

# Second Nature

## Recycling in Australia



A snapshot of the past, present and future of recycling in Australia prepared by Planet Ark for National Recycling Week 2012.



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## Foreword

# Australian Packaging Covenant

It is with great pleasure that the Australian Packaging Covenant supports National Recycling Week 2012 and the launch of *Second Nature – Recycling in Australia*.

National Recycling Week is a fantastic opportunity to reflect on what has been achieved to increase recycling rates by everyone working together – industry, government and consumers – and how we can continue to collaborate and build on these achievements.

Appropriate packaging on products is necessary – it helps us transport what we buy, provides us with information about the product, promotes the product and helps to protect it and us as consumers.

It also requires resources, such as raw materials, water and energy, that if used sustainably are able to be recovered and reused if we are clever enough to implement solutions.

Long term solutions require collaboration and innovative thinking. The Australian Packaging Covenant establishes a framework for the effective life cycle management of consumer packaging, delivered through a collaborative product stewardship approach. Over the twelve years of its existence, the APC has invested in research, services, education, technology and infrastructure.

The APC ensures all involved in the supply chain play their part in design, recovery and recycling, and takes a holistic, life-cycle approach to inform packaging decisions.

This approach has seen the overall recycling rate of consumer packaging increase from 39% in 2003 to 63.1% in 2011, and in 2011 there was

36.4% less consumer packaging being disposed of to landfill in than in 2003.

We have achieved a great deal in the recovery and recycling of packaging and I commend Planet Ark on the work they are doing to expand these achievements into other areas like electronic equipment, batteries and furniture, and to build awareness and engagement within the community to further grow our recycling culture.

If we work together, a community that manufactures, uses, distributes and recovers all materials in a sustainable way – and makes recycling second nature - is achievable.

**Stan Moore**  
**CEO**  
**Australian Packaging Covenant**

# Planet Ark

Recycling makes the world (and universe) go round. It may surprise you to know that all the atoms on Earth, including in your body, were created in ancient stars more than 4 billion years ago. Some of those atoms may once have been part of a tree or a dinosaur. They have been recycled over and over.

In nature, there is no such thing as waste. The 'waste' of one species is food for another, and all species exist together in give and take relationships. Take a tree – we're very fond of trees at Planet Ark - as an example: a tree is dynamic, not static; connected, not isolated. It takes nutrients, water and gases out of the environment and also returns nutrients, water and gases to the environment. At the end of its life it is consumed (recycled) by microorganisms. The tree is an integral part of the ecosystem, not separate from it.

Over thousands of years of civilization and progress, we humans have slowly emotionally separated ourselves from nature. We forget that we rely on the 'recycling' systems of nature for food and ecosystem services such as oxygen and fresh water. As we consume and dispose of material goods, all of which are ultimately extracted from nature, we remove resources from this dynamic system.

We can tell a lot about an individual or a group of people by what they throw away. Archaeologists study kitchen middens, the waste dumps of past societies, to see what they reveal about the food, customs, culture, clothing, lives and currency of the people who once lived there. Similarly, in telling the story of the history of waste and recycling in Australia over the last 200 or so years, we're also reflecting the changing nature of Australian life since European settlement.

Recent decades saw Australians begin to question the environmental impacts of our modern lifestyle and the myriad products we buy, consume and throw away. Planet Ark was born in the 1990s out of this desire to find a better way. We have been particularly active on the recycling front. National

Recycling Week was founded in 1997 to bring together governments, businesses and ordinary Australians to work together to make better use of our planet's resources, coordinate our efforts and celebrate our successes. We do in respect of - and inspired by - our wondrous natural environment.

There is also a practical imperative for our human society. This was highlighted in the recent CSIRO report on global megatrends, *'Our Future World'*. In the first megatrend of 'More from less', it highlighted that due to declining mineral ore grades "mining in the future may happen above the ground (i.e. recycling) more than below the ground". The terms 'urban mining' and 'above ground mining' are increasingly used to describe this.

In producing this report, Planet Ark hopes Australians will take a new look at the old problem of waste recovery, be proud of recycling successes and recognise where there are opportunities for improvement. We encourage people to read it to gain a better understanding of our myriad of recycling systems and their potential, and think about the increasingly important role they play in creating a more sustainable Australian society where waste doesn't exist.

**Paul Klymenko**  
CEO  
Planet Ark Environmental Foundation

## Acknowledgements

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# Introduction

In 2002 the landmark book *Cradle to Cradle*, by German chemist Michael Braungart and American architect William McDonough, was published<sup>1</sup>. This book called for our industrial systems to shift from linear 'cradle to grave' patterns that extract resources and produce waste, to circular patterns that are efficient and waste-free 'cradle to cradle'. A decade on, Australians are familiar with recycling, but we're still a long way from 'waste-free'.

When we consider the flow of resources through the economy and through our lives, it's useful to think in terms of circles and cycles, instead of lines with dead ends. For National Recycling Week 2012, we're stepping back to take stock of how far we've come with recycling, and looking ahead to the future. The theme of this report is **Second Nature**; it aims to offer us a *different way of acting* and a *different way of thinking* about the materials we use, recycle, and throw away.

## A Different Way Of Acting...

We often term habitual behaviours as 'second nature'.

'Green is the New Black' was a common headline of newspapers and magazines articles associated with the boom in interest in environmental issues in the last decade, with *An Inconvenient Truth* and Australia's prolonged drought capturing imaginations. But recycling and sustainable behaviour is too important to be viewed as a fashion trend. Planet Ark aims to bring about 'Green is Normal'. If we are to continue the standard of living we currently enjoy, we must become more resourceful to accommodate our growing population. This means changing our views of resources, rubbish and recyclables. It includes looking critically at products when shopping, questioning whether or not they're sensibly packaged or over-packaged, and thinking about what will happen to the products (or their packaging) when they reach the end of their useful lives. It involves changing our attitudes to the materials we use: enjoying them while they're in

use, but taking responsibility for keeping them in circulation by ensuring they are recycled.

## A Different Way Of Thinking...

Many 'modern' humans view nature as a source of materials that can be extracted and exploited. However, non-renewable resources are, by definition, limited. Even renewable resources, like wood or plant-derived biofuels, require land, water, nutrients and topsoil to grow. Recovered recyclable materials offer an alternative to virgin resources, often with reduced greenhouse impact and water use associated with manufacturing. As a society, we can stop looking at natural environments as a source of resources to exploit and start looking at the waste we generate as a 'second nature' – an alternative source of the feedstock needed to make the products we use.

## About This Report

To make *Second Nature* a reality, we must understand where we are and how we got here, before examining where we're going. This report explores recycling in Australia in three sections.

- **Recycling: The Past** looks at the history of recycling in Australia, how it developed in the context of international experiences, how it has grown, and the different forces and influences that have driven recycling initiatives.
- **Recycling Today** provides a snapshot of how Australia is performing, what we're recycling and what we're sending to landfill, the systems and services that are in place, the current challenges, and why some materials get recycled while others don't.
- **The Future of Recycling** looks at the environmental and resource challenges of the future, how they might be met, and the key priorities and opportunities.

# Recycling: The Past

The first half of the 20<sup>th</sup> century was dominated by two World Wars interspersed by an economic depression. Rations, scarcity and austerity meant that people recognised the inherent value of the food, energy and materials they used, and they wasted very little. “Make do and mend” was the thrifty catch cry of households, factories and other workplaces during World War II. Salvage operations collected metal, paper, rags and even bones. Many countries, particularly those with limited natural resources like Japan, continued their resource conservation efforts beyond the War.

Peace brought a growing prosperity in developed Western nations. From the 1950s onwards, there has been enormous economic growth in Australia, the United States and many other countries, due to advances in mining and manufacturing, and international trade. This period also saw an explosion in the variety of cheap consumer goods and disposable products, with bright, shiny toys, Tupperware, clothes and convenience items more accessible, affordable and available. Some disposable products, such as syringes, condoms and nappies, were developed to improve sanitation and reduce the spread of disease. Others were developed solely with convenience or pleasure in mind.

Prosperity brought with it the environmental problems of pollution, solid waste, litter, and land degradation. Governments were faced with the growing problem of managing the unwanted by-products of our prosperity.

The oil shock of the 1970s saw a temporary return to thrifty thinking. Rising energy prices resulted in investment in aluminium recycling, which saved significant amounts of energy. There was also community concern about packaging, particularly the litter items that spoiled the landscape. Local recycling collections began to emerge, building on the collection experience of sanitation and municipal waste management engineers. Australians looked on with growing interest as community-driven recycling developed in North America and Europe.

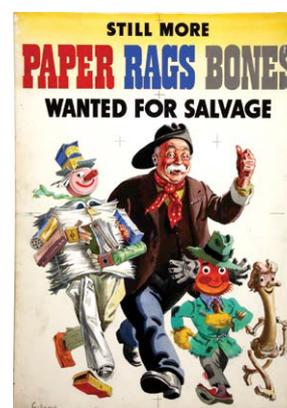
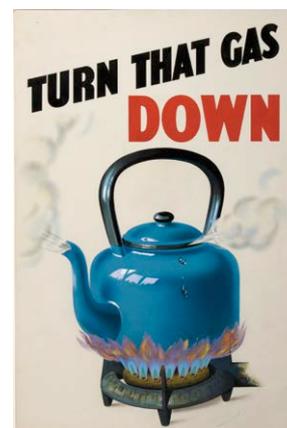
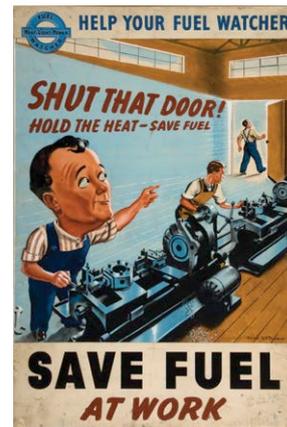
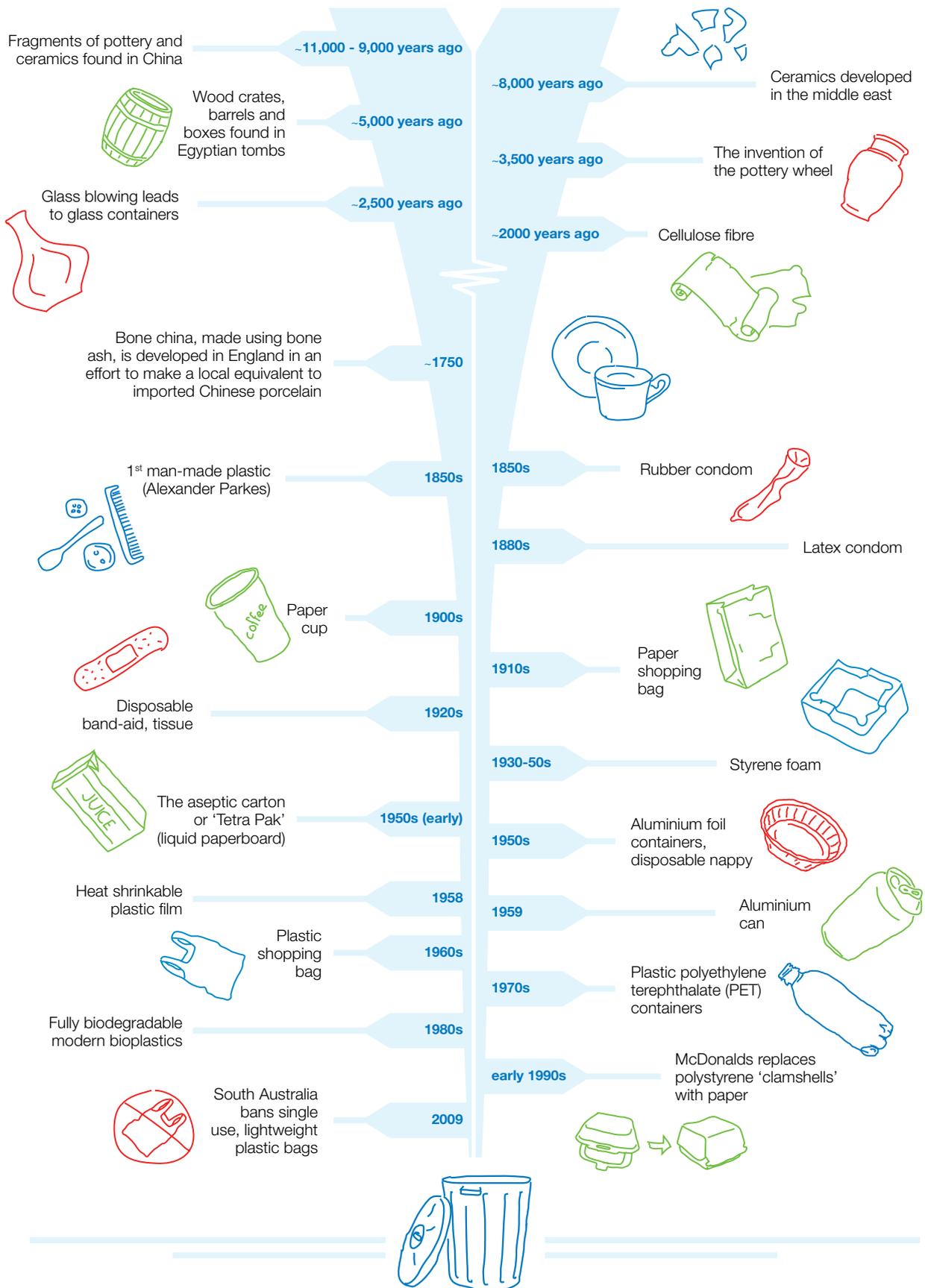


Figure1: World War II government public education posters from the United Kingdom<sup>2</sup>



# Disposable Products and Packaging Through the Ages<sup>3</sup>



## A History of Recycling in Australia

Product reuse and repair was a matter of necessity in Australia's colonial era, with many products made only overseas.

Early waste collection programs in Australia were driven by the need to make cities safe and healthy places to live. The removal and disposal of garbage from households aimed to prevent odours, vermin and the spread of disease. In the late 19<sup>th</sup> century, many NSW councils employed 'Inspectors of Nuisances' to manage waste problems. Australia's earliest recycling programs date back this era, with rag and bone collections from households. Rags were made into paper, while bones were used to make fertiliser, soap, glue and gelatine.

Waste disposal became a more pressing issue as Australia's population grew. Small local tips, or landfill sites, were dotted around the fringe of cities. Incineration facilities became widely used in the 20<sup>th</sup> century, but were controversial because of the air pollution they caused. Small backyard incinerators proliferated.

The first Australian paper mill to use recycled material was built in 1815 - it recycled rags into paper. Waste paper collections from households and factories started in Melbourne in the 1920s and became more common in the 1940s. This paper was typically reused or recycled into packaging material.

Australia, like most of the world, was hit by resource constraints during the two World Wars and The Great Depression.

Glass bottles were refillable until the 1960s, creating a demand for their collection and on-sale back to beverage manufacturers via 'bottle merchants'.

Waste became a greater public issue in the second half of the century, with growing concern about the environmental impacts of incineration and landfill, increasing volumes of waste being produced, and litter emerging as an issue. Single-use containers and disposable products became readily available, increasing these concerns. However, growing



Figure 2: Australian World War II 'War on Waste' public education poster

consumption meant growing demand for the raw materials to make them, including cardboard, glass and aluminium. Glass manufacturers set up drop-off centres for bottles in the late 1960s, and in the 1970s, Comalco and Alcoa began aluminium recycling programs. Industries established collection and reprocessing facilities as viable businesses. Effectively, community concern and commercial interests were the key drivers of the recycling programs we have in Australia today.

In February 1975, Canterbury Council in NSW became the first Australian municipality to use magnetic separation to recover steel cans from household waste.

In 1977, South Australia introduced container deposit legislation to encourage the return of beverage containers for reuse or recycling. This legislation primarily aimed to reduce both solid waste and litter.

Kerbside recycling schemes were introduced in the 1980s and early 1990s, initially in Sydney, and then spreading to the other major centres and more recently to regional areas. These schemes allowed households to separate out common items such



as paper, glass and aluminium, and later plastics, liquidpaperboard milk and juice cartons and steel cans. Early collections used woven sacks, which were replaced later by tough plastic crates, and later mobile garbage 'wheelie' bins.

In the 1990s, recycling collections in Australia shifted from being industry-run programs targeting high value items, such as glass and aluminium, to council-provided services paid for by ratepayers. Even garden clippings, which comprise up to half of our average household waste, is now recycled using composting and mulching methods in many council areas. Concord Council in NSW was the first to begin a garden clippings collection service in 1993.

The collection of recyclables is just one stage in 'closing the loop'. An effective 'cradle-to-cradle' approach requires the involvement of governments, recyclers and the packaging industry itself. In 1992, the Australian and New Zealand Environment and Conservation Council (ANZECC) endorsed a National Kerbside Recycling Strategy that included a range of voluntary recycling targets for the major packaging industries. Australia became one of the first countries to have a national voluntary recycling plan, which outlined commitments at all levels of industry. A concerted effort was made to extend kerbside recycling schemes to at least 90% of households in major urban areas. From 1990 to 1993, the rate of household recycling in Australia doubled.

## 21<sup>st</sup> Century Recycling

In July 1999, ANZECC Ministers agreed to the National Packaging Covenant to complement and further the achievements of the National Kerbside Recycling Strategy. Based on the principles of shared responsibility, product stewardship and lifecycle management, the Covenant seeks to: ensure costs are shared equitably; secure the viability of kerbside recycling by minimising the environmental impacts of consumer packaging waste; close the recycling loop; and develop economically viable and sustainable recycling collection systems.

The Covenant encompasses the entire packaging chain including governments, producers, wholesalers, distributors, retailers, fillers and brand owners, who make the key decisions about the design and characteristics of the packaging used for their products.

The Covenant began with an expected duration of five years, with signatories that included 8 Commonwealth, State and Territory Ministers, 2 local governments, 9 industry associations and 13 industry organisations/companies. By the time it was reviewed in 2005, it had grown to 645 signatories, and was extended for a second term of five years. On July 1st 2010, an open-ended, re-named Australian Packaging Covenant commenced. The Australian Packaging Covenant continues to take a multi-stakeholder approach to reducing the environmental impacts of packaging. As such, it supports recycling infrastructure and education efforts, including Planet Ark's National Recycling Week.

But as paper and packaging recycling rates reach record levels in Australia, our consumption patterns continue to shift. Advances in technology and product design and our thirst for new products and fashions are creating new and rapidly growing waste streams. High tech trash is now the new frontier for waste and recycling development in Australia and overseas.

## On Board The Ark

In 1993, Planet Ark established 'Cards 4 Planet Ark'; a retail-based recycling program for the collection of unwanted greeting cards. While a seemingly light-hearted initiative, the program had another purpose. 'Cards 4 Planet Ark' taught **retail take-back recycling** behaviour to the public. Having established this behaviour, it has since been successfully applied to collecting printer cartridges, mobile phones, domestic batteries, and to a lesser degree, plastic bags.

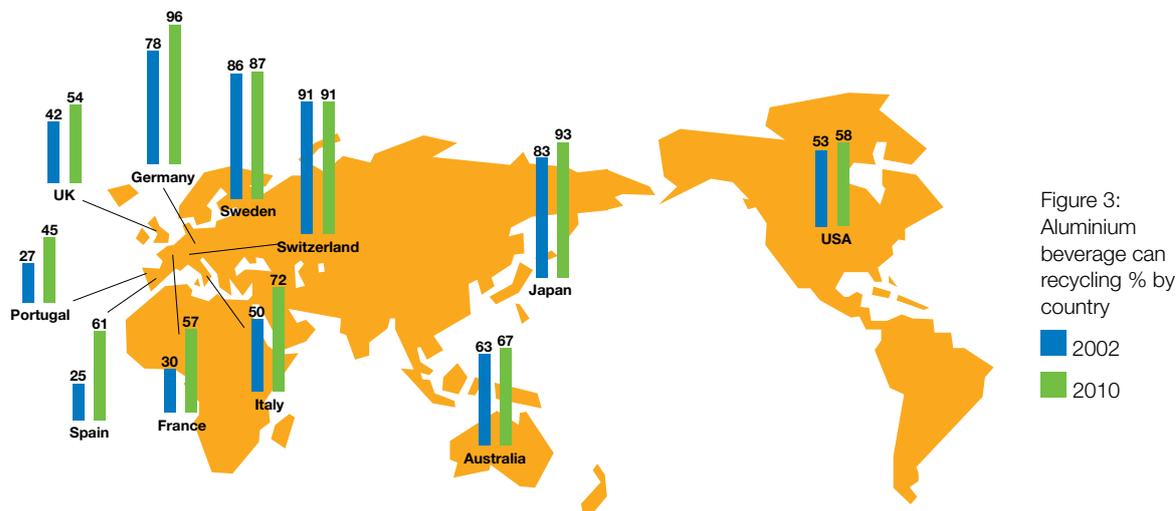


Figure 3: Aluminium beverage can recycling % by country  
 2002  
 2010

## Yes We Can! Drink Can Recycling Around The World

Aluminium is one of the world's most commonly recycled materials. Aluminium beverage can recycling programs are now well established in many countries. Several years ago, Planet Ark's snapshot of recycling efforts around the world<sup>4</sup> showed Australia's recycling rates were solid, established and reasonably high, but not world leading, reflecting the challenges of providing services to a vast country.

Despite Europe's green reputation, Australia's drink can recycling rates were well ahead of the United Kingdom, France and Spain in 2002.

The 2010 aluminium can recycling rates shows drink can recycling rates are continuing to climb around the world. The laggards have caught up and some of the leaders have surged ahead. Spain has gone from 25% to 61% and Germany has improved from its already great recycling rate of 78% up to 96%. Recycling cans is second nature in Germany.<sup>5,6</sup>

## Changing Drivers

The history of Australian recycling shows there have been many and varied drivers behind the development of recycling programs. The provision of **a safe, healthy living environment**, particularly for people living in cities, was a strong driver for waste management in the colonial era.

**Energy prices**, affected by international oil prices, influenced the development of the 'Cash for Cans' initiative of the 1970s, This is not surprising given that making new beverage cans from recycled aluminium requires 95% less energy than using virgin aluminium produced from bauxite. And, as previously discussed, **demand** for raw materials, **community concern** over landfill and incineration and a desire to prevent **litter** were all drivers of recycling programs in the 20<sup>th</sup> century.

1998 was one of the hottest years on record. Since then, Australia has experienced the hottest

decade, more extreme weather events, a prolonged and devastating drought, and a La Niña event that flooded much of the east coast. The world is beginning to experience the consequences of climate change and many people are making an effort to reduce their carbon emissions and adapt.

According to the Australian Bureau of Statistics, net emissions from Australian landfills fell from 14.2 million tonnes CO<sub>2e</sub> in 1990 to 11.1 million tonnes CO<sub>2e</sub> in 2008, largely due to efforts to capture landfill gas for use as an energy source<sup>7</sup>. This landfill gas is produced by rotting, biodegradable 'organic' waste (mainly food and garden clippings). Waste authorities are now turning their attention to keeping this waste out of landfill in the first instance. Therefore, **mitigating climate change** and reducing the impact of the carbon price are important drivers for waste and recycling programs.



# Recycling Today

So far, our discussion of waste and recycling has focused on programs householders contribute to. However that is not the complete picture of waste and recycling in Australia.

In the financial year 2006-07, **43,777,000 tonnes of waste** was generated in Australia. Of that, 52% recycled and 48%—21,069,000 tonnes—was sent to landfill, representing a significant lost opportunity to the materials economy<sup>9</sup>.

Waste authorities classify waste in terms of the three broad sectors that contribute to it:

**Municipal solid waste (MSW)** is the waste stream collected by local councils and is largely generated by households (but also includes public buildings, parks and public places). Municipal waste represents 29% of Australia's waste generation.

**Commercial and Industrial (C&I)** waste is generated by commercial office buildings, factories and other organisations in the business and industry sectors. The C&I sector represents 33% of waste generated.

**Construction and Demolition (C&D)** waste is that produced during the building, renovation and

demolition of buildings, houses, roads and other elements of the built environment. The C&D sector represents 38% of the waste generated.

Figure 4 shows the proportions of waste produced, recycled and landfilled by sector.

When people think of recycling, most associate it with household recycling and the many activities and initiatives that target the municipal sector. Given how much is happening in this sector, it's surprisingly the sector with the lowest proportion recycled. This is partly because the municipal waste stream is more complex—think of the wide range of products and materials used in the average home. In addition, households are a very diffuse source of waste. There are over 8 million households in Australia, which is a lot of houses to collect from. In comparison, the C&I and C&D waste streams tend to be simpler and more concentrated. Businesses pay contractors for waste and recycling services, and many of the big companies are managing their waste very well, to reduce the significant costs of waste disposal.

In the C&D and C&I sectors, it is the smaller players that are hardest to engage. Individually, they may not

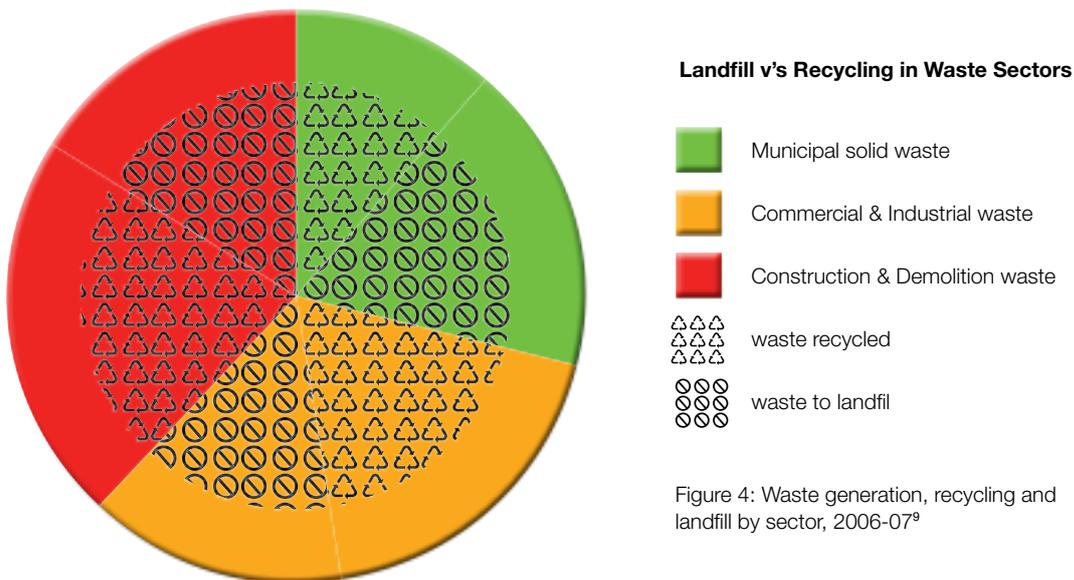


Figure 4: Waste generation, recycling and landfill by sector, 2006-07<sup>9</sup>

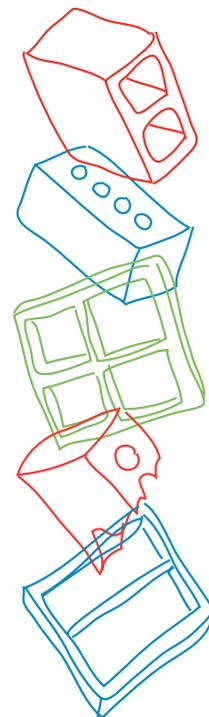


## Heavy lifting

At 38% of total waste generation, material from the construction and demolition (C&D) sector makes up the single biggest waste stream. This material includes excavated soil, bricks, wooden framing, concrete, glass, tiles and the full range of other products used to construct the built environment. Even though it is the largest waste stream, the C&D sector has the highest recycling rate currently at 58%.

Sydney-based C&D recycler Bingo Group has recycled in excess of a million tonnes of material since 2007 to achieve an industry leading 80% recycling rate. Developing markets for recycled material is part of the challenge for all recyclers. Working with developers, councils and governments is crucial for finding and developing these markets including changing building specifications. Bingo is currently undertaking a project to find ways to remove contaminants like nails, paper, rubber and plastics from used wood products to produce a higher grade output and reduce the residual waste being sent to landfill.

To further increase the recovery rate for material in the C&D field, recyclers need to invest in new processes and machinery that can more effectively separate out the complex mix of materials coming out of building or demolition sites. To further lift their recycling rate to the targeted 90% Bingo has looked to state of the art equipment from Europe.



produce large quantities of waste, but collectively they are significant. With C&I waste, it is the small to medium businesses and with C&D waste, it is home renovators or owner/builders that are difficult to reach with waste and recycling education. Keep Australia Beautiful has 'Clean Site' fact sheets that aim to help home builders and renovators reduce their environmental impacts. Planet Ark's [BusinessRecycling.com.au](http://BusinessRecycling.com.au) site has resources and information along with a comprehensive list of recyclers to make recycling at work easier.

Despite the challenges of improving household recycling, it is not a sector we can overlook in terms of education or materials recovery. Decision makers in businesses and workplaces go home at the end of each day. The attitudes shaped at home can influence behaviour and choices made at work. It's important that people don't leave their good recycling habits at home when they leave for work in the morning!

## Why Not Landfill?

The trouble with landfills is that they come with both environmental and financial costs. They cost a lot to build, run and (once closed) rehabilitate. These costs are paid for by businesses and industries that send their waste there, and by householders who pay rates to the local councils that provide garbage collection services.

Landfills can also pollute the local environment. As materials break down and the landfill site is exposed to weather, landfills produce the by-products of landfill gas and leachate—the toxic liquid produced as rainwater seeps through the rubbish. Landfill gas is approximately 40% carbon dioxide, 55% methane, 5% nitrogen (and other gases), and trace amounts of other organic compounds. **Methane** is a greenhouse gas that's 21 times more warming than the equivalent amount of carbon dioxide, and is an explosion risk and an awful smell for anyone living nearby.

Finally, landfill represents a lost opportunity. When materials are buried in landfill they are out of circulation and can't be easily reused or recycled by the people and industries that might otherwise welcome them.

## Packaging and Kerbside Collections

In Australia, local councils run household recycling collection services. Together with their waste contractors, councils decide the range of materials that are collected, the recycling bins used, and the frequency of collections. This means that recycling services can vary from one neighbourhood to another. The differing services provided by councils can lead to confusion over what can and can't be recycled in different places, particularly in regional areas (outside major cities) where the range of materials recycled is often reduced. An easy way people can make sure that they're recycling all they can is to search online at Planet Ark's [RecyclingNearYou.com.au](http://RecyclingNearYou.com.au) website.

The 2011 Australian Packaging Covenant performance data indicates Australia has dramatically reduced the amount of packaging sent to landfill, and has substantially increased the recycling of packaging between 2003 and 2011.

Australians recycled 2,759,595 tonnes of packaging in 2011, a huge 68.7% increase on 2003 recycling tonnages.

Australia's overall recycling rate for packaging has climbed from 39.2% in 2003 to 63.1% in 2011.

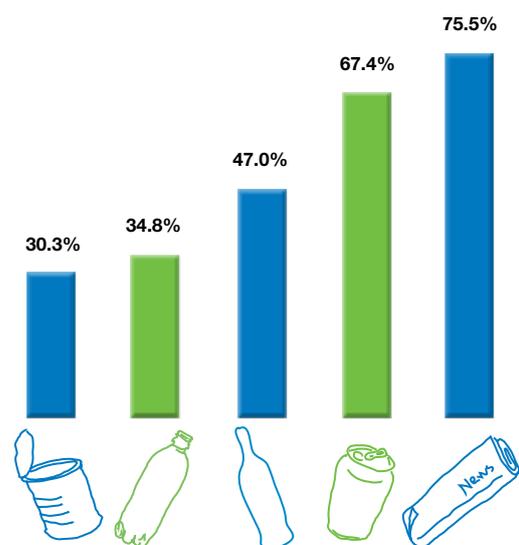


Figure 5: 2011 Australian recycling rates<sup>10</sup>

## Getting It Sorted

Recycling trucks take collected paper, bottles, boxes and cans to a Materials Recovery Facility (MRF) where they are sorted into their different material types. Sorting is either done by hand by recycling workers, by automated processes in specially designed machines, or using a combination of the two. It is increasingly done by machine in Australia's large cities where MRFs handle large volumes of recyclable materials.

Automated sorting uses the physical properties of different materials to separate them from each other. In particular, these technologies have been employed in Visy Recycling's Smithfield 'SuperMRF' facility servicing Sydney or the SKM Recycling Coolaroo MRF in northern Melbourne. For example, light weight paper can be blown off the sorting line by huge fans, steel cans are collected with industrial-sized magnets, aluminium cans and foil are collected using an eddy current separator (which induces magnetism into aluminium, repelling it into a collector), and glass and transparent plastics are separated by shining special lights on them and using their optic properties to identify and separate them. This sorting is enabled by the fact that each item, be it a metal can or a plastic bottle, is made of a single type of material.

## Beyond Paper and Package: When Recycling Gets Complicated

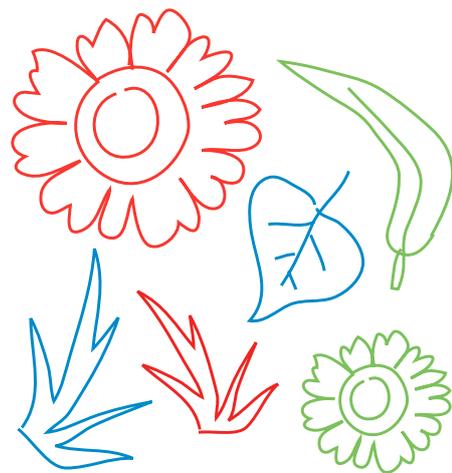
As previously discussed, council kerbside recycling collections are designed to take paper and packaging items that consist mostly of single materials. But many new products are complex, and contain many different materials. These materials are resources that theoretically could be recycled. However, when they are meshed together in complex structures, they become difficult to separate and sort.

Some of these waste products—like printer cartridges, cathode ray tube TV sets, computer equipment and lead acid batteries—contain potentially hazardous materials. In some cases they are sent to developing countries where they are pulled apart for recycling in conditions that offer little or no occupational health and safety measures to protect the workers. Recycling electronic or e-waste requires systems that can protect worker health and recover component materials, which can include plastics, glass, ferrous metals, gold, copper, toner powder, carbon black, lead, zinc, tantalum, nickel, ceramics and silver.

Early developments in the recycling of e-waste started small, literally! Small items, such as printer

## The Feast And Famine Of Garden Clippings

Increasingly, councils are collecting garden clippings from households. The materials collected are recycled into compost and mulch products or used to make plant-derived fuels. It can be challenging for councils and waste contractors to provide these services as the volume of garden cuttings produced varies with seasons and weather. The drought in southern Australia saw a change in gardening styles and reduced volumes of garden cuttings for processing. However wet weather associated with La Niña has seen lush gardens and a dramatic increase in garden cuttings.



cartridges and mobile phones are easier to collect and have served as an important learning experience for electronics resource recovery.

Steve Morris was once a **printer cartridge** remanufacturer who went on to become an e-waste recycling pioneer. Steve is the founder of Close the Loop Limited, the 'Cartridges 4 Planet Ark' resource recovery partner. Steve had a growing stockpile of printer consumables not suited to remanufacturing and he had promised his customers that they wouldn't go to landfill. He needed to find machinery not yet in existence to process this complex waste stream. He worked with recycling specialists and engineers to adapt existing technologies that separate materials, mainly from the mining industry, and eventually built the 'Green Machine'. Close the Loop partnered with Planet Ark, major printer cartridge manufacturers and retailers to develop a pioneering e-waste recycling program in Australia.

The 'Cartridges 4 Planet Ark' program has now recycled over 19 million printer cartridges - enough to fill more than 36 Olympic size swimming pools - in the decade since it began. Figure 6 shows the relatively steady growth of cartridge recycling, with

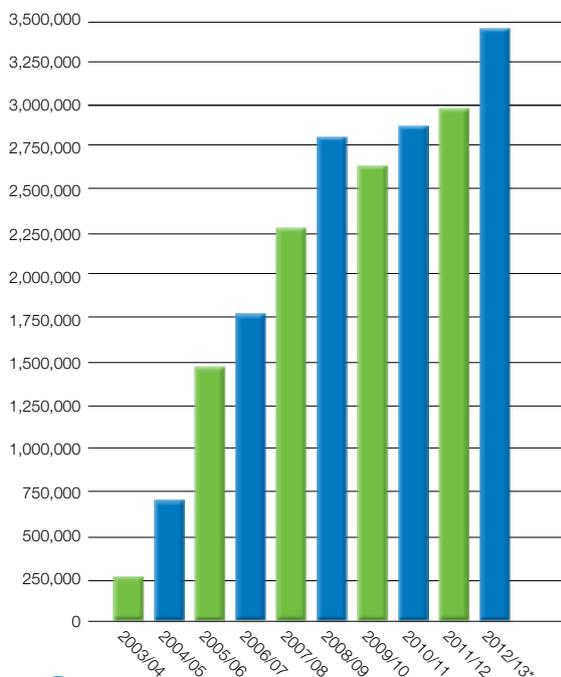


Figure 6: Cartridges recycled through 'Cartridges 4 Planet Ark' by year

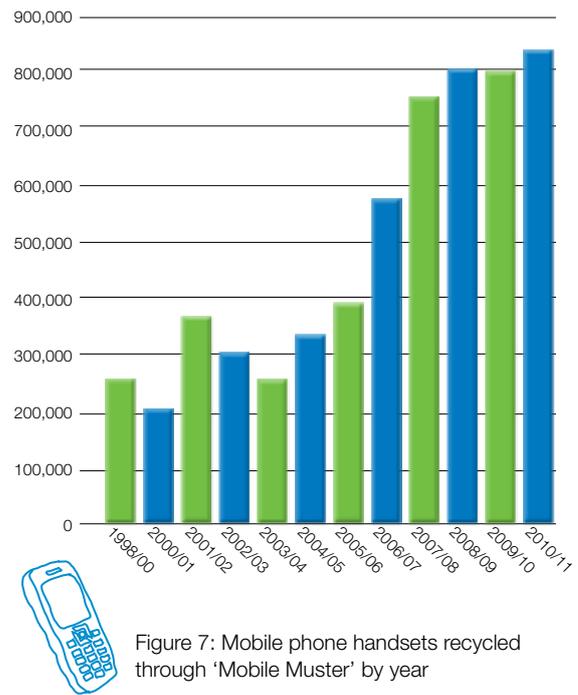


Figure 7: Mobile phone handsets recycled through 'Mobile Muster' by year

a notable small drop in recycling rates (reflecting a drop in consumption) following the Global Financial Crisis.

Another early e-waste recycling initiative is the MobileMuster program, the Australian Mobile Telecommunications Association's extended producer responsibility initiative. As at June 30, 2012, the MobileMuster program has collected 947 tonnes of **mobile phones** and components including 6.75 million handsets and batteries. Like 'Cartridges 4 Planet Ark' it has seen a steady increase in the number of items returned per year since the program began. In the case of mobile phone recycling, this reflects both the increasing public awareness that mobile phones can be recycled and the increasing ownership of new mobile phones.

**Batteries** are another example of complex recycling. According to industry estimates, nine out of ten car batteries (automotive lead acid batteries) are now recycled<sup>11</sup>. However, consumer batteries are not commonly recycled, as battery collection programs are a recent development. A little over 6% of handheld batteries are currently recycled in Australia. The public has consistently demonstrated an interest in recycling batteries as shown by the fact they are one of the top searches on RecyclingNearYou. In September 2012 Aldi

launched their ActivEnergy Battery Recycling Program, with support from Planet Ark, in all their stores. This is expected to have a positive impact on the recycling rate for the AA, AAA, C, D and 9V batteries they collect.

**Televisions and computers** are another rapidly growing source of e-waste. Computer technology quickly becomes out of date and televisions are being left on nature strips around the country as large, flat-screen TVs become cheaper and the analogue TV signal is phasing out. Recycling of these items is made less easy by their weight and bulk. This is of particular concern for charities, that often find unwanted e-waste dumped on their doorsteps. A recent survey showed that 95% of charities typically have an oversupply of e-waste. Many are losing money by having to find safe disposal options for e-waste, diverting funds from their important work<sup>12</sup>.

Fortunately, the National Television and Computer Recycling Scheme has begun work implementing a combination of government regulation and industry action to collect and recycle used televisions, computers, and computer accessories. A network of drop-off sites and collection events is being rolled out across the country. In the meantime, many services are listed at [RecyclingNearYou.com.au](http://RecyclingNearYou.com.au).



## Connected Homes

The rise in e-waste is driven by our love of technology and gadgets. ABS data on our computer-savvy, connected homes shows this is increasing:

- In 2010-11, 83% of Australian households had access to a computer at home. This is an increase of 10 percentage points since 2006-07.
- The percentage of Australian homes with access to the internet at home has also continued to increase, from 64% in 2006-07 to 79% in 2010-11.<sup>13</sup>

## Where, When, What and Why Do We Recycle?

Why are there recovery and recycling programs for plastic bags, but not nappies? Or VHS tapes? Or other products?

Every intervention has environmental and economic costs. Recycling machinery needs to be bought or designed and it can cost millions of dollars. While this machinery is used to recover material resources, it is also made from large quantities of them. Investors, including government agencies that provide grants, need to be confident that recycling infrastructure will deliver enough of an environmental, social and financial return on investment.

The key reasons why governments, industries, businesses and community organisations invest time, effort and money into developing recycling programs are as follows.

### To Recover A Resource And Make Money...

Some of the earliest materials recycled were metals, which are relatively easy to recycle and have a high commodity value. These programs are typically industry-driven by businesses that can see the economic benefits to recovering scrap when it is cheaper than raw material. Landfill charges also play a role, as they are typically higher for hazardous or valuable wastes. Companies will choose to recycle these materials to avoid paying increased disposal costs.



### To Prevent Pollution...

Some products and materials are useful resources when recycled, but potentially harmful pollutants if littered or disposed of incorrectly. Many collection programs have been designed to reduce litter or to keep contaminants out of the environment. As previously discussed, South Australia's container deposit program was designed to prevent drink containers from becoming litter, as has the National Bin Network. Similarly, the FluoroCycle program, a joint initiative between governments and industry to recycle used fluorescent lamps, is being rolled out to recover the mercury contained in fluorescent lamps, and keep this toxic heavy metal out of the environment.

### To Take Back Producer Responsibility...

Some businesses and industries proactively establish take-back programs for their products

as part of their Corporate Social Responsibility and Extended Producer Responsibility goals. 'Cartridges 4 Planet Ark' and MobileMuster are examples of Extended Producer Responsibility initiatives shared by multiple players (often competitors) in the same industry. Such programs work particularly well when the products have been designed to enable future recycling.

### To Keep People Happy

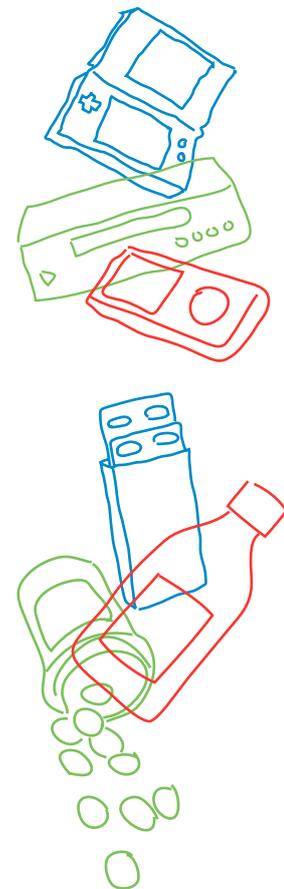
The final reason is public opinion. Politicians care enormously about what people's interests are, which is why issues that have high public support, like plastic bags and deposits on beverage containers, regularly appear on the agenda when state and federal environment ministers get together. Public pressure can lead to the establishment of recycling programs.

## Household Habits with Techno-Trash and Medications

Research hot off the press from the Australian Bureau of Statistics shows that e-waste recycling is starting to catch on. A survey showed that nearly a quarter of Australian households recycled or reused electronic equipment during the 12 months to March 2012. Of those, 48% took their electronic equipment to a drop-off point at a tip or waste transfer station, or other point.

However, there are other potentially hazardous items that we could be recycling but are not. In the 12 months to March 2012, 75% of Australian households disposed of at least one potentially hazardous item. 54% of households disposed of batteries and eight out of ten of these were disposed of via (non-recycled) garbage collections. A quarter of households disposed of medicines, drugs or ointments. Despite the best efforts of the 'Return Unwanted Medicines' program ([ReturnMed.com.au](http://ReturnMed.com.au)), only 34% of these households took unwanted medications back to business or retail collection points, while over half put medicines in with general garbage and 14% poured them down the drain. That's not a good way to promote healthy waterways! [RecyclingNearYou.com.au](http://RecyclingNearYou.com.au) has listings for electronic waste, batteries and medicines collections.

Ref: Australian Bureau of Statistics. (2012). *Environmental Issues: Waste Management, Transport and Motor Vehicle Usage, Mar 2012*, Cat. 4602.0.55.002



## Why NOT?

Calls to Planet Ark's recycling hotline have shown Australians want to recycle a wider range of materials. We've been asked about everything from old CDs to mattresses to VHS tapes and more. While there are the odd recyclers for niche materials, it is unlikely that national and widely available collection programs will be developed for products like VHS tapes and computer discs that have become obsolete (or that are heading in that direction). Establishing recycling for such items would deliver a limited return on environmental and financial investment.

## Back To Bed: Recycling Mattresses

One interesting item of waste is mattresses. They are often a headache for local councils and charities alike.

The average mattress weighs 35 kilograms and takes up 0.7 cubic metres of landfill space. Landfill operators aim to compact waste to about 1 tonne (or 1000kg) per cubic metre, so mattresses are an inefficient use of landfill. Many well-meaning people leave their old mattresses with charities. However, charities have little use for most unwanted mattresses, which generally come packed with dust particles, dead skins cells, dust mites, bacteria and mould spores.

There are a small number of mattress recycling services available in Australia that can sanitise those mattresses that are in good enough condition for reuse, and recover wood, foam, wadding, springs and some fabrics from the remainder. People that have a mattress to dispose of should contact their local council or state government waste authority for advice, or search the Furniture category at [BusinessRecycling.com.au](http://BusinessRecycling.com.au). If buying a new mattress, ask the retailer if they will take back your old one and recycle it.

## Closing the Loop

Recycling, like other business activities, is subject to the laws of supply and demand. Just as it's important for people and organisations to make sure they're recycling all they can, it's also important to buy back the products of recycling.



Figure 8: Raised garden bed made from recycled cartridge plastic and filled with compost (recycled food and garden waste)

Product packaging can include recycled content. Sometimes the product itself is made from recycled content, such as SAFE toilet tissue and paper towel, which is primarily made from used office paper. Other products made from recycled materials include stationery, mulch, insulation and landscaping materials. The plastic from 'Cartridges 4 Planet Ark' has been made into everything from pens to raised garden beds.

Another product that can be made with recycled content is carpet underlay. Together flooring and blind retailer Flooring Xtra and manufacturer Dunlop Flooring have developed EnviroTred, a carpet underlay that is made with recycled content and is 100% recyclable at the end of its useful life. Flooring Xtra stores actively support the "Recycle by Dunlop" program, whereby discarded and used foam underlay is collected and re-processed into a new reusable product.

In addition, Flooring Xtra and Dunlop Flooring will also contribute \$1 from every roll of EnviroTred sold to Planet Ark's National Recycling Week. For more information, visit: [recyclingweek.planetark.org/about/flooring-xtra.cfm](http://recyclingweek.planetark.org/about/flooring-xtra.cfm)



Figure 9: Collected foam ready for recycling into EnviroTred



# The Future of Recycling

## Immediate Priorities

Many environmentalists and scientists believe we're now in the Transition Decade, in which our society will have to dramatically transform to cope with climate change and increasing resource scarcity. This will up the ante for efficient waste management. We need to make considered decisions about how we can best use our material resources. For example, batteries are incredibly useful but made from many materials that are non-renewable. The remarkable CSIRO-invented UltraBattery is a hybrid energy storage device that integrates a supercapacitor with a lead acid battery. Its potential applications include car batteries for lower emissions transport and **renewable energy** storage. What will our priorities be in the future? Private vehicle transport or storing wind-generated electricity? With such potential being developed, the success of current car battery recycling programs is reassuring.

Another clean energy example is the research conducted at Swinburne University of Technology centre for Micro-Photonics, developing thin film solar cells that use small particles of silver and gold to spread sunlight within the cells, enabling them to trap more of the sun's strong UV light and convert it into electricity.

These two examples help us to recognise that the bridge to renewable power and a sustainable economy will include some non-renewable elements, such as the non-renewable materials used to make solar panels and batteries. Recycling non-renewable materials will become increasingly important for keeping them in circulation.

In an effort to fight climate change, recycling will also have an immediate focus on **biodegradable materials**. Household waste has been discussed earlier, but the C&I sector also sends large amounts—about 4 million tonnes per annum—to landfill. Figure 10 shows a breakdown of the C&I waste to landfill stream of which 62.5% is organic waste and 37.5% is inert waste (including metals, glass and plastics). While the idea of reducing food waste at work might be unfamiliar, the concept of a paperless office is not new, and

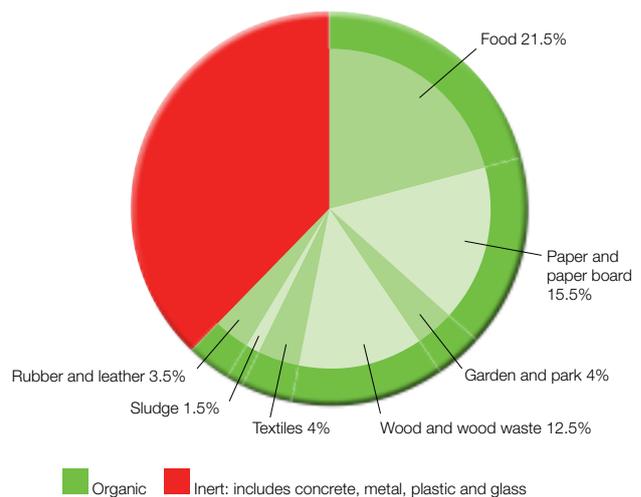


Figure 10: Commercial and Industrial waste types sent to landfill

## Recycling Solar

Ever wondered what the average solar photovoltaic panel is made of? A typical silicon-based solar panel has thin layers of semiconductor materials packaged in glass for protection.

Panels have a very long lifespan of well over 20 years. While they are increasingly popular in Australia, very few have reached the end of their product life to date. When they do, there will be glass, plastics, metals (such as aluminium and

copper) and semiconductor materials that can potentially be recovered.

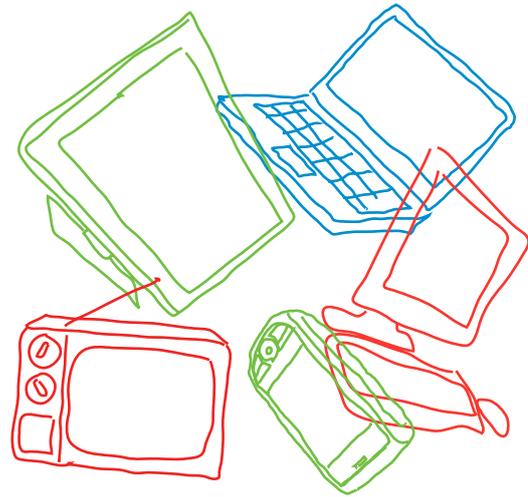
Europeans adopted solar panels much earlier, so it makes sense that Europeans are pioneering the recycling of end-of-life photovoltaic panels. PV Cycle ([www.pvcycle.org](http://www.pvcycle.org)), a voluntary take-back and recycling program funded by panel producers, is well underway. Tradable commodities, such as glass, silicon and aluminium, are recovered for recycling, with little material going to landfill.

**paper recycling** services are widely available, well-established, and included in the listings at Planet Ark's [BusinessRecycling.com.au](http://BusinessRecycling.com.au). Nearly a million tonnes of paper and paperboard is sent to landfill from the C&I sector every year in Australia.

E-waste is another top priority. About 16.8 million **TVs, computers and computer products** are disposed of each year in Australia—that's 106,000 tonnes of e-waste. Only about 10% of this is currently recycled and the problem is growing. The quantity of televisions and computers reaching the end of their useful life is expected to reach 181,000 tonnes or 44 million units by 2027-28.

**Legislation** has a role to play in providing conditions that encourage households and businesses to recycle more and to produce less waste.

- **Landfill pricing** can make it more expensive to send waste to landfill, providing an economic driver for resource efficiency. Recent years have seen an increase in landfill levies charged in NSW, WA and Vic.



- South Australia is taking the lead in improving waste management and recycling by legislating **landfill bans** for specific, priority materials. For example, in September 2012 fluorescent lighting, computer monitors and televisions were banned from Adelaide metropolitan landfills, with the ban on these and other electrical or electronic equipment becoming state-wide in September 2013<sup>14</sup>.

## Biodegradability

Biodegradation is nature's recycling system. It's the decomposition of organic materials or the products made from them. Substances are said to be biodegradable if they decompose naturally - through the action of micro-organisms - into the raw materials of nature. Materials made from plants or animal ingredients, such as paper, food scraps, and cotton sheets, are biodegradable over various lengths of time.

Humans rely heavily on biodegradability for the breakdown of unwanted solid materials. Up to 72% of the municipal solid waste (largely from households) sent to landfill is organic waste. Many recycling education initiatives have encouraged people to recycle items like plastic bottles by highlighting their lack of biodegradability, with messages like "plastic sits in landfill for centuries". Unfortunately, many

people have taken this to mean that it's okay to send biodegradable materials to landfill.

The level of heat, light, water and oxygen and other environmental conditions can speed up or slow down biodegradation and change the way chemical processes occur. In landfills, oxygen and sunlight are blocked out as materials are progressively covered with new layers of waste. In this, anaerobic condition, methane gas is produced as materials degrade, which contributes to global warming. Better ways to deal with biodegradable waste are by:

- Avoiding its production in the first place,
- Processing it on-site / at home with compost bins, Bokashi bins and worm farms, and
- Recycling paper and food and garden scraps through kerbside collections. Households and workplaces can find out more via: [RecyclingNearYou.com.au](http://RecyclingNearYou.com.au) and [BusinessRecycling.com.au](http://BusinessRecycling.com.au).



## Future Directions

We are now at a time in human history when the mineral resources that were concentrated in the earth's crust and that could be cheaply extracted have now been mined. Mining sector data reports declining ore grades for major mineral commodities produced by Australia. Concurrently, the recycling of complex wastes is rising. The CSIRO report *Our Future World* sees potential for the practice of what many call 'Above ground mining':

*"As a consequence waste is increasingly being viewed as resource-rich 'nonwaste' from which commodities can be 'mined'... Swedish mining company Boliden (2012) has identified that a growing share of the metal production will originate from recycling in the future. Mining in the future may happen above the ground (i.e. recycling) more than below the ground."*<sup>15</sup>

Industrial designers and architects have an important and inspiring role to play in helping us make better use of our resources into the future. They help society to do more with less by designing products and buildings that require less material, yet are still fit for purpose—a process called

'dematerialisation'. The aluminium beverage can is a little known example of dematerialisation, with the humble drink can moving from 16.1 grams in 1994 to 14.7 grams in 2005 through better design.

Designers can also design products so that they can easily be reused or recycled at the end of their product life. This is called 'design for disassembly'. The following case study is an example of both dematerialisation and design for disassembly.

Dematerialisation applied to buildings can save huge quantities of material, particularly greenhouse-intensive concrete. One example is the lightweight steel and plastic bubble structure of the 'Water Cube' (the Beijing National Aquatics Centre), which allows light penetration and requires a fraction of the material inputs of a traditional building.

Designers can also design products so that they can easily be reused or recycled at the end of their product life. This is called 'design for disassembly' or 'design for recycling'. Car manufacturer (and National Tree Day sponsor) Toyota was the first in the automotive industry to introduce the environmental assurance standard ISO14001 in its design and development division. Recyclability is assessed in advance at the vehicle development stage.<sup>17</sup>

## Recycling For Better Bling

Gold! It's been prized through human history, shaped the growth of Victoria, made Midas' life difficult, had practical uses, and been a form of currency. While it captures our imagination, few people think about where it comes from.

The gold rush days with large nuggets and little impurity are well behind us. Smaller amounts of gold are now extracted from literally tonnes of ore through mining operations. The ugly truth of beautiful gold is that its extraction from raw materials can be highly polluting. Gold dissolves in cyanide solutions and mercury, both of which are highly toxic. In the past, before the hazards of mercury were well understood, mercury was commonly used to extract gold. Cyanide extraction is now the industry standard, considered an

improvement on mercury, but still leaving behind cyanide-tainted mining tailings. One of Europe's worst environmental disasters was the 2000 Baia Mare cyanide spill from a gold mining operation into the Some River in Romania, killing large numbers of fish as the polluted waters moved downstream through river systems in Hungary and Yugoslavia<sup>16</sup>.

According to the Geological Society of Australia, modern mining and metallurgical techniques have allowed ores with as little as 2 grams per tonne of gold to be mined profitably. It's estimated that 1 metric tonne of obsolete mobile phones (not including their batteries) can yield 300 grams of gold, along with about 140 kg copper, 3.14 kg silver, and small amounts of palladium and platinum. Mining, particularly for materials like gold, has a significant and lasting effect on the landscape. Recycling e-waste keeps these precious materials in the loop.

# Conclusion

Australian recycling has come a long way. We have met the challenges of providing services to a relatively small population spread over a vast continent and our paper and packaging recycling rates are a testament to the enthusiasm Australians have for recycling and protecting the environment.

Yet we can't afford to rest on our laurels. Increasing affluence and consumption of material goods, a growing global population, and an increasingly complex waste stream means the goal posts are shifting. Australia needs to keep developing recycling programs and making use of those that are available to ensure our material resource security into the future. Households and businesses can start by ensuring they're using the

full suite of recycling services available to them by checking online at [RecyclingNearYou.com.au](http://RecyclingNearYou.com.au) and [BusinessRecycling.com.au](http://BusinessRecycling.com.au). We can also purchase recycled products and help our kids learn to be wiser with waste by getting them involved in events like National Recycling Week. Tips, information and activities are available online at [RecyclingWeek.PlanetArk.org](http://RecyclingWeek.PlanetArk.org).

Household paper and packaging recycling is arguably second nature for Australians. The next step is to bring our good habits to the workplace, extend our good habits to a broader range of products and materials, and review our attitudes about waste and consumption so that we can live in better balance with the natural environment. Naturally, Planet Ark will be there every step of the way.

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