer Responsibility: Stakeholder Concerns and Future Developments, INSEAD Social Innovation Centre, written by Nathan Kunz, Atalay Atasu, Kieren Mayers & Luk Van Wassenhove.

[38] Transboundary Movements of Discarded Electrical and Electronic Equipment, StEP Green paper, 2013. Djahane Salehabadi, Cornell University.

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