Report to
Environment Australia

The potential of Market Based Instruments to better manage Australia's waste streams

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EXECUTIVE SUMMARY

Waste policy continues to evolve from a focus on minimising harm to the environment through improper disposal of wastes to diverting waste from landfills to be recycled or reused. As part of this shift in focus, two principles have now been adopted by most State and Territory Governments, namely:

- The adoption of a 'hierarchy of waste' ideology - where reducing consumption is preferable to waste re-use and recycling which in turn is preferable to waste disposal - to guide waste policy development.
- The setting of targets for the amount of waste going to landfills. A national per capita waste reduction target of 50% by the year 2000 was adopted by ANZECC in 1992. More recently, several State and Territory Governments have announced policies with the objective of no waste to landfills.

A range of landfill levies, recycling and product stewardship programs have been adopted to reduce waste. Despite this, targets for the level of waste diverted from landfills have generally not been achieved.

The objective of this study is to assess the potential of market instruments to better achieve the goals of waste policy. Market instruments are policy mechanisms that provide direct or indirect monetary incentives to reduce waste or increase the level of recycling. Under certain circumstances, they may deliver outcomes faster and at lower cost than more prescriptive measures.

Policy objectives

From an economic viewpoint, the objective of waste policy should be to overcome failures in the market that leads to harmful impacts to the environment and local community, the cost of which are not borne directly by producers and consumers of goods. Harmful impacts may include:

- Excessive resource extraction leading to a faster depletion of natural resources.
- Emissions of harmful substances during resource extraction, production and consumption of goods, or from waste collection and disposal
- Impact on local amenity through the visual impact of landfills and odour impacts.

In Australia, the key waste management consideration for government has historically been disposal. Government has primarily provided waste collection and disposal, with costs met through broader revenue collections. In addition, landfills often had poor environmental controls that resulted in a range of harmful impacts. The combination of budgetary pressures and harmful impacts at landfills led to a policy focus on reducing volumes disposed to landfill.

Reforms of landfill regulation, technology and management practices have significantly reduced harmful impacts associated with landfilling. These improvements and cost-economies have also seen a dramatic reduction in the number of landfills, reducing local amenity impacts. By increasing the size of new landfills, the available capacity has in many instances increased despite the fall in landfill numbers. This has allayed fears of a scarcity of landfill space that some proponents have postulated to support the case for continued reductions in waste disposal volumes. Governments have also acted to improve budget positions through either the privatisation of major parts of the waste collection and disposal system or through the introduction of full cost pricing.

While these reforms have lessened the urgency of reigning back waste disposal volumes, communities have continued to express their desire for further improvements. This has prompted governments to broaden waste policy goals to include upstream life-cycle impacts associated with waste materials. Most waste policy objectives now include goals such as conserving resources, reducing the environmental impacts arising from the use of virgin materials and reducing the toxicity of products.

However the policies adopted still focus on reducing the volume of waste disposed to landfills, rather than seeking to directly reduce the environmental impacts during extraction, production and consumption. Numerous studies have shown that the bulk of the social costs from harmful impacts occur upstream of waste generation. The most comprehensive study undertaken indicates that the social costs of landfilling waste is less than 5% of the total social cost of production and consumption of goods. This is due to the fact that a large proportion by volume of the waste stream comprises inert or non harmful materials.

The low social cost of landfilling suggests the focus of policy should be designing market instruments that directly impact on upstream activities. Policies designed to lower the volume of waste to landfills will indirectly impact on upstream activities, but several studies have pointed to the difficulty of using one policy instrument to handle a variety of social externalities throughout supply chains.

Of course, disposal at landfills or illegally of some material such as batteries and electronic goods can have significant impacts on the environment. In these cases, policy should be focussed on managing these disposal impacts.

In this study, various market instruments have been assessed on the basis of their ability to achieve either of two policy objectives:

- Reducing the upstream impacts associated with solid waste disposal. Under this policy objective, volumes disposed are implicitly a proxy for the range of impacts created in upstream product supply chains that ultimately deliver residual wastes to landfill.
- Reducing the environmental impacts of post-consumer waste disposal. Under this policy objective, the focus is on designing instruments to make explicit the connection between potential environmental harm arising from the disposal of waste materials.

Comparative analysis of alternative market based instruments

The first report in this study – *Identifying instruments for investigation* – examined waste policy goals in Australia, canvassed the range of market instruments available and provided a broad comparative analysis of potential instruments for application in Australia. Based on that assessment and feedback from stakeholders, four market instruments were considered in more detail in our Part 2 report.

Two of the instruments were designed principally to address upstream impacts via reducing the volume of waste disposed to landfills. The second two instruments were designed principally to reduce downstream post-consumer impacts associated with waste disposal. In all cases, broader benefits that may arise throughout supply chains were also considered. Stakeholder comments on these assessments were sought and have been considered in finalising our assessments.

Notwithstanding the preliminary and illustrative nature of the assessments undertaken, some broad conclusions on the attractiveness of the instruments can be made. That is;

- ***tradeable landfill quota schemes*** could be used to promote greater reductions in the volume of waste disposed to landfills. However the upstream benefits that may result from the flexibility offered by trading could be offset by greater downstream environmental impacts at poorly managed landfills or through illegal dumping. Moreover, despite the greater certainty the instrument would provide in achieving volume-based waste disposal goals, the economic benefits realised may not be superior to those being achieved with current landfill levy instruments.
- ***competitive tender processes*** have the potential to improve the efficiency of subsidy / grant programs to cost-effectively reduce waste volumes to landfill. Alternatively, this instrument could be directed to targeting problematic wastes generating the greatest environmental impacts through illegal disposal. The instrument could be applied on a program by program basis and is not dependent on broader waste policy or legislative reforms.
- ***recycling certificate schemes*** also have the potential to help meet the objective of reducing the environmental impacts from the disposal of problematic wastes, as well as for resource conservation purposes where a direct link between waste management and resource extraction can be identified. While these instruments would present some challenges in development and administration, they have a number of attractive features. In particular, they can be used to closely align incentives with policy goals, can engage producers in downstream waste management, and would discourage illegal disposal – the major waste policy challenge identified by stakeholders.
- ***landfill emission fees*** appear attractive for promoting improved landfill management practices and reducing environmental impacts at landfills. However if this policy goal remains secondary to broader, albeit poorly defined, goals aimed at reducing upstream environmental impacts, then existing levy instruments may be preferable.

Conclusions and recommendations

This study has demonstrated that market instruments can play an important role in waste management in Australia. While such instruments will not always be the best tool available to government, in many instances they can offer an effective means to realize policy goals at lower cost. Stakeholders have been supportive of the wider use of market instruments, and have encouraged further investigation.

The success of market instruments will depend on attention to design features and their close targeting to policy objectives. On this latter point, the study has highlighted the need for governments to clarify policy goals for waste management.

Government waste management goals are moving away from a central focus on managing 'downstream' waste disposal impacts to minimizing 'upstream' impacts associated with resource exploitation and production processes.

The main market instrument currently being used is the landfill levy. The levy does not fit well with either upstream or downstream policy goals. Linkages between upstream environmental impacts and volumes disposed to landfill are too indirect. In addition, levies have not distinguished between waste streams despite the significant variation in associated upstream and downstream environmental impacts. Current levies also provide no incentive for improved management practices at landfills and undoubtedly have contributed to the increased illegal disposal of wastes with attendant environmental impacts.

In considering policy objectives for waste management, pursuit of upstream environmental goals requires careful attention. The rationale to pursue resource conservation through waste management instruments applied late in supply chains is at best tenuous and a poor surrogate for effective resources policy. Similarly, stakeholders have provided few insights into why industry policy (addressing principally emission practices) should discriminate between the environmental performances of production processes drawing on used materials compared to virgin materials.

We strongly recommend that governments review the merits of pursuing resources and industry objectives through waste management policy. Dogmatic adherence to the 'waste hierarchy' or the setting of arbitrary waste reduction goals not supported with clear assessments of likely costs and benefits may not be in the nation's best interests.

Governments of course will be mindful that community demands to promote resource conservation through waste minimization will not be easily shifted. Consequently, waste programs are likely to maintain this focus at least over the medium term. Whether or not market instruments are chosen for this purpose, investigation into which resources are of greatest concern and most directly influenced through waste management would seem a priority. Employing market instruments such as tradeable landfill quota schemes or recycling certificate schemes in the absence of such information cannot guarantee net social gains will be realized.

The application of market instruments to directly target downstream post-consumer waste impacts can be employed with greater confidence. Performance bonds are already being used, and moving landfill fees onto an emissions basis could be pursued in some jurisdictions with little regulatory or administrative changes needed. The development of market instruments to target problematic wastes is also promising and the subject of current investigations at national and state levels.

While this study has explored the potential application for market instruments to address an upstream or downstream policy goal, it would be possible to craft instruments that provided incentives for both. For example, landfill levies applied on tonnes of waste disposed could be differentiated by waste streams to reflect relative disposal impacts. However as canvassed in Section 4.2, it is generally more efficient to apply different instruments to achieve different goals. Hence rather than pursuing instruments that meet multiple goals, we recommend governments pursue a mix of instruments.

Finally, the success of any market instrument will be reflective of the design effort applied. Market instruments need to consider a range of institutional, technical, market and community issues and be crafted accordingly. Stakeholders hold much of the necessary information and effective consultation in the design stages will be required.

1 INTRODUCTION

Waste policy continues to evolve from a focus on minimising harm to the environment through improper disposal of wastes to diverting waste from landfills to be recycled or reused. As part of this shift in focus, two principles have now been adopted by most State and Territory Governments, namely:

- The adoption of a 'hierarchy of waste' ideology - where reducing consumption is preferable to waste re-use and recycling which in turn is preferable to waste disposal - to guide waste policy development.
- The setting of targets for the amount of waste going to landfills. A national per capita waste reduction target of 50% by the year 2000 was adopted by ANZECC in 1992. More recently, several State and Territory Governments have announced policies with the objective of no waste to landfills.

A range of landfill levies, recycling and product stewardship programs have been adopted to reduce waste. Despite this, targets for the level of waste diverted from landfills have generally not been achieved.

Against this background, Environment Australia is investigating the potential for a range of market instruments to assist in the management of solid non-hazardous wastes disposed to landfills. The use of market instruments in environmental policy encourages behaviour that reduces environmental impacts through signals in the market rather than through prescriptive legislation. In this way, market instruments can often deliver equivalent outcomes faster and at lower cost.

Environment Australia has commissioned BDA Group (BDA) and McLennan Magasanik Associates (MMA) to identify promising instruments and to undertake a preliminary feasibility analysis of adopting them in the Australian context. The information generated will be provided by the Commonwealth to State and Territory governments to facilitate discussions on alternative waste management strategies.

The study was undertaken in two parts. Part 1 involved a preliminary screening of potential market instruments for waste management. Part 2 was a comparative assessment of promising market instruments of interest to stakeholders. Feedback from stakeholders was sought on both the initial screening and comparative assessment of instruments. The findings of both parts of the study are combined in this report.

2 WASTE GENERATION AND MANAGEMENT

An overview of the quantities and composition of materials that are disposed of as solid waste across Australia is provided in this Section. Data on solid waste is beset by problems of definition, availability and quality. Estimates of major waste streams and classifications of concern are provided below, which will allow informed assessment of the impact of potential market based instruments.

2.1 Definitions

Estimates of waste flows have been guided by the solid waste classification guidelines developed by the CRC for Waste Management and Pollution Control[1] combined with a pragmatic consideration related to the available information.

Estimates:

- Are derived on a mass per annum basis
- Are classified by Municipal Solid Waste (MSW), Commercial & Industrial (C & I) and Building & Demolition[2] (B&D). These categories are further disaggregated where the categories contribute significant quantities of the waste stream.
- Include not only waste going to independent landfill, but also waste processed or disposed of through other routes such as recycling, composting, incineration or on-site landfill where this information is available.
- Exclude re-use of waste streams by an originating party. While re-use is certainly a valued disposition of material, very little information exists about this category and it is less relevant to the study than the other methods of disposal.

The definition of categories can differ between collecting parties, for example in the definition of inert materials, such as clean fill, going to landfill. This may cause inconsistencies between jurisdictions, but should not unduly affect overall outcomes.

Hazardous wastes, non-solid materials including waste oil, waste which is disposed of on-site (such as mining waste) and materials which do not contribute a significant proportion of the Australian solid waste stream are excluded. Waste generated from treatment of sewerage and waste water has also been excluded.

2.2 Waste generation

An overview of disposal across Australia about the year 2000 is provided in Figure 2.1. About 26.5 Mt of waste was generated – around 1,400 kg per person per annum. Of this some 17 Mt (900 kg/person) was landfilled while a further 9.4 Mt (500 kg per person) was recycled.

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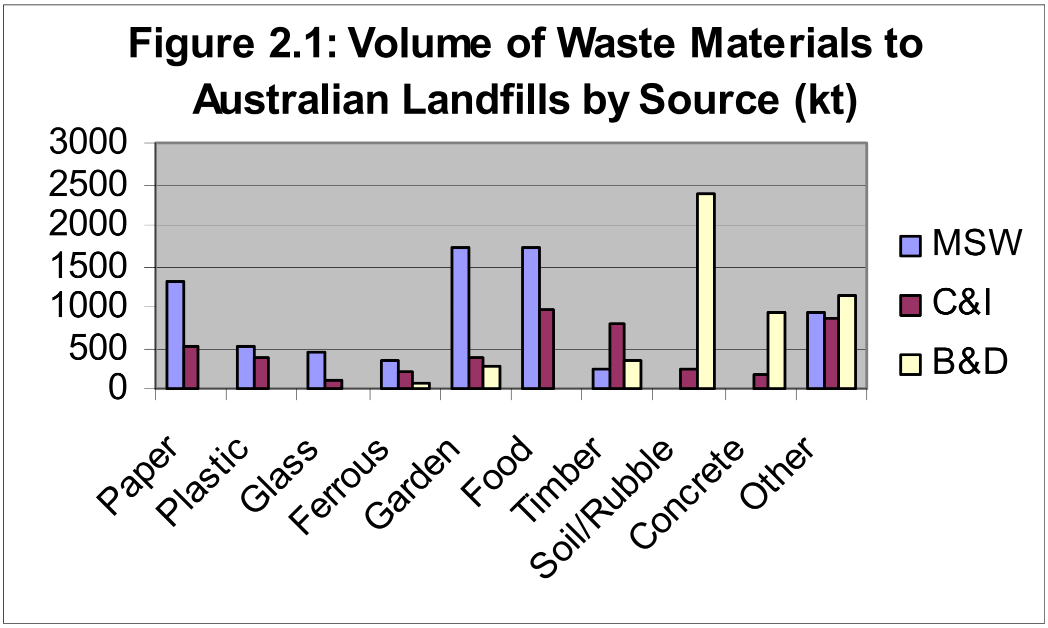
1 CRC for Waste Management & Pollution Control, Background to draft solid waste classification system, September 1993.

2 Often called Construction & Demolition (C&D).



Sources: The estimates in this table have been derived by BDA / MMA, drawing on a number of sources

The largest source of total waste generation is the building and demolition sector (38%), followed by municipal solid waste (36%) and then commercial and industrial sources (26%). However, most of the material going to landfill is understood to be generated from MSW as a higher proportion of B&D waste is recycled than is MSW waste[3]. About 42% of the solid waste material currently being landfilled is municipal solid waste, comprising domestic collections, hard waste, council collections and residential delivery to landfill or recycling. The remainder is approximately evenly divided between the B&D (30%) and C&I (27%) sources.

Inert building and demolition materials such as cement, bricks, rubble, asphalt and soil, with more than 8 MT, are the greatest materials generated as waste. Although these are increasingly recycled, they still form a large supply for landfill.

Other major material sources of waste are garden waste, food and animal waste, paper and cardboard and timber or wood products. These and building and demolition materials still present the largest material opportunities for making further significant reductions in volumes disposed to landfill.

Plastics materials, which are the source of significant public concern, constitute only about 4% of the waste generated in Australia by weight – although a significantly larger proportion of the waste stream in volume terms. About half of the beverage container materials are already being recovered. It is the remaining plastics which are likely to be of most concern.

2.3 Waste management practices

Waste management practises vary significantly according to State and individual local council. Services and fees for the collection and acceptance of waste material also vary. Typical ranges of services and charges are presented in the following sections.

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[3] There is some uncertainty about the level of B&D waste generated and recycled, especially in Queensland.

Data on the practices of councils in relation to solid wastes has been obtained through an examination of the waste management practices of a cross section of local councils throughout Australia. The quality of the data that has been readily available from councils is variable and there are considerable gaps in the compiled datasets. There are also large differences between the availability of data in each of the states.

2.3.1 Household Waste Services

The collection of general household waste is carried out in most councils throughout Australia on a weekly basis, commonly utilising wheeled garbage bins of varying size. In the majority of cases households are provided with a single size of bin. However, a growing number are providing the option of a lower annual waste management charge in return for utilising a smaller bin for weekly collections and / or allowing additional bins to be collected at extra cost (such as through the use of pre-purchased tags).

All material collected during these normal collections is landfilled without exception, apart from material going to the demonstration SWERF plant at Whytes Gully in Wollongong. At this particular facility, mixed waste is sorted for recoverables and used for energy generation.

In conjunction with the weekly or fortnightly waste service, most councils operate a recyclable collection for paper, glass, plastic and metal. The frequency of these programs may vary from that of the waste collection and in some regions split bins are used where the waste and recyclables are collected simultaneously using special dual compartment trucks.

Charges for these services are paid for by householders through annual rates, although these are not normally identified separately on rate notices. However, the identification of waste charges is increasingly being separately itemised on these bills. Variable charges are becoming available for households that do not require a weekly service for a large bin.

2.3.2 Hard Waste Collections

Hard waste collections involve the collection of large material that cannot be readily disposed of through the normal waste service. Materials collected in this way include tree loppings, large pieces of wood, fridges, freezers, washing machines, televisions, and other bulky waste.

The majority of councils offer these services through a contractor, and collections occur yearly, twice yearly or according to demand (through a booking service). Charges for these services are normally incorporated in the waste management charge in the annual household rates. The exception is that booked services may incur a charge if a single household has booked above a certain number of collections.

The degree of recycling of material collected through these services is limited. Recycling typically consists of degassing of refrigerators and freezers, recovery and sale of other operational appliances, sale for second hand parts or scrap metal of large appliances and green waste may be recovered for composting or mulch.

2.3.3 Transfer Station/Landfill Services

The majority of councils accept material directly at their transfer stations or landfill. Generally, there will be some form of charge for this service depending on the quantity and type of material and whether the person delivering the material is a resident of the council. The value of the charge is commonly zero for recyclable material and green waste, and for other waste will vary between zero for a personal vehicle boot load to $40 to $50 for a large trailer. Quantities larger than this are charged at commercial rates. Many country landfill sites are largely unmanned, particularly on weekends, and so effectively no charges are made for domestic waste.

Brisbane City Council utilises an innovative scheme of tip vouchers where each residence receives three annual tip vouchers, two of which allow acceptance of general waste and one for green waste. Any additional material delivered after use of these vouchers incurs a fee.

Most transfer stations and landfills operate at least some recovery and recycling services. These take the form of separate areas for the deposit of glass, aluminium, steel, and large appliances. These operations generally provide the operator with an additional revenue stream, as the materials are sold to the recyclers and second hand dealers or scrap merchants in the case of large appliances.

The cost of the services that are not charged for are absorbed and passed on to ratepayers through the annual waste charges and rates.

3 BENEFITS FROM REDUCING SOLID WASTE DISPOSAL

Detrimental impacts of landfill disposal include consumption of urban land, potential leachates from toxic wastes, release of methane from the decomposition of organic wastes, noise and odours impacting local amenity as well as air emissions and amenity impacts through the transportation of wastes to landfills.

For many materials, waste disposal per se may create few environmental impacts, although a range of environmental impacts may occur in the product supply chains. These include:

- Resource conservation impacts from unsustainable practices (environmental impacts during resource extraction, depletion of finite resources).
- Pollution associated with the processing of virgin or recycled materials.
- Material and product transport and marketing externalities.
- Externalities associated with consumption (such as greenhouse gases).
- Illegal disposal externalities (such as with littering, contamination sites, illegal dumping).
- Externalities arising from legal disposal (such as air and water emissions from landfills).

Given the interconnectedness of economic systems, it could be argued that most environmental issues could in some way be related to residual materials ending up in landfills. Accordingly, only broader upstream impacts are considered below, along with impacts directly associated with waste disposal to landfill.

Benefits from reducing disposal of solid non-hazardous waste to landfill fall into two key categories:

- Landfill benefits. These are benefits, realised at landfill sites, resulting from reduction in material deposited to landfill.
- Upstream benefits. These are benefits beyond landfills that result from changes in raw material extraction and production of materials, due to actions taken which reduce the disposal of material to landfill. Such actions may include source reduction (for example, lightweighting of containers), re-use, recycling, composting or waste to energy.

Although these are often considered in combination, they are separated in this report because different instruments may be considered depending on whether the primary policy focus is on volumes to landfills or broader benefits.

3.1 Landfill benefits

The extent of air, water and soil pollution at landfills will depend on the nature of controls used and the materials disposed of. A recent Australian study[4] commented that in Victoria:

- Most landfills range in size from 4 to 8 Mm^3, but some were as small as 1 Mm^3.

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4 Stage 2 report for Life Cycle Assessment for paper and packaging waste management scenarios in Victoria, January 2001 Centre for Design, RMIT University, CRC for International Food Manufacture and Packaging Science at Victoria University and CRC for Waste Management and Pollution Control at University of NSW.

- All landfills have a water stopping top-cover (mostly clay and one HDPE layer) with permeability estimated to be 1 to 3%.
- Most landfills have a landfill gas capture system, assumed to have a gas capture rate, with electricity generation at two locations, co-generation at one, heat supply from a fourth and flaring at two others
- Leachate collection was of variable quality.

The regulation and monitoring of landfills is now stringent. This should result in lower quantities of leachate, emissions to air and externalities over time.

A comprehensive analysis of landfill externalities was undertaken by the NSW EPA in 1996 to support increasing the State's landfill levy. The levy increase was introduced to reduce market distortion in waste disposal. The proposed rate of the levy is based on estimates of the external environmental and social costs of waste disposal[5]. The range of estimates is shown in Table 3.1.

Table 3.1: Landfill externalities in NSW ($/tonne of waste landfilled)

	Sydney Landfills		Non-Sydney Landfills	
	Low estimate	High estimate	Low estimate	High estimate
Greenhouse	$7.80 (60%)	$14.60 (44%)	$7.80 (74%)	$14.60 (57%)
Local amenity	$0.00 (0%)	$3.70 (11%)	$0.00 (0%)	$3.70 (14%)
Transport corridor	$2.30 (18%)	$2.90 (9%)	$1.20 (11%)	$1.50 (6%)
Intergenerational	$3.00 (23%)	$12.00 (36%)	$1.50 (14%)	$6.00 (23%)
Total	**$13.10**	**$33.20**	**$10.50**	**$25.80**

Both the level and incidence of these external costs of landfills are uncertain, especially for the two largest components, greenhouse gas emissions and intergenerational costs[6]. For both of these effects, the external costs may be substantially lower than previously estimated, with the total external cost of landfilling likely to be more in the range of $0 to $15 for the Sydney Metropolitan Area.

Except in a few places where new landfill is difficult to locate, the cost of landfill, including externalities, is unlikely to be very much greater than is currently being charged through the combination of gate fees and levies. The combination of stringent environmental regulation plus collection of landfill gas and its use for generation displacing fossil fuels may mean that, over time, the externalities of landfilling should reduce and may even be positive rather than negative for the community as a whole as landfills become low-cost biofuel generators[7].

While all materials contribute to landfill, different materials and products contribute differently to costs. High-density, inert materials are likely to be least costly to the community, followed by less dense and biodegradable materials with problem materials such as household hazardous waste the most expensive.

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5 NSW EPA (1996), Regulatory Impact Statement, Proposed Waste Minimisation and Management Regulation 1996, p38

6 see Appendix A, Part 1 Report

7 Although, as has been pointed out by Ecotec the location of emissions and externalities is also important, with different valuations possible at different sites. This is also true for any assessment of externalities.

This assessment considers cost associated with landfill alone. It does not include costs associated with litter or any valuation associated with upstream impacts of materials landfilled.

3.2 Upstream benefits

Waste policy by Australian and overseas governments has tuned to the broader supply chain environmental impacts that may be effected through waste management reforms, and this has led to the investigation of life-cycle impacts. The upstream benefits associated with reduced disposal to landfill of the different waste streams are considered below.

Municipal waste

The life cycle impacts of kerbside recycling were examined in the Victorian Life Cycle Study by RMIT. The assessment was based on the average recyclable material presented by a Melbourne household at the kerbside - 4.1 kg for recycling and 2.5 kg for disposal - and selected five environmental indicators or impact streams for examination. The results of the Study, translated into a per tonne basis, are presented in Table 3.2.

Table 3.2: Net benefit from recycling over virgin usage in Melbourne per tonne of material recycled

	Greenhouse (Kg CO2-e)	**Embodied Energy** (MJ)	**Smog precursors** (gC2H4-e)	**Water Usage** (L)	**Solid Waste** (Kg-residual)
Newsprint	767	3024	35	20752	812
Paper & Board	931	2444	33	22483	736
LPB	125	-1825	-600	2425	575
Glass	348	3776	-97	2038	984
Aluminium	14800	177867	267	1716667	5433
Steel Cans	1100	28129	859	882	1153
PET	955	49182	2627	-52818	609
HDPE	600	49730	9570	-76900	700
PVC	1750	22000	-250	48500	750
Total	774	7876	330	22649	892

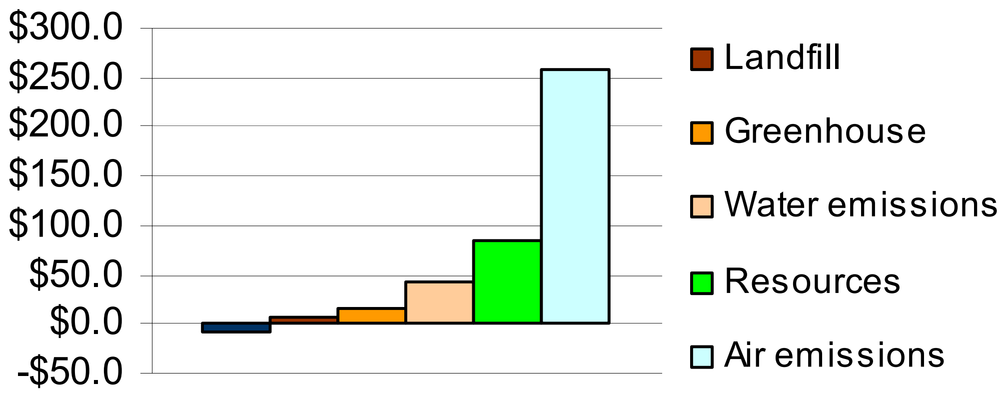
Source: Derived from Victorian Life Cycle Study

The benefits vary significantly between materials. While recycling of most materials seems beneficial overall from an environmental perspective, this may not be the case for all materials. For example, recycling of LPB has two negative impacts so that it is unclear whether recycling this material is beneficial overall especially given that LPB is imported from overseas.

The lack of consideration of where emissions take place is a major concern. For example, none of the virgin PET used is produced in Australia. If the boundary of the system is taken to be Australia, there is likely to be a net negative impact of recycling PET here.

Nolan-ITU (2001) estimated that kerbside recycling delivered an environmental benefit of around $400 per tonne of recycled material, based on an average 170kg per household per year. This estimate included the (negative net) impacts associated with the kerbside collection system and the (positive net) impacts associated with the recycling system, compared against landfilling and greater recourse to goods manufactured from virgin materials. The relative impacts are shown in Figure 3.1.

Figure 3.1: Environmental benefits of kerbside recycling $/t recyclate (Nolan-ITU 2001)



Around 75 percent of environmental benefits (around $300/t) come from reductions in air and water pollution arising from the avoided product manufacturing using virgin materials. The natural resource benefit of recycling represented some 21 percent of the benefits (or about $24/t and $60/t split between forest and mineral resource impacts respectively). Global warming or greenhouse gas benefits were estimated to be some 4 percent of benefits ($16/t). Landfill savings were estimated to represent only 1.6 percent of benefits ($6.50/t net of recycling residuals to landfill) while traffic impacts were a net environmental cost to the system of around 2 percent ($8/t).

As with most life-cycle assessments and non-market valuation exercises, the efficacy of assumptions and data used can be challenged. The methodology may have led to a systematic overestimation of likely impact costs. However for the purposes of this study of market based instruments, the relative size of estimated benefits is of most consequence.

The most striking observation made by Nolan-ITU (2001) was the relative insignificance of landfill benefits associated with recycling, valued at less than 2 percent of total benefits. They note that:

> *"'In the past, landfill savings have been heralded as a key environmental motive for recycling. The relatively low contribution of landfill savings to the net system benefit serves to highlight the magnitude of other environmental benefits which are not generally recognised – namely the avoided impacts associated with resource extraction, refining and manufacture for virgin materials".*

Container recycling programs

There have been two studies on the benefits and costs of recycling containers:

- The Institute for Sustainable Futures used streamlined life cycle assessment for four waste management options to estimate the benefits of container deposit legislation[8]. The results, shown in Table 3.3, indicate that recycling of PVC, aluminium, PET, steel and newsprint is highly environmentally beneficial on a $/t basis, HDPE somewhat beneficial and corrugated board only marginally beneficial. The study did consider the extent to which packaging is produced in Australia or NSW in that case. Further, the economic valuation was based on results from the Nolan-ITU Kerbside Study, despite noting that the authors specifically warned against using their results elsewhere.

Table 3.3: Assessed environmental costs of recycling versus virgin materials

Material	**Recycled Material Impact** ($/t)	**Virgin Material Impact** ($/t)	**Recycling Benefit** ($/t)
Newsprint	477	881	404
Corrugated Board	303	311	8
Glass	84	248	163
Aluminium	163	3214	3051
HDPE	333	413	80
PET	300	2096	1796
PVC	265	31196	30931
Steel	282	839	558

Source: Independent review of Container Deposit legislation in NSW, Table 3.4-6, Vol 2 p 140 For Sydney

- The Ecotec[9] Study also calculated costs and benefits of recycling and compared its results against those of previous studies. They found high positive net benefits for recycling aluminium, ferrous material and glass, generally a medium-sized benefit for recycling paper over virgin use. There was some uncertainty about plastics, with negative costs in some studies for recycling of plastic film and in some cases for PET, PVC and HDPE.

Virtually all studies show that recycling of aluminium, glass and steel results in benefits that significantly outweigh costs. This is also likely to be the case for newsprint and possibly other paper products, although the amount of paper product imported into Australia may need to be taken into account. While the Australian studies suggest significant benefits of recycling PET, HDPE and PVC, this is based on assumptions that the material is all locally produced with closed loop recycling. Neither of these are

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8 Institute for Sustainable Futures, UTS (2001), Independent review of Container Deposit legislation in NSW.

9 Ecotec Research and Consulting Limited, 'Beyond the bin, the economics of waste management options', report to Friends of the Earth, UK.

necessarily the case and the assumptions need further debate. It is unclear that recycling of mixed plastic has net benefit.

Organic Waste

The last few years has seen a very significant increase in the collection and composting of food and green waste from domestic and commercial and industrial sources. However, few studies have been carried out to demonstrate environmental life cycle and net benefit to the community.

A study by Nolan-ITU in association with Access Economics for the South Australian Department of Industry and Trade and EPA (Organic Waste Study)[10] reviewed six scenarios for handling organic waste. They concluded that all of the organic processing options considered, including the existing and expanded source separation composting, result in improved environmental outcomes compared with landfilled only.

The qualitative cost-benefit analysis was inconclusive about the likely economic ranking of landfill only, although the authors state that the results suggest that economic benefit would be less if there were no organic processing at all.

Other studies have concentrated on only parts of the life cycle analysis and are often inconclusive. For example, the US EPA's study into solid waste management and greenhouse gases[11] finds relatively small greenhouse gas savings from composting over landfilling of mixed organics (more for food discards and less for yard trimmings)[12] and comments on the considerable uncertainties[13].

The Ecotec study quoted a DETR study citing kerbside collection composting costs as STG 70 – STG 120 per tonne (about $170 – $300/t). The study is, however, unclear on the net externality costs of landfilling versus composting of organic materials.

In summary, there is little evidence available to demonstrate that large-scale kerbside collection and composting of green or food wastes has a positive externalities reduction benefit which exceeds the costs of collection and processing, or indeed that the net benefits of central composting exceed those of combustion.

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10 Nolan-ITU in association with Access Economics report to the South Australian Department of Industry and Trade and Environment Protection Agency, "Organic waste economic values analysis summary report" , January 2002

11 US Environmental Protection Agency "Solid Waste Management and Greenhouse Gases, a life-cycle assessment of emissions an sinks", May 2002.

12 Assuming national average methane recovery.

13 "Composting is a management option for food discards and yard trimmings. The net GHG emissions from composting are lower than landfilling for food discards (composting avoids CH_4 emissions), and higher than landfilling for yard trimmings (landfilling is credited with the carbon storage that results from incomplete decomposition of yard trimmings). Overall, given the uncertainty in the analysis, the emission factors for composting or combusting these materials are similar." US EPA p ES-10

Building and demolition

Large-scale building and demolition materials include concrete, asphalt, bricks, steel, soil, rubble and timber.

A Japanese study[14] has compared the energy costs of recycling various domestic building materials including wood, steel, aluminium, plasterboard and concrete. The study found that the recycled product used substantially less energy than the virgin product for aluminium and steel, somewhat less for timber related products and the same amount or more energy for recycling concrete and plaster-board. Reuse of structural elements offers considerably more environmental benefit than recycling, but this will require new building designs which anticipate eventual demolition.

While many residential construction materials such as timber, doors, windows, plumbing and bricks have high recovery rates, most are used for renovation or reuse, with only steel having a significant recycle component[15]. In commercial buildings recovery rates are understood to be lower overall, with more recycling rather than re-use, especially for concrete and metals.

While several studies have demonstrated the energy benefits of re-use of construction materials, the results are less clear for recycling, especially concrete. A CSIRO study is quoted as demonstrating that using recycled concrete as aggregate requires more energy than using freshly quarried aggregate, although the results are sensitive to transport distances. Commenting on the CSIRO study, Crowther notes: "This study is obviously limited to energy consumption issues and does not take into account other environmental burdens associated with the disposal of demolished concrete. Despite this, this study does show that it is not always reasonable to assume that recycling is the most environmentally beneficial option, and that a holistic life cycle assessment needs to be made.[16]"

Conversely, a Finnish study[17] which compared the full life cycle of road construction found that for pavement structures on a weighted basis, crushed concrete blast furnace slag performed better than natural aggregate – although the difference between them was small.

A report prepared for Environment Australia by RMIT[18] assessed the status and use of LCA tools in the building and construction industry in Australia. The study commented that there are currently only a few Australian building LCA databases and some data developed for energy and specific materials.

In summary, large quantities of waste B&D materials are generated and either reused or recycled in Australia. Apart from energy usage, little has been studied about the life cycle environmental impacts of the reuse or recycling of B&D materials. Nevertheless, it appears reasonable to assume that such re-use is likely to have beneficial outcomes unless the energy usage or emissions related to disassembly and

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14 Weijun Gao et al "Energy impacts of recycling disassembly material in residential buildings" in Energy and Buildings, 33(2001), 553-562

15 Philip Crowther, University of Technology, Queensland, Chapter 2 in Kilbert CJ and Chinni AR, "Overview of deconstruction in selected countries", CIB Report 252, University of Florida, August 2000.

16 ibid p 22.

17 Ulla-Maija Mroueh, Paula Eskola, Jutta Laine-Ylijoki, Kari Wellman and Esa Mäkelä Markku Juvankoski and Antti Ruotoistenmäki, "Life cycle assessment of road construction", Tielaitos, Finnish National Road Administration, (Finnra) report 17/2000, Helsinki 1999

18 Report to Environment Australia by Centre for Design at RMIT University plus others "Background report LCA Tools, data and application in the Building and Construction Industry", January 2001

transport are high. Life cycle studies suggest that there are also likely to be substantial energy benefits from the largely closed-loop recycling of steel and aluminium products. There may also be environmental benefits from recycling of timber – although the end-uses and possible contamination from timber treatment must be considered. It is unclear that there are environmental benefits associated with the recycling of concrete.

3.3 Benefits from managing problematic wastes

Some wastes make up a relatively small component of the waste stream in terms of volume disposed to landfill, but they have significant environmental impacts at the disposal phase. A major environmental impact of these wastes may arise from either poor management at the landfill site or as a result of illegal dumping. A number of wastes in this category are discussed below. Plastic bags have not been considered as they are predominantly a littering issue.

Tyres

Around 170,000 tonnes of waste tyres are generated in Australia each year. Around 57% is disposed to landfill and another 13% is estimated to be disposed of inappropriately. Used tyres persist in the environment. While they can cause problems at landfills, by far the greatest threat is from uncontrolled burning of tyres. This leads to toxic emissions and runoff from fighting these fires that can pollute local waterways and soils[19].

Vehicles

The ABS estimates that around 0.5 million vehicles reach the end of their operating life each year in Australia. As much as 195,000 tonnes of waste generated may be generated from end of life vehicles each year[20]. After recycling and recovery of car parts and metal, the residual products are landfilled. The residuals contain various materials such as rubber, glass, plastic, lead and other heavy metals, and automotive oils and fluids. There are a range of potential environmental impacts from end of life vehicles including pollution from dumped vehicles, leaching of fluids and contaminants at landfills and pollution from poor practices at recyclers.

Batteries and mobile phones

According to the Australian Mobile Telecommunications Association, the 12 million mobile phone users in Australia replace their handsets every 18-24 months[21]. Some 30 tonnes of mobile phones have been collected by the AMTA for recycling since 1999. Mobile phones and batteries contain heavy metals such as nickel, copper and cadmium, which would have adverse impacts on environment with inappropriate disposal. NiCad batteries also contain heavy metals and are used in a wide range of industrial and household applications.

Electricals and electronic appliances

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[19] Atech Group, A National Approach to Waste Tyres, prepared for Environment Australia, June 2001.

[20] Environment Australia, Environmental Impact of End of Life Vehicles: An Information Paper, 2002.

[21] NSW EPA, Consultation Paper: Extended Producer Responsibility Priority Statement, February 2003.

Around 2.5 million major whitegoods appliances are discarded every year resulting in millions of tonnes of metals, plastics, glass, composites and other materials. Major appliances contain various toxic and hazardous waste substances with the potential to damage surrounding ecosystems. The presence of toxics is a concern where there may be fires at landfills and also a problem for remediation of landfill sites. There is significant anecdotal evidence that dumping of these products occurs[22]. Small appliances also contribute significant amounts of waste. Resource NSW estimates that the amount of electrical waste from small appliances in Australia is 31,400 tonnes per year.

Computers and televisions are also high impact waste. Through industry modelling it is estimated that by 2006, 1.6 million computers will have been disposed to landfill in Australia[23]. The materials of principal concern for the environment are brominated flame retardants, cadmium, chromium VI, lead, mercury, and PVC plastic. Landfilling of computers poses significant health and environmental risks, particularly through substances leaching into soils and groundwater. There is anecdotal evidence of some illegal dumping of obsolete equipment.

3.4 Conclusions on waste impacts

Life cycle assessment, taking into account the full range of emissions, impacts of production and use of materials and landfills, plus integrated waste management modelling and cost-benefit analyses provide powerful tools for assessing waste impacts. A number of such studies pertinent to Australia have become available over the past few years.

Stakeholders provided contrary information of life cycle impacts of managing waste streams, with impacts varying with the assumptions used. Hence, life cycle analysis at best can only be a guide to the potential environmental impacts from changes to waste management.

While we would question some of the methodologies, especially the boundary-drawing and valuation techniques, the findings of these studies lead to some useful categorisations of materials and impacts.

Based on the studies discussed above it appears that three dimensions need to be considered in deciding on appropriate instruments for handling waste:

- Whether materials have high impact if sent to landfill. High impact materials include hazardous materials such as batteries that result in problem leachate, putrescibles and possibly organic materials which result in production of greenhouse gases and loss of amenity to nearby residents. Inert materials such as plastics, glass, metals and most B&D materials have low impact as a result of being sent to landfill.
- Whether the recycling of materials results in significant upstream benefits. Although there is scope for debate about the methodologies used and conclusions of available LCA assessments, it appears that the closed-loop recycling of aluminium, steel and beverage container plastics results in significant upstream benefits. However it is not clear that the recycling of organic waste, including

[22] Environment Australia, Major Appliances Materials Project, 2001

[23] NSW EPA, Consultation Paper: Extended Producer Responsibility Priority Statement, February 2003.

green and food wastes and timber or recycling of inert building materials results in significant upstream improvements.

- Whether materials have high impacts when illegally disposed. These appear to be greatest with the low volume problematic waste streams identified, including tyres, vehicles, batteries and electrical products.

4 WASTE MANAGEMENT POLICY IN AUSTRALIA

4.1 Evolution of waste policy in Australia

In Australia and overseas, the key waste management consideration for government has historically been disposal. Government has primarily provided waste collection and disposal, with costs met through broader revenue collections. As budget costs increased, cost-recovery was sought largely through flat-fee pricing systems with cross subsidies prevalent and failure to fully recover costs common. Consequently, increasing waste volumes impacted public budgets.

In addition, urban fringe dumps often had poor environmental controls that resulted in environmental and local amenity impacts – the latter leading to community resistance to new landfill sites being established. The combination of budgetary and landfill externality impacts led to a policy focus on reducing volumes disposed to landfill – and communities have been actively encouraged to assist.

More recently, significant reforms in landfill regulation, technology and management practices have reduced externality impacts associated with landfilling. These improvements and cost-economies have also seen a dramatic reduction in the number of landfills, reducing local amenity impacts. By increasing the size of new landfills, the available capacity has in many instances increased despite the fall in landfill numbers. This has acted to allay fears of a landfill scarcity crisis that some proponents have postulated to support the case for continued reductions in waste disposal volumes. Governments have also acted to improve budget positions through either the privatisation of major parts of the waste collection and disposal system, and / or through the introduction of full cost pricing strategies.

While these reforms have lessened the urgency of reigning back waste disposal volumes, communities have continued to express their desire for further improvements. Communities are embracing broader sustainability practices, and waste reduction is seen as a material way this can be done with opportunities for everyone to contribute. Consequently governments have broadened waste policy goals to consider the upstream life-cycle impacts that can be associated with ultimate waste materials – particularly the resource conservation and environmental impacts arising from the use of virgin materials. The emergence of the waste hierarchy captures this policy sentiment.

Currently there is a range of objectives of waste management legislation and programs across the jurisdictions. Most policy objectives now include environmental impact outcomes like conserving resources, reducing environmental impacts arising from the use of virgin materials and reducing the toxicity of products. Despite this, current policy interventions (outlined in Section 5) focus primarily on reducing the volume of waste rather than environmental impacts per se.

It is also useful to consider the key stages of the product supply chain and where the current policy interventions are directed. The key stages include resource exploitation, production, marketing, consumption, and transport of the waste stream for either disposal or reuse/recycling. The list below sets out the incidence of each main type of policy intervention:

- *Regulation* is being applied primarily to transport and disposal of the waste stream at the end of the supply chain.

- *Suasive* policies are generally applied at the end of the supply chain, for example through community education programs aimed at encouraging reuse and recycling.
- *Voluntary agreements* with industry generally relate to reducing waste generation and diversion of waste to recycling.
- Most *market based instruments* are currently applied at the end of the supply chain. These include recycling subsidies, user charges and landfill levies. Cleaner production subsidies take place earlier in the supply chain and are aimed at reducing environmental impacts and waste generation at the production stage.

Most policy intervention to date has taken place late in the supply chain, primarily when consumers are disposing of waste or when the waste reaches the landfill. However as shown in Section 3, the major environmental impacts occur early on when virgin materials are used and processed during production.

4.2 Direct and indirect instruments

Policy instruments can in principle be targeted at specific impacts associated with specific waste streams in specific parts of supply chains, or be broadened to capture a range of impacts or waste streams or incidence in supply chains. However as instruments become more broadly applied, the link between behavioural responses sought by the instrument and environmental benefits may become more tenuous reducing the effectiveness of the instrument.

Blackman and Harrington[24] make a distinction between environmental policy instruments that are direct or indirect. Direct instruments characteristically require the regulator to monitor environmental impacts (such as emissions), and include emissions standards, emissions fees, and marketable permits. On the other hand, environmental taxes and technology standards are examples of indirect instruments.

Figure 4.1: A classification of environmental regulatory instruments

	Direct Instruments	Indirect Instruments
Economic Incentives	• emissions fees	• product taxes
	• marketable permits	
Command and Control	• emissions standards	• technology standards

Indirect instruments like product taxes are less demanding of regulators than direct instruments in terms of instrument design, regulatory amendment, administration and enforcement. However these instruments do not create incentives to abate emissions per se, only to limit purchases of a good or activity linked with emissions. From the standpoint of incentives, a tax on pollution generated in the

[24] Blackman and Harrington (1999), The use of economic incentives in developing countries: lessons from international experience with industrial air pollution, Resources for the Future Discussion Paper 99-39, Washington

production and transport of a good is generally preferable to a product tax aimed at reducing the same emissions.

This problem is mitigated to the extent that there is a direct and predictable link between the taxed good and emissions. To the extent that there is not a direct link between the regulated input or management regime with desired policy outcomes, indirect instruments will dilute the policy signal, provide opportunities for evasion and potentially create perverse outcomes. For example, environmental taxes may also affect non-targeted activities. Although exemptions can be created, they may become unwieldy, subject to political pressure and lead to inefficient or perverse outcomes as regulated activities seek to rort available exemptions.

A range of studies of waste management policies supports the premise that applying market instruments needs to be focussed on their incidence in supply chains. It is ineffectual to use policy instruments at the waste disposal level to handle upstream as well as downstream externalities.

Walls and Palmer (2000), in their Resources for the Future report *Upstream Pollution, Downstream Waste Disposal, and the design of Comprehensive Environmental Policies*, conclude that different policy instruments are needed to address both upstream externalities and downstream disposal - one instrument cannot fully internalise multiple externalities.

An illustration of the difficulties in attempting to tackle upstream environmental issues with downstream waste management policy is provided in Box 4.1. The illustration is provided not to argue that wastepaper recycling is unfounded, but that its merits should be determined on the direct economics of recycling and account for downstream externalities associated with paper disposal – the management of Australia's native forests should be pursued through other policies.

The nature of environmental impacts also varies significantly *between* waste streams. For example, post-consumer disposal of batteries and tyres can create significant environmental damages through poor disposal practices. Conversely, disposal of inert building materials to landfill may create few disposal externalities, but failure to recover the embedded resource is thought by many to place greater pressure on the extraction of virgin resources, with attendant environmental impacts.

Therefore, the volume of waste disposed to landfill is a poor proxy for the range of environmental impacts arising across supply chains as well as for impacts between different waste streams. The relationships are too indirect to provide confidence that reducing waste volumes disposed will lead to demonstrable environmental benefits.

Nevertheless, several States have published strategic directions aimed at promoting (upstream) resource conservation outcomes via the pursuit of volume-based targets. Sub-targets have been set in some instances for particular waste streams based on perceived technologies available to divert and reuse wastes – rather than on any explicit prioritization of resources to conserve or where linkages with residual wastes disposed are strongest.

Box 4.1: *Can wastepaper recycling incentives save Australia's native forests?*

Many in the community believe that wastepaper recycling, promoted through a variety of instruments including kerbside source separation and landfill levies, will relieve pressure on the use of Australia's native forest resources. However diversion of wastepaper from landfill will have no effect on native forestry operations if redirected to:

- Illegal dumping, waste to energy, export (some 300 kt currently).
- Recycling, where recovered resource displaces imported wastepaper, wood fibre or product (some 2.4 mm^3 roundwood equivalent of wastepaper, woodpulp & paper products currently imported).
- Recycling, where recovered resource displaces domestic paper production based on plantation forestry or where pulpwood no longer processed is redirected to export (currently some 5,000 kt woodchips exported).

In total, only a fraction of paper products consumed in Australia is sourced from non-plantation native forests. Consequently wastepaper management policies are unlikely to influence native forest management practices in Australia.

4.3 Aligning market instruments and waste policy goals

Alternatively, policy instruments could be chosen to directly target impacts associated with waste management. Such an approach could target resource exploitation practices, pollution from upstream production / marketing / transport activities or externalities associated with downstream waste handling and disposal. Given the heterogeneity of impacts associated with alternative materials and supply chains, effective 'impact' instruments would need to be similarly differentiated. So for example, taxes applied at the product manufacturing or disposal stages would need to consider the nature and extent of associated impacts, rather than simply the volumes involved. That is, opportunities in these supply chains to introduce market instruments needs to be guided by the extent and significance of impacts.

Governments are already active throughout supply chains with a range of policy interventions to promote sustainable resource use. In the area of market instruments, notable applications in Australia include:

- Resource rent taxes (oil production), and tradeable quotas for forestry, fish and water.
- Performance bonds and emission fees to manage resource exploitation externalities.
- Emission fees, tradeable emission and offset schemes, cleaner production subsidies, renewable energy certificate scheme and subsidy programs to promote manufacturing processes that account for the environmental impacts they generate.
- Leaded petrol levy and proposals (in NSW) for the greening of vehicle sales tax & registration fees to encourage more environmentally benign transport options.

- Green power schemes and wood heater replacement subsidies to reduce air emissions associated with household energy consumption.

Government and industry stakeholders confirmed that waste policy objectives had shifted significantly from a focus on managing landfill disposal externalities to lessening upstream impacts. And of the upstream impacts, resource conservation rather than environmental impacts associated with production systems were viewed as the primary policy objective.

Despite available life-cycle studies indicating that environmental impacts associated with the processing and consumption of resources (such as air and water pollution) are likely to be more significant than those associated with resource depletion and extraction, stakeholders believe a strong community desire to promote resource sustainability has led to resource conservation now being the dominant waste policy goal.

It was also generally accepted that resource conservation policy was best pursued directly through natural resources and industry programs, rather than through waste policy. It was understood that the link between waste management and resource exploitation in many instances would be weak. However in the absence of comprehensive upstream policies, stakeholders believed waste initiatives for this purpose were worth pursuing, however imperfectly. The lack of any strategic targeting of waste policies to those waste streams that would have the greatest influence on Australia's natural resource base was not of significant concern. Perhaps for this reason, a continued focus on reducing volumes of waste to landfills as a policy metric received little challenge.

With the prominence placed on resource conservation, several stakeholders were critical that greater attention in this study was not directed to market instruments targeting *specific* resource conservation outcomes. We agree that several market instruments could potentially be directed to this end. However *which* resources such instruments should be directed at conserving is not apparent.

Most agricultural, forestry, mining, and energy resources extracted in Australia are exported, and changing the price signals faced by Australian consumers would have little impact on the management of our resource base. Key questions that need to be considered include:

- which resources are we trying to conserve? Locally consumed resources like sand, gravel and clay could be candidates, however, how scarce are they?
- what detrimental impacts could be avoided? Should conservation of resources be afforded the same attention as exploitation practices that result in impacts on biodiversity, land degradation or water quality?
- would addressing one resource simply result in greater exploitation of other resources with perhaps worse environmental impacts?
- does the resource conservation ethic captured in the 'Waste Hierarchy' adequately reflect conservation goals? For example, some stakeholders indicated that wood waste to energy represented an efficient recovery of resources, yet various policies prevented this use as it was

deemed as low value recovery (in the case of the Renewable Energy Certificates Scheme) or de-facto disposal (in the case of State policies on the use of wood residues).

If governments are to pursue a resource conservation waste policy goal, greater attention to these questions is arguably required. Clearly this is beyond the scope of this study.

In the absence of priorities for resource conservation, the volume 'metric' is used in this study as a proxy for resource conservation and broader upstream benefits. A range of potential instruments to reduce waste volumes to landfill are investigated. In addition, potential instruments specifically targeting downstream waste disposal impacts are investigated. While we argue that an *impact* waste policy objective would be more effective and efficient in reducing environmental damage associated with supply chains and waste management practices, it would represent a significant evolution from current policy settings directed at minimizing waste *volumes* and promoting unspecified resource conservation outcomes.

5 SELECTION OF MARKET INSTRUMENTS FOR INVESTIGATION

Market mechanisms generally provide an efficient means for allocating resources and organising the production of goods and services. Price mechanisms within these markets can ration scarce resources and provide incentives for the development of more efficient practices. However the existence of a range of natural resource and environmental issues indicates a failure of markets and basis for government policy interventions.

Due to market failure, private actions do not result in socially optimal outcomes, resulting in environmental degradation. Governments often act to correct these market failures. Effective intervention requires that a market failure exists *and* that the benefits of intervention outweigh the costs.

Existing regulatory approaches may promote inefficiency, inhibit innovation and impose unnecessary costs. This is because regulation usually imposes uniform regulation on all market participants, yet the cost of pollution abatement will vary, as may the damages of pollution discharged from various sources. Market instruments can often deliver equivalent outcomes at lower cost by allowing firms the flexibility to decide on whether to change their actions or incur higher costs. Those firms who face the lowest costs will make the environmental improvements.

Various market instruments were canvassed on the basis of their ability to achieve either of two policy objectives:

- Reducing the upstream impacts associated with solid waste disposal. Under this policy objective, volumes disposed are implicitly a proxy for the range of impacts created in upstream product supply chains that ultimately deliver residual wastes to landfill.
- Reducing the environmental impacts of post-consumer waste disposal. Under this policy objective, the focus is on designing instruments to make explicit the connection between potential environmental harm arising from the disposal of waste materials.

5.1 Types of Market Instruments

Market instruments generally operate as either a price or quantity based instrument.

Price based instruments assign a price to environmental impacts within existing markets through the imposition of charges, taxes or subsidies. Firms then respond to the modified market signals and adopt the resource use or management practice that offers them the greatest benefit and, if the policy is effective, leads to a better resource management outcome.

Price based instruments include charges and taxes (such as emission fees, user charges, product taxes, advance disposal fees and cleanup or restoration charges), subsidies and tax concessions, financial enforcement incentives (such as performance bonds and non-compliance charges), and deposit-refund systems.

Quantity based instruments create a market in the rights to engage in an activity (that may be associated with environmental damage) by restricting the total level of activity and allocating rights to participate in that activity. An efficient allocation of rights is then determined through a market mechanism. For example, rights may be created for the discharge of pollutants or for the protection of particular ecosystems, or existing rights for the use of resources such as water, forests and fisheries may be amended and made tradeable.

Property right approaches provide an incentive for those who can most efficiently undertake a desired activity to do so, while limiting the activities others do. In this way, total production of say pollution can be capped while minimising compliance costs. That is, those who can achieve pollution reductions at lowest cost will do so and sell their unused rights to others who face greater costs to achieve similar reductions.

Quantity based instruments include tradeable quota and certificate schemes, and offset schemes. The environmental regulator must determine the total quantity of the good, as well as a range of parameters that define who can own the various rights, the conditions under which trade can take place, how rights will be monitored and enforced, etc. Characteristics of efficient property rights include that they are well defined (divisible and exclusive), freely transferable, enforceable and secure. It is also critical that the definition of rights specify their use in time and space.

Because of the need to substantially overhaul existing legislation to create the regulatory framework needed for market approaches, these instruments have to date had limited use. In particular, there application has predominately been for the management of urban air pollution, where emissions are from already regulated and monitored point sources

Where the marginal benefits and costs of using the resource are well-understood, similar outcomes and efficiency of resource use can be achieved using either a price or a quantity instrument. In these circumstances the administration, monitoring and enforcement costs of each alternative will be important factors to consider when choosing between price and quantity instruments.

5.1.1 Market instruments to reduce waste volumes to landfill

- ***Tradeable landfill quota schemes*** **-** are quantity based instruments applied to waste disposed to landfills that would directly target a waste volume reduction goal. The quota would be allocated to landfill operators who would be required to limit landfilled volumes in accordance with quota entitlements held. Landfill operators could trade quota entitlements to ensure wastes were disposed at the more cost-efficient landfills. It would be possible to have liability rest with waste collectors (rather than landfill operators), but this would lead to increased administrative and enforcement costs without significant offsetting gains. The landfill 'scarcity' created would send a strong price signal to waste generators, and market forces would determine which wastes were diverted. There are no existing tradeable landfill quota schemes in Australia, but the UK has recently introduced such an instrument.
- ***Landfill levies*** – are applied to each tonne of material disposed at landfills with the aim also of reducing the volume of waste disposed. Most States and Territories in Australia already use landfill levies (see next section for details).

- ***Tradeable landfill diversion certificates*** **–** are quantity-based and applied to encourage waste 'diversion'. Such a scheme could be introduced at the national, state or regional level, and would be applicable for all waste streams. A threshold diversion rate would need to be set by the regulator. Designated product manufacturers would be required to hold certificates proportional to their volume or weight or value of production within a set period. Alternatively, liability could be placed on local government, such that a certain number of certificates were required based on population or waste volumes disposed to landfills. Certificates would be issued to re-users / recyclers based on net waste volumes processed and would be tradeable. As weight may be a poor proxy for compacted landfill volume, 'exchange rates' between different waste streams could be considered. There are no tradeable landfill diversion certificate schemes operating in Australia or overseas.

- ***Recycling certificate schemes*** **–** a more narrow application of a landfill diversion scheme is the use of tradeable recycling certificate schemes. It would be applied in the same way as the landfill diversion certificates, except to a narrower set of waste reduction activities. This type of scheme could be used to increase the quantity of waste recycled and/or to target products/materials that present significant environmental risks when illegally disposed. In the UK the introduction of minimum recycling targets for the packaging industry led to a tradeable recycling certificate scheme. There are no schemes of this type in Australia, although the renewable energy certificates scheme has significant parallels.

- ***Variable user collection fees*** **-** variable rate charging systems for (domestic) waste collection are price-based instruments applied by weight, bin number and/or bin size aimed at encouraging waste diversion. They are currently used by some councils in Australia.

- ***Recycling or composting subsidies*** **-** recycling and composting subsidies have been used widely amongst Australian States and Territories. A scheme could be based on direct subsidies per tonne of material diverted for recycling. Subsidies could also be used to target products / materials that present significant environmental risks when illegally disposed. To maximise waste diversion volumes with available budgets, subsidies could be allocated by competitive tender.

- ***Advance disposal fees*** **-** are fees levied on certain products based on the estimated costs of collection and recycling? They have been used widely overseas for a range of products such as beverage containers, tyres, batteries and mobile phones. There has been limited experience to date in Australia. ADFs could be introduced at a national level for selected high volume waste materials or for waste with high impacts when illegally disposed.

  To provide an incentive for innovation in product or process design to facilitate material reduction or greater recycled content, ADFs need to be performance based. Performance could also be linked to producers' downstream management of products entering the waste stream (eg; supporting reuse or recycling).

- ***Deposit refund schemes*** **-** have been used widely overseas, with container deposit legislation being the best known type of deposit refund scheme. South Australia has operated a deposit refund scheme for beverage containers since 1975. Wider use of deposit refund schemes could in principal be introduced for selected high volume waste materials or for wastes with high environmental impacts. The deposit could be collected at either the production or marketing stage and be refunded at either the household or recycling stage (depending on administrative costs). Generally these instruments are best suited for discrete products that have high marginal disposal costs, including in relation to littering.

- ***Product design incentives*** *(subsidies or taxes)* **-** or cleaner production subsidies are common overseas and in Australia. The programs generally provide grants for initiatives to reduce use of energy, water and material resources and to minimise waste and pollution arising from a product. Taxes for 'poor' design could in principle be used, but as this would require assessment of all products / producers, such instruments would be either very narrow or unwieldy in application (subsidies have the advantage of good performers self-nominating and hence reducing the administrative burden). A nationally coordinated subsidy scheme could be provided to product manufacturers (either directly or through tax concessions) to encourage design of new products or redesign of existing products that generate high waste volumes.

5.1.2 Market instruments to reduce waste impacts

- ***Performance bonds for landfills*** **-** regulatory requirements for environmental rehabilitation of poorly managed landfills may fail where operators become bankrupt or leave Australia. To overcome this problem with 'orphaned' sites, landfill operators would be required to post performance bonds to cover post-closure rehabilitation that may arise due to land or groundwater contamination. Performance bonds are not widely used in Australia for landfill operations, but are for the rehabilitation of mine sites.
- ***Emission fees for landfills*** **-** are not currently used at landfills in Australia, although NSW has indicated the likely extension of its current industrial emission fees (under its Load-based Licensing scheme) to landfills. Victoria requires landfills to pay load based fees, however, these are based on the volume of waste landfilled as a proxy for pollution load. Emission fees would directly target air and water emissions from landfill, and could also potentially be extended to include the management of amenity issues such as odour and noise.
- ***Emissions fees for waste to energy*** **-** emission fees are used in Australia for activities generating emissions and so could be extended to cover air and water emissions for waste to energy plants.
- ***Differential landfill levies*** **-** landfill levies are common across the States and Territories, but generally are not differentiated. In Western Australia there is a higher rate for general waste than inert waste. In Victoria, there are different rates for municipal, industrial and prescribed industrial waste. A range of exemptions and rebates provides a coarse differentiation in some other States. Differential landfill levies applied to different waste streams would be designed to reflect the impacts associated with disposing of those wastes.
- ***Instruments to reduce Illegal disposal externalities*** – a range of instruments, including recycling subsidies or certificate schemes, advance disposal fees and deposit refund schemes, can be used (and have been described above).

Table 5.1 summarises the potential instruments that could be used to meet key waste policy objectives and where they would be applied in the supply chain.

Table 5.1: Policy objectives and potential instruments

Policy objective	Applied to:	Potential Instruments
Reducing waste volumes	Waste disposal to landfill	o Tradeable landfill quota schemes o Landfill levies
	Waste diverted from landfill	o Tradeable landfill diversion certificates o Recycling certificate schemes o Variable user collection fees o Recycling or composting subsidies
	Upstream of waste generation	o Advance disposal fees o Deposit refund schemes o Product design incentives (subsidies or taxes)
Reducing waste impacts	Landfill or waste to energy externalities	o Performance bonds for landfills o Emission fees for landfills o Emission fees for waste to energy o Differential landfill levies
	Illegal disposal externalities	o Recycling subsidies o Recycling certificate schemes o Advance disposal fees o Deposit refund schemes

5.2 Existing market instruments to manage waste in Australia

A number of market instruments have already been applied for waste management in Australia.

Landfill levies

Most States impose levies at the landfill gate. The levies are paid as part of landfill charges by the council or waste management contractor and are recovered through rates and waste management charges. The variation in levy rates and their contribution towards total landfill charges across the States is illustrated in Table 5.2.

Table 5.2: Average landfill costs and government levies 2003 (municipal waste) ($/tonne)

State	Landfill Costs	State Levy	Total
NSW – metropolitan	50	18.2	67
– Hunter, Central Coast & Illawarra	50	9.6	8
Victoria – metropolitan	25	3-10	28-35
Queensland	35	0	35
Western Australia (metropolitan only)	35	3	38
South Australia – metropolitan	35	5	40
– non metropolitan	35	2	37
Northern Territory	35	0	35
Tasmania	35	0	35

Notes: NSW - levy rates in both metro and extended areas will rise to $25/tonne by 2012.
Victoria – levy rates vary depending on the type of waste and location. They will increase to $7-$30 by 2007/2008.
SA - landfill costs in metro areas are expected to increase to $60/tonne after existing landfills are full. The SA government recently announced that the levy in metro areas is rising to $10/tonne.

Most States use part or the entire levy funds collected for waste reduction projects. In Victoria the levy funds Ecorecycle Victoria. In NSW, 55% of the funds are hypothecated to waste management programs, including the administrative costs of Resource NSW.

Rebates and exemptions from levies are often used to provide an incentive for reuse and recycling. This has often made administration and enforcement complex, with some diverted material being used for purposes akin to disposal. In addition, rebates for reuse / recycling have been provided for materials separated at landfills irrespective of whether the materials are ever used. Anecdotal evidence suggests some stockpiling of materials that could be construed as above ground landfilling.

Although the stated purpose of most landfill levies is to account for environmental impacts, levies on various wastes are not differentiated to account for their environmental impacts in either landfilling or associated with upstream production and consumption activities. Also, as the incidence of the levies is on parties disposing waste to landfill, it provides no incentive for landfill facility operators to improve management practices and hence reduce environmental impacts below regulated levels.

It is interesting to note that the policy goal behind the NSW waste levy has changed in recent times. The levy was originally introduced to internalise the environmental impacts associated with disposal of waste to landfill. The rationale behind the more recent increase in the levy rate is now to promote upstream resource conservation. The levy rate has been set based on the *Alternative Waste Management Technologies and Practices Inquiry*[25] which estimated that it can cost up to $30 more to reprocess than dispose of common waste types.

Turning to the performance of levies in reducing the *volume* of waste disposed, the NSW review of the *Waste Minimisation and Management Act* (1995) by the NSW EPA found that the NSW waste disposal levy has improved the viability of recycling materials, primarily construction and demolition waste but also green waste, metal, glass and plastics. Wright 2002 states that the recycling performance of the

[25] Wright,et. Al. (2001) op.cit.

NSW construction and demolition sector is high by international standards and that this is due to the impact of the waste disposal levy on the relatively heavy mass of C&D waste, and the homogeneity of these materials making collection and sorting relatively efficient. However increased waste diversion or recycling volumes does not in itself indicate reduced environmental impacts or greater net benefits when all costs and benefits are taken into account.

It is difficult to assess how effective landfill levies in Australia have been given the range of other factors influencing waste disposal volumes to landfill. Available research indicates that the price elasticity of waste disposal is very low, suggesting the modest success in waste diversion may be attributable to other factors. For many recycled materials, requirements for source separation and the availability of subsidised collection and processing may have had a greater impact than landfill levies. In addition, governments have pursued a range of education and industry specific waste reduction programs, often with legislative backing.

Material diverted in response to the landfill fees will be those for which the cost of alternative management is lowest – this raises the problem of illegal dumping. By its nature, data on illegally disposed volumes is scant and it is therefore difficult to determine whether increased gate fees with the levies have led to increased dumping. It is notable however that some jurisdictions have significantly increased their policing of illegal dumping in association with the introduction of higher fees.

Variable user charges for domestic waste collection

In 1999 Atech undertook an investigation and review of existing variable rate charging schemes to assist NSW councils and Regional Waste Boards in determining appropriate fee regimes for waste collection[26]. They found user charges had been introduced for a range of reasons including:

- To reduce domestic waste going to landfill.
- To improve the equity of domestic waste charges.
- To provide financial signals in regard to the value of protecting the environment.

Atech state that user charges for domestic waste collection in Australia have been successful in the majority of cases, achieving waste reductions reportedly of up to 50% in some cases. Table 5.3 below summarises the performance of Australian schemes where quantitative information was available.

Table 5.3: Performance of Australian user charges for domestic waste disposal in 1999

Council	Scheme description	Effectiveness
North Sydney	4-bin scheme from 1993	Domestic waste collected fell 38% between 1991/92 to 1993/94.
Shellharbour	Frequency based scheme from 1996	Waste diversion from landfill disposal to recycling increased by 15%. Over a two year period 45% reduction in waste going to landfill.
Camden	3-bin scheme from 1996/97	Recycling participating increased from 40% to virtually 100%. Recycling increased by 440%.

26 Atech, Variable rate charges for domestic waste collection, prepared for Hunter Waste Planning and Management Board on behalf of the NSW regional waste boards, May 1999

City of Sydney	5-bin system since 1994	Four-fold increased in quantity of recyclables.
Hawkesbury	2-bin scheme since 1997	Small reduction in waste and an increase in recyclables reported.
Manly	Extra-bin scheme since 1995	Waste volumes reported to have dropped by 50%. Part of the drop is attributed to the introduction of a recycling service.
Warringah	2-bin scheme since 1997	Increase in waste and increase in recyclables. Differential in charges considered insufficient to provide and incentive for waste reduction.
Ecorecycle Victoria	15 Victorian councils introduced variable rate pricing as part of a Kerbside Development Program.	Reduction in general waste from an annual average of 15kg/household/yr to 6-9kg /household/yr. For every additional 2kg of waste diverted to recycling there is an estimated 1kg decrease in total waste (avoided).

Source: Atech, Variable rate charges for domestic waste collection, Phase 1: Investigation and Review, Prepared for Hunter Waste Planning and Management Board on behalf of the NSW Regional Waste Boards, May 1999

The reported success of these instruments seems incongruous with empirical studies of the effect of variable pricing. Various US studies argue that demand for garbage collection services is inelastic (Jenkins 1993, Hong et al 1993, Reschovsky and Stone 1994, Kinnaman and Fullerton 1997). For example, Kinnaman and Fullerton[27] cite 11 US studies that all identified waste disposal volumes as being relatively unresponsive to variable pricing regimes. The paradox may lie in the role of other complementary policies, such as the provision of recycling bins, education programs, and the like that accompanied the introduction of variable pricing regimes in Australia.

In addition, most councils report that the incidence of illegal disposal increased significantly when variable rate charges were introduced. Councils have used both enforcement and education programs to manage this.

Advance disposal fees

A form of advance disposal fees has been implemented in Australia within a broader *Extended Producer Responsibility* framework under the National Packaging Covenant. The covenant aims to minimise the environmental impacts of consumer packaging waste throughout the entire life cycle of the packaging product and develop economically viable and sustainable recycling collection systems. The covenant is supported by a National Environment Protection Measure requiring non-signatories to meet certain standards unless they can show they are achieving equivalent outcomes to those companies implementing the covenant. Participating companies provide an annual financial contribution towards funding a series of studies and programs to assist local government in the transition to a fully market based approach to kerbside recycling.

Recycling subsidies

The level of expenditure for kerbside collection of recyclables across Australia that is financed through local rates was estimated by Nolan ITU in 2000 at $275 million per annum. There is a substantial

[27] Kinnaman and Fullerton (1999), The economics of residential solid waste management, NBER Working Paper 7326, Canbridge

difference reported in the literature between the cost of kerbside collection services and the revenue from recyclables. The net financial cost of kerbside collection programs in Australia was estimated at $26/household per year. Based on 4.9 million households nationally the net national cost of recycling services is estimated at around $125 million.

The National Packaging Covenant contains a commitment for funding of $34.9 million towards improving the sustainability of kerbside recycling, including strengthening and expanding markets for collection materials. These funds are to be shared between government signatories and industry.

In most Australian States, some of the revenue generated from landfill levies is hypothecated to waste management programs, including recycling projects.

In NSW funds spent to support recycling over the last 8 years has included $3.7m allocated to Local Government for the maintenance of kerbside recycling activities; $1.2m grant program for regional councils for capital improvements to recycling systems; some of the $6m used as part of the community waste reduction grants program; some of the $100m allocated to regional waste boards and Resource NSW; and some of the $6m allocated by NSW to the national packaging covenant.

In Victoria, Ecorecycle spent $42.3m between 1997/98 and 2000/01 on private and public sector projects. Around two thirds of this was allocated to local councils and regional waste management groups to establish infrastructure for recycling and waste management. In 1999 the South Australian Government allocated $250,000 to assist rural communities for rural recycling and waste minimization.

While these subsidies and other recycling policies have led to increased diversion of landfill materials for recycling, recycling throughput has varied as market demand has fluctuated. This has led to instances of recyclate stockpiling and threatened the viability of some recycling collections and processing. This has on occasion prompted crisis funding to reimburse councils or recyclers for losses from downturns in recyclate markets. While efficiency gains in recycling collection and processing systems may be possible, in general, increased recycling volumes are likely to come at increasing per unit cost as additional material is gathered from more problematic sources (such as more remote or dispersed sites, collections without source separation or with greater contamination, lower grade materials, etc).

Several industry stakeholders argued that local government support for kerbside recycling should not be perceived as a subsidy. Rather it represented payment for a service sought by ratepayers, provided either directly through their Council workforces or through a private service provider chosen through competitive tender.

Business support assistance

Most States provide grants for cleaner production and recyclate market development. Some examples of business support assistance are:

- In 2001, the NSW Government established a Profiting from Cleaner Production Industry Partnership Program with $5m over three years from the Waste Fund.

- Resource NSW has a role in developing markets for recycled materials and has $3 million allocated for a research and development scheme.
- In Victoria, $200,000 raised from landfill levies was spent in 2001/02 on cleaner production programs.
- Under South Australia's pollution prevention fund $1.1m has been provided in financial assistance, primarily for cleaner production projects.
- In Queensland, $270,000 has recently been provided to encourage the establishment recycling facilities and markets for recycled products.

There are case studies available to demonstrate the success of individual cleaner production projects that have received funding under these programs. However, given the indirect and opportunistic nature of the grants schemes, their effectiveness in reducing the volume of waste disposed or environmental impacts in the supply chain is difficult to identify.

Deposit refund schemes

South Australia's deposit refund scheme has been effective in recovering beverage containers for recycling. There is a high level of public participation with return rates for 1998 of 84% for aluminium cans, 84% for glass bottles and 74% for plastic bottles. These rates are high by international standards, with average container recovery rates in the US of around 75% for States with CDL compared to 25% for non-CDL States.

A review of South Australia's container deposit legislation in 2000 found the total costs of the scheme to South Australia were $3.3 million per annum[28]. The review quantified benefits of $720,000 pa (replacement of virgin materials) and $150,000 in annual export income, leaving a net cost for the scheme of $2.43 million.

The major environmental benefits that were not quantified include:

- Substantial reduction of containers to the litter stream.
- Diversion of waste from landfill – CDL depots estimated to contribute 7% to a total domestic waste diversion rate of 17%.
- Pollution reduction – discharges from aluminium and PET production reduced in relevant communities in Australia through the use of recycled materials.
- Replacement of virgin materials - CDL estimated to replace 16,000 tonnes pa of sand, limestone and soda ash used for glass manufacture in SA (of a total of 40,000 tonnes pa replaced), contribute 3,000 tonnes pa of aluminium cans interstate for recycling and displace use of raw materials in PET production elsewhere in Australia.

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[28] Philip Hudson Consulting, Public Report on the Review of the Economic and Environmental Impacts of the Beverage Provisions of the Environment Protection Act 1993 (Container Deposit Legislation) in South Australia, March 2000

The review concludes that given the SA community's high acceptance of the deposit system, the community is willing to pay the costs of the scheme to achieve litter reduction and improved environmental outcomes.

The report from the NSW Independent review of CDL reviews the literature on the impact of South Australia's scheme on litter and states that the results are inconclusive. Containers are estimated to be 6% of the litter stream in South Australia, with 2% of this being containers included in the scheme. The available data for 1996 suggests that Victoria has a lower percentage of beverage items in the litter stream than South Australia. However, if only those containers incurring a deposit in South Australia are compared with other States, South Australia is lower than Victoria.

Performance bonds

In Victoria, financial assurances are used for landfills and premises handling certain industrial wastes. The assurance is based on the potential costs for cleanup, with provisions for discounting based on the quality of site engineering and management, providing site operators with an incentive to improve performance and risk management.

5.3 Screening of potential instruments

The potential market instruments were assessed on the basis of their ability to achieve either of the two policy objectives of either reducing the volume of wastes going to landfill (to promote upstream benefits) or in reducing the environmental impacts of (downstream) post-consumer waste disposal.

5.3.1 Instruments to reduce waste volumes to landfill

Table 5.4 provides a comparative assessment of instruments to manage waste volumes. The assessment is relatively subjective. Nevertheless, we believe it draws out the substantive differences between the instruments.

Policy compliance costs are likely to be lowest where instruments offer the widest range of compliance choices. Landfill quota and levy instruments focus on what is deposited in landfills, but not on what uses other material can be put to. Diversion certificate schemes would seek to prevent the use of diverted material in ways that posed environmental or health risks, and in certifying appropriate uses would reduce compliance choices. Recycling certificate schemes target more narrowly defined waste streams and reuse options, and so compliance costs can be expected to be relatively higher.

The attractiveness of landfill instruments in minimizing overall costs would be undermined where enforcement costs to prevent illegal or inappropriate disposal became significant. Managing / minimising illegal disposal is seen by many stakeholders as the weakest link in the waste management chain, and would need to be specifically considered when framing policy interventions. Diversion or recycling certificate schemes impose no penalty on material that is not diverted, and so would not encourage illegal disposal. These types of schemes are new to government and would require significant changes in administrative systems to implement and enforce.

Table 5.4: Comparative assessment of market instruments to manage waste volumes

Instrument	Effectiveness	Minimise illegal dumping	Minimise compliance costs	Immediate incidence of costs	Administrative feasibility
Landfill Quotas	√ √ √	X	√ √ √	Waste Generators	√ √
Landfill Diversion Certificates	√ √	√ √ √	√ √	Producers or Waste Generators	√
Landfill Levies	√ √	X	√ √ √	Waste Generators	√ √ √
Variable User Fees	√	X	√	Waste Generators (households)	√ √
Recycling Subsidies	√ √	√ √	√√	Government	√ √
Recycling Certificate Schemes	√ √	√ √	√√	Producers	√
ADFs	√	√	√	Producers	√
Deposit-Refund Schemes	X	√ √ √	√	Producers / Consumers	√
Product Design subsidies	√	√	√	Government	√ √

Recycling subsidies have been widely employed despite the costs to government, due in part to their administrative simplicity and stakeholder support. However they are likely to be relatively ineffective and fail to minimise compliance costs unless they are outcome based and use competitive allocation approaches.

Advance disposal fees that incorporate performance requirements are likely to be both narrow in focus and indirect in terms of volumes disposed to landfills. Consequently they would be comparatively ineffective, high cost and have little influence on illegal dumping. Deposit-refund schemes are simply not suited to the high volume waste streams despite their conceptual appeal in dealing with illegal disposal.

Essentially the choice of a market instrument to promote reductions in waste volumes disposed to landfills becomes a trade-off between effectiveness and implications for illegal dumping. If other policy instruments and enforcement regimes could prevent increases in illegal dumping at low cost, then landfill quota or levy instruments would be superior and administratively straight forward to implement.

Where this is not the case, a more indirect instrument may be preferable. This undoubtedly has prompted recent interest in recycling subsidy or tradeable certificate schemes.

The choice between a price and quantity based instrument must also be considered. With waste disposal believed to be relatively unresponsive to price signals, significant price incentives may be required to prompt a modest reduction in disposal volumes. The cost and viability implications imposed on the various agents involved in waste management would need to be carefully considered against anticipated benefits. With a quantity based instrument the price is determined in the market, and cost imposts may not be apparent. Alternatively, price approaches provide no certainty that targeted reductions will be achieved, and will also have budgetary implications for government.

To identify the best instrument taking into account effectiveness, illegal dumping, compliance and administrative costs, we recommended further investigation of volume based market instruments focusing on two quantity based instruments – namely landfill quota and landfill diversion certificate schemes, and one pricing instrument – subsidies allocated via competitive tender.

In our consultation on the screening of instruments, there was mixed support from stakeholders for tradeable diversion certificates. The instrument is conceptually appealing if volume reduction is the key policy objective, as it encourages a broader set of actions to divert waste from landfill compared to product based recycling certificate schemes. However, several constraints to implementing a landfill diversion certificate scheme were identified by stakeholders during consultation, including:

- Given the broad range of product types, there would be significant difficulties and costs in allocating and enforcing certificates (although it was suggested that liability could alternatively be placed on local government rather than producers, significantly reducing the administrative burden of such a scheme)
- Difficulties may be faced in certifying some reuse options and recycled product standards may be needed to ensure environmental or health problems did not arise
- Many reuse / recycling activities occurred on-site or by small operators, which would pose significant administrative difficulties and scope for rorting
- If applied at the State level, there would be an equity issue as interstate movement of resources and goods means local producers would fund recycling of imported waste streams
- The lack of data on levels of production, import, recycling and landfilling of some products makes it difficult to establish and maintain baseline data
- The instrument promises little benefit over and above what is being achieved through landfill levies, yet would be costly to administer.

Overall stakeholders were more interested in further assessment of product-based recycling certificate schemes directed at managing problematic wastes (notwithstanding this would be more pertinent to downstream rather than upstream impacts). Many of the design issues would be similar but the instrument had greater potential to fill a policy gap. Without dismissing the potential for a tradeable diversion certificate scheme to contribute to reducing volumes of wastes to landfill, we chose to direct Stage 2 analysis towards recycling certificate schemes.

5.3.2 *Instruments to reduce post-consumer waste impacts*

Turning to market instruments that could be employed to manage waste impacts, Table 5.5 provides a similar comparative assessment.

The potential market instruments identified seek to manage three types of impacts associated with waste disposal. Firstly performance bonds have been suggested as an instrument to encourage improved landfill management so as to minimise post-closure contamination. The instrument is likely to be effective, provide flexibility for landfill operators to innovate and reduce compliance costs, and should have negligible impact on gate prices and hence illegal dumping.

Secondly, landfill emission fees or differentiated landfill levies have been identified to manage air and water emissions that arise during the operational life of landfills. Emission fees should be more effective as they directly target emissions rather than requiring assumptions to be made about potential emissions associated with different wastes being disposed. Emission fees provide incentives for the use of compliance options at the landfill (such as methane recovery) and so should drive down compliance costs. Both instruments however would result in higher gate fees (unless there were offsetting reductions in current levies) that could encourage illegal dumping.

Lastly, a number of instruments have been identified that could assist in reducing impacts associated with the illegal disposal of wastes. Recycling subsidies or certificate schemes have broad potential application. Subsidy approaches could be enhanced if they were outcome based and employed competitive allocation methods to find low cost compliance options. Recycling certificate schemes could be superior in this regard, as well as providing greater certainty regarding recovered volumes – which for high risk wastes may be an imperative. Advance disposal fees have proved useful instruments to raise revenue, but are generally too indirect to leverage improved waste collection or recycling.

Some stakeholders expressed support for advance disposal fees as a tool for encouraging better recycling performance. Advance disposal fees may be a useful tool if there is a strong behavioural link between performance and the fee paid, and there is a well defined set of producers and importers of the product. Advance disposal fees are a price instrument corresponding to recycling certificate schemes (the quantity instrument aimed at achieving the same objective). The outcomes of performance-based advance disposal fees would be similar to recycling certificate schemes except that they have the potential to capture a broader set of reuse / recovery activities. Like recycling certificate schemes, stakeholders saw advance disposal fees as an effective tool in engaging producers in waste management issues. Given the available time for the assessment, we have had to limit consideration to only one of these instruments. For this reason and stakeholder support for further assessment of product based recycling schemes, we chose to look at recycling certificate schemes rather than advance disposal fees.

Table 5.5: Comparative assessment of market instruments to manage waste impacts

Instrument	Targeted impacts	Effectiveness	Minimise illegal dumping	Minimise compliance costs	Administrative feasibility
Landfill performance bonds	Post closure contamination	√ √	√	√ √	√ √ √
Landfill emission fees	Air & water emissions during life of landfill	√ √	X	√ √ √	√
Differential landfill Levies	Air & water emissions during life of landfill	√	X	√ √	√ √
Recycling Subsidies	Illegal disposal externalities	√ √	√ √	√	√ √
Recycling Certificate Schemes	Illegal disposal externalities	√ √	√ √	√	√
ADFs	Illegal disposal externalities	√	√	√	√
Deposit-Refund Schemes	Illegal disposal externalities	√ √ √	√ √ √	√	√

Deposit-refund schemes may be best placed to provide a direct incentive at the consumer level where littering is a problem (such as with beverage containers) or in relation to low volume but high impact wastes (such as batteries, tyres).

As a range of downstream impacts are being targeted under this policy approach, a mix of instruments was recommended. This could entail both landfill emission fees and performance bonds, coupled with instruments to manage illegal disposal of problematic wastes. Performance bonds were not recommended for further investigation as they are relatively straight forward in design, and some States are already moving to greater use of this instrument. Deposit-refund schemes are also receiving significant attention by government at present and so other instruments are recommended to be explored in the study.

Subsidies allocated by competitive tender were recommended for further investigation to reduce waste volumes, and the conclusions will be as pertinent for managing impacts from problematic wastes. Consequently, we recommended further investigation of impact based market instruments focus on landfill emission fees and recycling certificate schemes.

5.3.3 Instruments selected for further investigation

The table below identifies those waste management instruments that were selected for further investigation.

Table 5.6: Policy objectives and instruments for investigation

Policy objective	Instruments for investigation
Reducing waste volumes	1. Tradeable landfill quota schemes
	2. Performance subsidies by tender
Reducing waste impacts	3. Recycling certificate schemes
	4. Landfill emission fees

A comparative analysis of each instrument is provided in chapters 6 - 9. For each of the instruments, there are many alternative options for their scope, application and design. For our analysis, one specific application of each has been proposed. However, we are not seeking to argue the merits or otherwise of addressing a particular policy objective, waste stream, or instrument application.

Moreover, available data and time prevents the quantification of all impacts and consideration of detailed design and implementation issues. Nevertheless we believe each case study is sufficient for the purposes of illustrating the potential application of each instrument.

For each case study application, we outline the legislative powers and administrative settings required, key design issues, and an indication of the order of magnitude of costs and benefits relative to current policy settings. Important barriers and stakeholder issues are also outlined.

6 TRADEABLE LANDFILL QUOTA SCHEMES

Tradeable landfill quota schemes were shortlisted as promising instruments to use to reduce the volume of waste disposed to landfills. The comparative assessment in this chapter has been developed drawing on the conceptual framework of the proposed UK landfill permit scheme. For this case study we examine a landfill quota scheme applicable to all solid non-hazardous wastes going to landfill, whereas the UK scheme is to apply only to biodegradable municipal waste.

An Australian scheme could be applied nationally, however the potential to subvert quota restriction through dumping, particularly in rural and regional areas, may result in a scheme with high administration and compliance costs. A localized scheme covering a metropolitan area will avoid these problems, although some leakage of waste into adjoining landfills / dumping may still occur. Thus, although all issues will be discussed, the comparative analysis will focus on an illustrative scheme for the Sydney metropolitan area.

6.1 Description

A single quota would apply across all waste streams, and be implemented to reflect State targets for reducing waste disposed to landfill. The quota would be allocated in terms of the weight of material disposed, as a proxy for compacted volume. The liability for holding quota entitlements would rest with landfill operators. A quota entitlement would give the operator a right to landfill a certain quantity of waste in a year. Landfill operators would be able to buy and sell entitlements.

Total quota entitlement levels could decline in quantity over time to gradually meet disposal targets. Entitlements in excess of landfilled amounts accrued in early years of the scheme could be banked for use in later years. This would encourage operators to pass on incentives to waste generators early and offer a risk management approach to deal with short-term imbalances between waste volumes presented to landfills and entitlement availability. Entitlement banking has proved an important adjustment mechanism under the US Acid Rain Scheme where a sharp reduction in overall quota levels over time was applied.[29]

The scheme works by encouraging landfill operators to set gate fees so that profits per tonne of waste received will at least be equivalent to the cost of buying entitlements or the profit made in selling spare entitlements to other operators. It is expected that waste generators would divert waste to recycling or reuse activities where this represented a lower cost than gate fees. Through entitlement trading, waste disposal would shift to low cost landfills with wastes received being those for which alternative recycling or reuse posed the greatest costs. In aggregate, the combined costs of landfilling and recycling would be minimized.

Operators disposing more waste than their entitlements allowed would be forced to either purchase entitlements from other operators or pay a penalty. The penalty should reflect the marginal cost to society from having an additional tonne of waste landfilled rather than reused or recycled.

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[29] See for example Stavins (2001), Experience with Market-Based Environmental Policy Instruments, RFF Discussion Paper 01-58, Washington

The quota scheme would provide an incentive for recycling or reuse services. Recyclers would be competing to provide a cost-effective alternative than disposal to waste generators.

There are two assumptions underpinning the success of such a tradeable quota scheme:

- That the environmental benefits are similar no matter what type of waste is diverted from which landfill (despite there being clear differences across waste streams and landfills), and,
- That there are enforcement and regulatory procedures to prevent illegal dumping (which again may be questionable).

6.2 Legislative powers and administrative settings

It may be possible to implement a tradeable landfill quota scheme through a National Environment Protection Measure with supporting legislation at the State and Territory level (similar to the model proposed for the United Kingdom). Alternatively, individual States could introduce quota schemes at either the State or regional levels. Regulatory enforcement and day to day administration of any quota schemes would need to take place at the State level. If a national scheme is envisaged, legislation would need to be similar across the States to prevent leakage of waste across State boundaries[30]. Inconsistent legislation or a scheme enacted in only a few States could provide an incentive for waste to be transferred across State boundaries to avoid quota payments. Similar problems would arise if a scheme were applied across a limited metropolitan area surrounded by an extended urban area.

Each State currently licences selected landfills as part of their regulatory framework for waste management. Each State's quota would be enforced by amending the current licensing systems for landfill operators. States would have the option of establishing a scheme administrator to manage the day to day operation of the scheme. The rules of the scheme would be set in State regulations and the scheme administrator could be a private body.

Because of the potential complexity of a national scheme, it might be more appropriate to undertake a scheme covering a major waste catchment. This would cover say a major metropolitan region, where a State Government would have the legislative power to prevent leakage to adjoining regions. In the following discussion, we focus on a scheme covering a major metropolitan zone rather than a national scheme.

The licensing system would impose a duty on operators not to landfill more waste than they hold entitlements for (including entitlements which have been banked or which have been transferred from other operators). Regulations would also require the landfill operator to maintain certain records, gather specific information and send returns to the scheme administrator. The regulations would include appropriate penalties for landfilling of waste without holding the appropriate entitlements, as well as penalties for failing to meet any other administrative requirements of the scheme. Penalties for illegal disposal would also need to be reinforced and perhaps strengthened.

30 An example is the legislation enacted in each State to underpin the National Electricity Market.

6.3 Design issues

Table 6.1: Key design issues for tradeable landfill quota scheme

Design issue	Comment
Basis of quota	Weight of material disposed, as a proxy for compacted volume.
Quota targets	The quota level would be set at a level to reflect the State's target for reducing waste disposed to landfill. Each quota would initially be set to reflect a small initial reduction in waste to landfill and would decline over time to meet the target level in order to minimise transitional costs.
Liable parties	Landfill operators.
Obligations of liable parties	Liable parties must hold quota entitlements reflecting the volume of waste land filled each year.
Allocation of quota entitlements	Initial quota entitlements could either be auctioned or 'grandfathered' based on various and multiple criteria, such as to take into account both the amount of waste currently disposed to landfill, and the environmental performance of the landfill both in terms of landfill management practice and past efforts to divert waste from the landfill. For the illustrative purposes of this case study we have followed the UK lead and assumed grandfathering based on current disposal volumes.
Spatial scheme boundaries	Major metropolitan centre. The scheme could operate within individual Australian States and Territories in order to meet targets. Schemes could permit cross border trading as long as enabling regulations were made by each relevant State or Territory.
Coverage of waste streams	The quota scheme would operate for all solid waste streams – municipal, commercial and industrial and building and demolition.
Banking and borrowing	Banking should be unlimited to allow low cost options to be adopted early. Limited borrowing could be permitted to cover unexpected events.
Baseline	No baselines are necessary.
Penalty	Specified in regulations. Would be set at a rate to prevent cost imposts on waste generators exceeding the social benefits from waste diversion and associated increases in illegal disposal. It is notable that the UK scheme, developed to meet the EU landfill directive, has no suggestion of soft penalties to contain likely industry compliance costs.
Illegal dumping	Regulatory activities to prevent illegal dumping would need to increase alongside enforcement of the scheme.
Property rights of quota	Transferable between landfill operators. As in the UK scheme, third parties cannot purchase permits, they can only be owned by a landfill operator

Design issue	Comment
Regulator/administrator	State and Territory agencies currently responsible for regulation of landfills. States would have the option of using a private body to carry out administration of the scheme.
Funding of scheme	The scheme would be funded through a charge on the issuing of entitlements or money collected from penalties paid

6.4 Comparative Assessment

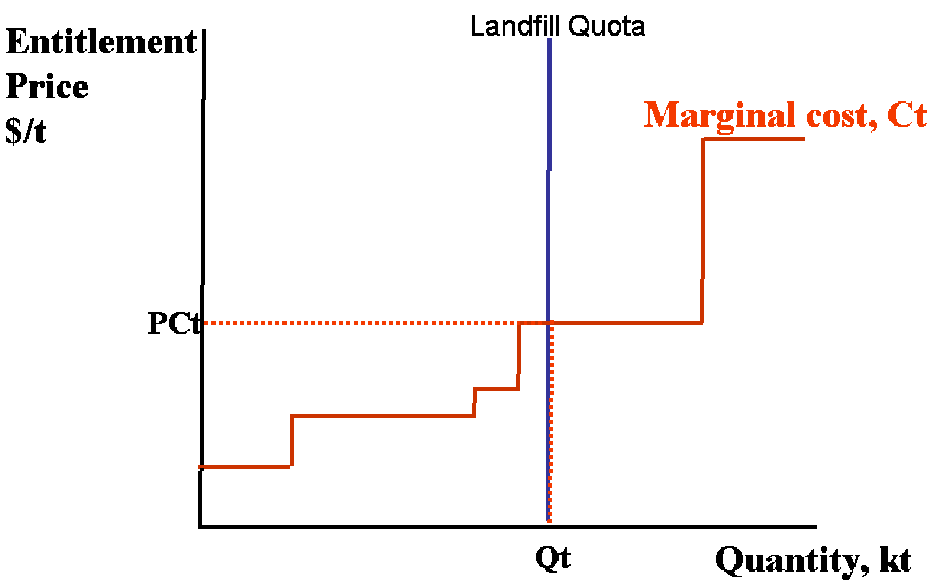
The quota scheme will be compared to the landfill levy currently used in the Sydney Metropolitan Area. The quota scheme is a property rights alternative to the pricing approach of the landfill levy.

6.4.1 Principles

The price of entitlements is primarily a function of the cost of recycling and reuse activities, the actual level of the quotas required to meet the target and the structure of the market for entitlements. The factors affecting these variables are described below.

Assuming a competitive market and low transaction costs, price formation in the entitlements market can be represented by Figure 6.1. The horizontal axis represents the quantity of entitlements required in tonnes. The vertical axis represents the price of entitlements in $/t. The quantity, *Qt*, represents the quota for all landfills in year *t*. The step curve designated *Ct* represents the net cost of recycling activities. The net cost is equal to the total cost of the recycling technology levelised over their project life and subtracting revenues received from sale of recycled products. Each step represents the cost of a particular recycling activity source, where the recycling activity is defined by type of technology and its physical location. The price of the entitlement, *PCt*, is equal to the net cost of the last technology that would be required to meet the specified quota in year *t*.

Figure 6.1: Landfill entitlement price formation



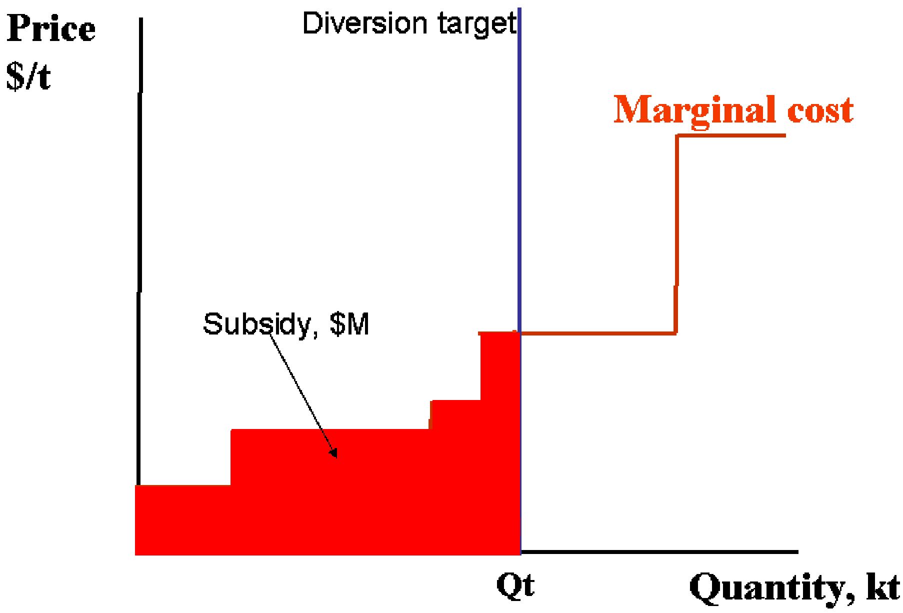
Under a competitive market regime with fully informed participants, the market-clearing price for entitlement equates with the levelised cost of the last recycling activity required to meet the quota. A high recycling cost would drive up the price of entitlements and in turn gate fees.

The price of quota entitlements is affected by a number of factors:

- The nature, cost and availability of recycling options.
- Prices received for the output from recycling (e.g. from sale of scrap metal, compost or refurbished products).
- Short-term factors, such as variations in waste generation volumes with major infrastructure developments or business cycles.

With knowledge of the cost structure of recycling or reuse activities and the total size of the quota entitlements, the outcomes under a tradeable landfill quota should be similar to a competitively allocated subsidy instrument (see Figure 6.2). Subsidies could be provided up to the equivalent certificate price (that is, the marginal cost of recycling) to achieve the specified level of waste diversion from landfills.

Figure 6.2: Use of subsidies to achieve similar diversion target



But in reality there are number of uncertainties that impact on the choice between a levy or tradeable quota. With a levy system, there is uncertainty over the level of landfilling that will ultimately be achieved. This arises because the response of waste generators and in turn recyclers to the levy cannot be estimated precisely. A tradeable quota scheme avoids this uncertainty by specifying a maximum level of landfilling. But the cost to achieve this target is unknown, with the result that the price of the quota could exceed the marginal benefit of diverting the target amount of waste from landfills. The choice between instruments then rests on which uncertainty poses greater risks to the community.

In summary, the differences between a levy instrument and a tradeable quota system would cover:

- Potentially lower compliance costs with a levy system
- Tradeable quotas could result in a concentration of landfilling access to fewer areas which would have equity implications and exacerbate illegal disposal if regional areas faced restricted landfill access
- Higher administration and enforcement costs with a tradeable quota system
- Less control on cost imposts with a tradeable quota system unless a non-punitive penalty regime was in place
- Market power problems could arise if there are only a few landfills involved or only a few recycling options.

6.4.2 Benefits and costs

A summary of the costs and benefits of a tradeable landfill quota scheme in comparison with the existing levy system is provided in Table 6.2. The comparison of benefits is predicated on the assumption that there is increased likelihood of achieving waste diversion targets with a tradeable quota scheme and that a non-punitive penalty is in place so that compliance costs do not exceed environmental benefits.

Table 6.2: Benefits and costs of a tradeable quota scheme

Sector	Benefits	Costs	Comment
Raw material suppliers	Reduced emissions of harmful substances and reduced extraction of virgin resources	Reduced demand	Benefits and costs likely to be minor as raw material diverted to export markets
Industry	Potentially lower emissions of air and water pollutants from recycling compared to the use of virgin materials.	Higher costs of production as switch to recyclable materials and switch to processes with reduced waste generation.	Impact could be marked for some commodities.
Consumers	Some switch to reusing materials / products rather than discarding.	Higher cost of products. Reduced demand for some products	Minimal impacts. Empirical studies demonstrate low sensitivity of demand for goods to waste disposal costs.
Recyclers / re-users	Reduced cost (or higher payment) for raw materials – that is waste.		
Landfill operators	Scope for higher gate fees with imposed landfill scarcity.	Lower overall throughput with the declining quota. Additional compliance costs.	Lower emissions restricted to methane emissions from organic material.

Government		Incurred administration costs and higher enforcement costs to prevent illegal dumping and rorting. These costs could be passed on to consumers via various fees.	Evidence presented during consultations suggests illegal dumping likely to be most prevalent in early stages of scheme.

The major benefits appear to be reduced resource consumption through the recycling and reuse of waste and some reduction of emissions of harmful substances during the production, distribution and consumption of products as a result of reduced demand for new products. The magnitude of the benefits will depend on the consumer's price elasticity of demand for products with high proportion of non-recyclable materials and the potential for substituting recyclable for non-recyclable materials in the production process.

The largest costs would be the higher administration and compliance costs. Compliance costs could be significant if high cost recycling schemes are required to recycle waste to meet low quota targets.

6.4.3 Costs to industry

The impost would be expected to fall hardest on the generators of soil and rubble, concrete and other construction materials from the B&D waste stream, because of the high volumes of these materials generated. The rates of recovery in the building and demolition sector in NSW are higher than in other States. An active recycling market has developed in Sydney in response to the relatively high waste disposal levy. A substantial amount of this waste is used for operational purposes at landfills (for example, for daily cover instead of virgin soil).

The NSW *Alternative Waste Management Technologies and Practices Inquiry* estimated that it can cost up to $30 per tonne more to reprocess than dispose of common waste types. The table below shows the estimated costs per tonne of different waste diversion scenarios involving increased recycling, source separation and streaming in different sectors.

Table 6.3: Cost per tonne of landfill disposal versus alternatives[31]

Costs	Municipal	Commercial and Industrial	Construction and demolition
Landfill	$57	$35	$35
Cost of diversion under a range of scenarios	$140-$155	$80-$95	$60-$65

A case study on the costs of compliance for a NSW scheme that required a reduction equivalent to the "improved" scenario in the AWMT report (reduction of waste to landfill of around 1 million tonnes per annum) provides some guidance to the increased costs likely. The report estimates that the cost of moving to these diversion rates would be around $29 million.

[31] NSW Alternative Waste Management Technologies and Practices Inquiry

6.4.4 Costs of government

There would be significant administrative costs involved in establishing the scheme. A computerised notification and reporting system could be developed to approve and track trades and report outcomes within each State. Regulatory authorities in each State would need to audit compliance with licences under the new arrangements.

6.4.5 Avoided environmental impacts of disposal

Section 3 examined available information on the benefits from reducing disposal of waste to landfill. The analysis suggests that the high volume waste materials most likely to be diverted (eg. B&D waste steam) have a low impact at landfill but may provide upstream benefits.

Table 6.4: Summary of impacts of introducing a tradeable landfill quota scheme

Costs	Benefits
➢ Compliance costs to landfill operators ➢ Administrative costs to governments ➢ Increased environmental impacts from illegal dumping (unless well controlled)	➢ Environmental benefits very dependent on which waste streams / materials are diverted

6.5 Barriers and stakeholder issues

Existing regulatory frameworks relating to the environmental performance of landfills and alternative options, as well as illegal dumping, need to be sound. Otherwise, the benefits that result from the flexibility offered by trading will be offset by greater environmental impacts at poorly managed landfills and illegal dumping. Illegal dumping is a major policy concern with this type of scheme if entitlement prices and in turn gate fees increase significantly.

Due to potential health and environmental issues associated with the stockpiling of some wastes prior to disposal at landfill or entry to recycling operations, safety net requirements would be needed to prevent orphaned wastes. This could arise where waste disposals presented at landfills exceeded entitlements readily available, such as near the end of an accounting period. Limited borrowing and a non-punitive penalty regime would be critical in this regard.

Existing regulatory frameworks may not be adequate in some States. Legislation would need to be developed to underpin the scheme.

6.6 Conclusions on landfill quota schemes

Acceptance of a tradeable quota scheme depends in part on the potential cost of meeting landfill targets. Although a tradeable quota scheme will increase the likelihood of achieving a target, this could come at a high cost to the community. Enforcing a soft cap on penalties to prevent compliance costs exceeding the benefits to the community may therefore be deemed essential. If this were the case, the instrument would essentially become a price instrument with little benefit over existing levy approaches.

Illegal dumping poses a particularly difficult issue as waste generators seek to avoid higher gate fees likely to be imposed. Administration and compliance costs will also be higher.

7 PERFORMANCE SUBSIDIES BY COMPETITIVE ALLOCATION

Recycling and composting subsidies have been used widely amongst Australian States and Territories. However subsidies to date have been 'input' based (such as business assistance programs or crisis funding), limiting their targeting and effectiveness. Subsidies allocated by competitive tender were chosen as an instrument with potential to be more cost-effective in reducing waste volumes. The comparative assessment in this chapter uses the example of performance subsidies allocated through competitive tender for a grants program to redirect waste from landfills to be reused or recycled.

7.1 Description

This instrument would comprise the use of performance subsidies – that is, direct subsidies based on the tonnes of material diverted from landfills and recycled or reused – and allocated by competitive tender. The advantage of such an instrument is illustrated in Box 7.1 in relation to subsidies for biodiversity conservation.

Box 7.1: BushTender biodiversity conservation auctions

The National Heritage Trust has committed some $2.5 billion to environmental works, via a range of interventions, particularly fixed-price subsidies, grants and capital works programs. However some, such as the Australian National Audit Office have commented that the program has been successful in raising awareness, but that few projects have led to significant long-term landscape changes[32].

A potential limitation of current approaches is that assistance is generally targeted at offsetting some input costs associated with providing environmental services rather than paying for delivered outcomes. For example, Bushcare grants may assist with fencing costs for preserving an area of native vegetation, but the exact environmental services being purchased (biodiversity, soil conservation, etc) are rarely estimated. In addition, assistance is generally provided on a fixed 'cost-sharing' basis, rather than seeking to identify those opportunities for the most cost-effective supply of services. These limitations have been the subject of a recent trial to use performance-based and competitive allocation instruments for biodiversity subsidies – BushTender.

The BushTender trial was conducted by the Victorian Department of Natural Resources and Environment in two regions of Victoria in 2001. The approach focused on providing subsidies based on assessed conservation outcomes that would be achieved and allocated subsidies via a competitive auction process. Stoneham, et al (2002) note the power of competitive allocation mechanisms to overcome the problem of information asymmetry;

'A fixed-price approach essentially reveals the wrong information from the parties involved. A grants approach (eg; a subsidy) requires the landholder to reveal the actions that they believe will improve the environment (when this information is perhaps held by environmental agencies); and agencies reveal the price that will be paid for these actions (when this information is often held by landholders).'

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32 Stoneham, Chaudhri, Ha and Strappazzon (2002), Auctions for conservation contracts: an empirical examination of Victoria's BushTender trial, paper presented to the Environmental Economics Network Conference, ANU 2-3 May 2003, Canberra.

The information that government has on the costs of different waste reduction activities is poor. Reuse and recycling businesses have information on their own unique costs. The aim of competitive purchasing approaches is to overcome this information asymmetry and allow low-cost opportunities to be revealed.

A recent report by the Productivity Commission[33] highlights that well-designed approaches can promote efficient allocation of resources without requiring governments to have prior knowledge of resource values or costs. Compared with administrative allocations, the report finds that market approaches are more transparent and less dependent on official's subjective judgement, and can yield greater cost savings for governments.

Alternative approaches that could be employed to competitively 'purchase' recycling / reuse services, include by:

- *Bilateral negotiation* – involves the direct negotiation between government and one or more sellers.
- *Competitive tender* – involves a discrete sales process where government retains significant flexibility in how the successful seller will be chosen and can allow negotiation on final terms with that bidder.
- *Auction format* – involves a more structured sales process of a clearly defined commodity with clear rules on how prices will be struck and bidders chosen to complete the sale.

Negotiated outcomes allow the unique circumstances of individual sellers to be considered and factored into price or non-price aspects of contracts. However the negotiations are only informed by the price information that the participants bring to the negotiations, rather than the collective valuations of all potential sellers. Consequently tender or auction approaches are more useful when the services – recycling / reuse of solid waste – do not have a fixed or determined market value. Auctions in particular can be used to maximise 'price discovery' by providing an explicit mechanism that identifies market depth and describes how prices are formed. They can also be less costly and time consuming than a series of individual negotiations.

A disadvantage with an auction format is the need for well-defined and standardised performance outcomes. As movement to competitive and performance based subsidy approaches is new, the use of a tendering process is more likely initially.

The Queensland EPA WasteWise Resource Recovery Grants program is indicative of the type of subsidy scheme that could employ a competitive tendering approach to improve the cost-effectiveness of subsidies provided. The WasteWise Resource Recovery Grants program is designed to assist businesses within Queensland to invest in practices that redirect resource commodities from landfills and recycle / reuse the materials. The priority wastes identified for the program include tyres, computer and related electronic scrap, end of life vehicles, whitegoods and components, batteries, gas cylinders, construction and demolition waste and solid organic wastes. The amount of funding provided is up to 30% of total project costs within the range $25,000 to $50,000. A number of secondary objectives for

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[33] Productivity Commisson, The Role of Auctions in Allocating Public Resources, Staff Research Paper, 2003

the program have been sought by Queensland EPA, including contributions to employment, regional development, supporting indigenous communities, and promoting technology and market development. While the adoption of multiple objectives will diminish the efficiency with which the primary objective of resource conservation can be achieved, a competitive tendering approach can allow different weights to be assigned to each objective and an optimal portfolio of projects to be selected.

As under the current application process, companies would indicate the amount and type of waste material to be diverted to recycling or reuse as part of their bids. The major difference would be that rather than having a fixed funding ratio, each applicant would nominate the level of funding sought. In this way, companies would compete against each other for funding and reveal their cost-effectiveness in providing the waste recycling / reuse service. Competition would ensure that successful bidders would receive just enough to facilitate the action while minimizing costs to the grants scheme.

If the focus of the program was only on reducing the volume of waste disposed to landfill, the bids would be ranked from most to least desirable based on the cost to the program in terms of $/tonne of waste diverted. Other objectives could be taken into account through a weighting process or the use of minimum and maximum caps.

Importantly, agreement would need to be struck on how recycling outcomes would be measured, reported and audited, and if appropriate how risks would be shared. For example, low-cost but risky ventures (such as involving new technology development) may require a greater proportion of support to be provided upon successful recycling / reuse of targeted volumes. Similarly, non-performance conditions for all recipients would need to be specified.

7.2 Legislative powers and administrative settings

A number of subsidy schemes currently implemented at the State and Territory level could use competitive tender processes to allocate funds. Subsidies are compatible with existing institutional settings and policy approaches. Competitive tender processes could also be used for any future subsidy mechanisms introduced either at the Commonwealth, State or local level.

7.3 Design issues

There are a number of key design issues to be considered in developing a competitive allocation process, such as for the Queensland resource recovery grants scheme. Table 7.1 below explores these issues.

Table 7.1: Key design issues for performance subsidies by competitive allocation

Design issue	Comment
Metric for funding	Tonnes of material diverted from landfill and recycled / reused, either over specified periods or as a rate per year. Applicable waste streams – by type and location – would need to be specified.
Form of bids	The simplest approach is for each applicant to submit one bid. Companies may benefit from the opportunity to adjust their bids in the light of other bids. This would improve efficiency but would also introduce additional cost/complexity.
Collusion / bid manipulation	This is more problematic with an auction process, rather than competitive tender process.
Multiple objectives	Weighting criteria could be applied to take into account other objectives or other criteria (eg. a desire to avoid all grants being high risk ventures, or all having a long timeframe for delivering outcomes).
Funding Contracts and Auditing	Legal contracts need to be established with successful applicants binding them to deliver the outcomes accompanying their bids, in order for the competitive allocation process to be credible. The current grant agreements covering agreed activities and expected outcomes may need to be strengthened.
Probity	The process would need to demonstrate principles such as fairness and impartiality, consistency and transparency, security and confidentiality and identification/resolution of conflicts of interest and compliance with legislation obligations and government policy (as they apply to tendering).
Potential for stockpiling or diversion to landfill.	Contracts would require that recycling / reuse actually take place. Once the recycled products are produced the likelihood of dumping should be small as long as product quality is competitive. As under current grants programs, support would only be directed to products assessed as meeting appropriate product standards and market needs.
Running and funding the tender process	Similar to the existing grant budget.

7.4 Comparative Assessment

This section compares a competitive allocation process to the current resource recovery grant program and discusses likely differences in costs and benefits.

7.4.1 Costs

The administrative costs of a competitive tender system would not be much greater than current grant allocation processes. There may be some additional costs involved in developing and negotiating formal contracts specifying waste reduction outcomes to replace existing grant agreements. In addition, greater attention may need to be given to enforcement. Compliance audits would need to identify not just how funding was spent, but also which wastes had been recovered and what recycled product manufactured.

There would also be some extra costs incurred by applicants in preparing and submitting bids, but these are not likely to be significant. The requirement to focus on outcomes and risk sharing is likely to ensure more comprehensive consideration of risk factors.

7.4.2 Benefits

Estimation of the benefits from moving from traditional subsidy schemes to a performance-based, competitive allocation approach would require information on the range and cost-effectiveness of available actions. As argued above, this information lies with industry and is difficult to estimate without detailed consultation or allowing it to be 'revealed' in a competitive tendering process. The two key benefits lie in:

- Better targeting of assistance by funding outcomes not inputs, and,
- Cost-savings through price discriminative allocation of subsidies.

The cost-savings achievable through the latter have been estimated for the recent BushTender trial[34]. It was estimated that a traditional fixed-price subsidy approach would have required a budget of 7 times that used with the competitive auction approach to secure the same outcomes. This benefit arises largely because the competitive tender, properly designed, forces applicants to reveal the true costs of their operations in order to be successful. This benefit may diminish over time if the auction were repeated, as competing applicants obtain better information about their competitors cost structure.

A fourfold difference in the cost-effectiveness of just 2 recent grants provided by EcoRecycle Victoria for diverting materials from landfill is also illustrative. In one instance funding was provided to develop compounds of recycled PET that could be used in the manufacture of geotextiles and industrial fabrics. The funding has contributed to the direct substitution of virgin PET with recycled PET at a subsidy cost of around $20 per tonne of material diverted from landfill. Funding has also been provided for recovery of materials from construction and demolition waste, at a grant cost of around $5.50 per tonne of material diverted from landfill.

7.5 Barriers and stakeholder issues

Many of the waste reduction grants from governments are aimed at research for market development, capacity building activities and community programs which do not provide immediate or quantifiable waste reduction outcomes. Similarly, grants are often provided for technology development with associated risks. These issues can be effectively overcome if there is clear definition of program objectives and risk sharing arrangements. In relation to the latter, government has typically assumed all risks. Performance based approaches should allow a better understanding and sharing of risks, and more explicit handling of investment risks in grant program project portfolios.

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[34] Stoneham, Chaudhri, Ha and Strappazzon (2002), Auctions for conservation contracts: an empirical examination of Victoria's BushTender trial, paper presented to the Environmental Economics Network Conference, ANU 2-3 May 2003, Canberra.

However subsidies do not provide a dynamic incentive, and so depending on the terms of contracts, subsidies may lock in programs which may be low cost in the short term, but of higher cost than as yet undeveloped processes in the longer term.

7.6 Conclusions on subsidies by tender

Without the detailed investigation of a specific program or of recycling / reuse opportunities available for specific waste streams, only a broad scoping of this instrument is possible. And it is for this very reason – the lack of information on the costs of alternative recycling options – that the use of competitive allocation instruments is so attractive. By design, competitive allocation processes are directed at revealing this information to government to allow more efficient use of public funds. Performance subsidies through competitive allocation processes could readily be adopted by governments as they are compatible with existing policy settings, would only require a small cost over current administrative allocation processes and are likely to be supported by stakeholders.

8 RECYCLING CERTIFICATE SCHEMES

Recycling certificate schemes have been identified as promising instruments to reduce the environmental impacts of problematic wastes at landfills and when illegally disposed. They could be used to manage wastes such as electrical appliances, tyres, vehicles, batteries and mobile phones. The comparative assessment in this chapter uses the example of a recycling certificate scheme for personal computers to examine the potential for this instrument to be used to address problematic wastes.

8.1 Description of instrument

The recycling certificate scheme would be based on the establishment of a national target for recycling of personal computers. The regulator would determine the amount of personal computers to be recycled / reused and would issue a corresponding number of certificates to recyclers / reusers. The scheme would place an obligation on major brand owners supplying personal computers to the Australian market (both manufacturers and importers) to finance the reprocessing of the target amount of computers in order to reduce the number of computers disposed to landfills. Brand owners would be obliged to hold certificates in line with the proportion of the total volume of personal computers sold over a particular period. The certificates would be purchased by brand owners from recyclers and submitted to the regulator each year.

8.2 Legislative powers and administrative settings

There are currently a number of legislative frameworks relating to the electrical appliance industry. These include Commonwealth and State laws seeking to implement the Basel Convention on the Control of Hazardous Substances and the Montreal Protocol on Ozone Depleting Substances. Other initiatives include the National Pollutant Inventory, Minimum Energy Performance Standards and Energy Labelling Programs by the Australian Greenhouse Office, and programs of State Energy Agencies. However, none of these frameworks appear adequate to support a recycling certificate scheme.

The recycling certificate scheme would need to be implemented at the national level. A strong regulatory framework would be required to ensure brand owners met the scheme requirements and also to accredit and issue certificates to bona fide recyclers. A new regulatory body could be established or an existing organisation (such as Environment Australia) could take on new functions. The day to day administration of the scheme could be carried out by a private sector organisation. Legislative powers and administrative capacity at the national level would need to be considered further. Duplication of regulatory and administrative effort at a State level would need to be avoided.

8.3 Design issues

This section sets out some of the key characteristics of personal computers and the personal computer market and then discusses issues associated with designing a recycling certificate scheme for this sector.

Computers are comprised of a range of plastics, metals and other material. Metals include both precious metals in small quantities (eg. gold, platinum and silver) and heavy metals which may contribute to environmental harm (eg. arsenic, cadmium, chromium, lead, mercury and zinc). There are a range of different plastic resins used in computer manufacture, with the majority consisting of Acrylonitrile Butadiene Styrene and High Impact Polystyrene. Flame retardants are also used in manufacture of printed circuit boards. Computers pose a hazard when disposed to landfill or where illegal disposal occurs, mainly due to the potential for leachate contaminated with heavy metals or harmful substances to enter soils and surface or groundwaters.

Rapid advances in technology mean the life of many computers is limited. These advances have been accompanied by decreases in cost and higher performance equipment leading to growth in the number of computers purchased and many units reaching the end of their life within a short period. The disposal of obsolete machines is expected to become more of a problem as the use of computers grows exponentially.

The Australian computer market is dominated by five manufacturers (Compaq, Dell, Hewlett-Packard, IBM and Toshiba) who account for around 50% of the market. In total there are around 1,400 computer wholesalers (including manufacturers and distributors). The companies that dominate the Australian market are subsidiaries of global companies, mostly of American or Japanese origin. Most companies do not manufacture components in Australia, and many undertake assembly of equipment using specific components produced overseas to the specification of international parent companies.

The table below lists the key design issues associated with establishing a recycling certificate scheme for personal computers.

Table 8.1 Key design issues for recycling certificate scheme for personal computers

Design Issue	Comment
Basis of certificate	Tonnes of personal computers acceptably refurbished or recycled through accredited reuse and recycling activities.
Recovery target	The recovery target would be set taking into account current recycling activities and the scope for increasing reuse and recycling in the future. For the purposes of this case study it is assumed that the current reuse / recycling rate for personal computers is around 30%, and the recovery target is set at 40% to be achieved over a five year phase in period.
Liable parties	Major brand owners supplying computing equipment to the Australian market (including those manufacturing equipment in Australia; those sourcing parts from other parties or importing parts from overseas and assembling equipment in Australia; and those importing final products for sale in Australia). A threshold size would need to be established to limit the number of liable parties to make administration of the scheme feasible.

Design Issue	Comment
Obligations of liable parties	The obligation would require each brand owner to hold a defined number of certificates over a defined period (created through the reuse / recycling of for example 1,000 tonnes of personal computers). Liable parties must either earn the required number of certificates in each year by direct recycling activities accredited by the regulator or purchase them through trading.
Level of individual liability	Each individual brand owner's liability would be determined in line with the national target and proportional to their share of the national sales of these products. For example, a brand owner with a 10% market share may be required to hold 300,000 certificates in the final year of the phase in period. An operator with only a 2% market share may be required to hold 60,000 certificates.
Acceptable recycling/reuse	Acceptable recycling and reuse activities would need to be specified and would include refurbishment for resale, dismantling for sale of parts, and recycling to recover materials to be used by manufacturers themselves, metal smelters, glass reprocessors, plastic reprocessors, or overseas users.
Accreditation of recyclers / reusers	Accreditation would be carried out by the regulator taking into account local requirements and the acceptability of recycling / reuse activities. Overseas recyclers would also require accreditation.
Certificate created	When 1,000 tonnes of personal computers are reused or recycled by an accredited activity. The recycler would need to certify that they received specified equipment and that recycling / reuse took place within a certain time period.
Value of different recycling activities	If there were significant differences in the environmental impacts of recycling activities there may be a case for differentiation between activities, resulting in a greater number of certificates earned a tonne of material recycled for activities with lower environmental impact. However, this may not be necessary if the primary objective is reducing impacts at landfills and from illegal disposal. Also recognition would need to be given to materials ultimately disposed to landfills – for example cannibalisation of computer for spare parts may still result in some plastics going to landfill.
Waste product standards	Minimum standards may need to be set for some recycling activities (eg. requiring pre-treatment of some materials containing heavy metals, preventing recycling of flame retarded plastics).
Property rights of certificate	Recycler / reuser
Banking and borrowing	Banking and limited borrowing could be permitted.
Baseline	All current recycling activities would be included, subject to accreditation.

Design Issue	Comment
Penalty	The penalty would be specified in regulations and would not be punitive, so as to cap financial imposts and deter abuse of market power.
Import and export	Imported materials recovered from computers overseas would not be able to generate certificates. Materials recovered in Australia but recycled through an accredited overseas recycler would receive certificates.
Regulator / administrator	The regulator could be a new organisation or existing national body (for example Environment Australia). Day to day administration of the scheme could be carried out by a private sector organisation.
Funding of scheme	The scheme would be funded through a charge on the issuing and trading of certificates. Cost of accreditation of overseas recyclers would need to be met by the recycler.

8.4 Comparative Assessment

The comparative assessment presented in this section is indicative only and provides order of magnitude estimates of key impacts likely from the introduction of a recycling certificate scheme for personal computers in order to highlight key issues in considering this type of scheme. Data and assumptions are largely drawn from MMA (2001).

MMA estimated that the reuse / recycling rate for personal computers would be around 30% of sales by 2004 (see table below).

Table 8.2: Fate of personal computers in Australia in 2004

Personal computers	Number of units
Sold (both new & resold)	2,646,000
Reused	478,000
Recycled	327,000
Stored	1,455,000
Landfilled	1,074,000

Source: MMA 2001

The comparative assessment presents the likely impacts of introducing a recycling certificate scheme to reach a 40% rate of recycling / reuse of personal computers over the five year period from 2004 to 2008. This would require the recycling / reuse of around 250,000 additional units by 2008 or 650,000 units over the five year period (see Table 8.3). As the basis for the certificates would be the weight of personal computers recycled, the actual number of units recycled / reused may differ.

Table 8.3: Possible reuse / recycling targets under a recycling certificate scheme

	2004	2005	2006	2007	2008
Reuse/recycling target	32%	34%	36%	38%	40%
Extra units for reuse/recycling	42,000	58,000	112,000	188,000	250,000

Notes: Reuse / recycling of computers are expected to increase in future without the scheme. Extra units refers to the number of computers required to be recycled / reused over and above this.
Source: MMA 2001

8.4.1 Compliance costs

Compliance costs would be borne by the brand owners (manufacturers and importers) either directly from reuse / recycling activities or by purchasing certificates from accredited reusers / recyclers.

The cost of recycling computers is estimated to range from around $4-$13 per unit in different parts of Australia (estimates for 2004). The average unit cost for all computers recycled / reused in Australia is estimated at $10. This includes the costs of collection and transport, recycling and disposal of residuals. The costs associated with reuse of parts after disassembly are similar to the costs of recycling for material recovery. These costs are largely recovered through revenue earned on the sale of component parts and recycled materials. However, the costs of collection and transport of additional units may be higher under the scheme as there may be a need to collect computers from more remote locations to generate certificates.

Given that there are a significant number of units in storage, mainly in urban areas, the increase in costs may be small for the target recovery rates chosen for this example. If the increased cost of collection and transport increased recycling costs by $3 (to the upper end costs faced in regional areas) then the net cost of recycling / reuse of the additional units would be $3. The extra 650,000 units recycled / reused over the five years may cost recyclers / reusers an extra $1.5m in present value terms (discounted at 7% over the five years). The price of the certificates would reflect these costs. The compliance costs faced by individual companies would depend on their level of obligation under the scheme (reflected by their market share) and the opportunities for reuse and recycling.

Some recent studies suggest the costs of recycling computers may be higher than the average $10 outlined above. For example, a recent television collection and recycling pilot study in Melbourne estimated a minimum net cost of around $26 per unit. However, the results are sensitive to the *increase* in costs expected to arise from a recycling scheme, rather than recycling costs per se. For example, if the increase in recycling cost was $10 rather than $3, the estimated compliance costs would rise to $5 million.

There would also be administrative costs incurred by liable parties and recyclers / reusers in complying with scheme requirements.

8.4.2 Costs of administering the scheme

There would be significant administrative costs involved in establishing the scheme. The regulator would have a number of responsibilities including calculating the certificate liability, accrediting recyclers, creating and registering certificates, registering certificate sales, monitoring and auditing compliance, reporting on the system, setting penalty levels, invoking penalties and receiving surrendered certificates. There would need to be sound certification, tracking, auditing and reporting systems.

The number of brand owners required to hold certificates under the scheme would depend on the threshold set for participation. There would be at least five major brand owners who would be liable parties under the scheme. The number of recyclers expected to seek accreditation is unknown.

There would be significant development and setup costs to establish the scheme as well as ongoing administrative costs. There would be fixed costs incurred to establish systems for accreditation, reporting and trading. Expert input may be required to certify accredited reusers / recyclers. Administration of the renewable energy certificate scheme was initially estimated to cost $6.5 million over the first four years and around $1.5m per year in subsequent years. The administrative costs of a recycling certificate scheme for personal computers would be expected to be lower, particularly if limited to the major suppliers. For illustrative purposes it is assumed that the costs may be around $1m in the first year and $0.75m for subsequent years. The present value of the administrative costs would be around $3.3m over the five years. Once established, the costs of adding other sectors to the scheme would be lower.

8.4.3 Avoided costs of landfill disposal

The recycling certificate scheme could reduce the number of personal computers disposed to landfill by 650,000. The timing of this benefit, however, is dependent on whether the computers that are recycled / reused have been stored or would have been disposed to landfill in that year. Computers that are stored have been estimated to remain in storage for around three years (MMA 2001). In order to generate a conservative estimate of the avoided costs of landfill disposal, it is assumed that the avoided costs of landfill disposal would not accrue until after three years.

The costs of landfill disposal are estimated to be between $12 and $115 per unit across Australia (estimates for 2004). The average unit cost for all computers disposed to landfill in Australia is $20. These estimates include the costs of collection, transport and landfilling.

Assuming the benefits accrue over the period 2007 to 2011, the present value of avoided costs of landfill disposal is estimated at around $8m. The total costs avoided may be higher than this as most units recycled would have ended up in urban landfills where the cost of landfill disposal is relatively higher. However, some stakeholders commented that the avoided cost of landfill disposal from the MMA 2001 report appears high. If the average cost of disposal was $10 rather than $20, the present value of avoided costs would be reduced to around $4m.

As stated above, this analysis assumes that avoided cost of ultimate landfilling of stored are not accrued until after 3 years. One of the benefits of a recycling scheme would be to reduce storage times and increase the likelihood that computers could be recycled[35].

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35 One of the issues on onsite hoarding of disused computers is that the c omputer hardware become out of date and cannot be recycled into useful components. Discarding to landfill or processing to remove scrap material are then the only options available.

8.4.4 Environmental impacts

Disposal of computers to landfills can have significant impacts at landfills. The major concern is leaching of heavy metals and other hazardous materials into soils and waters. The reduction in computers disposed to landfill under the scheme would be expected to avoid 0.05 tonnes of heavy metals leaching into soils & water at landfills over the five years. The minimum value of this environmental impact is estimated at $180-$7,000 per kilogram, with the wide range reflecting differences in the estimates of the health costs accruing to different leachates, the rate of leaching and the location of the landfill to relevant water ways (MMA 2001).

In order to generate conservative estimates of benefits it is assumed that the avoided leachate occurs over the period 2007 to 2011. The present value of the benefits is estimated to range from around $6,000 to $240,000.

With greater recycling of personal computers there would also be an increase in greenhouse gas emissions associated with the transport and reprocessing of computers. Offsetting these emissions, would be a reduction in emissions if the scheme results in less new computers being manufactured or if materials recovered from disused computers displaces extraction and processing of virgin materials. These have not been estimated.

8.4.5 Results

The comparative assessment is indicative only and presents key impacts for one possible scheme design.

Table 8.4: Costs & benefits of computer recycling certificate scheme over five years

Type of costs	Estimate	Type of benefits	Estimate
➢ Compliance costs to brand owners	$1.5m	➢ Avoided costs of landfill disposal	$8m
➢ Administrative costs to governments	$3.3m	➢ Reduced leaching of hazardous substances into soil and groundwater from landfills and illegal dumping (0.05 tonnes heavy metals)	Minimum value range from $6,000-$240,000
➢ Increased air and water pollution from increased recycling activities	Not estimated		

The comparative assessment suggests a recycling scheme for computers may provide net benefits. However, there are a number of uncertainties that need to be examined in more detail and issues that would need to be resolved. Key issues include:

- The compliance costs are dependent on the opportunities for recycling / reuse and are likely to increase over time as computers are collected from more remote locations. Obviously they would be much greater if a more aggressive recovery target was chosen.
- The administrative costs of the scheme are a significant cost and are dependent on the threshold chosen for liable parties and the number of recyclers / reusers likely to seek accreditation.

- The analysis assumes that the market for recycled materials and parts is sufficient for the quantity of material targeted for recycling under the scheme.
- There is uncertainty over the likely increase in recycling costs under a scheme and the avoided costs of landfill disposal.

The distribution of costs and benefits under the scheme is also worth noting. The compliance costs would be borne by liable parties and passed on to consumers as part of the price of new products. The administrative costs of the scheme would also be funded by the major suppliers required to participate in the scheme and passed on to consumers of computers. The savings in costs of landfill disposal would accrue to local governments & waste generators paying gate fees. The benefits of reducing leaching of hazardous substances would accrue to Australian communities.

There are two pilot recycling schemes that may provide useful information to further assess the merits of a recycling certificate scheme for computers. These are the pilot take back and computer recycling pilot for computers in the Sydney region by Compaq and MRI and the pilot recycling scheme in Western Sydney run by the Australian Information Industry Association, Resources NSW and HMR.

8.5 Barriers and stakeholder issues

Good information is required to set recovery targets. If a target is set too high, the costs of meeting the objective increases beyond the level of benefits yielded by reprocessing activities. Good information on end markets is also important.

Small and medium size enterprises may find it difficult to participate, however if liable parties are limited to large suppliers then they bear all the compliance costs.

Some stakeholders would like to see recycling certificate schemes tailored to provide incentives for eco-redesign. To this end, the obligation on suppliers could be modified according to the level of hazardous materials in each product. However, this would make the scheme less transparent, and make the market for recycled certificates less liquid and more costly to administer.

The equity implications of placing the liability on brand owners would also need to be considered. If current efforts to design products for disassembly and recycling were not considered, the scheme would operate to the advantage of brand owners who have not adopted eco-design principles.

8.6 Conclusions on recycling certificate schemes

The preliminary assessment suggests recycling certificate schemes may have merit for some products that pose an environmental threat at landfills or when illegally disposed. Recycling certificate schemes are a new approach requiring significant development effort. Minimising administrative costs while ensuring a sound regulatory framework would be a challenge, and there is a need to ensure that there are end uses for recycled materials if these types of schemes are to achieve their aims.

9 LANDFILL EMISSION FEES

Landfill emission fees were shortlisted as a promising instrument to reduce the environmental impacts of waste disposed to landfills. The comparative assessment in this chapter uses the example of landfill emission fees based on a direct extension of the pollution fees paid by industrial activities under the NSW Local Based Licensing (LBL) fee scheme.

9.1 Description

Landfill emission fees would be applied to wastes disposed to landfills to account for the impact of wastes in producing air and water emissions during the operational life of landfills. The basic model for the scheme is payment of an annual emission fee for selected pollutants based on the load (or amount of pollution) emitted from the landfill, how harmful the pollutants are and where the pollutants are released. The scheme would also take into account the pollution level that can be reasonably achieved with modern technology and good management for each type of landfill. The scheme provides strong incentives if an operator is not using modern technology or practices or if management and control systems are poor. It also provides an ongoing incentive for continual improvement for operators using accepted technologies and management practices. It would also provide incentives to divert materials which could emit harmful substances to be recycled and re-used (as long as the emission fees are passed on to disposers in gate fees).

9.2 Legislative powers and administrative settings

Landfill emission fee schemes could be implemented at a State/Territory level through existing regulatory systems. Any emission fee scheme would need to be underpinned by a strong regulatory system. All States have a regulatory framework in place and currently licence certain types and sizes of landfills. Some States currently implement load based fees for some industrial activities.

The changes required to implement an emission fee scheme for landfills would vary across the States. NSW, Victoria and WA already have some form of load based fee arrangements for some licensed activities. For other States, load based fees could only be implemented with substantial changes to the system of licensing landfills.

9.3 Design issues

The challenges for emission fee schemes are determining appropriate fee levels and developing robust emission estimation and reporting systems without imposing significant administrative or monitoring costs. Table 9.1 below explores some of the key design issues.

Table 9.1: Key design issues for landfill emission fee scheme

Design Issue	Comment
Assessable pollutants	Significant pollutants currently included in the NSW LBL scheme that are emitted from landfills include: *Air pollutants*: Volatile organic compounds, Nitrogen oxides, Sulphur oxides, Fine particles, Benzene, Hydrogen sulphide *Water pollutants*: Mercury, Total nitrogen, Total Phosphorus, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Zinc, Phenol Although not in LBL, other potential pollutants in the future include greenhouse gases and odour.
Liable parties	Landfill operators
Obligations of liable parties	Landfill operators must pay an annual fee based on the load (or amount of pollution) emitted from the landfill.
Threshold size of landfill	The scheme could be applied to licensed landfills. While excluding smaller licensed landfills would reduce administrative costs, improved management at these landfills may provide the greatest benefits.
Calculation of assessable load	Protocols would need to be developed setting out acceptable methods for calculating emissions of pollutants from different types of landfills. The protocols would incorporate emission factors and could draw on the NPI reporting methods.
Pollutant weightings	Pollutant weightings reflect the potential for each pollutant to damage the environment. These could be taken directly from the NSW LBL fee scheme.
Critical zones	The critical zone weightings provide greater incentives to reduce pollutants in areas that are already overloaded with that pollutant or in environmentally sensitive areas. Specific critical zone weightings would need to be developed by identifying stressed or environmentally sensitive catchments in each State.
Emission fee levels	Emission fee levels are determined by the fee unit value or dollar amount charged for each unit of pollution. Ideally, emission fee levels would be set to reflect the external environmental impacts of landfill disposal.
Emission thresholds	Emission thresholds for different types of landfills would be set to reflect the pollution level that can be reasonably achieved with modern technology and good management.
Emission fee formula	Assessable load X pollutant weighting X critical zone weighting X fee unit value (double the above for loads above emission thresholds)
Fee reductions	Fee systems would include fee discounts to encourage improved environmental performance, for example for making operational changes to reduce the impact of pollutants entering the environment or entering an agreement with the regulatory authority to reduce loads at a future time (for example over one year).

Design Issue	Comment
Penalties	Specified in regulations.
Regulator	State and Territory agencies currently responsible for regulation of landfills.
Funding of scheme	The extra administrative costs could be funded through an increase in the administrative component of licence fees for landfills.

9.4 Comparative Assessment

This section compares emission fees to existing landfill levies and discusses the likely impacts of introducing emission fees while reducing landfill levies to provide incentives to improve the environmental performance of landfills. The assessment does not quantify the costs and benefits of introducing landfill emission fees in States and Territories.

9.4.1 Emission fees payable

Emission fees paid by landfill operators are not economic costs, they represent a transfer payment between landfill operators and the government. However, the fees are intended to encourage a response from landfill operators. Compliance costs will be incurred where operators carry out activities to reduce emissions in response to the fees or where they lose business as a result of higher costs. If landfill levies are reduced at the same time as emissions fees are introduced, then the extra impost on landfill operators could be minimised while still providing an incentive for better performance through the better targeting of fees.

Table 9.2 provides the likely distribution of emission fees by pollutant if the following were adopted:

- the fee formula in the NSW LBL scheme; and
- emission estimation techniques for the National Pollutant Inventory[36].

[36] Environment Australia, Emissions Estimation Technique Manual for Municipal Solid Waste Landfills, 2002

Table 9.2: Indicative % of emission fees payable for selected pollutants in NSW LBL scheme

	% of fees payable
Air pollutants	
➢ Volatile organic compounds	<0.1
➢ Nitrogen oxides	21.8
➢ Sulfur dioxide	<0.1
➢ Fine particles	78.1
Water pollutants	<0.1

Notes: Fee estimates for a landfill receiving 50,000 tonnes per year that is 10 years old. The analysis does not include greenhouse gases.

The fees for air pollutants are much greater than for water and the largest individual fee estimate is for emissions of fine particles.

The fee unit values will determine the overall fee landfill operators would pay, and should be adjusted so that the fees reflect the external impacts of landfill disposal in each State/Territory. If fee levels were set to take into account all external impacts of landfill disposal, then current levies could be removed. Whether the net impact on gate fees rose or fell would depend on the existing levy rates, waste streams and management practices being employed.

For illustrative purposes, total emission fees for various landfills have been calculated using the emission fee rates and settings in the NSW LBL scheme. Table 9.3 below compares the fees that would be payable by landfills with and without emission controls.

Table 9.3: Comparison of fees with & without controls[37]

Size of landfill	Fee without controls	Fee with controls
Small	$460,000	$130,000
Medium	$2,300,000	$640,000
Large	$4,700,000	$1,300,000

Notes: Uses fee unit value of $35 under current NSW LBL scheme. Assumes small landfill takes 10,000 tonnes per year, medium 50,000 tonnes per year and large 100,000 tonnes per year. The landfill "with controls" assumes a leachate collection system with 70% efficiency and gas collection of 75% with a control efficiency of 97%.

For landfills with good environmental management, total fees equate to around $13 per tonne. For landfills with poor environmental management, the fees would equate to around $45 per tonne. The levy rates currently paid in each State range from $0 to $17 per tonne and were shown in Table 5.2.

[37] The annual fees have been calculated by multiplying the estimated annual load of selected pollutants by the pollutant weighting in the NSW LBL scheme (reflecting potential damage) and fee unit value of $35

This analysis does not include all the air pollutants that are included in the LBL scheme or greenhouse gases. It is indicative only and is directly dependent on the fee unit value chosen. Nevertheless, it suggests that where landfill levies are currently high (such as in NSW), replacing the current levy with emission fees may result in a reduction in total fees paid by landfills and passed on to waste generators. However, in States where current landfill levies are relatively small or do not exist, total fees are likely to increase. This would have implications for illegal disposal and the need for greater enforcement activity.

9.4.2 Compliance costs

The compliance costs to landfill operators will depend on the level of fees, the emission reduction activities undertaken in response to the fees and the costs of those activities.

A survey of major MSW landfills in metropolitan areas in Perth, Adelaide, Melbourne and Brisbane was undertaken in 1997[38]. The key results relating to environmental management were:

- Only one third of the landfills were lined
- Half had landfill gas management
- Two thirds had leachate treatment systems

A recent Australian study (2001) found that most landfills in Victoria have a landfill gas capture system, however the efficiency of leachate collection is variable[39].

In NSW many local authorities have improved management of landfills in response to regulation during the 1990s[40]. Significant advances have been made in leachate capture and treatment, odour and vermin control, and capture of landfill gas.

A recent audit of rural landfills by the NSW EPA[41] identified significant operational failings at landfills and associated impacts on the environment. Of the 30 landfills in the audit, 24 had inadequate gas controls and 22 had inadequate leachate controls. Most landfills included in the audit were accepting between 5,000 and 20,000 tonnes per year of waste.

Rural landfills in other States are likely to have similar environmental management issues. While it has been suggested that emission fee schemes could be used as an alternative for where landfill levies are currently paid, emission fees may also be a useful tool in the future to improve management in regional areas where levies are not currently paid.

Conventional wet landfills with good design and management measures in suitable locations are estimated to cost around $30-$45 per tonne for putrescible waste[42]. Conventional dry landfill costs are similar because they still require leachate collection systems and gas monitoring as a contingency.

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[38] Xu et al Australian Urban Landfills: Management and Economics in Waste Management & Research 1999 17: 171-180.

[39] Stage 2 report for Life Cycle Assessment for paper and packaging waste management scenarios in Victoria 2001 Centre for Design, RMIT University, CRC for International Food Manufacture and Packaging Science at Victoria University and CRC for Waste Management and Pollution Control at University of NSW

[40] Tony Wright Shaping the Vision and Strategy for Sustainable Waste Management in NSW 2002

[41] NSW EPA Compliance Performance Report for Rural Waste Landfill Facilities 2002

[42] Report of the Alternative Waste Management Technologies and Practices Inquiry 2000

Typical costs at urban landfills Perth, Adelaide, Melbourne and Brisbane in 1997 were estimated at around $16 per tonne.[43] While better information would be needed to assess the likely compliance costs of introducing emission fees, this suggests that there would be some scope for emission fees to improve environmental performance at landfills.

If the NSW LBL pollutant weightings were adopted, the most significant fees would be payable for nitrogen oxides and fine particles generated during the combustion or purification of landfill gas. This is likely to provide incentives for the introduction and upgrade of landfill gas capture systems.

9.4.3 Impact on gate fees

Depending on the level of emission fees, there may be an incentive for landfill operators to charge differentiated gate fees. Materials with high impacts when landfilled include hazardous materials such as batteries that result in problem leachate, putrescibles and possibly organic materials which result in production of greenhouse gases and loss of amenity to nearby residents. Inert materials such as plastics, glass, metals and most B&D materials have low impact as a result of being sent to landfill.

Given these differences between waste streams, landfill operators may introduce differential gate fees in line with externality impacts. For example, there may be lower rates for inert materials and higher rates for hazardous materials. Organics may pay less if there is methane capture.

If the LBL model was used directly, then the most significant component of the emissions fees would be for air emissions and differential gate fees would be most likely to differentiate wastes based on the potential for air emissions.

However the extent that gate fees could be differentiated and the targeting of incentives passed to waste generators will depend on the nature of incoming waste, as it may be difficult to determine the composition of different materials in mixed waste streams.

9.4.4 Administrative costs

The following types of administrative costs would be incurred in establishing emission fee schemes for landfills: scheme development including developing regulations, emission estimation protocols and administrative and reporting systems; training of staff; ongoing implementation including annual reporting, payments and enforcement; and auditing programs.

The NSW EPA has had recent experience implementing emission fees as part of broader reforms to establish a new integrated licensing system. Much of the EPA's licensing administrative effort to establish the new system would have been required in the absence of emission fees. Two specific administrative programs were introduced with load based licensing in NSW: the LBL regional officers program and the LBL auditing program. There were 5 regional officers employed for a two year period as a transitional arrangement to assist the EPA's regional offices to implement LBL (around $800,000 over 2 years). The LBL auditing program required 4 officers allocated over 3 years to audit licensees who pay load fees under LBL (around $200,000-$300,000 over 3 years). There is also a Technical Review Panel to provide ongoing advice on technical issues. Around 300 licensees currently pay load

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[43] Xu et al Australian Urban Landfills: Management and Economics in Waste Management & Research 1999 17: 171-180.

based fees and they cover a wide range of industries / activities, some of which have very complex processes. In NSW the costs of extending emission fees to cover landfills would be much lower than the costs stated above.

In States where emission fees are not currently used costs may be around:

- $500,000 for development of scheme and administrative systems over 2 years
- $300,000 for training and transitional arrangements over initial 3 years of implementation
- $150,000 ongoing administration and enforcement costs.

If emission fee levels increased the financial impost on landfill operators (eg. where landfill levies do not currently exist) then there may also be a need for greater enforcement to manage illegal dumping.

9.4.5 Environmental impacts

Landfills have the potential to cause significant environmental problems including surface and groundwater contamination, off-site landfill gas migration and impacts on local amenity. The environmental benefits of introducing emission fees will depend on the response of landfill operators. If the LBL pollutant weightings are used the most significant incentives would be provided to reduce nitrogen oxides and fine particles generated during the combustion or purification of landfill gas. Past studies have valued the economic benefit of reducing a tonne of NOx at $1,385 and the value of reducing a tonne of fine particles at $18,500[44].

Emission fees schemes provide ongoing incentives for improvements. The fee structure in the NSW LBL scheme ensures that the greatest incentives are provided for the most harmful pollutants in the most sensitive areas. If greenhouse gases or other impacts such as odour were included in the future the scheme could also generate corresponding environmental benefits.

There is the potential for increased environmental damage from illegal dumping if emission fees substantially increased the financial impost on landfill operators and appropriate enforcement measure were not in place.

9.5 Barriers and stakeholder issues

A number of key issues have been identified:

- Introduction of emission fees requires a strong regulatory framework. This does not exist in all States and Territories.
- Where rationalisation is underway and smaller landfills are still operating but are likely to close, ensuring good post-closure management may be more important than improving current environmental performance.
- Some stakeholders have indicated that fee increases may not be politically acceptable in some areas and that greater enforcement to manage illegal dumping may be required.

[44] EPA 1998 Regulatory Impact Statement Proposed Pollution Control Regulation 1998

- Stakeholders need to have confidence in the emission estimation techniques used as a basis for setting fees. The existing NPI estimation methodology is not seen as adequate. In particular, methods for estimating emissions of gaseous pollutants from landfills are seen as highly unreliable.
- More information is needed on the external costs of landfill disposal in different States / locations to enable efficient fee regimes to be set.

9.6 Conclusions on landfill emission fees

Landfill emission fees represent a logical extension of pollution tax regimes currently employed in a number of states to manage environmental impacts associated with large industrial premises. In principal they would allow a better targeting of incentives than is possible via existing levies. This would encourage landfill operators to pursue improved management practices.

As environmental performance varies considerably between landfills, the benefits of introducing such an instrument are likely to outweigh the costs. Whether incentives were passed on to waste generators via differentiated gate fees would depend upon the waste streams being received.

The most critical issue would be whether existing regulatory frameworks were adequate for administering the instrument and enforcing appropriate disposal practices. Landfills in many regional areas have low levels of regulatory oversight. This presents an opportunity for significant environmental gains, but also significant administrative costs. In regions where current levies are relatively low, the adoption of emission fees could also encourage increased illegal disposal, introducing further regulatory costs to support the instrument.

10 CONCLUSIONS AND RECOMMENDATIONS

This report has examined waste policy goals in Australia, canvassed the range of market instruments available to support these goals and provided a broad comparative analysis of instruments for potential application in Australia. It has also provided a more detailed comparative assessment of four illustrative instruments that could be applied to improve waste management. This section considers the overall attractiveness of the instruments investigated and identifies the challenges for further investigation and development of market instruments for waste management.

10.1 Attractiveness of investigated instruments

Notwithstanding the preliminary and illustrative nature of the assessments undertaken, some broad conclusions on the attractiveness of the instruments can be made. That is;

- ***tradeable landfill quota schemes*** could be used to promote greater reductions in the volume of waste disposed to landfills. However the benefits that may result from the flexibility offered by trading could be offset by greater environmental impacts at poorly managed landfills or through illegal dumping. Moreover, despite the greater certainty the instrument would provide in achieving volume-based waste disposal goals, the economic benefits realised may not be superior to those being achieved with current landfill levy instruments.
- ***competitive tender processes*** have the potential to improve the efficiency of subsidy / grant programs to cost-effectively reduce waste volumes to landfill. Alternatively, this instrument could be directed to targeting problematic wastes generating the greatest environmental impacts through illegal disposal. The instrument could be applied on a program by program basis and is not dependent on broader waste policy or legislative reforms.
- ***recycling certificate schemes*** also have the potential to help meet the objective of reducing the environmental impacts from the disposal of problematic wastes, as well as for resource conservation purposes where a direct link between waste management and resource extraction can be identified. While these instruments would present some challenges in development and administration, they have a number of attractive features. In particular, they can be used to closely align incentives with policy goals, can engage producers in downstream waste management, and would discourage illegal disposal – the major waste policy challenge identified by stakeholders.
- ***landfill emission fees*** appear attractive for promoting improved landfill management practices and reducing environmental impacts at landfills. However if this policy goal remains secondary to broader, albeit poorly defined, goals aimed at reducing upstream environmental impacts, then existing levy instruments may be preferable.

10.2 Where to from here?

This study has demonstrated that market instruments can play an important role in waste management in Australia. While such instruments will not always be the best tool available to government, in many instances they can offer an effective means to realize policy goals at lower cost. Stakeholders have been supportive of the wider use of market instruments, and have encouraged further investigation.

The success of market instruments will depend on attention to design features and their close targeting to policy objectives. On this latter point, the study has highlighted the need for governments to clarify policy goals for waste management.

Government waste management goals are moving away from a central focus on managing ‘downstream’ waste disposal impacts to minimizing ‘upstream’ impacts associated with resource exploitation and production processes.

The main market instrument currently being used is the landfill levy. The levy does not fit well with either upstream or downstream policy goals. Linkages between upstream environmental impacts and volumes disposed to landfill are too indirect. In addition, levies have not distinguished between waste streams despite the significant variation in associated upstream and downstream environmental impacts. Current levies also provide no incentive for improved management practices at landfills and undoubtedly have contributed to the increased illegal disposal of wastes with attendant environmental impacts.

In considering policy objectives for waste management, pursuit of upstream environmental goals requires careful attention. The rationale to pursue resource conservation through waste management instruments applied late in supply chains is at best tenuous and a poor surrogate for effective resources policy. Similarly, stakeholders have provided few insights into why industry policy (addressing principally emission practices) should discriminate between the environmental performance of production processes drawing on used materials compared to virgin materials.

We strongly recommend that governments review the merits of pursuing resources and industry objectives through waste management policy. Dogmatic adherence to the ‘waste hierarchy’ or the setting of arbitrary waste reduction goals not supported with clear assessments of likely costs and benefits may not be in the nation’s best interests.

Governments of course will be mindful that community demands to promote resource conservation through waste minimization will not be easily shifted. Consequently, waste programs are likely to maintain this focus at least over the medium term. Whether or not market instruments are chosen for this purpose, investigation into <u>which</u> resources are of greatest concern and most directly influenced through waste management would seem a priority. Employing market instruments such as tradeable landfill quota schemes or recycling certificate schemes in the absence of such information cannot guarantee net social gains will be realized.

The application of market instruments to directly target downstream post-consumer waste impacts can be employed with greater confidence. Performance bonds are already being used, and moving landfill fees onto an emissions basis could be pursued in some jurisdictions with little regulatory or administrative changes needed. The development of market instruments to target problematic wastes is also promising and the subject of current investigations at national and state levels.

While this study has explored the potential application for market instruments to address an upstream or downstream policy goal, it would be possible to craft instruments that provided incentives for both. For example, landfill levies applied on tonnes of waste disposed, could be differentiated by waste streams to reflect relative disposal impacts. However as canvassed in Section 4.2, it is generally more efficient to apply different instruments to achieve different goals. Hence rather than pursuing instruments that meet multiple goals, we recommend governments pursue a mix of instruments.

Finally, the success of any market instrument will be reflective of the design effort applied. Market instruments need to consider a range of institutional, technical, market and community issues and be crafted accordingly. Stakeholders hold much of the necessary information and effective consultation in the design stages will be required.

APPENDIX A: Institutional Arrangements for Waste Management in Australia

The Commonwealth Government's main role in waste management is to establish and promote cohesive national waste reduction arrangements. Legislative and policy arrangements for waste management are primarily the responsibility of the State and Territory Governments. Local governments often have a regulatory role as well as operating waste facilities and implementing local programs.

In this appendix, there is a brief overview of the current policy goals and institutional arrangements for waste management in each State and Territory.

The ***Commonwealth's*** initiatives are generally undertaken through the Environment and Heritage Ministerial Council and Environment Australia's administration of the National Heritage Trust. A national per capita waste reduction target of 50% by the year 2000 was adopted in 1992. The Commonwealth currently plays a policy role in a number of waste issues, working in partnership with other government and industry bodies. The Commonwealth coordinates national approaches to problematic wastes, for example, providing a secretariat to the National Packaging Covenant, developing product stewardship frameworks for electrical/electronic appliances and waste oils, and considering legislative options for plastic bags.

The ***New South Wales*** Waste Minimisation and Management Act 1995 set up a waste reduction target of 60% by the year 2000. This Act was replaced in 2001 by the Waste Avoidance and Resource Recovery Act. The new Act establishes a statutory body (Resource NSW) with responsibility for setting non-legislative targets and indicators. The draft NSW Waste Avoidance and Resource Recovery Strategy released by Resource NSW in September 2002 includes the following quantitative targets:

- to maintain waste generation levels between 2000 and 2005
- to increase recovery and utilization of materials in the following sectors:
  - Municipal – from 26% to 66%
  - Commercial and industrial – from 28% to 63%
  - Construction and demolition – from 65% to 76%

The main institutions responsible for waste management in NSW are the NSW Environment Protection Authority (NSW EPA), Resource NSW and local government. The NSW EPA licenses scheduled waste activities, enforces general environmental legislation, collects waste disposal levies and undertakes a range of education and cleaner production programs. Resource NSW facilitates and implements waste avoidance and resource recovery programs. Local Government is a service provider, regulator for new development, and is also responsible for local delivery of waste programs.

Waste management policy in ***Victoria*** is designed to improve resource use efficiency and divert wastes from landfills. There is an integrated framework of regulatory, economic and planning measures for solid waste management. There were significant reforms to waste management arrangements under the Environment Protection (Resource Efficiency) Act 2002. Victoria's waste management framework includes a number of economic and financial policy measures, including load-based licensing fees, financial assurances for landfills, levies on waste deposited to landfills and grants programs to support cleaner production initiatives, improve waste management infrastructure and foster sustainable use of resources.

Waste management policy is the governed by the EPA. Waste management is progressively being undertaken by regional waste management groups, which carry waste management activities on behalf of local councils.

In ***Queensland*** the general framework for waste policy is set out under the Environment Protection (Waste Management) Regulation 2000 and Environment Protection (Waste Management) Policy 2000, both administered by the Environment Protection Authority of Queensland. The framework establishes a hierarchy for prioritising waste management to achieve best environmental outcomes. The hierarchy in order of priority is: waste avoidance, waste re-use, waste recycling, energy recovery of waste and waste disposal. The principles to be used to manage wastes include polluter pays, user pays and product stewardship.

The waste management hierarchy and principles described above provide a basis for waste management programs that may be required as a condition of approval for an environmentally relevant activity for industry, for voluntary waste reduction programs and for State and local government waste management strategic plans.

In ***Western Australia*** the focus of waste management policy has recently shifted from one of managing waste to minimise environmental harm to a policy objective of eliminating waste though sustainable practices. Waste policies in Western Australia are set through the Minister for Environment and Heritage Western Australia. The policy document *Towards Zero Waste (2001)* set the objective of achieving zero waste disposal by the year 2020.

The Government established a Waste Management Board to provide strategic advice on waste management issues. The Waste Management and Recycling Trust Fund, administered by the Waste Management Board, assists local government, industry and the community to reduce waste and recycle, and to reduce the impact of waste on the environment. The fund is raised from a levy on waste disposed to landfill in the Perth Metropolitan Area. The Government recently announced an inquiry into the effectiveness of the Trust Fund in meeting the new goals of reducing wastes into landfills. A Resource Recovery Rebate Scheme also operates to encourage the provision of services that achieve recovery of resources from the waste stream.

In ***South Australia*** the Integrated Waste Strategy for Metropolitan Adelaide 1996-2015 sets out broad principles and objectives for waste management. The EPA has statutory responsibility to oversee waste management to minimise impacts on human health and the environment. The existing waste management environment protection policy under the Environment Protection Act 1993 is narrow and deals primarily with medical waste. The SA Government announced in January 2003 that it will establish a new statutory waste management body “Zero Waste SA” to work with the community, local government and the recycling and waste disposal industry to develop an integrated waste management strategy. The new body and its programs will be funded through an increase in the waste depot levy. New waste initiatives will focus on waste avoidance, reduction, recycling, reuse and recovery.

The ***Australian Capital Territory*** waste strategy “No Waste by 2010” sets strategic directions for waste management. The strategy includes a policy goal of no waste disposal by the year 2010. Strategic planning, policy advice and management of contracts and service agreements for a range of waste and recycling activities are undertaken by ACT NOWaste (a business unit of the Department of Urban Services).

Tasmania is in the process of developing a waste management strategy[45]. The Strategy will aim to achieve the Tasmanian Government objective of reducing waste volumes to landfill by 50% by 2005 from 1990 levels. A partnership agreement on waste management between State and local government has recently been negotiated[46] outlining agreed waste management priorities to be addressed over a 12 month period. The Tasmanian Government sets regulations governing the establishment and management of transfer stations and landfills, and develops guidelines and action plans for certain waste streams. Local councils are responsible for the collection and disposal of waste and the provision of recycling services. Many councils have formed regional bodies to manage waste streams on a regional rather than local council basis.

The ***Northern Territory’s*** Waste Management and Pollution Control Act 1998 addresses waste in the broadest sense in the context of pollution control. The Territory’s Department of Lands, Planning and Environment is responsible for administering the legislation.

[45] The information onTasmania’s waste policies is sourced from Tasmanian Government (2001), *National Packaging Covenent Action Plan for April 2001 to June 2002*, Hobart

[46] Tasmanian Government (2001), ibid

APPENDIX B: International experience with market instruments for waste management

The US solid waste industry has undergone significant change over the last two decades with a shift to fewer, larger landfills with greater environmental regulation and a significant reduction in landfill externalities. US programs have been characterised by ambitious waste reduction goals and supply side recycling support policies, such as kerbside recycling impositions & grants, leading to a glut of recycled materials. This has prompted demand side market development subsidies, such as tax credits, low-interest loans, and government purchasing policies. A number of market instruments have been introduced.

The European Union has established a high level waste management strategy, based on a series of waste management directives with specific targets for recycling, recovery and disposal. The European Union set a recycling target of 50%-75% by the year 2000. Countries within the European Union have implemented various versions of producer responsibility programs.

Market based instruments that have been used overseas include user charges for domestic waste collection, landfill levies, advance disposal fees, product charges, tax credits, virgin materials taxes, deposit refund schemes, tradeable recycling certificate schemes and tradeable landfill quota schemes. Examples of each are listed below.

Variable charges for domestic waste collection

- In the US there are 4,000 communities using unit-based pricing for domestic waste. Some are pay as you throw and others use a fixed fee by bin size.
- Many EC countries have implemented variable fees for garbage collection.
- A review of international schemes suggests they have achieved reductions in waste volumes of 20-50%[47]

Landfill/disposal levies

- The UK introduced a landfill tax in 1996 with an explicit environmental objective. The tax will rise from its current £13 per tonne to £35 per tonne. There is also a landfill tax credit scheme that allows landfill operators to allocate up to 20% of their tax liability to approved environmental projects.
- In Denmark there has been a tax on landfill and incineration since 1987. The rates are currently £50 per tonne for landfill and £44 for incineration. The taxes are reported to have had a dramatic effect on building and construction waste disposal volumes.
- In Japan there is a levy on disposal of recyclable materials. The levy is calculated using a scaling factor for the particular industry involved and a unit cost for the type of recyclable.

[47] Atech, Variable rate charges for domestic waste collection, prepared for Hunter Waste Planning and Management Board on behalf of the NSW regional waste boards, May 1999

- Landfill taxes are used in a number of other countries, including Netherlands, Switzerland and Sweden

Product taxes and advance disposal fees

- In Switzerland there is a fee on mobile phones of 16 cents to cover recycling and a recycling fee for televisions of US$20. There are also advance disposal fees on aluminium cans, PET bottles, glass bottles and batteries.
- Canadian charges include an ADF for paint sold in British Columbia (50 cents per gallon), and a $4 charge for tyres in Alberta, a recycling levy on beverages sold in Manitoba (2 cents) and deposits on beverage containers in Quebec, Nova Scotia, Newfoundland and New Brunswick.
- In Sweden there are recycling fees on scrapped vehicles, batteries, tyres and packaging (plastic, paper and metal).
- In Germany and Austria there are advance disposal fees for refrigerators.
- In the Netherlands there is a levy on electric and electronic appliances and on new car sales to finance recycling.
- In Denmark there are recycling fees for tyres and Ni Cad batteries.
- In the US, a one cent advance disposal fee for containers was used in Florida between 1993 and 1995. The fee was performance based in that packaging materials that reached a recycling rate of 50% were exempt. Since then, advance disposal fees have been used widely in the US for tyres and beverage containers. Advance recovery/disposal fees have been proposed for televisions and computers in Nebraska and South Carolina.
- In Denmark there are product charges on packaging correlated to environmental impact based on life cycle assessments. Glass has an index of 1 and aluminium has the highest index of 18.
- In Belgium there is an eco-tax on PVC to limit its use, and taxes on batteries, disposable cameras, packaging, industrial products and beverage containers. For beverage containers companies either pay the tax or achieve a specified recycling rate.

Tax credits

- Many US States have provided tax incentives for recycling (in 1998 there were 22 states). They have provided credits or exemptions on sales, income or property taxes for the purchase of equipment or machinery used in recycling or pollution control.

Virgin materials taxes

- The UK introduced an aggregates levy in 2002. The levy applies to the commercial exploitation of rock, sand and gravel. The levy is £1.60 per tonne. The levy was introduced alongside a £35m per year sustainability fund to promote alternatives to virgin aggregate and to reduce the environmental impact of aggregates extraction.

- In Denmark a virgin materials tax levied on PVC was introduced in 2000, designed to obviate the expensive scrubbing techniques required for incineration. There are also raw materials taxes on gravel, stone, clay and chalk (the only raw materials extracted in Denmark).
- In Sweden there has been a tax on extracted gravel since 1996.

Deposit refund schemes

- In the US deposit-refund schemes for beverage containers have been introduced in ten states. About 30% of the US population has container deposit laws in their area. The systems typically apply to glass, aluminium, plastic, or other containers. Some systems are now being expanded to include other types of products such as office products like photocopier machine toner cartridges. Maine and Rhode Island have used these systems to encourage recycling of lead acid/automobile batteries.
- In Denmark, there are deposit refund schemes for beer and soft drink containers and aluminium cans.
- In Switzerland there are deposit refund schemes for small consumer batteries.
- In Sweden there are deposit refund schemes covering beer and soft drink containers, glass and PET bottles, aluminium cans and small consumer batteries.
- Germany has used a deposit refund scheme for detergent and paint containers.
- Austria has deposit refund schemes for fluorescent lights and tyres.
- Korea has deposit refund schemes for beverage containers, batteries, tyres, televisions, washing machines and lubricating oils.
- Taiwan has a deposit refund scheme for PET bottles.

Tradeable recycling certificates

- The UK government introduced packaging regulations, obligating producers and users of packaging materials to meet minimum recycling targets. This resulted in an active market for trading packaging waste recovery notes, although it was not originally envisaged as a trading scheme when the new regulation was introduced.

Tradeable landfill quota schemes

- The UK government has introduced a trading scheme for landfill permits. The scheme is designed to reduce the amount of biodegradable municipal waste sent to landfill to 35% of 1995 levels by the year 2020. Municipalities will have an incentive to reduce generation of biodegradable wastes to stay within the permit limits.