Australian Government

Department of the Environment and Heritage

Department of the Environment and Heritage Submission to the Productivity Commission Inquiry into Waste Generation and Resource Efficiency

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Executive summary

The Department of the Environment and Heritage (DEH) welcomes the opportunity to present a submission to the Productivity Commission's Inquiry into Waste Generation and Resource Efficiency.

Waste generation and disposal can have significant environmental impacts. These include emissions to air, land and water (including greenhouse gas emissions) at various stages in the product life cycle from extraction of raw materials to processing, marketing, transport and consumption, as well as the direct impacts associated with disposal.

Due to a range of market failures (including externalities and information failures) and institutional and regulatory barriers, the environmental costs of production and consumption are often not reflected in market prices. Collective action by governments, industry and the community to correct these failures can, if well designed, lead to improved social, environmental and economic outcomes.

Although regulation has in recent decades addressed many of the negative externalities directly associated with disposal of waste to landfill, managing the impacts of waste disposal remains an important environmental issue for Australia. The changing nature of the waste stream, the need to embrace emerging disposal and treatment technologies, and evolving community expectations present significant challenges for future policy on waste management.

The traditional focus of waste policy on preventing or mitigating the adverse health and environmental impacts of waste disposal while still important has expanded to take into account broader resources policy considerations. Waste policy can significantly affect (and be affected by) the efficiency of resource use. It therefore forms an integral part of broader resources policy. This is important because there can be significant environmental and (as evidence presented in the body of this submission suggests) economic benefits from improving resource efficiency and resource recovery.

Waste generation and disposal need to be considered within a product life cycle framework. A comprehensive, holistic analysis of the environmental, health and social impacts throughout a product's life cycle can reveal upstream market failures that lead to inefficient waste outcomes. It can also help identify circumstances where adverse impacts associated with disposal can be avoided through action at the extraction, design, manufacturing or consumption phases of the product life cycle.

Effective development of national waste and resource efficiency policy depends on access to accurate national data on the flow of materials and products in Australia. Such information also assists governments and industry to determine priorities, monitor existing schemes, and respond to international developments. The collection of data to underpin national action requires engagement of Australian Government agencies, including the Australian Customs Service and the Australian Bureau of Statistics. Enhanced information about material and product flows could also help local government councils select cost-effective waste and recycling collection systems

and help industry develop more efficient production processes and recyclable products.

Taking a life cycle approach, modern waste policy seeks to reduce adverse impacts and internalise unavoidable costs within the product price, through action at the point in the product life cycle or value chain where this can be most effectively and efficiently achieved.

In Australia, product stewardship schemes are being used by industry and governments to bring the key players together to understand and correct market failures in the life cycle of products and materials, such as packaging, newsprint, plastic bags, refrigerants, farm chemicals, motor oil and polyvinyl chloride (PVC). Schemes are also being developed for tyres, televisions and computers. The findings of this inquiry could usefully inform the design of such schemes.

The move to product stewardship schemes reflects a shift by governments, industry and communities from viewing waste disposal as an inevitable side-effect of modern living. Waste is increasingly viewed as something which contains value but, where the recovery of valuable elements is not cost effective, as something which should be avoided.

The Australian Government has limited constitutional powers to engage directly in waste management issues; responsibility rests largely with state, territory and local governments. The role of the Australian Government in waste management has evolved in recent years, however, and DEH now has an increasing level of involvement in waste policy development, with a particular focus on developing unified national approaches for key products and ensuring that inconsistent state-based policies and actions do not adversely affect national markets for either products or recovered resources. DEH is also involved in waste policy where it relates to Australia's international commitments.

Product stewardship schemes have been implemented largely through voluntary and co-regulatory arrangements involving the Australian Government, state governments and industry. Harmonised action on waste issues of national significance is the responsibility of the Environment Protection and Heritage Council (EPHC) and the National Environment Protection Council. Through these bodies, the Australian Government works with state and territory jurisdictions to develop product stewardship and other schemes in circumstances where a cohesive, national policy is required. An important driver has been the need to avoid inconsistent regimes among jurisdictions which could adversely affect national markets. The *National Environment Protection Act 1994*, through which national co-regulatory product stewardship arrangements are being developed, aims to ensure that Australian people enjoy the benefit of equivalent protection from pollution, and that decisions of the business community are not distorted, and markets not fragmented, by variations between participating jurisdictions in relation to the adoption or implementation of major environment protection measures.

As discussed above, recent national approaches aim to address resource efficiency associated with particular products or industrial sectors, rather than focusing exclusively on the environmental impacts of disposal. They recognise the effect of

changing consumption patterns on waste generation, as well as the importance of addressing life cycle environmental impacts associated with production and consumption.

Governments have used a variety of approaches to promote greater materials efficiency and increased rates of recycling, for example:

- policy instruments such as the co-regulatory agreements (e.g. the National Packaging Covenant) and negotiated industry codes of practice
- market-based instruments and other forms of intervention (e.g. direct support to councils to improve recycling collection infrastructure) that act as incentives for particular activities
- information-based instruments that seek to change behaviour through the provision of better information (e.g. cleaner production demonstration programs, recycling guidelines and case studies).

Co-regulatory schemes have been favoured by key industry sectors because they address the problem of 'free riders' who may otherwise, under a purely voluntary scheme, enjoy an unfair competitive advantage. Co-regulatory schemes provide industry with flexibility to determine the most efficient and effective strategies to manage waste issues associated with their specific products and circumstances, while affording protection from competitive disadvantage from free riders.

Future waste policy will need to have regard to the changing patterns and opportunities in production, consumption and waste treatment, and to ensure that interventions are directed in a way which delivers the best prospects for enhanced economic, environmental and social outcomes for Australia.

This submission highlights the need for data to underpin the development of waste management policy. It also focuses on the value of product stewardship initiatives and concludes that as resources available to governments to deal with waste management and resource efficiency issues are limited it is vital, particularly for national-level actions, that efforts be focused on areas of genuine high priority and that interventions are strongly grounded in a thorough assessment of the problems and the costs and benefits of the options available for dealing with them.

This submission is set out as follows:

Section 1 Provides a short introduction, including the context for the inquiry and a description of DEH's role in relation to management of waste issues.

Section 2 Provides background information on waste and recycling data and trends in Australia, the relationship between waste generation and material flows and the Australian economy, factors influencing waste generation, and a historical overview of Australian waste management policy, including changing community attitudes to waste and recycling, set in the broader context of Australia's approach to sustainable development.

Section 3 Reviews the costs and benefits of waste management and resource efficiency, with a focus on the environmental and economic costs of landfill, and the benefits from reducing and recycling waste.

Section 4 Identifies the market failures associated with waste and inefficient use of resources, including institutional and regulatory barriers.

Section 5 Discusses the nature of various forms of government intervention available to address market failures. Current activities of DEH and the EPHC in pursuing better waste and resource efficiency outcomes are reviewed, including the important role of product stewardship schemes. Data needs and sources are identified.

Section 6 Presents conclusions, with suggestions on fruitful areas for action by industry and government to improve waste and resource efficiency outcomes for Australia.

Appendices A to E provide detailed information to support the submission.

1. Introduction

The Department of the Environment and Heritage (DEH) provides leadership in the protection of Australia's environment and the sustainable use of our natural resources in a broad social and economic context. In particular, DEH works with Australian business organisations and industry sectors to improve the environmental performance of industry, as well as with the states and territories through the Environment Protection and Heritage Council (EPHC) to develop and implement national policies on environment protection issues, including waste management, eco-efficiency and sustainability. DEH also engages with the international community to address environmental issues, including activities and agreements on sustainable development.

Waste generation and disposal can have significant environmental impacts. These include emissions to air, land and water at various stages in the product life cycle from extraction of raw materials to processing, marketing, transport and consumption as well as the direct impacts associated with disposal. Due to a range of market failures, and institutional and regulatory barriers, these environmental costs are often not reflected in market prices. The failure of markets to get prices right can result in inefficient use of resources, lower economic growth than would otherwise be the case, and adverse environmental and social impacts. Collective action by governments, industry and the community to correct these failures can, if well designed, lead to improved social, environmental and economic outcomes.

Effective waste management has significant environmental protection benefits for all Australians, including reducing disposal impacts (such as air and water pollution, greenhouse emissions, litter and amenity impacts), conserving resources and reducing the environmental impacts associated with extracting and processing virgin raw materials. Similarly, addressing market failures that impede resource efficiency can correct the demand for materials, energy and water, and reduce the environmental impacts that occur in the provision of these inputs.

Waste management is generally the responsibility of local, state and territory governments who manage the 'implementation end' of waste issues such as collecting and dealing with household garbage, managing landfill and overseeing the legislative framework to protect human health and the environment. However, the role of the Australian Government in waste management has grown in recent decades. Today, DEH has an active role in waste management, particularly where the Australian Government has international commitments (e.g. World Commission on Sustainable Development, the Basel Convention), or where pursuit of a cohesive, national policy is required to give clarity and certainty to the market. DEH has also taken a leadership role, through EPHC, on national product stewardship schemes including for tyres, plastic bags and packaging.

The waste policy objectives of governments have evolved over the past two decades. Originally focused almost exclusively on applying traditional command and control approaches to prevent or mitigate the adverse health and environmental impacts of waste disposal, the focus of waste policy has broadened to reflect changing societal views that 'wastes' are potentially valuable resources which should be recovered for reuse wherever practicable. There has also been an acknowledgement by governments around the world that many environmental problems are linked, directly or indirectly, to products, and that these diffuse pollution sources require more flexible policy tools than those associated with the traditional command and control approach.

Lacking the immediate imperative of manifest threats to human health and the environment, this 'second wave of waste policy' has been implemented largely through non-regulatory policy instruments, and product stewardship has been the approach of choice, particularly of EPHC. Current initiatives will soon come to maturity and further sustainability benefits will be secured by taking a broader life cycle approach that will complement product stewardship. The findings of this inquiry can usefully inform the next phase of policy development.

This submission addresses the central issues of the inquiry. Two independent reports have been commissioned to support this submission. While DEH has drawn on these reports, all the views expressed in them do not necessarily reflect DEH's views. These reports are provided as appendices.

- The first, by Hyder Consulting, provides data on waste disposal and recycling in Australia, a summary of the environmental impacts of waste disposal, and an identification and discussion of the barriers to recycling waste products (Appendix A).

- The second, by Martin Taylor, Albena Bossilkov and Rene van Berkel at the Centre of Excellence in Cleaner Production at Curtin University of Technology, provides a preliminary estimate of the economic and sustainability benefits of improved resource efficiency (using Australian case studies and international examples) and reviews barriers, motivators and policy opportunities to enhance resource efficiency in Australia (Appendix B).

Appendices C, D and E provide more detailed information:

- Appendix C: Examples of industry data collection programs

- Appendix D: Product stewardship examples

- Appendix E: EPHC waste filter criteria flowchart and National Waste Framework.

2. Context for the inquiry

2.1 Waste generation, resource efficiency and sustainable development

2.1.1 Degradation of ecosystem services

The natural environment provides people with a range of ecosystem services, such as resources, amenity and waste assimilation. Ideally, these services will be reflected in market signals and economic development will ensure that the ability of the environment to support human activity is not compromised. However, due to market failures such as externalities and information failures, research indicates that ecosystem services are being degraded at an unsustainable and inefficient rate. In addition, degradation of ecosystems could grow significantly worse in coming decades, with two drivers of ecosystem change – climate change and excessive nutrient loading – likely to become more severe. The degradation of ecosystem services is threatening the natural processes on which life and our standard of living depend (UNEP 2005b).

Globally, resource consumption and waste generation are contributing to the degradation of ecological sources (e.g. land, water, forests and fisheries) and sinks (the ability of the earth to absorb wastes). There is growing international consensus that current patterns of resource consumption are unsustainable and that, particularly in the developed world, resource productivity must improve by a factor of four, 10 or 20 to be economically and environmentally sustainable (von Weizsacker et al. 1997; Weaver et al. 2000).

2.1.2 Sustainable development

The Australian Government is committed at both an international and national level to the principles of sustainable development, to reduce the impacts of resource consumption and waste generation on ecosystems. Initially defined in 1987 by the World Commission on Environment and Development, sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainability goals were adopted by all levels of Australian government in 1992 with the National Strategy for Ecologically Sustainable Development. The strategy defined sustainability as ‘using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased’ (COAG 1992). It provided a broad national agenda for sustainable development in Australia.

The Productivity Commission noted that:

> The case for government programs or policies specifically related to Ecologically Sustainable Development rests on a number of market failures that may be associated with some sustainable development issues– such as public goods, externalities, open access to resources with undefined property rights, and high scientific uncertainty. Under these conditions, market forces are unlikely to lead to socially optimal or economically efficient outcomes (PC 1999 p xviii).

Increasingly, sustainable development has been incorporated into the policies and programs of Australian governments as a significant policy objective which prefers long-term benefits to short-term gains.

2.1.3 International context

Australian governments, industry and community groups were involved in two significant international conferences on sustainable development: the Earth Summit (Rio de Janeiro, 1992) and the World Summit on Sustainable Development (Johannesburg, 2002). The outcomes of the conferences are known respectively as Agenda 21 and the Johannesburg Plan of Implementation (JPOI), and oversight of both documents is provided by the United Nations Commission on Sustainable Development (CSD).

Australia is actively involved in meetings of the CSD, implementation of Agenda 21, and more recently, the JPOI. Important issues covered in both documents are the need to improve consumption and production patterns to make them more sustainable (UN DESA 2003, paragraph 14), and the need to prevent and minimise waste and maximise reuse, recycling and use of environmentally friendly alternative materials (UN DESA 2003, paragraph 22). The UN's Marrakech Process has been established to advance the goal of sustainable consumption and production through the development of 'a 10-year framework of programmes to support regional and national initiatives to accelerate the shift towards sustainable consumption and production' (UNEP 2005a).

The approach of the CSD to the implementation of sustainable development through initiatives to address consumption and production patterns, including waste and resource use efficiency, is consistent with global policy trends. For example, the European Commission's *Thematic strategy on the sustainable use of natural resources* (December 2005) aims to decouple resource use from economic growth by reducing the environmental impacts of resource use while improving resource productivity overall. The commission's *Thematic strategy on the prevention and recycling of waste* (December 2005) promotes more ambitious waste reduction policies and introduces life cycle thinking more formally into waste policy.

Against this background of international activity on sustainable consumption and production, the Productivity Commission's Inquiry into Waste Generation and Resource Efficiency provides an opportunity for Australia to look beyond generally recognised problems associated with specific waste streams to a whole-of-life-cycle view of resources, products and wastes. In particular, the inquiry has the potential to identify aspects of production and consumption where inefficient use of resources (including energy) at various life cycle stages leads to sub-optimal outcomes for society. In addition to irreversible damage to ecosystems, these sub-optimal outcomes can include reductions in enterprise profitability, innovation and competitiveness in national and international markets.

2.2 Australian economy and material flows

Despite our small size, Australia's open economy has achieved an annual growth rate of 4 per cent since 1990 (DFAT 2005). Australia's sustained economic growth, high labour and general productivity, and strong environmental record are continuing to contribute to the nation's prosperity (DPMC 2004).

Our traditional export strengths – agriculture, minerals and energy – continue to make a strong contribution to national wealth, and in exchange for our export production Australians have access to an increasingly wide range of imported goods and services at competitive prices. This flow of imports plays an important part in maintaining our standard of living.

Our fast growing economy and reliance on export commodity industries mean that Australia has a large and growing rate of material flows (Poldy & Foran 1999). Current best estimates put the materials use in Australia at around 175 tonnes per person per annum, compared to countries such as Germany (60), Japan (27), United States (82) and the Netherlands (32) (Newton 2001).

Total material flows comprise export and domestic components, as well as hidden and direct components. Hidden material flows components can include overburden from mining operations, wastes from mineral concentration processes, and soil loss associated with agricultural production. Although hidden flows do not provide direct value to producers, they are the result of economic activities which do benefit the producing country. However, hidden flows, which represent over 70 per cent of total material flows, typically pose costs to the producing country through environmental degradation which may not be adequately reflected by market prices.

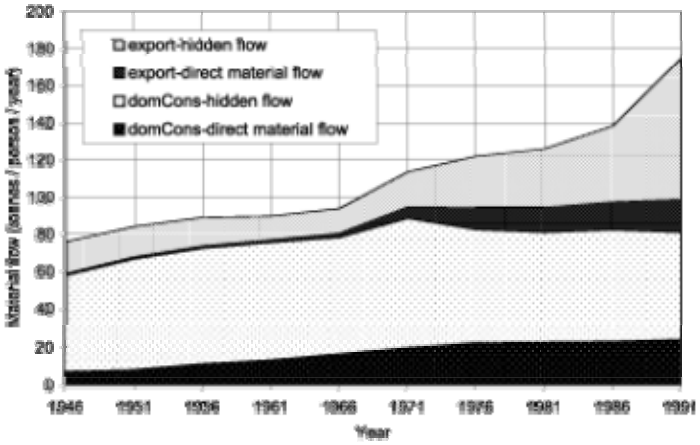

Figure 1: Components of total material flows per person in Australia, exports and domestic consumption, each disaggregated into direct material input and hidden flow
(Source: Foran & Poldy 2000, cited in Newton 2001)

Total material flows are often accepted as a proxy indicator of several environmental impacts. Where it is considered that these environmental impacts are not appropriately priced, material flows could also be used as a partial indicator of inefficient environmental outcomes. Comparing total material flows shows how global, regional and local impacts from production occur in and are attributed to exporting countries (e.g. Australia), even though the uses and demands for these materials occur in overseas markets (Newton 2001). The use of total material flows as an indicator is bound by limitations, as on the one hand the movement of materials requires energy, and causes emissions and land disturbance, while on the other total material flows does not differentiate between those materials which pose greater environmental, health and safety risks per unit of mass than other materials (e.g. pesticides versus road base materials) (Taylor et al. 2006, p. 6).

2.3 Waste generation – disposal and recycling in Australia

One consequence of Australia's fast growing, materially intensive economy is the production of large quantities of waste. Where prices throughout the product life cycle do not fully reflect the environmental costs associated with production, consumption and disposal, the quantity of waste generated in Australia is arguably too great. Understanding the extent of

the problem in Australia requires good information. However, Australia lacks comprehensive, reliable waste information.

Both government and non-government organisations frequently describe Australia as one of the highest producers of waste in the world (ABS 2005a). Municipal waste is reported as 690 kilograms per person, the third highest in the Organisation for Economic Cooperation and Development (OECD) countries (after Iceland and the United States), and higher than the OECD average of 590 kilograms. These figures are all based on information collected by the OECD, and are drawn from data estimated in the late 1990s (OECD, 2004a). More recently the 2004 Australian Bureau of Statistics (ABS) Waste Management Services survey found that approximately 18 million tonnes of waste was landfilled in 2002–03 (ABS 2004b), though information for Tasmania and the Northern Territory could not be included in this figure. While there are no national data on recycling, it is generally assumed that the majority of waste generated is disposed to landfill (ABS 2005a and PC 2005).

In an attempt to compile more up-to-date waste and recycling data for Australia, DEH commissioned Hyder Consulting to collate available data on waste and recycling in Australia. This is a significant task, and to our knowledge has not been undertaken before. Although the data are incomplete, Table 1 shows that approximately 32 million tonnes of waste were generated in Australia in 2002–03, and that about 15 million tonnes, or 46 per cent of this, were recycled.

Table 1: Waste generation and diversion rates for the main states of Australia, 2002–03
(Source: Hyder 2006 p. 5)

State/territory	Disposed	Recycled	Total generated	Diversion rate
	Tonnes			*%*
NSW	6 341 000	5 830 000	12 170 000	48
Victoria	4 180 000	4 429 000	8 609 000	51
Qld	2 722 000	1 251 000	3 973 000	31
WA	2 696 000 (1)	826 000	3 522 000	23
SA	1 277 000	2 156 000 (2)	3 433 000	63
ACT	207 000	467 000 (3)	674 000	69
Total (4)	**17 423 000**	**14 959 000**	**32 382 000**	**46**

(1) The total disposal figure for WA is for metropolitan Perth.
(2) The total recycling figure for SA includes meat waste, a prescribed industrial waste.
(3) The total recycling figure for the ACT includes cooking oil and fat, motor oil, salvage and reuse, and paint.
(4) There are currently no data available for Tasmania and the NT.

2.3.1 Comment on data

The information collected by Hyder (2006) is generally drawn from reports produced by state and territory government agencies. Hyder note in their report that the availability, quality and timeliness of data on waste and recycling vary widely between the jurisdictions. Further, different methodologies and material classifications are used, so the data collected are often not directly comparable. Data for Tasmania and the Northern Territory are not available, and

little is available from Western Australia, although the Department of Environment (WA) is currently undertaking a study to determine the total level of recycling in Western Australia.

Hyder provides an overview of methodologies used by jurisdictions to derive waste and recycling data, as well as an account of the actual data collected and published by each jurisdiction.

a) Waste

While there is a considerable amount of information available on the total quantity and composition of waste disposed to landfill, detailed compositional data are lacking (with the exception of Victoria, New South Wales and South Australia, where all loads of prescribed industrial waste are tracked and recorded). Nationally, little is known about the quantities and characteristics of hazardous materials generated by households and disposed to landfill.

b) Recycling

Fewer published data are available on recycling, particularly on materials recovered from the commercial, industrial, construction and demolition streams. However, New South Wales, Victoria and Western Australia are using a similar methodology to determine recycling levels in their jurisdictions, which will enable broad comparisons to be made. Data are generally collected on a material basis (e.g. plastic, glass, concrete), and there are limited national and state data available on the consumption and recycling of products. To fill this gap, Hyder has estimated the diversion rates of 50 significant products, using data from material recycling surveys undertaken by state agencies and industry associations. Hyder identifies:

- a 'high' recycling rate (greater than 50 per cent) for beverage packaging, automotive batteries, cars, cables and roofing iron
- a 'medium' recycling rate (20 to 50 per cent) for hot water systems, small appliances, clothing, gas cylinders, flexible plastic freight packaging, food packaging, bricks and roofing tiles
- a 'low' recycling rate (less than 20 per cent) for mobile phones, power tools, footwear, mattresses, computers, fluorescent tubes, ni-cad batteries, grocery packaging, LDPE and HDPE retail carry bags, tyres, asphalt road materials, office fittings, paint and paint packaging, piping and window glass
- no recycling for treated timber, fixed line phones, televisions, CDs and DVDs, toys, video cassettes, personal batteries, printers and computer peripherals.

2.3.2 Municipal waste – comparison with the European Union

Hyder's (2006) data show approximately 30 per cent of Australia's municipal waste is recycled, and the remainder is landfilled (Table 2). Australian municipal recycling is comparable to (though slightly lower than) the average municipal recycling rate in Europe (30 per cent compared to 36.4 per cent). Australian governments have relied on persuasion to achieve this level of recycling, subsidising collection services and introducing waste disposal levies to encourage the recycling of materials, particularly of beverage packaging, cardboard and newsprint from the household waste stream.

In contrast, recycling in Europe is achieved primarily through legislative means. European Union Directives (concerning vehicles, packaging, electrical and electronic products)

establish mandatory producer responsibility for particular products, set recycling targets, and define the role of industry and other stakeholders in collection and recycling. There are significant costs involved. The estimated costs of the ELV (end of life vehicle) Directive in the United Kingdom are between £111.76 million and £536.14 million per annum, and the WEEE (waste electrical and electronic equipment) Directive will cost between £357 and £670 million per annum in the United Kingdom (Dempsey 2004; DTI 2003b; DTI 2003c).

The European Commission estimates that the costs of financing packaging recycling in Europe amount to between €5–8 billion per annum (DTI 2002; DTI 2003a), which is .1 per cent of European GDP and 5 per cent of environmental expenditure. However, as the directives are implemented by member states the costs of recycling and the levels of recycling achieved vary with the implementation system. For example the German packaging recycling scheme exhibits significantly higher costs to industry (€1000 million) than the UK scheme (€100–200 million) (Dempsey 2004; DTI 2003a).

Table 2: Australian municipal waste generation (tonnes), 2002–03

(Source: Hyder 2006, p. 8)

	Landfill		**Recycled**		**Total generated**
Australia	6 202 000	70%	2 701 000	30%	8 903 000

Table 3: European municipal waste management, 2003

(Source: DEFRA, 2006)

	Landfill (%)	**Recycled/composted (and other) (%)**
Greece	91.8	8.2
Portugal	74.8	3.5
United Kingdom	74.0	18.0
Ireland	69.0	31.0
Finland	63.3	27.6
Italy	61.8	28.9
Spain	59.3	34.2
France	38.1	28.2
Austria	30.0	59.3
Luxembourg	22.6	35.7
Germany	19.9	57.2
Sweden	13.6	41.4
Belgium	12.6	51.8
Denmark	5.0	41.2
Netherlands	2.7	64.4
EU 15 average	**44.9**	**36.4**

2.3.2 International trade and recycling

Some recyclables are diverted from the waste stream in Australia and traded on international markets. In Australia, trade in recyclable waste classified as hazardous (e.g. lead acid batteries, used electronic equipment, used oil and household waste such as paper, plastics and cans) is restricted by Australia's commitments under the Basel Convention, a multilateral environmental agreement implemented through the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*, which is administered by DEH. The restrictions on trade in hazardous waste are subject to the caveats of Article XX of the General Agreement on Tariffs and Trade (GATT), and allow trade if a permit is granted. A key issue considered when granting a permit under the Basel Convention is whether the trans-boundary movement, ultimate treatment and disposal will be conducted in a manner meeting internationally acceptable standards of environmental performance. Another is whether Australia has the domestic capacity to properly deal with the wastes.

Estimating the level of trade in recyclables to and from Australia is confounded by definitional issues (e.g. Customs codes) and an inadequate understanding of volumes arising in Australia. Nonetheless, for certain streams some estimates of the minimum level of trade have been developed, based on data obtained from permits issued under the *Hazardous Waste (Regulation of Exports and Imports) Act 1989* and the volume of seized illegal shipments. For example:

- Around 20 per cent or 20 000 tonnes of Australia's used lead acid batteries are exported. Around half of these are exported to China and Vietnam and half to New Zealand. The price paid for used lead acid batteries in Australia is considerably lower than the price now paid in overseas markets.
- Approximately two million used computers are exported each year. Half of these are fairly recent models exported for reuse overseas. The other half are typically older obsolete product with little hardware or software support which are exported for scrap recovery.
- Poorly sorted household waste (such as that collected from kerbside collections) is classified as hazardous under the *Hazardous Waste (Regulation of Exports and Imports) Act 1989.* While Australia uses technology to sort waste such as this, overseas markets use labour at a much lower cost. It is understood that approximately half of Australia's plastic recyclables are exported. A small proportion of this waste would be hazardous.

Trade in recyclables is affected by the following factors:

- Large price differentials between markets provide an incentive for export, such as in the case of the used lead acid batteries where lead is in demand for batteries for rapidly expanding car fleets in Asian countries.
- Export for recovery may be encouraged by significant labour cost savings (such as in the case of used electronic equipment and household waste).
- Regional differences in infrastructure can make it more economical to export some wastes.

The Australian Government recognises that some companies wish to export some waste overseas for recycling. Exports must of course comply with the relevant international and national obligations such as the Basel Convention and Australia's domestic legislation.

2.4 Trends in waste generation and recycling

Due to the limited historical data available on the quantity and composition of materials recycling throughout Australia, and incomplete contemporary data, it is difficult to accurately determine waste and recycling trends. However, for the purposes of this submission, two methods have been used to approximate waste and recycling trends in Australia:

- The first converts the data to sustainability indicators as used in the 2002 report *Are we sustaining Australia?* (EA 2002) and compares the 1996–97 OECD data in *Are we sustaining Australia?* with the 2002–03 data from Hyder (2006).
- The second compares data available between 1993 and 2002–03 for Sydney, the Australian Capital Territory and Victoria.

2.4.1 Sustainability indicators

Over the last decade there has been substantial Australian and international work on the development of environmental indicators. The aim of such indicators is to relate economic, social and environmental factors, providing integrated information on how a nation, region, sector or activity is performing in achieving the goals and objectives of sustainable development.

In 2001, Australian Government Ministers endorsed a set of headline sustainability indicators for Australia with the aim of comparing successive sets of data to determine Australia's progress towards sustainability. In addition to the headline indicators, supplementary indicators were identified, including waste generation per capita and GDP. These were selected as indicators of changes to the total pressure on resources and ecological systems.

DEH released a report in 2002 entitled *Are we sustaining Australia? report against headline sustainability indicators* (EA 2002), which used the headline and supplementary indicators to measure and report against the core objectives of the National Strategy for Ecologically Sustainable Development. The report used the most recent waste data available (1996–97 OECD statistics).

In an effort to provide national trend data using sustainability indicators, the information from the Hyder (2006) report has now been used to develop indicators for 2002–03, and compare these indicators to those in *Are we sustaining Australia?*

Table 4: Waste generation in Australia relative to population and economic activity

	1996–97	**2002–03**	**% change**
GDP	$508 113 m [(1)]	$734 604 m [(6)]	45
Population	18 517 600 [(2)]	19 872 600 [(7)]	7
Waste to landfill	21 220 500 tonnes [(3)]	17 423 000 tonnes [(8)]	-19
Waste recycled	1 528 000 tonnes [(4)]	14 959 000 tonnes [(9)]	825
Waste generation	22 748 500 tonnes [(5)]	32 382 000 tonnes [(10)]	42
Waste to landfill per capita	1.15 tonnes	.87 tonnes	-24
Waste to landfill per $million GDP	41.76 tonnes	23.47 tonnes	-44
Waste generation per capita	1.23 tonnes	1.62 tonnes	32
Waste generation per $million GDP	44.77 tonnes	44.07 tonnes	2
Recycling per capita	.08 tonnes	.75 tonnes	812
Recycling per $million GDP	3 tonnes	20.37 tonnes	577

[(1)] ABS Cat No. 1301.0 2001 Yearbook
[(2)] ABS Cat No. 3101.0 Jun 2005b Australian Demographic Statistics
[(3)] ABS Cat No. 1301.0 2001 Yearbook Australia
[(4)] ABS Cat No. 1301.0 2001 Yearbook Australia
[(5)] ABS Cat No. 1301.0 2001 Yearbook Australia
[(6)] ABS Cat No. 5206.0 Sept 2003 National Income, Expenditure and Product: Australia's National Accounts
[(7)] ABS Cat No. 3101.0 Jun 2005b Australian Demographic Statistics
[(8)] Hyder (2006)
[(9)] Hyder (2006)
[(10)] Hyder (2006)

These figures are indicative only, as the 1996–97 data are less reliable than those from 2002-03. In general, the data show increasing waste generation per capita, and a decline in waste to landfill achieved through a significant increase in recycling.

2.4.2 Data for ACT, Sydney and Victoria

Table 5: Changes in waste generation between 1993 and 2002–03 (tonnes)
(Source: Hyder, 2006)

		1993	2002–03	% change
Sydney	Waste to landfill	3 175 000[(1)]	4 151 000[(3)]	+31
	Waste recycled	201 000[(2)]	4 675 000[(3)]	+2223
	Total	**3 376 000**	**8 826 000**	**+161**
Victoria	Waste to landfill	4 067 000[(4)]	4 181 000[(6)]	+3
	Waste recycled	1 283 000[(5)]	4 429 000[(6)]	+245
	Total	5 350 000	**8 611 000**	**+61**
ACT[(7)]	Waste to landfill	416 000	207 000	-50
	Waste recycled	118 000	467 000	+295
	Total	**534 000**	**674 000**	**+26**

[(1)] NSW EPA (1999); Nolan-ITU (1998); various regional waste plans and updates (1996–2000)
[(2)] NSW EPA (2003)
[(3)] NSW DEC (2004)
[(4)] Sustainability Victoria (2005)
[(5)] Sustainability Victoria (2004b)
[(6)] Sustainability Victoria (2004b); Sustainability Victoria (2004a); Golder Associates (1999); Sustainability Victoria (2002) and Victoria EPA landfill levy returns 2002–03
[(7)] ACT NoWaste (2005)

Table 5 shows similar trends to the national indicators in Table 4 with a growth in total waste generation, maintenance in the quantity of waste disposed to landfill, and a large increase in recycling. Table 5 also illustrates state and regional trends in waste generation.

In Europe, the amounts of municipal waste (of which on average two-thirds comes from households) increased in most of the EU-15 and the new member states during the past decade, more or less in line with GDP growth. Growth in municipal waste generation per capita between 1990 and 2001 was more modest in the new member states (10 per cent) than in EU-15 (30 per cent) (EEA 2005).

2.4.3 Factors influencing increasing waste generation

The continued growth in waste generation per capita is influenced by many factors related to consumption patterns and lifestyle.

Australians are tending to live in smaller household groups, with the average household size shrinking by 14 per cent over the 20 years to 2001 (ABS 2004a). At the same time homes are becoming more luxurious with multiple electronic appliances. Australians are buying increasing numbers of TVs, DVDs, PCs, laptops, mobile phones and stereos. A recent survey of households across most of the capital cities of Australia – Sydney, Melbourne, Brisbane, Adelaide, Perth and Canberra (62 per cent of all households nationally) – provided baseline information about e-waste in metropolitan households in Australia. The survey

showed that by product type, TVs are by far the most numerous single equipment type in households (2.3 per household on average), followed by videos/DVDs (2.2 per household) and radios (2 per household). There is an average of 9.2 computer related items per household, or 38.4 million items in total.

This survey also found that the percentage of households acquiring items is significantly greater than the percentage of households disposing of them. Around twice as many households had acquired TVs and computer screens as had disposed of them within the last 12 months, with a three-fold difference for computer box units. This means that there is an increasing backlog of electronic and electrical equipment in homes which will need to be disposed of in the future (IPSOS 2005).

Consistent with this Australian survey, data from the United States Environment Protection Agency (US EPA) indicate that waste derived from products is the largest proportion of the overall waste increase over the past 40 years (Western Australia Waste Management Board 2005).

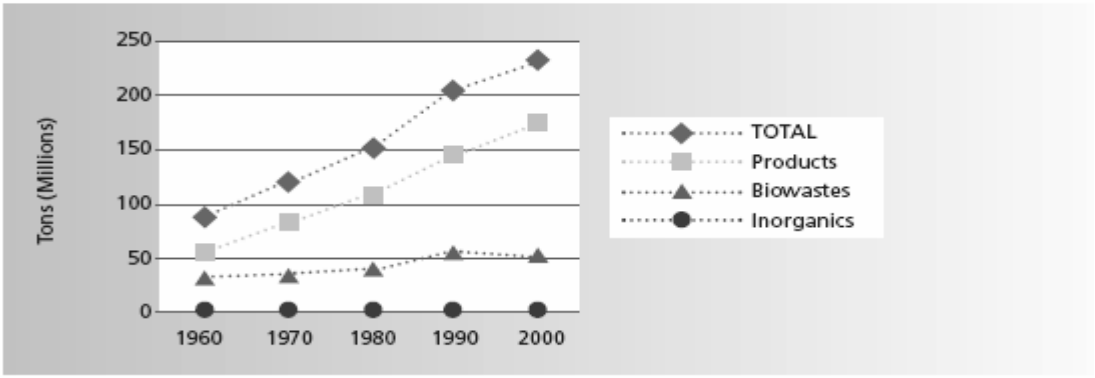

Figure 2: Waste generation in the US from 1960 to 2000
(Source: Western Australia Waste Management Board 2005)

In a major report on household consumption and the environment, the European Environment Agency (EEA) reports that an average personal computer in Europe remains in use for three years (EEA 2005). Electronic equipment – personal computers, cameras, cellular phones, notebook computers, TVs and many other small electronic devices – results in around 5.5–7 million tonnes of e-waste per year, a stream which is increasing by 3–5 per cent per year. The overall composition of electronic equipment scrap is characterised by a high metal content (more than 50 per cent); plastics account for about 20 per cent and glass just under 10 per cent. The increase in consumption of household electrical equipment means there is also an increase in product packaging.

The EEA report further notes that, due to changes in fashion, reduced durability of goods and low prices (compared with the cost of repairs), electronic and communications tools and household appliances (washing machines, dishwashers, ovens, microwaves, refrigerators, freezers and air-conditioners) are now replaced more often.

Convenience has become a major factor in determining food choice. The demand for pre-prepared and processed food has continued to rise, with a resultant increase in the amount of packaging.

The Australian population is ageing which changes consumption patterns, influencing the quantity and quality of resources used and waste generated by the community. For example, expenditure on personal travel and health is increasing in Australia, as is the purchase of second homes. EEA (2005) believes that overall, consumption related to housing is expected to increase and the 'life-time' of products will continue to shorten, particularly for electronic and communication goods. The Australian community is likely to show similar trends to Europe.

While levels of consumption are linked to rising incomes and demographic or lifestyle changes that influence consumer needs and preferences, there is also a growing amount of research on other consumption drivers. There are various theories, including the role of consumption in:

- display and status-seeking behaviours
- convenience, habit, and individual responses to social and institutional norms
- constructing and maintaining personal identity
- communicating belongingness, affiliation, group identity and allegiance to certain ideals
- construction of narratives and rituals to add meaning to lives (Jackson & Michaelis 2003).

2.4.4 Factors influencing increasing recycling

Tables 4 and 5 show tremendous growth in recycling, which has come through the provision of new and improved kerbside collection services (including increased collection frequency, better collection containers and a wider range of materials/products collected), extensive community education programs and the development of new and more stable markets for recycled materials. In addition to the data shown in Table 5, recycling volumes have also grown dramatically in Queensland, Western Australia and South Australia (Hyder 2006).

Evolving from collection of newspapers, aluminium cans, and glass bottles over 20 years ago, a broader range of material is now collected including packaging cardboard, office paper, steel and some types of plastic containers. Recovery yields have also improved as systems mature. However the range of materials collected has not expanded significantly in the past five to eight years.

Over the past five to 10 years there has also been enormous growth in recycling of materials from the building construction and demolition industry. This has been strongest in Melbourne, Adelaide and Sydney. The past 10 years have seen the commencement of asphalt and timber recycling, together with major increases in concrete and metal recycling (Hyder 2006, pp. 17–18).

While many kerbside recycling systems are now at a mature level (e.g. in Victoria) there are opportunities across Australia to increase recycling yields and reduce costs by implementating best practice systems. There is likely to be significant expansion of organics recovery from municipal, commercial and industrial sources and increases in commercial and industrial recycling in general, with large gains in construction and demolition recycling markets such as Queensland and Western Australia.

2.5 Community concern

Waste is an environmental issue of concern to most Australians. Waste management is understood by the public as an environmental issue of high importance, with people in a 2003 NSW survey considering it as the fourth most pressing environmental issue after water, air and flora and fauna protection (DEC NSW 2004). The community also believes it is important to reduce the amount of waste disposed to landfill (Harrison Market Research 2005) because landfill sites take up valuable space, cause pollution and are a repository for wasted resources (Taylor et al. 2001). Almost all Australians engage in some form of recycling and/or reuse of waste, and the level of participation continues to increase (ABS 2005a), driven to a significant extent by the notion that it is socially responsible (Harrison Market Research 2005).

Heightened community concern over waste disposal as an environmental issue is also reflected in the continued growth in participation rates at the annual Clean Up Australia Day event. In 2004, over 677 000 volunteers (Clean Up Australia 2004a) donated approximately 1.5 million hours to Clean Up Australia (Clean Up Australia 2004b). This was a 13 per cent increase in the participation rate from the previous year (Clean Up Australia 2004a).

Australian surveys consistently show that consumers are interested in recycling and purchasing products that are environmentally preferable, and that inadequate information is one important barrier to doing more. For example:

- a NSW survey of consumer demand for environmental packaging found that over half of respondents (51 per cent) look for recycling logos when shopping and 55 per cent will pay more for products that are environmentally friendly (Taverner Research Company 2004, p. 4)
- 52 per cent of respondents to another NSW survey said that they had often chosen environmentally preferred household products during the previous 12 months and 40 per cent had often avoided excess packaging (DEC NSW 2004, p. 59)
- a survey of community attitudes to recycling in Victoria found that over half of respondents seek out products that have recycled content (54 per cent) (IPSOS 2005, p. 1).

2.6 Australian policy overview

2.6.1 Australian waste policy – past and present

Today, waste management policy cannot be seen in isolation from resources policy. Indeed it can be seen as a sub-set of broader resources policy, since policy on waste management interacts with policy on the utilisation and conservation of resources. Another way of putting this is to say that waste management policy needs to be framed in a whole-of-life-cycle context, seeking to optimise outcomes against a range of economic, environmental and social objectives across all stages of a product's life, rather than being concerned only with what happens to it at end –of life. This has not occurred in the past in any systematic way, but provides a framework for future policy development.

For many years, government policies in Australia have focused on the collection, transport and treatment/disposal of wastes. This concentration of policy and regulatory effort is evidence of the fact, long recognised, that free markets often fail to reflect the full costs of environmental impacts of waste management (particularly waste disposal). To deal with the

external costs of managing wastes, bodies of policy and regulation have been established in most mature economies designed to correct the more obvious externalities.
In Australia, such polices and regulations (often characterised as command and control regimes) have had the greatest impact on landfills in major urban areas[1]. Over the past decade or so, regulatory regimes have been progressively tightened. As a result, the majority of landfills currently servicing major population centres now meet stringent planning and regulatory requirements in relation to location, design, construction and operation. Consequently, such landfills generally do not present significant risks in terms of generating external environmental costs through air and water pollution, noise, dust and the generation and spread of disease. Residual risks are discussed in section 3.1.

Some older landfills, including many in areas outside the capital cities, fail to meet modern environment protection requirements. In rural areas, landfills are often unsupervised, poorly managed, and present some risks in terms of leachate generation and water pollution. While upgrading numerous small, rural landfills to best practice standards may not be financially viable, there are opportunities to significantly reduce externalities associated with waste management in these areas. This could involve closing unsatisfactory landfills and providing for the transfer of waste to best or better practice regional facilities. In Victoria, for example, this approach has been supported by statutory requirements for regional waste management plans and by funding support from a landfill levy to assist the progressive closure of many small rural landfills and the establishment of local transfer stations and regional landfills.

In parallel with the development of prescriptive regulation to control the adverse effects of waste disposal, Australian governments have, over the past 10 to 15 years, increasingly directed policy towards encouraging the diversion of materials from the waste stream, principally for recycling. This policy was motivated not simply by a desire to conserve resources and to retain the embedded value in recovered material, but also by:

- a desire to conserve landfill space in areas where this was scarce (which in turn was linked to increasing unwillingness of 'host' communities to accept new landfills)
- increasing community desire to recycle materials (particularly packaging material such as aluminium, glass, plastic and newspapers)
- a growing unease among regulators about potential long-term effects of various contaminants in the domestic waste stream
- broader policy, both in Australia and internationally, supporting the goals of sustainable development.

Reflecting these concerns, a range of objectives are specified for waste management legislation and programs across Australian jurisdictions. Most policy objectives now include environmental outcomes like conserving resources, reducing environmental impacts arising from the use of virgin materials and reducing the toxicity of products (BDA2003).

Unlike Europe, where regulatory measures have been employed by a number of countries to achieve recycling objectives, Australian governments have relied (with considerable success) on persuasion to implement these goals. Governments have subsidised collection services and waste disposal levies to encourage the recycling of materials, particularly of beverage packaging, cardboard and newsprint from the household waste stream.

[1] Policies and regulations have also been used to control the environmental and social impacts of illegal waste disposal, particularly litter. Early concerns about the increasing use of non-returnable containers in the 1970s and their impact on litter resulted in container deposit legislation being introduced in South Australia (1975) and education and advertising programs to encourage responsible disposal.

In the case of Sydney, where landfill space has for some time been in short supply, high disposal costs have influenced government policy actions (chiefly in the form of a substantial landfill levy) to prompt significant investment in advanced technology at new materials recycling facilities (MRFs) able to sort and recover a much broader range of materials than in the past. By contrast, in Melbourne, where there is readily available landfill space and the landfill levy is much lower, relatively low disposal costs have greatly restricted investment in new, technologically advanced MRFs. The Victorian Government's recently adopted Towards Zero Waste Strategy aims to address this via direct intervention in the market to promote processing of wastes prior to disposal.

In addition to intervening to encourage recovery of materials at –end –of life, Australian governments have sought to encourage improved resource efficiency in earlier life cycle stages, notably the production stage. In addition to the environmental rationale which has been the main driver of government attempts to stimulate end-of-life resource recovery, government efforts to promote 'resource efficiency' during production also aim to enhance the cost-competitiveness of Australian industry.

Over the past decade or more, a range of terms have been applied to describe a broad theme relating to reducing waste generation and the intensity of materials use in economic activity. Perhaps the most widely used of these terms is 'resource efficiency'. At its most basic, resource efficiency means getting the most out of what you have – the full range of resources including input materials, water, energy and your workforce. Resource efficiency encompasses consideration of all resources and is not concerned with waste or materials intensity in isolation.

The concept of resource efficiency is used in a number of different contexts. At the societal (or waste policy) level resource efficiency is about getting the best return for society out of our resources. Improvements in resource efficiency can have broad environmental and economic benefits. At a company level resource efficiency is about maximising returns to the company (often called eco-efficiency or cleaner production, see section 4.3). There are various ways companies can act to improve their resource efficiency such as by reducing the amount of materials used, reducing manufacturing costs, reducing waste materials, and reducing costs of compliance with environmental legislation.

In summary, the waste management policies of Australian state and local governments (until relatively recently the Australian Government has played a minor role in this policy area) originally focused almost exclusively on applying traditional command and control approaches to prevent or mitigate the adverse health and environmental impacts of waste disposal. Over the past two decades, this policy focus has broadened to reflect changing societal expectations – principally, that wastes should be seen as resources and, where practicable, recovered for productive purposes.

More recently, Australian governments have developed policies and actions to address broader issues of resource efficiency associated with particular products, rather than focusing exclusively on the end-of-life environmental impacts of disposal. Where such policies are inconsistent across state and territory boundaries, there is the potential for these schemes to adversely affect national markets for both products and recovered resources. In cases where the products and issues involved are national in character, coordinated product-based policies are being developed via the national councils of environment ministers (the EPHC and National Environment Protection Council). A key reason for Australian Government

involvement in waste and resource efficiency policy is the development and implementation of nationally consistent or compatible product policies and actions.

The market failures these life cycle based policies seek to address are more subtle than those associated with various waste management activities. The failures are still principally in the form of externalities, but in this context the externalities are primarily associated with a failure in the market to recognise and fully reflect the real environmental costs (e.g. those associated with emissions of greenhouse gases) in the price of material, energy and water inputs to production. As such, they do not lend themselves to traditional broad-brush regulatory corrections, but rather to industry or product-specific voluntary or co-regulatory approaches. For example, the National Packaging Covenant engages all sectors of the packaging supply chain (packaging manufacturers and fillers, retailers, collectors, reprocessors) and all spheres of government, to minimise the environmental impacts arising from the disposal of used packaging; conserve resources through better design and production processes; and facilitate the reuse and recycling of used packaging materials. Such approaches seek not only to encourage a 'resources not wastes' view, but also to promote cost-effective waste avoidance during the production and consumption stages of the life cycle (through, for example, improved design and mix of materials and elimination of toxic constituents).

2.6.2 Tyranny of distance and the development of a national approach

The bulky and/or heavy nature of Australia's major waste streams (including household and municipal wastes, construction and demolition wastes, and most commercial and industrial wastes) results in waste management costs being dominated by the cost of transport. As a consequence, the great bulk of these waste streams are dealt with relatively close to their source (either by landfilling or, to varying degrees, by reuse and recycling). With the exception of Sydney, where a major shortage of landfill space close to the city necessitates long-distance haulage of wastes, other metropolitan and most provincial centres have significant landfill capacity within some 20 to 30 kilometres of their urban boundaries.

The only significant exceptions to this rule are packaging materials, newsprint and lead acid batteries which are collected nationally and sent to central reprocessing facilities located primarily in New South Wales and Victoria, and relatively small volumes of specialised and difficult to manage hazardous wastes (e.g. chlorinated organics and some forms of biomedical waste), which are shipped across state borders to specialised facilities. The small size of specialised waste markets results in a very limited number of treatment/disposal facilities and in long-distance haulage being the rule.

Issues arising from the collection, transport and disposal of most forms of solid waste have been controlled by policies and regulation at state government, and to a lesser extent local government, level. Not until quite recently has there been much interest among jurisdictions or the Australian Government in coordinating or harmonising policy or regulation of even the more hazardous waste streams. For example, a harmonised national approach to controlling the cross-border movement of hazardous waste was not established until 1998 when the National Environment Protection (Movement of Controlled Waste between States and Territories) Measure was introduced.

However, as noted above, governments are increasingly adopting a national, life cycle approach to waste management policy, targeting various consumer products (such as televisions, computers and used tyres) which are marketed nationally and which pose similar end-of-life management problems in all jurisdictions. Tyres, for example, cannot be

effectively compacted and so pose physical problems in landfills, tending to 'float' towards the surface. E-waste contains a range of metals, some of which are toxic and accumulative in the environment and hence pose a risk, particularly if disposed of to an unlined landfill.

Businesses and industries involved in the production/import and sale of such products have, not surprisingly, encouraged governments to adopt consistent nationally coordinated policy approaches to deal with such products. In the case of the packaging industry, a commitment by governments not to introduce differing state-based schemes, but rather to commit to a consistent national approach, has been a precondition of industry participation in the National Packaging Covenant – a co-regulatory product stewardship scheme.

Table 6: Trends in the development of waste policy

	Awareness of waste – perceived problems	**Policy tools**	**Policy outcomes**
1970s	Litter/depletion of resources	Container deposit legislation, community education (e.g. Keep Australia Beautiful)	Beverage industry involvement in recycling, increased community awareness of litter
1980s	Amount of waste/impacts in landfill	Kerbside recycling, regulation of landfills	Reduced externalities associated with urban landfills, increased recycling
1990s	Life cycle impacts/business inefficiencies	Cleaner production, design for environment, eco-efficiency	Documented case studies, increased awareness in industry of financial costs of waste
2000s	Unsustainable patterns of production and consumption	Product stewardship, life cycle management, national whole–of-government approach	Industry–government partnerships, voluntary industry programs to reduce waste and improve product design (e.g. to assist in recovery and recycling)

3. Costs and benefits of waste management and resource efficiency

3.1 Costs of landfill

3.1.1 Overview

Landfills have low operating costs compared to expensive waste reprocessing systems, and can be located relatively close to the urban centres they serve. While most metropolitan population centres are not short of potential landfill sites, securing community and political acceptance for the use of these sites remains very difficult, notwithstanding the tight regulatory regime. The real or perceived social disadvantages of landfills (and other waste management facilities such as transfer stations and material recovery facilities) – traffic, noise, dust, odours and leachate – are the basis of strong community opposition. These factors increase the need to maximise the use of landfill space in already approved, best practice facilities.

Problems arising from landfill depend on the nature of landfill controls, the site and the materials disposed. High-density, inert materials are likely to be least costly to manage and cause fewer environmental impacts, followed by less dense and biodegradable materials, with hazardous household waste likely to cause the greatest impacts (see Table 7).

Table 7: Product externalities in landfill

Product	Externalities
Plastics bags and film	Contribute to litter around landfills (aesthetic, wildlife and farm impacts)
Timber and wood products	Contribute to methane emissions (biodegradable); treated timber contains copper chrome arsenate (CCA) which may be present in leachate
Paper/cardboard	Contributes to methane emissions (biodegradable)
Plastics	Some plastics contain phthalates (PVC) and heavy metal pigments and stabilisers which may be present in leachate. These materials have the potential to impact on the health of humans and other organisms
Electronics and appliances	Contain heavy metals and flame retardants which may be present in leachate
Batteries	Contain heavy metals which may be present in leachate
Garden and food organics	Contribute to methane emissions (biodegradable)
Household chemicals	Oil, paints and pesticides contain toxic substances which may be present in leachate
Tyres	'Float' to the surface and cause problems in landfill management

The principal residual environmental concerns associated with best practice landfills are emissions of greenhouse gases (particularly methane) and the possible long-term leakage into the environment of heavy metals and other hazardous materials associated with plastics (such as phthalates), household chemicals, consumer electronic products and earlier generation rechargeable batteries (such as ni-cads). Some of these materials are persistent and can

become concentrated at higher levels in food chains, potentially disrupting metabolic processes, including reproduction. Low levels of some of these persistent materials have also been linked to cancer in humans and other animals.

Other environmental consequences of landfill include energy use in transporting waste, noise and odours impacting local amenity, as well as air emissions and amenity impacts through the transportation of wastes to landfills.

3.1.2 Air pollution

The National Greenhouse Gas Inventory estimates that in 2003, 2 per cent of total net national greenhouse gas emissions were emitted from the waste sector (Australian Greenhouse Office 2003). The majority of these emissions comprised methane gas, generated by the decomposition of organic matter in landfills. The waste degradation process occurs slowly and methane emissions continue long after waste is disposed of to landfill. Estimates in any year include a large component of emissions resulting from waste disposal over the preceding 30 years. There remains a continuing need for effective regulatory control of all aspects of landfill disposal and to pursue implementation of best practice where it is currently absent.

While most landfills have a gas capture system, not all of the methane is captured. Based on the best available knowledge at the time (using US EPA and EcoRecycle Victoria data), a life cycle assessment of recycling and landfill technologies in Victoria assumed that 55 per cent of the gas can be captured, and of the 45 per cent which is not captured, 10 per cent escapes through the landfill cap over its total life cycle (Grant et al. 2003). This estimate was based on limited data and should therefore be considered indicative only.

3.1.3 Water pollution

The potential impact of contaminants in the waste stream such as heavy metals is through leaching into groundwater. While most modern urban landfills are lined with impervious membrane layers, the quality of leachate collection systems varies and a small percentage may escape and pose an environmental risk (Grant et al. 2001, p. 43). Risks involved depend on the location and degree of reliance on groundwater supplies, for example Perth's reliance on groundwater dictates a higher level of concern than other major cities. Unlined rural landfills may also result in the migration of leachate either into surface or ground water. There is a particular concern in rural areas over the illegal disposal of pesticide containers to landfill; these can pose a significant threat to surface and ground water.

3.1.4 Environmental costs

The quantification of environmental externalities of landfill varies greatly between different areas and depends on a number of factors such as the extent of the use of transfer stations, the role and use of contractors, the nature of equipment used and the geographic location of landfills in relation to population. Different conditions in different areas within Australia and overseas mean that cost must be determined as far as possible at a local level. However, concepts developed elsewhere can be useful in identifying costs and these concepts allow development of a broadly acceptable set of pricing principles.

For example, in 1996 the New South Wales Environment Protection Authority (NSW EPA) undertook a study assessing landfill externalities (NSW EPA 1996). They estimated that the

external costs of metropolitan landfills range from $13.10 to $33.20 per tonne. The externalities considered in this study included greenhouse gas emissions, local amenity costs, transport costs and intergenerational costs (indicating the cost to future users of consuming existing landfill space, reflecting increasing replacement costs). Of these, greenhouse gas emissions (between 60 and 44 per cent of total) and intergenerational costs (between 23 and 36 per cent of total) are the largest components.

BDA group (2004) updated these findings and estimated that the environmental impacts of metropolitan NSW landfills cost from $2.30 to $14.30 per tonne. They found that the main external cost associated with landfills is greenhouse gas emissions (54 per cent of total for the high estimate). This analysis presents quite a different picture of the environmental impact costs of landfills than the original NSW EPA study. A number of adjustments were made to reflect changes in landfill management practices and different environmental damage valuations, namely:

- lower greenhouse gas emissions estimates based on the increase in the extent and efficiency of methane recovery and new research findings on greenhouse gas emissions from solid waste
- lower local amenity costs given the increasingly remote location of landfills
- lower intergenerational costs because of the large capacity of current landfills and the availability of former mine and quarry sites at low cost for new landfill sites implying no increase in replacement costs (BDA Group 2004 p. 84).

The Australian Government estimated in 1994 that the environmental costs of landfill were around $127 million or around $13 per tonne. This took into account leaching into waterways, litter, odour, greenhouse and other atmospheric emissions and dust (DEST 1996).

The ACT Government undertook a broader, detailed study to estimate the costs of waste management when preparing their 2002 waste strategy, and estimated that the net environmental, economic, and social cost of waste going to landfill was $105 per tonne. This included a range of environmental and social costs, as well as direct economic costs valued at approximately $77 per tonne (e.g. expenditure on overheads, capital costs, administration, and post-closure and remediation costs). Greenhouse costs were estimated as $6 per tonne; social costs, such as amenity impacts, were estimated as approximately $5 per tonne; and environmental costs of monitoring flora and fauna and the potential new legislation were estimated as $0.40 per tonne (Kenney Lin et al. 2001).

The European Commission also undertook an economic valuation of environmental externalities from landfill disposal. In 2000, the commission estimated the net external cost of waste disposed of at landfill to be between €11 and €20 per tonne ($A18–$A33 at that time). Like the Australian studies, the European Commission found greenhouse gas emissions to be a major component of the net external cost. However, amenity impacts were estimated to be larger than in the Australian studies. This can be expected as Europe has higher density living and larger populations, so more people can be expected to directly experience amenity impacts from landfill.

3.1.5 Disposal costs and levies

Landfill levies have been introduced in some states to address externalities and to raise funds for recycling and waste reduction programs (Table 8). Landfill gate charges in Australian

cities (the total price to dispose of waste, including revenue to the landfill operator and the landfill levy) are shown in Table 9.

Table 8: Australian landfill levies per tonne

	Location	Type of landfill operation	NSW [1]	VIC [2]	SA	WA [3]
2005	**Metro**	Municipal	$21.20	$7.00	$10.50	$3.00
		Industrial, Construction &Demolition	$13.20	$11.00	$10.50	$1.00
	Non-metro	Municipal	$21.20	$5.00	$5.25	
		Industrial, Construction &Demolition	$13.20	$9.00	$5.25	
2006	**Metro**	Municipal	$22.20	$8.00	$10.80	$3.00
		Industrial, Construction &Demolition	$22.20	$13.00	$10.80	$1.00
	Non-metro	Municipal	$14.70	$6.00	$5.40	
		Industrial, Construction &Demolition	$14.70	$11.00	$5.40	
2007	**Metro**	Municipal	$28.20	$8.00	$11.15	$3.00
		Industrial, Construction &Demolition	$28.20	$13.00	$11.15	$1.00
	Non-metro	Municipal	$20.70	$6.00	$5.60	
		Industrial, Construction &Demolition	$20.70	$11.00	$5.60	
2011	**Metro**	Municipal	$56.70			
		Industrial, Construction &Demolition	$56.70			
	Non-metro	Municipal	$52.50			
		Industrial, Construction &Demolition	$52.50			

[1] New $6 per year increase recently announced
[2] Levies to be reviewed in 2007
[3] Proposal to increase currently subject to comment

Table 9: Current landfill gate charges

Location	Landfill gate charge per tonne
Sydney	$85–$90
Melbourne	$40–$50
Brisbane	$55
Perth	$30
Adelaide	$50
Canberra	$50

3.2 Costs of litter

The impacts of littering and illegal dumping are also significant externalities associated with the life cycle of products. The social costs of littering include aesthetic loss, damage to pedestrians and car tyres from sharp objects left on roads or in public places, and damage to stock and wildlife. With about 85 per cent of Australia's population living within 50 kilometres of the coast, Australia's coastline and beaches contain many forms of litter and debris. This includes remote areas in Tasmania (300–400 debris items per kilometre), and

Antarctica (80–100 debris items per kilometre) (Wace 1995, cited in ABS 2003a, p. 143). Plastic debris from urban sources and derelict fishing gear (mainly nets) impacts on the Australian marine environment, in particular posing a threat to protected species and marine habitats, impacting on commercial fisheries resources, possibly increasing the spread of marine pests, and creating hazards to navigation and to human health and safety. The impact of marine debris in Australia is a significant and costly problem (Kiessling 2003). However, it must be noted in developing any policy response that some 80 per cent of lost and derelict nets found in northern Australian waters are likely to be from Asian fisheries.

The majority of direct costs of litter are borne by local governments, and to a lesser extent by waterway managers, particularly in urban areas. The Nolan ITU report *Plastic shopping bags: analysis of levies and environmental impacts* (December 2002) states that approximately $200 million per year is spent by local and state governments on total litter clean-ups, in addition to the money spent by private sector landfill operators and community organisations such as Clean Up Australia; $4 million is the figure estimated for the clean-up of plastic bags alone.

In Victoria, it has been estimated that storm water gross pollutants are composed of approximately 20 per cent litter (plastic, paper and metal) and 80 per cent organic material (such as leaves and twigs). It is estimated that around 100 000^{m3} or one billion items of litter reach Melbourne's waterways each year. Victorian councils spend up to $89 million on both litter clean-up and litter prevention activities, including sweeping the streets, emptying and servicing street litter bins and litter traps and cleaning up litter each year.

Litter traps on drains are an important part of litter management, but are not a solution. Melbourne Water has estimated that it would cost around $450 million to install enough litter traps on Melbourne's drains to reduce litter loads by 70 per cent. Annual costs to maintain these traps would be over $8 million per year. A standard litter trap can cost anything from around $350 000 up to $650 000 or more depending on the type of litter trap, the size and the storm event it is expected to cope with (Sustainability Victoria 2005).

3.3 Benefits from reducing and recycling waste

3.3.1 Diversion from landfill

A major objective of government policy on waste reduction and recycling has been to reduce the social and environmental impacts of landfill (discussed above in section 3.2). Recycling programs in Australia already divert 45 per cent of all waste from landfill.

3.3.2 Life cycle environmental benefits

Given the interconnectedness of economic systems, it could be argued that most environmental issues are in some way related to materials that end up in landfill. And, while some consumer products create few environmental impacts at disposal other, often significant, environmental impacts may occur at various stages of the product life cycle. These may include, for example, resource conservation impacts from unsustainable extraction practices; emissions to air, land and water associated with the processing of virgin or recycled materials (including soil erosion and salinity); greenhouse gas emissions; material and product transport and marketing externalities; and impacts associated with consumption and illegal disposal (such as littering or dumping).

Increasingly, the rationale for government intervention to promote diversion of materials from various waste streams has broadened to emphasise more general policy objectives, specifically:

- helping to conserve resources by reducing demand for virgin material inputs to production, thus avoiding various environmental externalities associated with the production and supply of such inputs
- retaining the embedded value in recovered materials such as steel, aluminium and glass, thus helping to conserve non-renewable resources and reducing various forms of pollution.

These objectives provide a valid basis for the ongoing application of well-targeted policy measures to promote recovery of certain materials. This is particularly true where the combination of government action with geographic and economic factors is able to generate viable markets for such materials. It is recognised that, in many cases, targeted policies are preferred to address market failures. However, where difficulties in implementing such targeted policies exist, the promotion of recycling and recovery could be a valid and practical mechanism to achieve upstream objectives. As noted above, the interconnectedness of economic systems would enable these objectives to be effectively addressed by downstream policy instruments.

A life cycle assessment (LCA) study was undertaken by Grant et al. (2001) to assess the value of kerbside recycling in Victoria. The assessment was based on the average recyclable material presented by households. The total mass of such material presented at the kerbside for recycling and disposal was 6.6 kilograms per household per week, and included the following materials: newsprint, other paper and board, liquid paper board, glass, aluminium, steel cans, PET, HDPE, PVC, and mixed plastics. The results indicate the benefit of recycling over landfill and using virgin materials for production. The study found the net savings from a household's weekly recycling to be:

- 3.2 kilograms CO2eq. (greenhouse gases)
- 32.2 MJ of embodied energy
- 1.3 g C2H4eq. smog precursors
- 92.5 litres of water use
- 3.6 kilograms of waste diverted from landfill.

The study indicated, however, that the environmental benefits of recycling vary greatly according to the material. Recycling of most materials studied was found to be beneficial to the environment overall, but recycling liquid paper board (waxed cardboard used for juice and milk cartons) may not have an overall environmental benefit.

The LCA found that for several of the environmental indicators included in the study, the most significant benefits of recycling were from the avoided impacts of manufacturing virgin materials. While most of the solid waste benefits were at end of life, and most greenhouse savings (47 per cent) were from avoided methane emissions at landfill, savings in embodied energy, smog precursors and water use were primarily due to the replacement of virgin materials with recycled materials. The study therefore concluded that one of the most important factors in maximising the benefits of recycling is to ensure that materials are

recycled to the highest value product to avoid the production of high value, and high environmental impact, virgin materials.

Another study undertaken for EcoRecycle Victoria (Grant et al. 2005) provided an environmental evaluation of recycling savings and impacts for the main commercial and industrial (C&I) and commercial and demolition (C&D) waste materials currently collected and recovered in Victoria. Table 10 shows the total savings for global warming, cumulative energy, water use and solid waste for all C&I and C&D recycling for 2002–03 and equivalence values.

Table 10: Total savings and equivalence values for all recycling in Victoria for 2002–03
(Source: Grant et al. 2005)

Impact category	Most likely value	Equivalence	Equivalence
Global warming	2.43E+09 kg CO2	1.9 trees planted by every Victorian	4590 km driven by every household in Victoria
Cumulative energy demand	4.94E+10MJ LHV	5.4 months of energy for every household in Victoria	2.2 days of television for every person in Victoria
Water use	3.15E+07 kL H2O	16 810 Olympic sized pools	72 showers for every person in Victoria
Solid waste	3.20E+09 kg	3485 1/4 acre blocks filled to the top of 2m fence line	87% of Melbourne Cricket Ground

Note: Based on 4.9 million Victorians at 2.63 people per household.

3.3.3 Triple Bottom Line benefits

A study by Nolan-ITU & SKM (2001) for the National Packaging Covenant Council found that kerbside recycling delivered an environmental benefit of around $68 per household. Like the Grant study, the Nolan study considered the net impacts associated with kerbside recycling when compared to landfilling and use of virgin materials for production. The results of this study indicate that there is a net benefit of $42 per household per year where each household presented 170 kilograms of recyclable material each year. This comprises a net financial cost of $26 per household and an average environmental benefit of $68 per household per year. The study finds that most of the benefit (75 per cent) comes from a reduction in air and water pollution arising from avoided product manufacturing using virgin materials. The natural resource value of recycling is estimated to account for 21 per cent of the benefit, followed by greenhouse gas benefits (4 per cent). Landfill savings, taking into account only the aesthetics and land impacts (loss of land for other uses) of landfills, account for less than 2 per cent of the overall benefit of recycling, while traffic impacts represented an environmental loss of around 2 per cent.

Commercial and industrial, and construction and demolition, recycling make up a significant proportion of the waste generated (approximately 70 per cent), with most of the recycling (approximately 60 per cent) occurring in Victoria. Investment in recycling businesses is significant. A study undertaken by the Allen Consulting Group (2004) on commercial, industrial, construction and demolition recycling in Victoria demonstrates real benefits to the state from such activity in economic, environmental and social terms. These include:

- economic benefits of between $1.8 and $4.3 million per annum in terms of productivity improvement to the building and construction industry (or roughly $12 000 to $28 800 per employee)
- an environmental benefit of $7.2 million per annum through the reduction of noise and dust and reduced loss of biodiversity that would have occurred though increased quarrying
- social benefits in providing employment and contributing to society's objective of waste minimisation.

Studies show that savings available through the construction industry are significant. For example, a waste minimisation and recycling project implemented during construction of the Dandenong Police and Court Complex achieved cost savings which were equivalent to almost 3 per cent of construction costs (McDonald 1994).

While there have been some questions as to the efficacy of assumptions and methodologies of these studies, they give an indication of the environmental impacts associated with waste, much of which will not be reflected in market prices without some mechanism to internalise them.

3.3.4 Improving industry competitiveness

Waste reduction, recycling and resource efficiency present significant opportunities for industry to improve its competitiveness by reducing losses of valuable material inputs to production, wasted energy and loss of productive time. In their review of the economic opportunities available for Australian business, Taylor et al. (2006) estimate that the economic opportunity from greater eco-efficiency (resource efficiency implemented at the company level, see section 4.3) is significant, at approximately 1–3 per cent of annual turnover in particular sectors. Economy wide, for those sectors, this is valued at $4.5 billion per year.

While theoretically the net financial benefits available through improving resource efficiency should lead to the widespread adoption of necessary improvements in practice and technology, this has not tended to be the case (particularly among, but not limited to, small to medium sized businesses). The reasons for this are complex and covered in section 4.3.2.

Table 11: Summary table – costs and benefits of waste management and resource efficiency

Activity	Cost	Benefit
Landfill	Traffic, noise, dust, litter, odours Potential leakage of heavy metals, methane emissions Loss of resources, including value added to material during production	Low operating costs, can be located close to the urban centres they serve (dependent on location) Health and amenity benefits, particularly in urban areas
Litter and illegal dumping	Aesthetic loss, injury to pedestrians and animals, damage to vehicles Marine debris poses a threat to marine habitats Majority of economic cost borne by local government Potential costs to human health	
Diversion from landfill for recycling	Despite recent increases in landfill charges, relative costs favour landfill for many materials in many parts of Australia. Financial costs of recycling include: • disposal costs for non-recyclable contaminants • operating costs of collection, transport , sorting and reprocessing • capital costs of collection and recycling infrastructure Environmental costs include energy consumed and wastes and emissions generated in transport and reprocessing	Helps conserve resources by reducing demand for virgin material Reductions in energy and water use and air pollution due to the replacement of virgin materials with recycled materials. Benefits vary greatly according to material Lower cost input materials for businesses using recycled materials (for materials with a cost advantage e.g. glass cullet, metals, cardboard, post-industrial plastic scrap) Active engagement of community in recycling programs has spin-off benefits in promoting greater awareness of environmental impacts and encouraging more responsible behaviour in other areas (to be confirmed) Benefits associated with waste collection and disposal including health and environmental benefits
Eco-efficiency (resource efficiency in industry)	Cost to individual businesses of gathering information on new processes or technologies and implementing change	Using less material reduces environmental impacts across a product's life cycle (from extraction to disposal) Improves individual firms' competitiveness by reducing losses of valuable material inputs, wasted energy and loss of productive time Development of business skills (e.g. systems, strategies, analytical skills) that will deliver both environmental and business performance (Taylor et al. 2006 p 14) Projected economic value to Australia estimated at 1 per cent of turnover for 35 business sectors ($4.5 billion per year) (Taylor et al. 2006).

4. Market failures and other barriers

4.1 Introduction

The Productivity Commission's issues paper for this inquiry identifies three main classes of barriers to 'optimal approaches to waste management and the development of markets for recovered resources' (2005, pp. 19–23). These are various forms of market failure (in particular, externalities); institutional barriers (including cultural barriers); and regulatory barriers. The following section examines each of these types in relation, firstly, to waste management and disposal and recovery of resources from the waste stream (section 4.2) and, secondly, to resource efficiency (section 4.3). While this split is a convenient one for the purposes of discussion, it needs to be emphasised that some barriers (for example, a failure to fully internalise disposal costs) impact across more than one stage of the life cycle. A summary is provided at the end of this section in Table 12.

Section 5 discusses the nature of various forms of government intervention capable of addressing these barriers, and reviews factors affecting the choice and effectiveness of such interventions.

4.2 Waste and resource recovery

4.2.1 Market failure

The principal forms of market failure are externalities, which lead to the full social costs of waste not being reflected in private costs, (section 4.2.1 a) and information failure, a lack of complete information on the part of waste generators/consumers and waste managers, (section 4.2.1b). Section 4.2.1c outlines other forms of market failure.

A number of market failures which contribute to inefficiencies in resource use and waste management are identified below. Addressing these failures will create an overall increase in social welfare.

a) Externalities and pricing signals

External costs of landfill: As noted in section 3.1, there have been significant improvements in the design and operation of landfills serving most larger urban centres, with a consequent increase in the cost of disposal to landfill. Despite this, disposal costs to landfill in most parts of Australia still do not reflect the full external costs, particularly the potential long-term costs associated with pollution from leachate or methane emissions, and post-closure rehabilitation. In 1996, 62 per cent of councils were found to have made no provision for site rehabilitation or replacement costs in their disposal charges (DEST 1996).

The risks associated with landfill over the long term are still uncertain, presenting an unquantified risk of liability to future generations. These risks are generally not factored into costs.

Society makes choices about how to dispose of its waste. A key influence in this decision is the relative cost of two main options: landfill and resource recovery. On the whole, the current financial unit cost for disposal of waste to landfill is less in Australia than the financial unit cost for resource recovery of most materials. Where externalities associated with landfill are not fully internalised, this contributes to the relative costs of the two alternatives favouring landfill for many materials.

Waste disposal pricing: Price signals to waste generators (both household and industrial/commercial) are also distorted by pricing practices adopted by municipalities and the private sector. While an increasing number of councils separate rate charges for waste and recyclables, and some charge to supply larger or additional waste bins, the majority apply a single, combined annual rate for collecting waste and recyclables. The marginal private cost of waste disposal to a householder is therefore zero, or at best negligible (even though the marginal social cost is not). There is no additional cost to a householder each time they put out their bin for collection and there is no financial incentive for a householder to separate their waste for recycling or to reduce their generation of waste.

Collection and disposal of waste from commercial and industrial premises is, in almost all areas, carried out by the private sector under commercial contracts rather than as part of municipal collections. However, while there is a direct charge paid by the waste generator, such charges (particularly in the case of small enterprises) are based on the number of skip loads collected rather than on the actual volumes of waste. This, combined with the fact that collection frequencies are usually set in the waste contracts, reduces the incentive for generators to reduce waste or to divert recyclables from their waste streams.

Further, landfill levies do not always differentiate between different products or materials, even though it is clear that the associated externalities vary across products and materials. The price signal does not reflect the true cost of disposal for different products or materials and hence is likely to distort the nature of the waste stream.

The lack of appropriate pricing for waste disposal also means that there is little financial incentive for consumers to modify their purchasing decisions in order to reduce waste or increase recyclability. The lack of consumer informed preference gives manufacturers little incentive to consider the end-of-life costs of the products they make, resulting in products and packaging that may be unnecessarily heavy, inappropriately designed for single use, or which are too complex and too difficult to recycle. For packaging, the National Packaging Covenant provides a model of how such important issues can be addressed through product stewardship rather than legislation or market-based instruments.

There are likely to be high costs associated with implementing policies that target consumers to ensure they face the full costs of waste disposal. These costs (which include transaction and administration costs) may result from technical limitations, such as not being able to measure the content of post-consumer waste. Therefore, there may be a case for targeting producers (for example, through product stewardship schemes) instead of consumers if this results in lower administration or transaction costs.

Resource pricing: Hyder (2006, pp. 34–36) discusses how pricing structures and signals strongly affect resource recovery in Australia. Resource recovery levels tend to be higher and more sustainable for materials and products where:

- the price of the material recovered for recycling compares favourably to the price of the competing virgin materials
- there is a strong market demand for the recovered material
- there is therefore a clear profit to be made from the sale of the recovered material after meeting the costs of collection and processing.

Conversely, resource recovery levels tend to be lower and less sustainable for materials and products where:

- the market price of the recovered material does not compare favourably to the price of the competing materials
- there is limited market demand for the recovered material
- as a result of the above factors, the price paid for the recovered material does not necessarily meet the cost of the material's collection and reprocessing and requires subsidisation.

There are several reasons why the price of a recovered material may not compare favourably to the price of a competing virgin material, including differences in economies of scale, efficiency of transport and processing technologies, as well as lower quality of some recycled materials (Hyder, 2006, pp. 34–36). These help to explain the economics of recycling but are not necessarily linked to market failure.

Natural resource subsidies: Another factor which may result in market failure is the payment of government subsidies to the resource industry. The 1998 OECD report entitled *Improving the environment through reducing subsidies* concluded that many subsidies damage the environment by encouraging over-production and the wasteful use of inputs. Where environmental externalities are not fully internalised into the price of virgin material, the effect is similar to a subsidy on the virgin material and hence acts as a barrier to the development of markets for competing recycled materials. It also acts as a barrier to improved resource efficiency (see section 4.3.1).

Table 10: Examples of market failures associated with recycling specific products

Product or material	Barriers to recovery	Market failure
Green and food organics	Recycling fees are similar to disposal fees, providing little financial incentive for source separation by waste generators Recycled organics have trouble competing with low cost alternatives (fertilisers, soil conditioners) There is a perception that recycled organic compost poses risks e.g. weeds, disease	Negative externalities of landfill disposal (e.g. methane) are not included in disposal charge Positive externalities of recycled compost are not reflected in price (e.g. improved soil structure, water conservation) There is information failure – inadequate knowledge about quality of recycled organics R&D to develop new markets for recycled organics occurs at a socially sub-optimal level because of perceived risks to the individual firm
Tyres	There is a low level of demand for waste tyres due to cost of reprocessing compared to cost of virgin materials Rubber is a thermoset (cannot be remelted) and is therefore difficult to recycle back into tyres	R&D to develop new markets for recycled rubber (e.g. in new tyres) occurs at a socially sub-optimal level because of perceived risks to the individual firm
Computers	Computers use a large number of different materials and are difficult and therefore expensive to disassemble and recycle. They are often overengineered Some materials are hazardous, e.g. leaded glass, and difficult to recycle	Disposal and recycling costs are not included in the purchase price so typically these costs do not enter the consumption decision. Consumers do not face differentiated prices for disposal and so there is little incentive for consumers to buy the product which is designed for easy recycling As such, manufacturers have no incentive to design for recycling Negative externalities associated with leaded glass (potential for lead to leach out into groundwater) and other heavy metals and flame retardants are not included in the price. While leaded (CRT) screens are being phased out many are still in use or storage and externalities may be associated with newer (e.g. LCD) technologies) R&D to improve recyclability or develop new markets for recycled materials (e.g. leaded glass) occurs at a socially sub-optimal level because of perceived risks to

		the individual firm
Batteries	Batteries contain a variety of different materials (metals and other) which need to be separated during the recycling process. There are no local reprocessors so the materials need to be exported Batteries contain hazardous materials (heavy metals)	Negative externalities of landfill disposal (e.g. heavy metals) are not included in the disposal charge Disposal and recycling costs are not included in the purchase price so there is no incentive for consumers to buy rechargeable batteries R&D to develop new recycling technologies occurs at a socially sub-optimal level because of perceived risks to the individual firm

Transaction costs: Where the existence of transaction costs (including search and coordination costs) impedes action to address adverse environmental outcomes, there may be a role for government to act to remove or minimise transaction costs. In the case of waste disposal, where an individual faces high transaction costs associated with one form of disposal over another, it is likely that they will choose the cheaper disposal option. Where this option has negative environmental impacts, governments may act to alter transaction costs. Examples include making recycling easier by providing a road-side collection service, or providing rubbish bins in parks.

While litter may arise directly from collection and transport of recyclables and, in particular, from landfill disposal, the great bulk of litter results from the behaviour of individuals in public places. This results in environmental and social costs. As such, the direct costs of littering (those associated with clean-up) are borne by local councils and public land managers, while the indirect costs (impacts on wildlife, on water quality and on visual amenity) are borne by society as a whole. Individual litterers derive the benefit (disposal of the unwanted material with minimal effort) at no cost, except in the unlikely event that they are detected and subject to enforcement action. In summary, littering is a classic tragedy of the commons (Hardin, 1968).

b) Information failure

Where prices or other signals do not provide information about the environmental impacts of products, individuals are forced to base their decisions on imperfect information. If individuals would make a different decision with more complete information, then this is a form of information failure. Limited availability of information, particularly to waste generators, is a major factor affecting levels of waste generation and resource recovery. The absence of appropriate price signals, as discussed above, is itself an important form of information failure, but it is by no means the only one.

Product designers: Product stewardship programs encourage manufacturers to consider waste and recyclability at end of life when they design products ('design for the environment'). A barrier to implementation is the lack of accessible and credible information on environmental impacts and recyclability of materials that would enable manufacturers to choose material with the lowest environmental costs. 'Design for the environment' may involve high costs to business in accessing such information. Overall, product stewardship may provide a valuable tool for correcting a variety of market failures (information failure, pricing failure etc).

Waste generators – Industrial and commercial: Awareness by industrial and commercial waste generators of even the direct costs of their wastes may be limited by the fact that such costs are often not clearly identified in their accounts. Because waste management costs often constitute only a small percentage of a business's overall costs, they tend to be bulked in with other 'overheads'. This is despite the fact that (as various case studies have shown) the potential savings through waste reduction may significantly increase marginal profitability (see sections 3.3 and 3.4.).

Waste generators – Householders: In the case of householders, apart from a lack of knowledge of the potential environmental impacts of their waste, other areas of 'information deficit', or of misinformation, can include:

- lack of information on the acceptability of different materials in kerbside collections, leading to contamination and increased cost (e.g. the presence of the recycling loop symbol does not guarantee that a material is actually acceptable in a kerbside recycling collection)
- uncertainties associated with the labelling of recycled content in consumer products reducing the effectiveness of 'buy recycled' campaigns.

These information deficits can have a negative impact on both recycling behaviour and the purchasing of environmentally responsible products. If consumers do not have complete information on the properties of a commodity they want to buy, and with more complete information they would alter their consumption decision, then this is a case of information failure. Consumer surveys have found that many consumers would prefer to buy environmentally improved and/or recyclable products (see section 2.4). Surveys have also identified a number of information barriers to greener purchasing. For example:

- a NSW packaging survey found that a majority of respondents (60 per cent) believed that there is a lot of conflicting information around on the environment; nearly half (45 per cent) agreed that they find it impossible to say which products are environmentally friendly and which ones are not; and 88 per cent agreed that they need to understand the environmental damage from the products they use before they will change their purchasing behaviour (Taverner Research Company, 2004 p. 3)
- in a smaller survey of consumer attitudes to environmentally friendly packaging, 60 per cent of respondents said that they purchased environmentally friendly packaged products. The main reasons given for not purchasing environmentally friendly packaging were inadequate labelling (27 per cent) and not enough knowledge (41 per cent) (Groves, 2003).

Waste generators – Purchasing officers: A lack of knowledge by purchasing officers (in both public and private sectors) of the performance characteristics of recycled materials and of changes in materials standards to allow use of recyclate can act as a significant impediment to purchase of recycled products and may significantly restrict the growth of markets for recycled materials.

Local government: A lack of awareness in local government of the significance of cross-subsidies between other areas of service and waste collection and disposal may act as an impediment to more efficient and transparent rating systems. Similarly, the lack of information on cost-effective collection and recycling systems may result in councils adopting sub-optimal contracts, which are often necessarily locked in for long periods. (This issue is further explored in section 4.2.2 in the context of institutional barriers.)

c) Other forms of market failure

Research and development: Companies in the waste management and resource recovery sectors tend to invest in research and development (R&D) at a level that is socially sub-optimal. Innovation is essential if society as a whole is to gain the potential benefits of increased resource efficiency and resource recovery. For example, investment in R&D is needed to develop cleaner manufacturing processes, to improve the efficiency and effectiveness of resource recovery activities and to develop new markets for recovered materials.

There are many technical, commercial and environmental challenges involved in recycling complex products (e.g. electronics) and materials that have not traditionally been recycled (e.g. food organics). Tyres are one of many examples of a product which is challenging to recycle for technical reasons, with most recycled rubber being crumbed for use in low value products such as mats rather than replacing virgin material in new tyres. Car tyres account for approximately 60 per cent of total annual rubber consumption. For this reason it is important to explore all opportunities to 'close the loop' by using scrap rubber to make new tyres. However, the investment in R&D required to achieve this is likely to be significant.

Firms generally under-invest in R&D because they determine, based on their expectations of the outcome, that they will be unable to realise or appropriate the benefits of their investment. This may be due to the perceived:

- technical risk i.e. that the outcome of the R&D may not solve their problem
- market risk i.e. that the market may not accept the new technology and/or
- risk that intellectual property rights may be difficult to assign, or the new technology might be quickly imitated (Audretsch et al. 2002).

For these reasons some governments in Australia, through organisations such as environment protection authorities, Zero Waste SA and EcoRecycle Victoria, have chosen to subsidise R&D activities by the waste management and recycling industries.

Market power: The Productivity Commission's issues paper for this inquiry also raises the possibility of market power resulting in barriers to entry of new firms to the waste management industry, thus restricting competition and innovation. This seems unlikely, particularly in the waste transport and landfill sections of the industry, despite the domination of waste transport and landfill disposal of putrescible waste in most parts of Australia by a small number of large firms. These firms, together with the more numerous small firms operating solid inert landfills, have a history of strong competition for market share, which has been a factor in holding down increases in disposal charges in many areas, especially for solid inert wastes (see section 3.2).

While over the past 10 years or so, the collection and sorting of reclaimed material has become concentrated in a relatively small number of large and medium sized companies, competition for kerbside recycling contracts appears to remain strong, at least in the larger urban areas. (The level of competition for recycling contracts in rural and more remote areas, where transport costs are higher, is more problematic.) In the materials reprocessing sector, the very high capital costs of establishment have resulted in a relatively small number of specialised facilities, often drawing materials from across a number of states. Although the high set-up costs of these facilities may deter new investors, the primary source of competition is external i.e. competition with virgin materials. Such competition (together

with periodic competition from export markets) has driven the major existing players to innovate and invest in technology to reduce costs.

4.2.2 Institutional barriers

Institutional barriers such as cultural norms and management inertia can impede innovation and the adoption of improved practices.

a) Local government

Local government is a major purchaser of waste management and recycling services (and in some rural areas remains both a purchaser and a provider). Large metropolitan councils will often have sufficient in-house expertise to identify best practice in waste and recycling contracts. Increased out-sourcing of these services, together with the increasingly complex systems and technologies involved (especially in recycling), creates real difficulties for many councils in framing and evaluating tenders and administering subsequent contracts, resulting in the potential for accepting sub-optimal systems and incurring higher costs (economic, environmental and social). The cheapest option is not always the best for the environment or the community when viewed from a long-term financial perspective.

In Victoria, the aggregation of councils into regional waste management groups responsible for planning has promoted sharing of expertise and of physical resources such as landfills. More recently, it has led to the development of regionally based waste management and recycling contracts, which take advantage of the groups' greater scale of operation and purchasing power to achieve improved practice and more cost-effective outcomes.

Despite this development, council contractual arrangements can act to restrict their capacity to adopt innovative systems and technologies when these emerge. Most council recycling contracts tend to be five to 10 years in length to allow the provider to amortise up-front capital costs and to guarantee the supply of material. Contracts of substantially greater length are likely to be employed in the future (at least in metropolitan areas) to help defray the costs and mitigate risks associated with proposed large, high technology facilities which require very large initial capital outlays.

b) Consumers

Culture and related factors also have a significant effect on waste generation and resource recovery trends. The aphorism (generally attributed to Arthur C. Clarke) that 'wastes are just resources we're too stupid to recognise' points to what others have described as a necessary paradigm shift in the way developed countries think about wastes. Many societies in developing nations see wastes as resources, but this is not the general view in developed countries.

As discussed in section 2.3.3, many demographic, social and psychological factors are contributing to increased per capita waste generation in our highly developed consumer society, including planned obsolescence; rapid changes in fashion; the growth in diversity and sheer quantity of consumer products (many of which, if not single use, are non-durable); and changing demographics and patterns of family formation (which tend for example to favour smaller food serves and pack sizes).

The market is geared to manufacture new products rather than repair and upgrade older products. While this may not be a failure of the market, it certainly is a strong social driver and presents an impediment to maximising the value from resources used in manufacturing products. In computers for example, upgrading a motherboard or chips would involve a fraction of the materials involved in replacing the whole computer.

c) Purchasing officers

As noted above, lack of knowledge on the part of purchasing officers can act as a barrier to the purchase of recycled materials and hence to the development of markets. But barriers other than lack of knowledge may also be relevant – barriers which relate to institutional cultures. Specifically, even when there is full knowledge that the recycled materials are cost-competitive and suited to purpose, factors such as inertia, risk aversion ('no-one gets fired for buying IBM') and long-standing prejudice may affect purchasing decisions and restrict market development.

4.2.3 Regulatory or government barriers

Hyder (2006) describes how poorly targeted, designed or executed government intervention can act as a barrier to achieving the desired environmental, social and economic objectives.

Traditional command and control approaches to regulating waste management have achieved much over the past 30 years to protect human health and the environment from the impacts of poor practice (see section 2.6). While there is still room for improvement, governments are increasingly recognising the limitations of traditional regulatory tools in achieving further gains for the environment and society. As a consequence, environmental regulators are turning to outcome-based measures (such as performance-based licences), co-regulatory approaches (where industry and governments partner to regulate for desired outcomes) and economic drivers (such as recovery or disposal charges) to promote best practice and encourage diversion of wastes.

Regulatory barriers can still be identified, though the situation is far from uniform, varying from jurisdiction to jurisdiction and between individual planning authorities. Examples of barriers include:

- planning schemes, permits and appeal systems which unduly restrict the establishment of improved waste management and resource recovery facilities
- inflexible statutory standards (for waste and recycling facilities) which fail to reflect beneficial innovations in technology and practice (for example, buffer distances set in some planning schemes in relation to transfer stations and composting facilities which establish single fixed separation distances from sensitive uses rather than employing variable distances dependent on case-specific assessment of risk)
- inflexible application of the waste hierarchy in statutory processes which may inhibit better resource recovery utilising energy recovery
- unduly restrictive approaches to licensing waste disposal facilities which restrict innovative approaches to cover and other matters
- unnecessarily restrictive standards which prevent the use of recycled materials. For example, until recently many contracts used by road agencies and local government specified the use of virgin aggregate, precluding the use of recycled aggregate despite

its being of equal performance. In many areas this has changed and contracts specify a performance outcome
- a lack of consistency across different jurisdictions.

Other government failures or barriers identified by Taylor et al. (2006) are:
- inadequate information at decision-making levels of government
- lack of 'systems thinking' i.e. whole-of-government approach
- lack of economic cost-benefit thinking across government
- lack of environmental awareness and sensitivity in non-environment departments.

4.3 Resource efficiency

As discussed in section 2.6.2, over the past decade or more a range of terms have been applied to describe a broad theme relating to reducing waste generation and the intensity of materials use in economic activity. Perhaps the most widely used of these terms is resource efficiency.

The concept of resource efficiency is used in a number of different contexts. At the societal level resource efficiency is about getting the best return for society out of all physical resources and materials used in the production and use cycle. Improvements in resource efficiency can have broad environmental and economic benefits. At a company level resource efficiency is about maximising returns to the company. There are various ways companies can act to improve their resource efficiency such as reducing the amount of materials used, reducing manufacturing costs, reducing waste materials, and reducing costs of compliance with environmental legislation.

At the company level, related terms include waste prevention, cleaner production and eco-efficiency. Much of the international business community uses the term eco-efficiency because it emphasises efficiency (which is inherently attractive to business) and because it has broad connotations. The World Business Council for Sustainable Development defines eco-efficiency as:

> being achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level in line with the Earth's estimated carrying capacity (WBCSD, 2006).

Taylor et al. (2006 p. 5) provides more detailed definitions of these terms and their inter-relationships.

4.3.1 Market failure

Some of the market failures that contribute to an inefficient use of resources are the same as those that result in excess waste and sub-optimal levels of resource recovery i.e. externalities (inadequate pricing of waste disposal and of virgin materials) and information failure (inadequate information available to waste generators and consumers on the costs of waste and benefits of resource efficiency). Some of the market failures relevant to resource efficiency are summarised in this section.

a) Externalities and pricing signals

Externalities associated with waste management which also act as barriers to resource efficiency within organisations were discussed in section 4.2 i.e. landfill disposal charges do not reflect the full costs of disposal; and prices paid for waste collection services do not adequately reflect marginal costs.

On the input side, a number of market failures can influence manufacturers' product design decisions. These failures relate to resource pricing and costs of product disposal or recycling at end of life.

Harvesting or extracting and then processing virgin raw materials can generate external costs e.g. land degradation, biodiversity loss or greenhouse gas emissions. As discussed in section 4.2.1, where these external costs persist the private costs of virgin raw materials do not reflect the full social costs and hence the true cost of virgin raw materials may be at a socially undesirable level. Where these costs can be internalised, producers face prices that reflect the full costs of environmental damage and have an incentive to use virgin materials more efficiently or use alternatives such as recycled materials.

As mentioned above, the costs of waste disposal or recycling are not built into product prices because these are paid by the end user through taxes, rates or private waste disposal charges; not by the producer. These costs are therefore not considered by the product designer when they make choices about which material is used and how efficiently it is used. One of the objectives of extended producer responsibility (EPR) regulations, which are being introduced in some countries, is to internalise disposal costs in design decisions. The impact of material choice on waste to landfill at end of life is illustrated below in Table 11. This illustrates how design decisions can have major impacts on resource efficiency. A research project was undertaken on the impact of different material and design choices on the quantity of packaging material disposed to landfill after use. The example is for milk packaging. The quantities shown are grams of packaging discarded per litre of milk served, after taking into account any material which is recycled (i.e. adjusting for the recycling rate).

Table 11: Design case study – the impact of packaging design on waste to landfill
(Source: Grant & Lewis, 1997)

Type and size of packaging	Amount of waste to landfill (grams/litre of milk served)	Difference
LDPE bag of fresh milk	6.2	x 2
4L HDPE bottle of fresh milk	10.9	x 3
2 litre HDPE bottle of fresh milk	12.3	x 4
2 litre liquidpaperboard carton of fresh milk	27.7	x 9
1 litre liquidpaperboard carton of fresh milk	27.9	x 9
1 kg bag of milk powder	2.9	x 1

This information demonstrates the importance of good design and the potential for good design to reduce material intensity or the flow of materials through the economy.

b) Information failure

Producers lack complete information on the full costs associated with an inefficient use of materials. This is a form of failure where producers would make different production decisions with more complete information. The full cost of waste to business does not just lie in waste disposal and transport charges. The generation of waste incurs a number of costs, including internal treatment and administration costs, raw material costs, labour and energy. These costs are usually hidden within an organisation's overhead costs and are not well understood. The following case study of a plastics moulding business provides insight into the value of 'resource efficiency thinking' to the economy.

Case study 1: Hidden costs of wastes

A plastics moulding business pays the equivalent of $50 per tonne, or 5 cents per kilogram, for waste collection and disposal. This company generates and disposes of 20 kilograms of plastic extrusion waste per day.

The purchasing costs of plastic polymer are $2.50 per kilogram; staff spend 10 minutes per day managing the waste (costing about $3 per day or another 15 cents per kilogram); energy used to heat the plastic adds 1 cent per kilogram, as do warehousing and handling costs.

This example shows that the 'full' costs of the plastic extrusion waste are $2.62 per kilogram or $2620 per tonne, not $50 per tonne as would be identified in the company's accounts. Action to reduce waste has broader financial benefits than just reduced waste collection costs (EcoRecycle Victoria, 2001).

4.3.2 Institutional barriers

There is an opportunity to increase the productivity of the Australian economy through the targeted pursuit of resource efficiency and waste reduction. To realise this opportunity the barriers, or failures, in the way businesses operate need to be addressed by government policy and market and consumer information.

Recent research in microeconomics and management strategy has contradicted assumptions in economic theory that firms are rational and maximise profits. This research has concluded that inefficiencies are widespread and significant. This is due to cognitive limits of managers who are time poor and who face high levels of complexity and conflicting drivers, as well as the 'path dependency' of technology. Firms are therefore less likely to respond to changing market conditions than they would be in a (theoretically) ideal world (Paton 2001 cited in Taylor et al. 2006).

An in-depth review of business-level barriers to resource efficiency and waste minimisation initiatives, based on consultation with firms and other stakeholders, identified a number of barriers and incentives (Gunningham & Sinclair 1997, cited in Taylor et al. 2006).
The primary barriers identified in this Australian study were:

- a lack of information and expertise, particularly among smaller firms
- a resistance to cultural change on the part of management
- competing business priorities, especially the pressure for short-term profits

- the high initial cost of new, cleaner technology.

Similarly, the study confirmed primary motivators and drivers as:

- ability to share information through networking and business partnerships, and access to external expertise, particularly for smaller firms
- desire to maintain good community relations, particularly for larger firms
- convergence of more efficient production processes with sophisticated cleaner production processes, such as environmental management systems
- access to financial incentives for investment in new, cleaner technology.

Another survey (ACCI 2003, cited in Taylor et al. 2006) focused on environmental activities and outcomes, and the interplay of barriers and motivators. The three most frequently mentioned barriers were:

- cost of implementing improved operations (reported by 35 per cent of small businesses and 55 per cent of large businesses
- lack of time (reported by 35 per cent of large businesses and 46 per cent of medium businesses
- lack of commercial benefit from improved operations (reported by 33 per cent of small businesses and 43 per cent of large businesses.

With regard to motivators, three stood out as the most common motivators for environmental performance in businesses. These were:

- increased environmental awareness (reported by 52 per cent of small businesses and 68 per cent of large businesses
- cost savings (reported by 39 per cent of small businesses and 56 per cent of large businesses
- compliance with regulations (reported by 25 per cent of small businesses and 50 per cent of medium and large businesses.

There is growing recognition among overseas policy makers and scholars that it might be more fruitful to focus on enhancing motivators than removing barriers (e.g. Harris et al. 2004 and Kemp et al. 2004, cited in Taylor et al. 2006 pp. 32–33). There is clear evidence that some companies manage to overcome the barriers once they have recognised the benefits. Moreover, it is in human nature to find excuses, or barriers, for things that are not perceived to be in one's own interest. Of course, the renewed focus on motivators does not ignore the fact that barriers exist, and may need addressing. It does however focus on influencing the decision-making context for firms.

From the perspective of a firm or other organisation considering and implementing resource efficiency, motivation is influenced by a compelling business case (i.e. recognition that resource efficiency delivers value to the business). Generally, as discussed by Taylor et al. (2006 pp 32–33), there appears to be profound undervaluation of the business case for resource efficiency. Reasons include the following.

1. *Firms being unaware what impact poor environmental management and performance can have on their short-term profitability and long-term value and viability.* This is often hidden in statements like 'competing business priorities'. The *perception* that there is no business case for resource efficiency and/or waste prevention is commonly rooted in:

    - *lack of management accounting*: underestimating environmental costs as a result of deficient management accounting systems
    - *lack of environmental business risk assessment*: absence of an up-to-date inventory of the environmental aspects and risks of the business operations, and an assessment of their potential impact on the environment and on the continued viability of the business
    - *resistance to change* and/or failure to recognise that business conditions (including government and community expectations) have changed over time
    - *uncertainty over environmental priorities*: scepticism about environmental motives of government, communities and market partners.

    As illustrated in the above case study, (Case Study 1: The Hidden Costs of Waste), broadly speaking these are failures in the company's internal management and information systems and procedures. These failures show the need for enhancements of the company's capabilities, which will benefit resource efficiency as well as contribute to overall profitability and viability of the business.

2. *Firms that experience relatively low environmental and resource costs and business risks.* These firms are aware of their cost and risk exposure, and conclude on this basis that resource efficiency is not a business priority. The view that there is no business case for resource efficiency and/or waste prevention is then rooted in factors outside the firm's own sphere of influence, for example:

    - low costs of resource inputs and waste disposal
    - low regulatory compliance risk
    - low environmental awareness among customers, suppliers and other stakeholders.

    Making the business case will require changes external to the company e.g. profound changes in market and customer expectation, changing resource prices and availability, or changes in regulatory regime.

4.3.3 Regulatory or government barriers

Regulatory or government barriers to improved waste management and enhanced resource recovery have been summarised in section 4.2.3 above. Barriers of this type can occur early in the product life cycle, thus restricting improvements in resource efficiency.

Apart from the fact that various externalities are not reflected in the price of many virgin inputs to production, some forms of government subsidy (both direct and indirect) can also serve to disguise the true price of such inputs. Examples include:

- variable tariffs for inputs such as energy and water, under which increasing marginal use is associated with reduced marginal cost (some jurisdictions specifically seek to attract energy intensive industries with low tariffs)
- access and service charges for some natural resources (such as native forest, irrigation water supply) which have over the years arguably not reflected full cost to government (discussed in section 4.2.1)
- lack of appropriate rehabilitation bonds for some mining enterprises, which has acted as an effective subsidy with governments having to use public funds for essential clean-up and restoration.

Such subsidies can significantly weaken price signals, reduce sensitivity to waste, discourage more efficient practices and technologies and deter innovation and investment.

Some forms of environmental command and control-based regulation (now largely restricted to the area of facility approvals and licensing of facility emissions) have the potential to lock in particular forms of equipment and processes and may therefore act as an impediment to the uptake of cleaner, more efficient technologies. The clear imperative for environmental regulators during the 1970s and 80s was to control egregious forms of pollution via prescriptive 'end-of-pipe' controls. However, a continuing emphasis on the use of such controls in some areas in the 1990s arguably reduced the effectiveness of early moves to prevent pollution at source via cleaner production practices and technologies. Fortunately, a more enlightened approach by most regulators over the past decade has led to much greater emphasis on the use of outcome focused regulatory models, which can encourage and facilitate the adoption of innovative, cost-effective pollution prevention measures.

Table 12: Summary of barriers to resource efficiency and resource recovery

Type of barrier	Barrier	Resource efficiency	Resource recovery
Negative externalities and pricing signals	Landfill disposal fees do not reflect full social costs (e.g. amenity loss, air and water pollution and risks to the environment in the future or to future generations)	◀▌	◀▌
	Landfill levies do not differentiate between products and materials with different externalities	◀▌	◀▌
	Waste collection fees do not reflect marginal social costs (marginal private cost is effectively zero)	◀▌	◀▌
	Consumers have no financial incentive to modify purchasing behaviour to reduce waste, giving manufacturers no incentive to consider waste or recyclability when designing products	◀▌	◀▌
	Some of the environmental costs of resource extraction and processing are not included in market prices, increasing the price differential between virgin and recycled materials	◀▌	◀▌
	Private clean-up costs of litter and external costs (e.g. loss of amenity, hazard to wildlife) are not paid by the waste generator		◀▌
	Subsidies paid to companies involved in extracting, harvesting or processing virgin materials contribute to excess demand and reduce the competitiveness of recycled materials	◀▌	◀▌
Information failures	Most organisations are unaware of the full private costs of waste, and impacts of waste on short-term profits and long-term viability	◀▌	◀▌
	Manufacturers have insufficient information on external costs of materials and technologies to implement design for environment	◀▌	◀▌
	Householders have insufficient or misleading information on the recyclability of different products (reduces quantity and quality of kerbside collected materials)		◀▌
	Consumers have insufficient or misleading information on the environmental impacts or recyclability of products to satisfy purchasing preferences for environmentally preferred products	◀▌	◀▌
	Councils often lack sufficient information on cost-effective collection systems		◀▌
	Purchasing officers lack sufficient information on performance characteristics of recycled materials to guide purchasing decisions		◀▌
Other market failures	R&D is undertaken at sub-optimal levels by industry due to perceived risks to individual companies (technical, market and intellectual property protection risks)	◀▌	◀▌

Type of barrier	Barrier	Resource efficiency	Resource recovery
Institutional or cultural barriers	Some councils lack the expertise required for optimal decision-making on recycling and waste contracts		◀▌
	Councils award long-term waste and recycling contracts which restrict their ability to adopt the most innovative systems and technologies		◀▌
	Inertia, risk aversion and prejudice among purchasing officers in organisations restricts demand for recycled or remanufactured products		◀▌
	Demographic, social and psychological factors are contributing to increased consumption	◀▌	◀▌
	Companies face real or perceived capital barriers to innovation	◀▌	◀▌
	Companies have competing priorities e.g. short-term profits vs long-term environmental sustainability	◀▌	◀▌
	There can be sub-optimal decision-making by company managers (e.g. due to resistance to change, or lack of knowledge, expertise, time)	◀▌	◀▌
Regulatory or government barriers	Planning processes are a barrier to the establishment of improved waste management and recycling facilities		◀▌
	Inflexible standards and licensing processes for waste and recycling facilities delay the adoption of innovative technologies and practices		◀▌
	Unnecessarily restrictive standards prevent the use of recycled materials in some applications		◀▌

5. Strategies for government intervention

Governments have available a range of strategies for intervening to correct market failures and other barriers to improved resource efficiency and waste management. This section briefly reviews the primary reasons for such intervention, which have been elaborated in earlier sections, and then examines two broad mechanisms for helping to focus such intervention: helping to generate appropriate information; and developing product stewardship initiatives. It concludes by examining options for taking forward findings from this inquiry.

5.1 Overview of drivers for government intervention

In summary, the reasons for government intervention in waste and resource efficiency are twofold:

- Waste may be a form of inefficiency which can be attributed to market failure and other barriers discussed in section 4. Policies that promote resource efficiency and recycling can increase the productivity and competitiveness of Australian industry and promote a more efficient allocation of resources.
- The Australian community is generally committed to environmental protection and sustainable development. This is evident from behaviours reported in market research surveys, as well as participation in community activities and the political process at all levels of government. Waste reduction and resource efficiency are seen by the community as valuable ways to assist in achieving the goal of sustainable development.

5.2 Government intervention to achieve resource efficiency

5.2.1 Recommended approaches for government

Taylor et al. (2006, pp. 36–38) drew on work undertaken by the World Business Council for Sustainable Development (WBCSD 2000) and proposed a range of interventions for governments to improve resource efficiency. In summary, the WBCSD recognises that governments can implement policies that encourage economic growth and favour reduction of resource use and avoidance of pollution with incentives for eco-efficiency. Policy measures to leverage business initiatives for more eco-efficiency might include:

- *Identifying and eliminating perverse subsidies*: Where unsustainable practices are supported with subsidies, the subsidies should be reduced and eventually removed.
- *Internalising environmental costs*: In several economic sectors, considerable costs caused by environmental pollution are still not included in the price of goods and services. Until this is changed, the market will continue to send the wrong signals and polluters will have no incentive to change and adapt the performance of their products and processes. (This is an important issue that warrants addressing at the national level; the EPHC provides a vehicle for a collaborative effort by the Australian Government, states and territories).
- *Shifting tax from labour and profit to resource use and pollution*: Any tax shifts would need to be implemented in a predictable way, avoiding an increase in the overall tax burden (while identified by the WBCSD, it is noted that this measure would represent a major shift in the method of taxation in Australia, which would require wide consultation inside and outside government).

- *Developing and implementing economic instruments*: These might include emissions or pollution trading mechanisms as an incentive for companies to implement eco-efficiency measures.
- *Promoting voluntary initiatives and negotiated agreements*: Governments should negotiate agreements and support voluntary initiatives designed to promote sustainability in particular sectors or market areas.

The OECD has argued a broadly similar case for action by governments through the establishment of an additional layer of *strategic waste prevention*. This is described as 'a (government) policy concept that concretely situates waste prevention within a longer-term resource management and sustainable development perspective' (OECD 2000).

The elements of the OECD approach are:

1. *Integrated life cycle approach*: In government's case, this means integration horizontally across government (i.e. adopting a whole-of-government approach to the issues) and vertically with all levels (particularly important in a federal system such as Australia's where each of the three tiers of government has a role to play in developing and/or implementing policy). It means establishing implementation partnerships with stakeholder groups, and includes actions at appropriate stages in the life cycle of the materials' use and waste generation. (Such actions would include a focus on product design to avoid hazardous materials and other impediments to effective recycling or other forms of resource recovery at the end of the product life). There is also a need to ensure sufficient institutional funding and expertise to guarantee consistency and efficacy of program delivery and implementation.
2. *Leveraging stakeholder knowledge*: This emphasises the need to involve business and industry, public interest groups, academia, other agencies and levels of government.
3. *Policy and program assessment and review*: Given the long timeframes of some of the required changes, policies and programs need regular review so that they evolve with changes in waste generation drivers (population, affluence/consumption patterns, and technology).
4. *Developing and sharing practical experience*: In the OECD framework, this applies to working with other nations.

The OECD report also lists 24 instruments which may be used to influence waste prevention. These are grouped under regulatory, economic and suasive as shown below in Table 13.

Table 13: Instruments potentially influencing waste prevention
(Source: OECD 2000)

Regulatory	**Economic/ market-based**	**Suasive/ partnership**
• Extended producer responsibility via product take-back (may also qualify as suasive) • Liability assignment • Pollutant release and transfer registers (may also qualify as suasive) • Disposal ban • Virgin material depletion quota • Virgin material import ceilings • Facility standards/permits	• User fees • Subsidy removal • Raw material charge • Grants (R&D, infrastructure) • Deposit-refund • Landfill tax • Tax incentives • Advance treatment fee • Material exchanges	• Setting waste prevention targets • Greener public procurement guidelines • Design for environment • Technical assistance • Education and information provision • Public–private partnerships • Corporate environmental reporting (may also qualify as regulatory) • Eco-labelling • Environmental management systems

The choice of instruments to address a particular waste issue needs to be assessed in view of the overall government framework and the 'essential function' of each instrument. OECD suggests the following five assessment criteria:

- *Environmental effectiveness*: Components include health risk reduction, environmental impact, resource efficiency.
- *Economic efficiency*: Components include impact on prices, employment, competitiveness, growth, trade.
- *Innovative advancement*: 'Dynamic efficiency' of stimulating technological and managerial innovation enhances environmental and economic outcomes.
- *Political acceptability*: Components include public participation, transparency, social equity, conformity with existing agreements.
- *Ease of administration*: Components include policy integration, simplicity and flexibility of operation, compliance levels, costs (government and private).

5.2.2 Australian government responses

Given the complex mix of barriers and drivers discussed in section 5.1, Australian governments have used a number of approaches in seeking greater resource efficiency and increased rates of recycling. For example:

- market-based instruments and other forms of intervention (e.g. direct support to councils to improve recycling collection infrastructure) that act as incentives for particular activities

- information-based instruments that seek to change behaviour through the provision of information.

The mix of approaches has strongly favoured information-based instruments and, to a lesser extent, market-based interventions, with relatively few instances of direct application of regulatory instruments.

a) Regulatory and policy instruments

In recent years, Australian governments have encouraged the adoption of self-regulatory and co-regulatory policy instruments rather than command and control regulations for promoting resource recovery, resource efficiency and cleaner production. These include:

- voluntary/self regulatory instruments that mandate specific behaviour e.g. the newsprint industry waste reduction and sustainability agreements
- agreements negotiated between regulatory agencies and private sector enterprises or sectoral organisations and supported by government regulation e.g. the National Packaging Covenant (see section 5.4)
- reporting requirements such as the National Pollutant Inventory
- industry codes of practice (e.g. plastic shopping bags, Responsible Care).

b) Market-based instruments

These instruments seek to address the market failure of 'environmental externalities' by incorporating the external cost of resource use and waste disposal.

In general, externalities related to resource use are not included in prices. Indeed, as discussed in section 4, other factors can result in artificially low prices for resources, such as energy and water, which may contribute to these resources being overused. A rare example of direct government intervention to address externalities associated with the supply of virgin materials is the UK Government's establishment of a levy on virgin aggregate.

Landfill levies have been applied in a number of Australian jurisdictions in an attempt to internalise the cost of externalities associated with disposal. In general, it has not been possible to set levies at a sufficiently high level to achieve desired environmental goals (though arguably the Sydney–Newcastle–Wollongong levy may have an impact on marginal demand for landfill disposal). Even if levies were able to be set at sufficiently high levels to internalise externalities, the question would remain as to whether social welfare would be improved overall.

Levies are introduced for a range of reasons:

- to reduce demand (but as noted demand has a considerable degree of inelasticity, and most levies have been set too low to achieve this objective)
- to reduce the externality driven competitive advantage of landfill and enlarge the window of potential profitability of recycling (same qualification)
- to provide funds to directly support recycling, either in the short term via subsidies for major capital expenditure, or (unwisely) as ongoing subsidies
- to supplement a state's general revenue

- to help governments convince people they are taking waste and recycling issues seriously.

Economic arguments are often used to justify levies, but in practice tend to be the least important factor motivating the establishment and quantum of levies.

Other market interventions include government financial subsidies, in the form, for example, of:

- low-interest loans, or direct grants, which can target specific industries or sectors to stimulate greater resource efficiency and technological development
- grants to councils to improve recycling collection systems.

Such financial subsidies are often funded from landfill levies.

c) Information-based strategies

In addition to creating appropriate regulatory and financial frameworks for improved resource efficiency, governments have relied heavily on the use of information-based measures. These have generally sought to build capacity within industry, for example through the publication and dissemination of guidelines and relevant case studies.

Examples of government introduced information-based strategies include:

- promoting awareness of targeted, high profile demonstration projects, to demonstrate the techniques and cost-saving opportunities associated with materials efficiency
- encouraging educational institutions to incorporate preventative environmental management within their curricula, particularly within engineering and business courses
- requiring public disclosure of information on environmental performance by, for example, establishing a pollutant release and transfer register, stimulating greater voluntary corporate reporting, and requiring the provision of information on use of specific materials
- initiating and/or supporting measures to inform consumers, such as eco-labelling schemes and environmental product declarations
- promoting the adoption of training initiatives
- issuing high profile awards for enterprises that have achieved greater materials efficiency or cleaner production.

Examples include:

- the (former) Commonwealth EPA Cleaner Production Case Studies (1996), the EcoReDesign program (1994–1997) and Environment Australia's Eco-Efficiency Agreements (2001–2004)
- a range of Victorian programs including the Cleaner Production Loan and Grants Schemes (1988–1995), EcoRecycle Victoria's Partnership Program with the Australian Industry Group and the City of Geelong to assist small to medium businesses to undertake waste audits (2001–present) and EPA Victoria's Cleaner Production Demonstration Programs
- Queensland EPA's Signature Partnership Program, helping companies adopt new resource efficient practices (ongoing)

- NSW's Profiting from Cleaner Production Industry Partnership Program
- the South Australian Greener Business Alliance
- programs delivered in Western Australia through the Centre of Excellence in Cleaner Production.

Further information, outcomes and case studies from various Australian jurisdictions can be found in Taylor et al. 2006, Annex III.
Information-based approaches have been used in preference to direct regulation to require best practice, reflecting the fact that such regulation would be difficult to frame (except in generalities); tend to stifle innovation; be unlikely to generate least-cost solutions; and be impractical to enforce, particularly among the many thousands of small to medium enterprises.

Early Australian work on barriers and motivators for cleaner production (Gunningham et al. 1997) has had a major impact on policies and strategies for resource efficiency and waste reduction around Australia. It has justified a reliance on information dissemination strategies and voluntary agreements, through case studies, sector specific methods and tools, and eco-efficiency agreements, such as those reflected in the Australian National Cleaner Production Strategy (ANZECC 1998).

While there are numerous government- and industry-supported case studies which show that net economic benefits accrue from applying resource efficient practices and technologies (see for example EcoRecycle Victoria, 2006; Department of the Environment and Heritage, 2006; Environment Protection Authority (Vic), 1997; Gertsakis et al. 1997), such case studies have generally been limited in their catalytic effect, particularly where small and medium sized enterprises are concerned, with only limited uptake beyond the case study participants. Over time it has become increasingly evident from Australian programs that reliance on information dissemination strategies has limited potential to effect change in businesses' practices. This appears to be due to a number of inter-related reasons:

- *The generally low effectiveness of information strategies in changing individual and organisational behaviour:* This is also encountered in other areas such as kerbside recycling, household energy efficiency, public transport, road safety and health promotion.
- *The limited effectiveness of an appeal to environmental consciousness*: Information and education materials have typically focused on environmental and legal risks associated with poor environmental performance (e.g. the impact of leaching from waste dumps and the fines incurred for non-compliance). However, surveys repeatedly show that many business owners do not see their businesses as having a considerable impact on the environment, and therefore are not susceptible to environmental messages.
- *The dual role of government (in particular environmental agencies:*. Most programs have been sponsored and/or delivered by or on behalf of environmental agencies. Given that these agencies are primarily viewed as regulators, well-intended advice may not be accepted and acted upon by the regulated firms. There may therefore be value in industry and environment agencies working in partnership to reach such firms.
- *Competitive advantage*. Many firms are keen to retain the competitive advantage of lessons learned and are reticent about sharing this knowledge.

- *Slow rate of diffusion of innovation*. Management research shows that demonstrated best practices tend to spread slowly, even among divisions of the same firm (Paton 2001, cited in Taylor et al. 2006).

5.2.3 Opportunities for Australian governments

The inability of information strategies to achieve a step-change in the number of businesses pursuing resource efficiency initiatives, as well as in the depth and comprehensiveness of initiatives implemented by the forward-looking companies, is of concern, and there is no simple solution (van Berkel 2004a, cited in Taylor et al. 2006 p. 36).

Opportunities exist for Australian governments to investigate further the policy tools recommended by the WBCSD and the OECD. These tools include greater use of market-based instruments to better internalise costs of disposal and recycling in decision-making, and to provide incentives for companies to implement eco-efficiency measures; and more actively promoting voluntary initiatives and negotiated agreements such as product stewardship agreements.

Another promising opportunity is for governments to work with industry associations to build on an increasing trend for large firms to bring pressure to bear on their numerous suppliers to improve and verify their environmental performance (e.g. through ISO 14001 certification). Working in partnership with industry associations and potential mentors such as local chambers of commerce, local government and utility service providers, governments have an opportunity to greatly multiply the leverage of their programs in this area. At the national level, there may be opportunities for EPHC to pursue new measures based on this industry partnership model.

5.3 The need for improved data

As noted in the Productivity Commission's issues paper for this inquiry, good quality data assist sound policy development processes and enable industry to more effectively participate in markets for recoverables or otherwise manage waste. However, to justify the costs of its collection there must be a clear benefit from obtaining the data, whether it is at the national, state or local level, or related to market sectors or products. Moreover, the impact on individual businesses should be minimised.

The nature of policy or business decisions varies across these levels/sectors, and data should be relevant to those levels. For example, for local governments and their contractors waste management is a significant service business, so it is in the interests of both parties to have available a sufficient level of detail about waste and recyclables to allow them to effectively manage their performance.

This level of detail may not be necessary to support policy decision-making, but aggregating such data upwards can ensure higher level data are robust. However, Australia has traditionally struggled to generate adequate top level data because of a lack of consistency and cooperation across jurisdictions/local governments.

An overview of data requirements and the issue or barrier that generating sufficient data would address is provided in Table 14.

Table 14: Summary of data requirements

User	Purpose	Driver or barrier	Type of data
Australian Government	Compliance with State of the Environment, and OECD reporting requirements	Sustainable development policies International commitments e.g. UN and OECD reporting *Environment Protection and Biodiversity Conservation Act 1999* requirements (national State of the Environment reporting)	Total amounts of waste generated, landfilled and recycled
Australian, state and territory governments (EPHC)	Policy development and evaluation	Transparent and effective policy process for development and monitoring of national product stewardship programs and resource efficiency policy development	Production, importation, sale, consumption, disposal and life cycle environmental impacts (including production impacts) of certain products Material flows data for key sectors
State and territory governments	Regulatory systems	Reduction of externalities associated with landfill (states and territories)	Source and sector of product landfilled (where possible) Information on contamination of groundwater, litter escape
Local government	Planning for and managing waste and recycling contracts	Evaluating competing waste collection/management systems Limited information on and experience with risk issues associated with long-term waste management contracts Reducing contamination of collections	Full costs of alternative collection and management systems Contamination – types of contaminants and rates of contamination
Industry	Design of eco-efficient and environmentally improved *products*	Market failure – imperfect information	Life cycle environmental impacts of materials and processes, e.g. life cycle assessment data or material inputs per unit of service data
Individual companies	Design of eco-efficient and environmentally improved *processes*	Market failure – imperfect information	Full costs of waste generation and disposal Water, energy and materials used per unit of production

5.3.1 Data on waste

There is a demand for good quality and ongoing statistical data on waste. For manufacturing companies, such data can assist in the pursuit of financial and environmental benefits that flow from cleaner production and the application of eco-efficiency principles. For waste management companies, data on waste can help determine the potential for profit from involvement in various collection, recycling and disposal enterprises.

For DEH, one of the key needs for national data is to fulfil obligations for national State of the Environment and OECD reporting purposes and policy development and implementation. National data needs include:

- total waste generated including quantities of household, municipal and industrial waste)
- amount of waste landfilled against the level of total waste generated
- amount of material recycled against the level of total waste generated.

Reliable and comprehensive national data on these indicators are not available at present. Available information, used to compare Australia's performance on waste with other countries, is patchy because of lack of agreed indicators and collection mechanisms. Different jurisdictions collect different types of data on waste and products, and some collect no data at all. As discussed in section 2.3, OECD data indicate that Australia's per capita waste generation is 690 kilograms per year. This figure is frequently used by governments and non-government organisations as a driver to motivate industry, governments and communities to take more action on waste, but it is based on 'estimated data referring to the late 1990s' (OECD 2004a).

Accurate national data on waste and recycling would support more balanced, less reactive policy development. More recently, the ABS Waste Management Services survey 2002–2003 (ABS 2004b) has been used to collect volumetric information on waste to landfill, but figures are not available for all states and territories and no information was collected on recyclables. National waste data are probably most cost-effectively obtained through statistically designed surveys of identified businesses or disposal systems (e.g. landfill sites, recycling firms). It should be noted, however, that the collection of such information would have significant costs for both government and businesses.

5.3.2 Product flows and impacts – data for product stewardship

National data are needed to assess the merits of developing and then implementing product stewardship schemes. These data will need to be quite different from traditional waste management data: they will need to be product focused and include national data on the production or importation, sale, consumption, life expectancy and disposal of identified products. Accurate information about product flows could identify opportunities for resource recovery and the development of secondary markets. Information on the amount of certain consumer products (e.g. packaging) in the litter stream would help construct appropriate policy responses.

The lack of national data on the flow of products through the economy hinders the development and monitoring of product stewardship schemes. For example, the lack of accurate baseline data on packaging in Australia restricted the evaluation outcomes of the

first National Packaging Covenant (1999–2005), and proved to be a source of significant conflict during negotiations for the second covenant (2005–2010).

To resolve this issue, the current covenant requires signatories to provide information on the type and quantity of the packaging they use. This information will be verified through a survey (by the National Packaging Covenant Council) of packaging manufacturers, and review of Customs importation data. However, for the packaging that enters Australia on packaged goods (e.g. food, furniture, white goods), there remains a significant data gap which will need to be addressed in the ongoing monitoring and evaluation of the program.

There is also a lack of accessible and locally relevant data on the environmental impacts of specific products and materials. Product stewardship and resource efficiency programs have traditionally been designed to reduce waste and increase recycling, but these schemes are increasingly focused on reducing the life cycle environmental impacts of products. Appropriate information is required to support more effective policy development (e.g. identifying priorities) as well as design for environment (see also section 4.2.1a) within firms.

There are various tools available to support decision-making (e.g. life cycle assessment) but they require good quality data. Measures to address such data needs should be built into future product stewardship schemes, for example for tyres and TVs.
There is a need for a suitable methodology and baseline data for a national database on flows and impacts for identified products of concern. The database should include quantitative data on the production, importation, sale, life expectancy, disposal, reuse and recycling of such products. It should also include qualitative and quantitative information on life cycle environmental impacts where available, including impacts of resource extraction or harvesting, use of hazardous materials or processes, recyclability and impacts in landfill.

5.3.3 Inputs to production – data for resource efficiency

To pursue upstream resource efficiency objectives effectively, governments need data to identify the up-stream impacts and characteristics of production, including inputs of identified products or materials. Perhaps the greatest value of such data will flow to individual businesses, as the process of compiling and reporting data (e.g. on materials used or waste produced) often uncovers opportunities to save money. For example, monitoring levels of waste generated over time may indicate inefficiencies in the production process and options for using fewer raw materials and/or using different types of raw materials. Once these are recognised, companies have the opportunity to develop ways to reduce their waste (e.g. reusing waste onsite, or selling parts of their waste stream for other manufacturing processes and uses), or to use materials more effectively (Environment Australia, 1999).

Ideally, data collected by companies and governments would include time-series data on the water, energy and materials used per unit of production. By monitoring the inputs of key sectors over time, it would be possible to identify potential environmental impacts and to track the eco-efficiency of Australian industry. Care would need to be taken to secure only an appropriate level of data for national policy setting purposes to avoid unnecessary costs. The level of data collated by businesses should be largely dictated by business needs. Support may be needed in the form of guidelines and education to encourage companies to integrate data with existing business systems (e.g. accounting systems, environmental management systems and product development processes).

A multitude of tools and information sources on eco-efficiency is available, but these appear to be underutilised. This may, at least in part, be due to their strong reliance on the environmental or sustainability consciousness of the business. A national, one-stop-shop web portal may assist in increasing their use. However, a stronger focus on the business case, in terms of costs and risks, is required to raise industry demand for eco-efficiency information and training.

While the Australian Bureau of Statistics (ABS) has an outputs focus and does not generally collect information on the inputs to production, it may be possible to add requests for this information to existing ABS industry surveys in identified sectors. However, the collection of such data may have significant up-front costs for both industry and government and would need to be undertaken with clear objectives and an assessment of the costs and benefits involved.

5.3.4 Sector-wide data collection

The National Packaging Covenant succeeded during its first phase (1999–2005) in engaging some 600 firms across the packaging supply chain (see case study 2, section 5.4.2). Within its broader objectives of promoting product stewardship and improved security for kerbside recycling, the covenant also sought to encourage improved availability and reliability of data on quantities of packaging materials produced and entering the waste stream.

While reporting under phase one of the covenant has generated some data, it has been limited in scope and is of restricted value as an input to policy development and priority setting. The more extensive reporting arrangements under phase 2 of the covenant should lead to an improved understanding of specific materials and waste flows in the packaging supply chain (within the limitations discussed in section 5.3.2 above).

Similarly, reporting on waste under various public environment or sustainability reporting banners has been limited in extent and usefulness. Despite benefits of public reporting generally, companies (especially small companies) are not motivated to collect and publish the data. Data disclosure at the company level also raises competitive advantage issues.

DEH's experience is that companies are more willing to participate in data collection where they are assured that information will be aggregated and individual results not identifiable. Good examples of industry sector data programs exist (e.g. Publishers' National Environment Bureau, Plastics and Chemical Industries' Association, Australian Food and Grocery Council, see Appendix C) and these models could be used to guide the development of further data collection (targeting the flow of products and materials as well as inputs to production) for emerging product stewardship schemes.

Specifying reporting responsibilities under product stewardship or similar agreements could be a valuable way for governments and industry to promote the generation of national data sets, though in reality levels of participation and quality of data will always be variable. Some of these opportunities include:

- facilitating the collation of suitable level data for key products or materials
- verifying government-generated data
- monitoring the flow of key products through the economy i.e. products of concern to governments, industry and the community, and/or products with clearly identified externalities not yet accounted for.

Working through industry associations can increase the likelihood of securing the desired level of participation by individual companies. Of course, every effort should be made to ensure reporting requirements are as clear and simple as possible to minimise the cost to businesses and governments.

Australian Government agencies, such as Australian Bureau of Statistics, Customs, the Australian Taxation Office and the agencies who intend to use the data, need to be involved in design of data collection regimes.

5.3.5 Material flows analysis

Another area for potential national data collection relates to material efficiency and, in particular, to assessing the flow of certain materials through the economy. Both the United Nations and the OECD support and promote material flows accounting as a high-level indicator of environmental pressure.

Material flows shows the movement of materials through the economy, recording the total mass of natural resources and products that are used by the economy, either directly in the production and distribution of products and services, or indirectly through the movement of materials which are displaced in order for production to take place. A material flows account balances the inputs (extraction of natural resources from the Australian environment and imports of goods) with the outputs (wastes, emissions to air and water, exports) as well as net additions to stock and accumulation (in terms of new buildings etc.) within the economy.

The direct inputs of materials into the economy derive primarily from domestic extraction i.e. from biomass (agricultural harvest, timber, fish and animal grazing), fossil fuel extraction (such as coal, crude oil and natural gas) and mineral extraction (metal ores, industrial minerals such as pottery clay, and construction material such as crushed rock, sand and gravel). The direct input of materials from domestic sources is supplemented by imports of products, which may be raw materials such as unprocessed agricultural products, semi-manufactured or finished products.

As discussed in section 2.2, comparing total material flows shows how global, regional and local impacts from production occur in, and are attributed to, exporting countries (e.g. Australia), even though the uses and demands for these materials occur in overseas markets (Newton 2001). However, the usefulness of total material flows is limited for domestic policy purposes, and information about lower level substance or sector specific material flows would be more valuable in helping to understand the flow of key materials through the economy.

5.3.6 Data collection methods

Data collections for waste policy, product stewardship and resource efficiency purposes should ideally relate to key performance indicators consistent with those used internationally. The OECD is currently developing key performance indicators for waste management that could be used to compare Australia's performance in relation to other OECD countries. However, given the unique circumstances that exist in Australia (large continent, small population concentrated in cities, industrialised economy, need for long distance transport), such indicators will need to be applied and interpreted with care. It may therefore be

valuable for Australia to use additional indicators which reflect the nation's particular circumstances and policy needs.

5.4 Product stewardship

Product stewardship is one framework through which government, industry and other stakeholders can address the environmental impacts of identified products. It recognises shared responsibility for the environmental impacts of a product throughout its full life cycle or value chain. Product stewardship seeks to reduce adverse impacts and internalise unavoidable costs within the product price through action at the point(s) in the value chain (or product life cycle) where this can be most effectively and efficiently achieved (EPHC 2004a).

There are recognised inefficient environmental, social and economic outcomes that occur throughout the life cycle of a product, including at the design, production, use and disposal stages.

In an effort to reduce these inefficiencies many industry groups, governments and individuals are seeking to improve the management of products over their life cycle to correct these distortions and remove failures. In Australia, several industry sectors including newsprint, mobile phones, retailers who issue plastic bags, and PVC (or vinyl) have developed voluntary product stewardship schemes. Governments are also working with industries (including packaging and tyres) under co-regulatory models to deliver better environmental outcomes through product stewardship (see case studies 2 and 3 in section 5.2.4). Regulatory product stewardship schemes exist for oil and hydrochloroflurocarbons and synthetic greenhouse gases.

DEH considers that the principles of product stewardship (which make it clear that a manufacturer's responsibilities extend beyond the factory gate) provide a solid basis from which to address the environmental impacts of identified products. In contrast to extended producer responsibility (EPR), which generally places responsibility wholly, or largely, on producers (brand owners and importers), product stewardship emphasises the need for shared responsibility among producers, consumers and governments, aiming to determine the most appropriate distribution of responsibilities along the value chain.

Product stewardship is widely accepted internationally, and is the preferred approach in the United States and Canada, though there is a strong push for mandated EPR schemes in Europe and some Asian countries (e.g. Japan). Under Australian product stewardship schemes, manufacturers and importers are subject to the same requirements, consistent with our World Trade Organization obligations.

Although some jurisdictions advocate state-based EPR or product stewardship schemes for certain products there is strong support, from both industry and governments, for nationally consistent product stewardship schemes. National schemes avoid the inefficiencies and significant costs to industry of potentially inconsistent state-based schemes, and provide clear uniform standards for all market participants. National schemes also support the development of national markets for recovered resources – an important issue where economies of scale and long transport distances between major population centres are key.

By way of illustration, there would be significant inefficiencies in the introduction different approaches in each jurisdiction to the management of packaging (including beverage

containers). In contrast, the National Packaging Covenant provides national consistency and reduces potential regulatory burden for business that would come with multiple schemes. The diverse range of suggested approaches to manage light-weight plastic carry bags is another example of potential inefficiencies. If implemented, these different approaches (including bans, levies, advance disposal fees, substitution with degradable bags) would impact on individual businesses and distort nation markets. The potential impacts of diverse schemes emphasises the importance of strong Australian Government leadership in the development and implementation of nationally consistent approaches.

Product stewardship schemes provide the opportunity to examine all phases of a product's life cycle and to take primary action where it is most needed and in the most effective and efficient manner. In Australia, most product stewardship schemes focus on market failures associated with the disposal of specific products by removing barriers and making recycling more practicable and profitable. Product stewardship can also stimulate improved product design and improved water, energy and materials efficiency in the manufacture of products. Given that Australia imports a significant proportion of its finished goods, however, policy objectives for manufactured goods such as electrical products are more likely to be achieved where similar schemes (either product stewardship or EPR) for the same products exist overseas.

Various voluntary, co-regulatory or regulatory product stewardship schemes are used nationally (Table 15). The approach taken depends on a number of factors, including the environmental impact of the product and the nature of the industry. In pursuing and adopting any product stewardship scheme, consideration is given to the requirement of the Council of Australian Governments (COAG) to apply sound policy development processes. This includes clearly establishing the scope of the problem to be addressed, assessing the costs and benefits of various options for addressing the problem, and fully engaging all potentially affected stakeholders. The regulatory impact statement process provides the mechanism to achieve this.

Table 15: Examples of Australian product stewardship programs
(Details in Appendix D)

Type of program	**Products covered by programs**	**Programs under development**
Voluntary	PVC, agricultural and veterinary chemicals and chemical containers, plastic bags, newspapers, mobile phones	Consumer batteries and restriction of hazardous substances in electronic goods – Restriction of Hazardous Substances
Co-regulatory	National Packaging Covenant covers all domestic packaging e.g. plastics, paper, cardboard, aluminium and steel cans.	Computers, televisions, tyres
Regulatory	*Product Stewardship (Oil) Act 2000* covers oil, the *Ozone Protection and synthetic Greenhouse Gas Management Act 1989* covers ozone depleting substances and synthetic greenhouse gases including those contained in refrigeration and air-conditioning equipment	

5.4.1 Voluntary product stewardship

Voluntary product stewardship schemes (see Appendix D) may be developed with government assistance, advice and involvement, or they may be driven and managed solely by industry. Voluntary schemes tend to succeed where the industry has few players, is well-organised and can respond in a direct way to community concerns. Industry ownership ensures cost-effectiveness, national consistency and shared responsibility for a product amongst those participating in its life cycle. For example, the 15 years of voluntary agreements between Australia's sole newsprint manufacturer, newspaper and magazine publishers and Australian governments (through the Australian and New Zealand Environment and Conservation Council (ANZECC) and then EPHC) has resulted in a newspaper recycling rate of 74 per cent – the best in the world.

Where voluntary agreements are ineffective, governments can work with the industry concerned to improve outcomes. For example, EPHC commenced negotiations with the Australian Mobile Telecommunications Association (AMTA) after its voluntary recycling program, despite the best of intentions, recovered only a small number of mobile phones. In response, AMTA launched a strengthened MobileMuster scheme in January 2006.

5.4.2 Co-regulatory product stewardship

Co-regulation is an approach involving some form of government regulatory action in support of specific industry product stewardship schemes. The approach is more flexible than direct regulation and allows scope for industry innovation in addressing environmental issues. Importantly, it ensures that firms who 'do the right thing' are not penalised or disadvantaged in the market-place.

EPHC's national framework for co-regulation (currently under development) provides threshold criteria to determine whether a product stewardship proposal from a specific industry sector is suited to co-regulation. The response to the discussion paper released by EPCH in December 2004 shows that the framework is largely supported by Australian industry, as it provides the basis for a clear, nationally consistent approach, and clear and underpinning enforcement from governments (EPHC, 2004b). While there are circumstances in which governments may initiate negotiations (e.g. where there is strong community pressure to improve the environmental performance of particular products), the initiative for a new scheme would usually come from industry. For example, the tyre and computer industries both approached governments with proposals to develop new co-regulatory schemes. Another potential candidate for a co-regulatory scheme is PVC, as the Vinyls Council is concerned that companies involved in its voluntary product stewardship commitment may face commercial disadvantage in the marketplace.

Co-regulatory product stewardship schemes can be both efficient and innovative, but developing the detail of schemes and the underpinning regulation places significant demands on the resources of both industry and government. Schemes can take years to negotiate and implement. During this time, existing regulations and community expectations may change. Negotiations in Australia with the TV and tyre industries started in 1999 and are only now reaching agreement on the scope of their respective product stewardship schemes.

Also, effective co-regulation can be hampered by the capacity of jurisdictions to implement and enforce free rider regulations. It has become apparent, through the development of the (generic) product stewardship National Environment Protection Measure (NEPM), that jurisdictions do not yet have in place an adequate or constitutionally robust statutory

framework to ensure free riders are subject to at least equivalent requirements to those who join the voluntary component of a co-regulatory agreement. Jurisdictions vary in their capacity to enforce requirements such as end-of-life product take-back.

Resourcing concerns can be addressed through cost recovery mechanisms. Restricted competition may be an unintentional outcome from product stewardship agreements. The Australian Competition and Consumer Commission has a role in monitoring and advising on the potential competition impacts of product stewardship agreements. If an agreement is purely voluntary, there should be no problem. If it is part of a co-regulatory agreement, the regulatory requirements are no different from any other regulation and would be subject to cost/benefit analysis and a regulatory impact statement. The fact that the product stewardship agreement provides flexibility (within a co-regulatory framework) means that it is less likely to act as a barrier to entry than would a straight regulatory approach.

Case study 2: National Packaging Covenant

The National Packaging Covenant is the only co-regulatory product stewardship scheme currently in operation across Australia. It is an agreement between industry and government to minimise the environmental impacts of consumer packaging waste and to develop economically viable and sustainable recycling collection systems. The covenant is supported by framework legislation, the National Environment Protection (Used Packaging Materials) Measure (NEPM), which applies to brand owners who choose not to participate.

As occurs with many product stewardship schemes (voluntary, co-regulatory, mandatory), assessment of the first National Packaging Covenant (1999–2005) was hindered by the lack of data on the production, consumption, recycling and disposal levels of packaging. Although individual signatories were required to report against key performance indicators, these were relevant to the signatory's actions, rather than universal indicators which all signatories reported against. As a result, quantitative measurement of the covenant's achievements could not be undertaken. Also, during this period, there were few or no national data available on the amount of packaging consumed, recycled and disposed of to landfill. The issue of collating appropriate data is an important consideration for other product stewardship schemes.

Despite these limitations, the 2004 evaluation of the National Packaging Covenant found sufficient evidence in the signatories' annual reports that the covenant had led to improvements in recycling and a reduction in the environmental impacts of packaging. The following case studies illustrate these improvements:

- A manufacturer of plastic film packaging has developed a thinner packaging film that uses 18% less materials. This reduced the amount of material used, reduced the energy used to produce the film (and associated greenhouse emissions) and therefore reduced the amount of waste going to landfill.
- A large warehouse operation (one site) that previously used over 5000 cardboard boxes per week, replaced these with a fully reusable plastic bin system to save 1.35 million cardboard boxes per year. The system was being rolled out to the other 72 warehouses with an estimated saving of up to 10 million cardboard boxes per year.
- A large food manufacturer that redesigned its packaging to improve the way it uses cartons has reduced the numbers of cartons used by 20% each year, the number of pallets by 4500, and the number of truck trips by 100 – a significant reduction in transport, energy and associated greenhouse costs.
- A major retailer working with one of Australia's largest chicken suppliers – both covenant signatories - have changed how they package fresh whole birds. Birds are now bagged in a shrink bag, eliminating the need for a plastic tray. This removes over three million plastic trays from the waste stream each year.
- A major food packaging manufacturer reused 1000 tonnes of paper fibre in a manufacturing process and diverted that waste from landfill. This saved 200 tonnes of raw materials, and avoided using 800 000 litres per annum of fresh water in its manufacturing process.
- Another company, a well-known household name, increased the recycled content in the manufacture of garbage bags by 12%. The company also reduced its waste to landfill from 442 tonnes to 60 tonnes per annum.

In addition to these significant environmental savings, each of these companies would have secured significant financial savings as a result of reduced fuel bills, energy bills, landfilling charges, and other efficiency spin offs. For example, avoiding landfill costs of $40 per tonne would secure a company $40 000 if it avoided landfilling 1000 tonnes of waste. Magnify these benefits over the value chain and they start to mount up.

In July 2005 a strengthened and revised covenant and NEPM were introduced, including a national overarching recycling 'aspirational' target of 60–65 per cent (from a baseline of 48 per cent), and more rigorous performance indicators and reporting. These data, together with an annual audit of packaging material consumption and recycling to be undertaken by the National Packaging Covenant Council, should provide a robust basis for governments to measure the success of these co-regulatory arrangements for packaging.

Case study 3: Tyres

Some 18 million automotive tyres are discarded each year in Australia, many inappropriately.

Tyres create problems both in landfills and, when disposed of inappropriately, in the broader environment. Unless tyres are shredded, landfilling can create management difficulties as whole tyres can 'float' to the surface. Inappropriate disposal of used tyres into the broader environment creates public health and environmental hazards as they provide breeding sites for mosquitoes and dumped tyres have ignited, causing fire hazards and releasing toxic gases into the atmosphere. Recycling options are available: for example after chipping and crumbing, tyre derived materials can be made into products including adhesives, roads and soft-falls in playgrounds and sporting arenas. In addition, the energy embodied in tyres can be (and is presently being) recovered by using tyres as a fuel in cement manufacturing. Despite these opportunities, the cost barriers that currently exist in what is an immature market (high transport and collection costs and lack of infrastructure) mean that tyres in Australia are largely still disposed to landfill.

Product stewardship provides an ideal mechanism to develop a market-based solution to this problem. Tyre manufacturers and importers are working in an open and cooperative manner with each other and other industry stakeholders and governments to develop a national scheme to manage tyres at the end of their life. The objective of this scheme (still being developed) is to encourage the further development of secondary markets to maximise the recovery of the value in used tyres. This will in turn address end-of-life externalities associated with tyres.

If agreed, the proposed intervention in the market would be for a limited period (e.g. a maximum of 10 years). A small, voluntary disposal fee paid in advance would be applied to scheme participants and funds raised would be used to facilitate the collection and recovery of used tyres by providing a benefit payment to the recycler. To ensure that participants do not suffer a financial disadvantage in the market-place, governments are being asked to introduce national free rider legislation (co-regulation). As most of Australia's tyres are imported, the Australian Government will have a crucial role in helping to develop and implement these product stewardship arrangements. Customs, DEH and the states will need to work together to monitor the movement of tyres into the country and identify which companies are importing the tyres. This information can then be matched against those companies that are members of the industry product stewardship scheme and 'free riders' identified.

In summary, this proposed scheme has been developed following a systematic policy development process. If it proceeds, the scheme would target identified market failures and intervene in the market for a limited time to accelerate the development of suitable infrastructure and secondary markets. In doing so, it would ameliorate end of life externalities: public health risks, environmental risks and operational problems presented to landfill managers.

5.4.3 Product stewardship with regulatory support for financial mechanisms

The third approach to product stewardship is a fully regulatory approach, in operation at the national level for oil and ozone depleting substances. While the scope of the Productivity Commission inquiry excludes liquid and gaseous wastes, waste oil and ozone depleting substances can be disposed to landfill, with serious environmental impacts. Some experiences from the development and implementation of programs for oil and ozone depleting substances could be applied to the management of solid wastes.

a) Product Stewardship for Oil Programme

The Product Stewardship for Oil (PSO) Programme which consists of the *Product Stewardship (Oil) Act 2000* and the transitional assistance program ($34.5 million from 2001–2007) began in January 2001 and is managed by DEH.

The oil manufacturing and recycling industry is a diverse sector, with a wide range of stakeholders ranging from multi-national oil producers through different sized domestic recyclers to small 'backyard' family concerns. Prior to the introduction of the PSO Programme, recyclers reported tight margins and low levels of profitability. This, combined with the fragmented nature of recycled oil markets and reported consumer reluctance to purchasing re-refined lubricant for use in engines, acted as a significant barrier to increasing the capture rate of the 100–150 million litres of Australian used oil that was neither collected nor recycled. Without intervention, expansion of Australia's capacity to recycle and reuse oil was expected to occur very slowly at best.

The issues outlined above influenced the move to a mandatory approach for waste oil. Regulatory and non-regulatory options were considered, including national industry codes of practice, national agreements with industry participants, a co-regulatory agreement, command and control legislation, a tradeable certificate system, and a levy system on lubricant sales (Minister for the Environment and Heritage 2000).

The option selected for the PSO Programme employs a levy and benefits system. While there is no direct connection between the levy and the benefits, the payment of the levy ensures that some of the costs of used oil recycling are borne by the markets that gain the benefit from the production and use of that oil, rather than coming from public monies or other markets. The transitional assistance funding has been used over six years to cover the operating costs of the PSO Programme, including the relevant running costs of DEH, the Australian Taxation Office and the Oil Stewardship Advisory Council. The transitional funding has also been used to establish a nationwide network of used oil collection facilities at local government sites throughout Australia; run a PSO Programme public awareness campaign to encourage individuals and industry to dispose of used oil in an environmentally responsible manner; and support the establishment of an oil re-refining industry. An evaluation of the PSO Programme concluded that it had been effective in encouraging the collection of used oil and its recycling and reuse, but that it fell short of what could be called a complete product stewardship arrangement because the major oil companies have not become seriously engaged in the process (ACG, 2004a). The same study considered that there was 'a need to further explore the potential for oil companies to enhance the PSO Programme's effectiveness' and made a formal recommendation to that effect.

b) Product stewardship for ozone depleting substances

Product stewardship requirements are mandatory for all importers of hydrochlorofluorocarbons (HCFCs) and synthetic greenhouse gases (SGGs) in Australia. Under the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* all importers of HCFCs and SGGs must participate in a scheme to provide for the appropriate disposal of these substances at end of life. While regulations specify that importers may nominate how they will meet the product stewardship licence condition, to date all have elected to meet their product stewardship responsibility by joining Refrigerant Reclaim Australia (RRA).

RRA resources the product stewardship scheme through a $1 per kilogram contribution which funds the receiving, managing and recycling or destroying of collected refrigerant from across Australia. The system provides a financial incentive for technicians to recover, rather than vent, these chemicals. The scheme is a cost-effective means for minimising avoidable emissions of HCFCs and hydrofluorocarbons (HFC) from refrigeration and air-conditioning equipment.

Initially, a voluntary industry scheme was introduced which applied only to bulk importers of HCFC (eight licensees in total). However, in order to further reduce the quantity of ozone depleting substances vented into the atmosphere, the product stewardship requirements were extended in 2005 to all importers of refrigeration and air-conditioning equipment containing either HCFC or HFC refrigerant. The scheme now involves some 600 licensees, from very small importers to the refrigeration, air-conditioning and automotive sectors. Without a collective industry association to cover the diverse range of participants, a regulatory model was selected as the most appropriate mechanism.

In addition to the refrigeration and air-conditioning industry, ozone depleting substances and SGGs are also used to produce foams, aerosols and solvents. Continued work on actions to minimise avoidable emission of ozone depleting substances and SGGs from these industries may also lead to further product stewardship arrangements.

Compared to voluntary or co-regulatory approaches, benefits of a regulatory product stewardship program include the ability to directly and quickly embrace a large number of diverse industry players in the market. For example, negotiations for the PSO Programme were driven by government, and implementation did not have to wait for consensus, as is the case with voluntary or co-regulatory agreements which are often crafted to meet the needs of the least willing participants. Both the ozone and oil product stewardship schemes also generate reliable data on production levels and recovery rates.

The regulatory nature of both schemes means, however, that there is some inflexibility, and necessary operational changes take some time to execute through legislative amendments. For example, the application of the waste oil levy initially applied to all oil uses, including those where the oil could not be recycled. This disadvantaged the paint and chemicals industry and it took some time before the legislation could be modified to exempt certain uses of oil from the levy. The degree of inflexibility of regulatory schemes depends on the specific implementation mechanism, however. For example, the ‘licence condition’ mechanism of the ozone product stewardship scheme enables industry to retain some control over the product stewardship arrangements, and provides importers with an opportunity to ‘opt out’ by importing equipment that does not contain HCFCs or SGGs.

The regulatory nature of the schemes also limits their evolution, and opportunities for action on issues, such as minimising upstream environmental impacts, are not available.

5.4.4 Possible further role for product stewardship to correct downstream market failures

There are additional areas where product stewardship could be explored as one way of addressing particular market failures, such as those caused through the disposal in household waste of hazardous products or products that have a hazardous impact on recycling or waste management systems. Two case studies are presented below – about disposal of lead acid batteries and gas cylinders – to illustrate the need for a mechanism (possibly product stewardship) to create a more productive and efficient market-place.

Case study 4: Lead acid batteries

Lead acid batteries are used in cars, trucks and motorcycles. Approximately 95 per cent are already recycled at end of life, with most others being disposed of in domestic waste. The batteries contain lead, lead compounds and acid, and for this reason are justifiably classified as hazardous waste. Lead compounds are highly toxic to humans, plants and other animals if ingested or inhaled.

In landfill, there is a potential long-term risk associated with both the acid and lead if they leach into groundwater. A more immediate problem has emerged at the new integrated waste management facility in Sydney (operated by Global Renewables at Eastern Creek), which extracts recyclable materials before processing the residual material to produce energy and compost.

The Sydney facility receives an average of 80 lead acid batteries from the domestic waste stream each day, and around 50 per cent of these are already crushed before they arrive. This means that the wastes have already been contaminated, with both lead and acid released by the batteries. The Australian Compost Standard places strict limits on the amount of heavy metals permitted in compost as a very small number of lead acid batteries will compromise the quality of the compost (Warnken ISE, 2005).

An international Green Lead™ program already exists for lead which includes a chain of custody and certification scheme initially focused on batteries (see: http://www.greenlead.com/). Clearly, some additional work could be undertaken as part of a domestic program to further enhance the recovery of lead acid batteries to improve their recovery at the end of life and keep the remaining batteries out of the waste stream.

Such a program would need to involve organisations such as battery manufacturers and importers, battery retailers, the automotive industry, local and state government, waste contractors, transfer station and recycling centre operators, battery recyclers and operators of resource recovery facilities such as the one at Eastern Creek.

Sometimes we see immediate consequences of products being disposed of inappropriately. Gas cylinders can, while very safe to use under normal conditions, become explosive devices when introduced into waste management or metals recycling systems.

As part of any approach to managing the life cycle impacts of products, the first step for both lead acid batteries and gas cylinders would be to establish the scope of the problem and actions currently under way to address those problems. The mechanism of product stewardship can assist in bringing together the key stakeholders along the product supply

chain. Building on this knowledge, the stakeholders can then work together to put in place a cost-effective response to the identified problem, whether that be by strengthening current voluntary schemes or possibly introducing co-regulatory schemes. Again, the mechanism of product stewardship may be able to assist in correcting what appear to be market failures.

These two case studies illustrate how product stewardship may be able to contribute to improving social welfare and specifically to reducing impacts on companies operating in the market-place and reducing the impacts on people and the environment.

Case study 5: Gas cylinders

Gas cylinders used for barbeques, camping stoves and other domestic appliances contain valuable materials that can be recovered.

Gas cylinders can be refilled, but after passing their use-by date need to be refurbished (if possible) or recycled. Some companies in Australia have established programs to refurbish and refill larger cylinders (see http://www.swapngo.com.au/index.htm) but not the smaller cylinders. However, the recovery of such products is undertaken in a very haphazard way across Australia.

Most transfer stations do accept gas cylinders. The problem is that these cylinders may inadvertently find their way into the recovered metal stream and be sent to metal recyclers. In a metal recycling facility such cylinders can explode in the shredder causing physical damage and resulting in shut-down times. Such incidents can also erode the trust of local communities and local governments adding significant costs and making it more difficult for such facilities to operate. Gas cylinders can also cause problems when they are disposed of with general rubbish and compacted in garbage trucks or in landfill (where they may also explode). Both in recycling facilities and at landfills, gas cylinders can pose a significant occupational health and safety risk to workers and impose a financial cost on recyclers.

Like lead acid batteries, one possible solution is to ensure that the cylinders are removed from the waste stream and handled safely through a separate recovery program. One option might be for the current voluntary programs to be extended into a national program. A national product stewardship program could be established to address the problem in conjunction with gas brand-owners, retailers, metal recyclers, gas cylinder recyclers and local government.

5.4.5 Conclusions

Co-regulation seems to provide the most effective and flexible approach to product stewardship. Voluntary arrangements, while appropriate for industries where there are a few well identified players, will not deal adequately with the issue of free riders, which is a growing issue for many sectors that are trying to improve environmental performance. Finally, ‘black letter’ regulatory approaches lack the flexibility to effectively engage all participants and respond to changes in technology and the market-place.

5.5 Role of the Environment Protection and Heritage Council (EPHC)

The EPHC brings together Ministers from all Australian jurisdictions and New Zealand whose responsibilities include the management of all types of waste. The Australian leaders also form a statutory body (NEPC – the National Environment Protection Council) which has the power to establish legislative instruments (national environment protection measures) that apply nationally.

NEPC and EPHC are uniquely placed to take a long-term, national view of issues associated with resource efficiency and waste management; determine where coordinated national action is needed; agree on consistent national approaches and apply the resources necessary to implement these.

NEPC is established under the *National Environment Protection Council Act 1994*, (the *NEPC Act*), the objective of which is to ensure that people enjoy the benefit of equivalent protection from pollution wherever they live in Australia, and the decisions of the business community are not distorted, and markets are not fragmented by variations between participating jurisdictions in relation to the adoption or implementation of environment protection measures (clause 3 of the *NEPC Act).*

In establishing NEPC, the Commonwealth and the states acknowledged that there are benefits to the people of Australia in establishing national environment protection standards, guidelines, goals and associated protocols (schedule 4 to the *NEPC Act*). It is through the *NEPC Act* that regulatory instruments to support waste, resource efficiency and product stewardship can be developed at the national level.

While some waste issues are local or regional, with limited relevance to a national ministerial council, other issues (e.g. management of some types of hazardous waste) are chiefly of concern to the larger, more industrialised jurisdictions. In these cases smaller jurisdictions have been reluctant to contribute time and effort to the development of a harmonised national approach for these products or materials. In this context, one of EPHC's key achievements, since its establishment by COAG in 2001, has been agreement on a set of 'filter criteria' (Appendix E) which it employs to identify issues relating to waste management that can benefit from a coordinated national policy approach.

Filter criteria which help to inform decisions on waste issues include:

- the nature and severity of the risk to the environment (including the risk to human health)
- the significance of any resource efficiency concerns
- whether the issue is national in character, and the availability of effective policy instruments to address the issue
- the level of government at which such instruments can best be applied.

Application of the filter criteria has enabled EPHC to develop an agenda on resource efficiency and waste management issues which reflects areas of common concern. EPHC has established, under the auspices of its standing committee of senior officials, a working group on waste to provide advice on particular waste issues.

These measures have improved EPHC's ability to identify truly national resource efficiency and waste management issues. However, application of the filter criteria does not give a clear basis for ministers to establish priorities within those matters identified as being of national significance. An extension of the criteria-based approach to clarify specific priorities would help, particularly given the limitations of jurisdictions' capacity to devote resources to such work.

EPHC's agenda has (in line with the 'precautionary principle') given considerable weight to improving the management of particular products, materials or waste streams that have the potential to harm the environment (for example when disposed to landfill), or to compromise the recycling or reuse of materials reclaimed from the waste stream. In doing this, EPHC has also been concerned not only to protect the environment, but also to realise the potential to recover materials and embedded resources (energy and water) from the waste stream.

Many case studies from a broad range of Australian industries demonstrate that significant improvements in profitability can be made from the introduction of resource efficient practices and production technologies. Most case studies come from eco-efficiency or cleaner production programs which aim to correct the market failure of poor or incomplete information and inadequate management tools within businesses. In most cases, the time taken to achieve a return on the necessary investment is short.

Through the development of a product stewardship NEPM, ministers are now working to engage industry sectors/groups in co-regulatory arrangements which encourage innovative voluntary arrangements to reduce environmental impacts and promote resource efficiency, such as the National Packaging Covenant. Such arrangements will be underpinned by harmonised national regulatory approaches ('safety nets') which ensure that those who choose to remain outside the voluntary industry arrangement meet product stewardship obligations that are comparable to those who participate.

In October 2003, EPHC ministers noted the need to move up the supply chain and look at wastes from a broader perspective – in other words, to adopt a whole-of-life-cycle approach – when considering priorities, policies and action. This opened up a range of possibilities to consider the resource efficiency and environmental impacts of parts of the product life cycle that have not generally been the focus of attention i.e. the consumption, design, and resource input stages.

6. Conclusions and recommendations

The Productivity Commission's inquiry provides an opportunity to chart future directions for waste and resource efficiency policy in Australia.

As discussed in detail in the previous sections, the focus of Australian waste policy has evolved from managing the environmental impacts of waste disposal to embracing a more holistic, life cycle approach. The seeds of this change were sown at least a decade ago.

While waste management remains primarily the responsibility of state, territory and local governments, the role of the Australian Government in waste management has developed in recent years. Today, DEH actively participates in national waste policy development, with a particular focus on developing a unified national approach on key issues, avoiding a situation where inconsistent state-based policies and actions would otherwise adversely affect national markets, and providing resources to develop and implement national legislative measures.

During the 1990s, regulators and others realised that the more egregious effects of poor waste management practices were being progressively dealt with via command and control strategies. At the same time, they recognised that greater efficiencies could be achieved by identifying and addressing a wider group of externalities and associated market failures in addition to those associated with poorly managed, polluting landfills, for example through targeting waste reduction and recycling.

These externalities and market failures, which have been extensively discussed in the body of this submission, are less amenable to traditional regulatory control. Rather, in recent years they have been more effectively addressed through an innovative mix of policy approaches, often driven at the national level, and implemented by governments and industry. In parallel, efforts to improve all aspects of waste disposal (particularly landfill) have continued, but the policy focus has evolved to encompass a whole-of-life-cycle view of resources and wastes, with priority being given to correcting the more difficult-to-fix market failures, and targeting the phases of the product life cycle where the most cost-effective gains can be made.

Australia is well placed to continue down this path. We employ a judicious mix of education and well-targeted government intervention to foster efficient recycling industries based on robust markets. Such interventions have taken the form of education campaigns targeting householders; landfill disposal levies; and short-term financial incentives (but not ongoing subsidies) to encourage best practice. Our agreed national product stewardship schemes for key products and recovered resources avoid market distortions across state boundaries. The result has been recycling rates for household packaging material and newsprint that rival, or in some cases exceed, those achieved anywhere in the world. Furthermore, Australia has achieved these outcomes without recourse to the complex regulatory regimes which have been implemented by the European Union at considerable cost to industry, governments and consumers.

Given this experience, Australian governments need to ensure that efforts to achieve improvements in waste management and resource efficiency at all stages of the product life cycle continue to apply an appropriate mix of policy tools, which focus on desired outcomes while ensuring flexibility and promoting innovation.

Taking a life cycle approach, waste policy should seek to reduce adverse impacts and internalise unavoidable costs within the product price through action at the point in the product life cycle or value chain where this can be most effectively and efficiently achieved. A challenge for governments is to gain the maximum benefits to social welfare through improvements to resource efficiency at the production stage (through design for environment, cleaner production and environmental accounting) and the consumption stage (through well targeted product labelling and consumer education about sustainable purchasing), as well as continuously improving waste disposal (e.g. landfill) practices.

An important point to note is that waste policy should not aim to pursue waste reduction or recycling for its own sake, but rather to maximise social welfare by:

- reducing the environmental impacts associated with the manufacture, consumption and disposal of products

- achieving more efficient (and therefore more sustainable) use of Australia's renewable and non-renewable resources.

Well-designed action in pursuit of these objectives can deliver economic benefits to individual industry players, as well as the Australian community. Governments need to continue to work closely with industry and the community to address the causes as well as the impacts of waste, for example by:

- improving the *design* of *products* which are unnecessarily heavy, complex or difficult to recycle

- *improving production processes* which do not operate at optimal efficiency and, as a result, generate unnecessary wastes or are unnecessarily resource intensive

- responding to and influencing *changing patterns of consumption* which play a part in driving the volume and character of waste streams.

In Australia, product stewardship schemes have provided an effective mechanism to bring industry and government players together to identify and correct market failures (including externalities) for a wide variety of products and materials in a cost-effective way. The product stewardship approach allows governments to leverage knowledge and effort from the different stakeholder groups. A co-regulatory model for product stewardship schemes is being pursued by government and industry because purely voluntary schemes fail to address the problem of 'free riders', i.e. players enjoying a competitive advantage because they do not participate in the voluntary waste reduction/recycling program. Under a co-regulatory approach those who choose not to participate in an approved voluntary scheme are subject to direct regulation to ensure they deliver the same level of environmental performance.

Along with an overarching legislative co-regulatory framework for product stewardship, nationally agreed product-specific schemes are being developed for a range of consumer products (e.g. tyres, televisions and computers). These initiatives have the potential to drive major gains in environmental protection, resource efficiency and profitability. Benefits can flow to the environment, but also to the Australian economy as a whole, through the development of new markets in innovative products and services and increased competitiveness.

In summary, DEH recommends future action in the following areas.

6.1 Waste disposal and management

The development of best practice management guidelines for rural, regional and metropolitan landfills would help address shortcomings in solid waste disposal in Australia. There would also be value in establishing a clearing house to provide local governments with access to best practice technical specifications for the provision of recycling and waste management services.

6.2 Community awareness and information

The implementation of existing schemes at the local level would be strengthened by nationally coordinated action to improve the information available to householders on the recyclability of products and materials, and to advise them of product stewardship schemes in which they can participate.

6.3 Product stewardship

Governments should further encourage industry to develop voluntary schemes for product stewardship to manage the life cycle impacts of their products and processes. For industry sectors where voluntary schemes are ineffective or unlikely to succeed, the development of co-regulatory product stewardship arrangements can provide a cost-effective way forward. In some cases the development of product stewardship schemes will need the support of regulatory and monitoring arrangements to deal with imported products.

6.4 Resource efficiency

In line with COAG's broader micro-economic reform agenda, action is needed in areas where subsidies are distorting market signals and impeding efforts to improve environmental performance and resource efficiency.

A review of existing methods of environmental valuation would provide a basis for developing an agreed set of national valuation tools to assist industry and government to further develop green or full cost accounting.

A review of recent resource efficiency/cleaner production/eco-efficiency programs could help to identify common success factors and impediments to progress so as to inform development of new approaches and policies.

Governments should promote awareness and uptake by business of existing guidelines and tools (and, where necessary, develop new tools) to enable them to integrate data on resource efficiency with existing business systems and identify opportunities for improved materials efficiency. Governments and industry can work together to investigate the potential to include specific resource efficiency considerations (e.g. consumption, design and resource inputs) in new and, when reviewed, existing product stewardship schemes.

6.5 Data on waste and resource efficiency

This submission has identified a number of areas where development of effective policies, programs and practices is impeded by the absence of accurate data on waste and resource efficiency. There is a need to:

- develop indicators for waste management which form a subset of broader environmental indicators, consistent with those recommended by the OECD and tailored to the Australian circumstance

- ensure appropriate social, economic and environmental data are secured to underpin the development of sound national policy initiatives and monitoring of the implementation of such initiatives, including improved national data collections on

    a. total waste generated, including quantities and composition of household, municipal and industrial waste

    b. amount and composition of waste landfilled against the level of total waste generated

    c. amount and composition of material recycled against the level of total waste generated

- establish a framework for developing consistent approaches and methodologies to data collection, addressing in particular

    a. inconsistency of data collection approaches at a state level

    b. the need for data disaggregated by source sectors and product where possible

    c. the need for greater consistency in the methodology used by industry organisations to collect data

- establish collection and reporting methods to support the implementation of product stewardship schemes, in particular

    a. national data on the production or import, sale, consumption, life expectancy, reuse, disposal and recycling of identified products

    b. accessible and locally relevant data on the environmental impacts of specific products and materials used to make these products (including where available use of hazardous materials or processes, recyclability and impacts at landfill)

- address data needs so as to enhance resource efficiency, specifically

    a. the flow of key materials through the economy for priority sectors

    b. the impact of these material flows within Australia

    c. time series data on materials, waste, water and energy use per unit of production within key sectors (these data would be of value to both individual businesses and at an economy-wide level).

6.6 Actions for Australian governments

The resources available to governments to deal with waste management and resource efficiency issues are limited so it is vital, particularly for national-level actions, that efforts be focused on areas of genuine high priority and that interventions are strongly grounded in a thorough assessment of the problems and the costs and benefits of the options available for dealing with them. While recognising the current strong community drivers for action on certain waste streams, Australian governments need to work together to:

- clarify priorities for national action, ensuring that adequate resources are available from the Australian Government and state and territory governments to investigate and address the highest priorities. For issues subject to national action objectives need to be clearly specified, with a clear benefit to society (economic, social and environmental) from government intervention

- continue to explore a full range of instruments (including market-based and legislative instruments) available to achieve policy objectives in the most efficient and cost-effective manner, taking into account the capacity of various jurisdictions to implement such instruments.

Looking to the future, governments should further evaluate the interactions between sustainability, waste and resource efficiency objectives and policy instruments. This evaluation should underpin the development of a more strategic framework for waste management and resource efficiency, which is built on economic efficiency and sustainability principles.

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Acronyms

ABS	Australian Bureau of Statistics
ACG	Allen Consulting Group
ACCI	Australian Chamber of Commerce and Industry
AMTA	Australian Mobile Telecommunications Association
ANZECC	Australian and New Zealand Environment and Conservation Council
C&D	Commercial and demolition
C&I	Commercial and industrial
CCA	Copper chrome arsenate
COAG	Council of Australian Governments
CRT	Cathode ray tube
CSD	United Nations Commission on Sustainable Development
DEC NSW	Department of Environment and Conservation, New South Wales
DEFRA	Department of Environment, Food and Rural Affairs
DEST	Department of Environment, Sport and Territories
DFAT	Department of Foreign Affairs and Trade
DPMC	Department of the Prime Minister and Cabinet
DTI	Department for Trade and Industry
EA	Environment Australia
EEA	European Environment Agency
ELV	End of life vehicle
EPHC	Environment Protection and Heritage Council
EPR	Extended producer responsibility

GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
HCFC	Hydrochlorofluorocarbon
HDPE	High density polyethylene
HFC	Hydrofluorocarbon
Hyder	Hyder Consulting
JPOI	Johannesburg Plan of Implementation
LDPE	Low density polyethylene
MRF	Materials recycling facility
NEPM	National Environment Protection Measure
NSW EPA	New South Wales Environment Protection Authority
OECD	Organization for Economic Cooperation and Development
PC	Productivity Commission
PET	Polyethylene terephthalate
PSO Program	Product Stewardship for Oil Program
PVC	Polyvinyl chloride
RRA	Refrigerant Reclaim Australia
SSG	Synthetic greenhouse gases
UN DESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environment Programme
US EPA	United States Environment Protection Agency
WBCSD	World Business Council for Sustainable Development
WEEE	Waste electrical and electronic equipment