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Recycling in NSW

by

Stewart Smith

Briefing Paper No 8/95

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EXECUTIVE SUMMARY

This paper presents an up to date analysis of the state of recycling in NSW. Presented within a framework of waste minimisation, the viability of recycling schemes, the potential of particular materials to be recycled and suggestions to improve recycling rates are all discussed. Some of the main findings include:

- recycling programs have concentrated on beverage containers which comprise a relatively small part of the waste stream, at the expense of green and kitchen waste which comprises a much larger portion of the waste stream.
- landfill waste disposal costs do not reflect the environmental costs of landfill and are cheap and underpriced. The economics of recycling are therefore often marginal.
- whilst market prices for many recyclables are now quite stable, they are subject to change according to whims of the market, a market that often has access to very cheap virgin materials.
- of the 177 local councils in NSW, 96 provide a kerbside recycling collection service, of which 70 are provided on a weekly basis. 22 councils provide no recycling service at all.
- as recycling collection techniques improve and become automated, the cost of collecting and processing recyclables decreases. However, many council areas are still serviced by the expensive "three men and a truck" collecting only limited types of recyclables.
- the number of goods able to be recycled has increased dramatically, however the market motivation to use these materials for recycled products lags behind technical innovation.
- governments have been busy promoting recycling, but have paid inadequate attention to promoting markets for goods made from recycled materials.
- governments, having promoted recycling to citizens, have a further obligation to lead by example to strengthen markets for recycled goods by preferential buying of "environmentally preferred" products.
- governments may strengthen markets for recycled goods by ensuring that consumers are environmentally aware and informed, and that industry conforms to standards of package labelling.

INTRODUCTION

Australians dump over 14 million tonnes of domestic, commercial and industrial waste per year into landfill.¹ There is a trend to increasing per capita waste quantities, with Sydney commercial, industrial and demolition waste increasing 18% per year for the five years leading up to 1993, and a steady increase in household waste by weight.²

This increasing waste mountain is creating problems of disposal. Disposal of waste may lead to pollution, landfill depots are filling up, and there are a shortage of sites for new depots.³ Valuable resources are being buried within landfill depots, and for this reason alone it makes sense to reduce the amount of material entering the disposal system.

To reduce waste, governments have put in place waste management strategies. The National Waste Minimisation and Recycling Strategy⁴ identifies a waste management hierarchy, where in order of preference, options should be:

- Waste avoidance - practices that prevent the generation of waste altogether
- Waste reduction - practices which reduce waste
- Waste reuse - direct reuse of waste materials for the same grade of use
- Waste recycling or reclamation - using valuable components of waste in other processes
- Waste treatment - to reduce hazard or nuisance, preferably at the site of generation
- Waste disposal.

¹ Commonwealth Environment Protection Agency (1993) *National Waste Minimisation and Recycling Strategy*.

² *Ibid*, p.8.

³ For information on Sydney's waste management strategy, see Smith, S. (1994) "Waste Management in the Sydney Metropolitan Area." NSW Parliamentary Library Briefing Note No. 029/94.

⁴ Commonwealth Environment Protection Agency (1993) *National Waste Minimisation and Recycling Strategy*.

Whilst recognising that recycling does not come top of the waste hierarchy, this paper concentrates on this issue. Recycling is the recovery of used products and the reprocessing of materials back into their original form or into new forms or products.⁵ It could be said that recycling has been promoted by industry and government much more vigorously than higher elements of the waste hierarchy as recycling is much easier to achieve and less politically sensitive. Recycling requires action by the community, waste avoidance and reduction/reuse makes greater demands on industry. There is still widespread confusion about recycling in the community, and this paper is an attempt to clarify information. It is in three parts, Part I refers to the waste stream and the contribution recycling can make to reduce waste, Part II describes the recycling costs and benefits for a wide variety of recyclable materials, whilst Part III discusses incentives for recycling.

PART I RECYCLING AND THE WASTE STREAM

THE WASTE STREAM

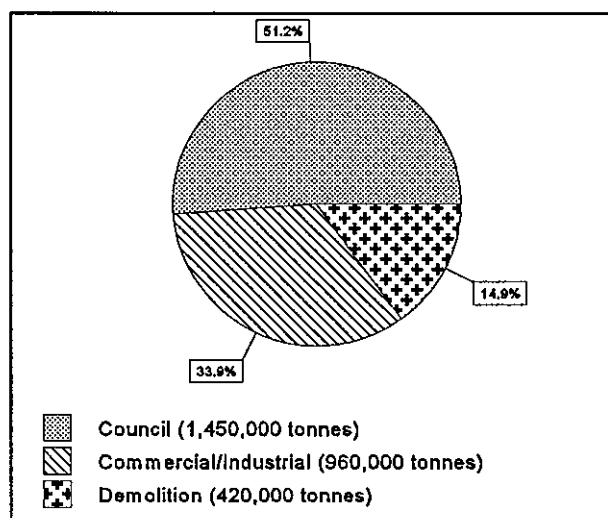
The Federal Government released the National Waste Minimisation and Recycling Strategy in 1993. The Commonwealth adopted the goal of reducing the amount of waste going to landfill by 50 percent by the year 2000. The NSW government's approach to waste management is contained in the policy document *No Time to Waste*,⁶ which accepts the commonwealth's waste reduction goal. The contributors to the waste stream are shown below in Figure 1.

Clearly the greatest contributor to the waste stream is local government, which collects waste from residents. A 1993 study found that the average Sydney household generates 21.6 kg of waste per week, of which 3.2 kg is placed out for recycling.⁷ If Council sourced waste can be reduced by half we would be well on the way to reducing total waste by 50%. To reduce the amount of waste going to landfill it is helpful to look at the components of the waste stream. From the three sources listed in Figure 1, a further breakdown is shown in Table 1.

⁵ Industry Commission (1991a) *Recycling Volume 1: Recycling in Australia*. Report No. 6/1991.

⁶ New South Wales Premiers Department (1994) *No Time to Waste*. NSW Government Policy Statement on Waste.

⁷ Recycle NSW (1993) *Garbage Bin Analysis and Recycling Audit*.

Figure 1 - Waste Generated in Sydney Metropolitan Area 1992⁸Table 1 - Waste Composition by Weight (%)⁹

	COUNCIL AND COMMUNITY	COMMERCIAL AND INDUSTRIAL	CONSTRUCTION AND DEMOLITION
Newsprint	6	-	-
Other paper products	15	25	-
Glass	8	-	-
Metals	6	16	2
Plastics	8	12	-
Wood and garden waste	21	21	13
Food waste	25	17	-
Other	11	9	35
Non-degradable solids	-	-	50

⁸ NSW Environment Protection Authority (1993) *New South Wales State of the Environment 1993*.

⁹ New South Wales, Parliament (1993) *Joint Select Committee Upon Waste Management* (L. Kernohan, Chairman).

It can be seen from Table 1 that of Council and Community waste, the greatest contributor is the wood/garden and food waste (46%). These materials are compostable, and do not need to enter landfill as they presently do. Interestingly, much of the recycling effort so far has been directed towards the packaging end of the market, such as glass and paper, which comprise a relatively small part of the waste stream. The remainder of this paper analyses how recycling may help reduce the waste stream.

THE NATIONAL KERBSIDE RECYCLING STRATEGY

The Australian New Zealand Environment and Conservation Council (ANZECC) released in 1992 the Report on the Establishment and Implementation of a National Kerbside Recycling Strategy (NKRS).¹⁰ The Strategy identifies roles and responsibilities for key players in the waste management field. The NKRS recognises the key role of local government and suggests the following roles:

- ensuring that the full avoidable costs of disposal are taken into account in setting charges and determining service fees.
- implementation of user pays approaches for waste services (eg, weight or volume based charging)
- arranging kerbside collection of recyclables and ensuring that the system is reliable, cost-effective and convenient.
- development of alternative methods such as using drop-off centres for collecting recyclables in areas where kerbside is not cost effective.
- active promotion of the kerbside program
- regional co-ordination of collection and sorting schemes, to achieve economies of scale
- introduction of other waste reduction schemes such as composting
- development of performance based contracts with those selected to provide waste and recycling services, with a contract period being sufficiently long to encourage investment in suitable equipment by the contractor.

¹⁰ Australian and New Zealand Environment and Conservation Council (1992) *Report on the Establishment and Implementation of a National Kerbside Recycling Strategy*.

Industry also has a key role to play in any recycling program. The NKRS noted that the main role of industry is to develop viable markets for the use of secondary materials, to develop reprocessing technology for the use of these materials and to sell those materials on the market. A major responsibility of industry groups is to commit themselves to their respective waste reduction targets.

The roles of State and Territory governments were outlined as:

- to provide the policy and program framework within which the kerbside and complementary systems operate
- assist the development of key elements of the system
- audit national performance and work with the key parties involved to determine what targets are met
- provide a lead in environmentally responsible behaviour, through means such as purchasing products made from recovered materials where they are price competitive and fit for the purpose
- remove unnecessary regulatory impediments to the use of re-processed materials
- use of statutory powers where available and if necessary, to ensure local government involvement in kerbside recycling in accordance with the national strategy.

The Commonwealth's role as identified by the NKRS include:

- development of a national strategy for waste reduction
- provision of a fiscal regime that does not discriminate against the use of recovered materials
- provision of trade controls which prevent dumping of recovered materials in Australia
- support for the development of re-processing industries with export potential, including service industries which form part of the wider system
- support for research, development and commercialisation of waste management

- monitoring and reporting of national waste reduction and recycling performance
- provide support for promotional programs to support national kerbside program.

It would be useful for the different levels of government to reassess their performance in regard to these identified key roles.

The ANZECC Kerbside Recycling Strategy established targets for rates of recycling with a 1995 achievement date. Table 2 shows what the recycling rates were when the targets were set in 1992, the 1995 target rate and rates achieved by end of 1994. Whilst the targets are voluntary, the Commonwealth has noted that "once targets have been refined and if monitoring indicates a lack of progress it may be necessary to implement regulations to achieve compliance with long term goals."¹¹

Table 2 - NKRS Recycling Targets

PRODUCT (AND 1992 % RECYCLING RATE)	% RECYCLING TARGET RATE END 1995	% RECYCLING RATE ACHIEVED END 1994
Newsprint (32)	40	44
Glass (36)	45	41
Plastic containers(6) comprised of: ¹²	25	No data
HDPE	50	20
PET	30	22
PVC	15	No data
Aluminium cans (62)	65	62
Liquid paperboard containers (<1)	20	4 - 7
Steel containers (<1)	25% by 1996 40% by 2000	4 - 10
Paper packaging	71% of input to be secondary fibre	No data

¹¹ CEPA (1993) *op. cit.* p.31.

¹² For an explanation of these terms please refer to the plastics section in Part II.

It can be seen that whilst some of the industries will meet or have already met their targets, others such as liquidpaperboard and steel containers are not likely to.

The Strategy notes that the ultimate objective is waste reduction, so that to meet recycling targets other methods of waste reduction in addition to recycling may achieve the objectives. For instance, making products lighter, known as light weighting, will contribute less material to landfill. However, light weighting also has the effect of making kerbside collection schemes less economic, as more product has to be collected for the same weight.

THE ECONOMICS OF RECYCLING

Recycling processes and recycled products must compete in the market place, a market place that is dominated by cheap virgin materials and low cost landfill disposal prices. It is well recognised that land fill prices are undervalued, and do not take into account full environmental and social costs of their operation. This makes the economics of recycling often quite marginal. Waste disposal is charged for in two different ways, a transfer station charge and direct landfill charges. Transfer stations are located around the metropolitan Sydney area, and compact rubbish before being sent to landfill. Waste disposal charges are listed in Table 3.

Table 3 - Waste Service Disposal Charges for 1994/95

SMALL VEHICLES	TRANSFER STATIONS	LANDFILLS
Up to 200kg	\$7.00 per vehicle	\$5.00 per vehicle
Over 200kg	\$48.80 per tonne	\$34.30 per tonne
COMMERCIAL AND INDUSTRIAL		
Mixed Wastes	\$48.80 per tonne	\$34.30 per tonne
Tree trunks over 150mm diameter	Not accepted	\$57.50 per tonne
Bulk demolition	Not accepted	\$57.50 per tonne
Polystyrene	\$824.20 per tonne	\$704.20 tonne
Tyres	Not accepted	\$34.30 shredded \$110.50 unshredded

COMMERCIAL AND INDUSTRIAL	TRANSFER STATIONS	LANDFILLS
Paper Load > 25% recyclable Load > 25% non recyclable	Not accepted \$73.80 per tonne	Not accepted \$59.30 per tonne

Using the transfer station pricing of mixed waste, \$50.00 per tonne, as a general benchmark (although landfill is only \$35.00), it is useful to compare the cost of collecting recyclables. The Association of Liquidpaperboard Manufacturers estimate that it costs on average \$200 per tonne to collect their products, whilst the Industry Commission estimates collecting and sorting costs of \$50 - \$70 per tonne for paper, with transport costs of \$20 - \$40 per tonne of paper.¹³ The cost of disposal, collection and price paid by manufacturers for different materials is shown in Table 4

Table 4 - Costs of Recycling

MATERIAL	COST OF LANDFILL DISPOSAL PER TONNE	COST OF COLLECTION PER TONNE	PRICE PAID BY MANUFACTURER TO COLLECTOR/TONNE
Newsprint	\$73.80	\$70- \$112	\$40 guaranteed minimum as part of NKRS.
Glass	\$35-\$50	\$113	\$90
Aluminium cans	\$35-\$50	\$850	\$600 collector from merchant, \$900 to merchant
Liquid paperboard	\$35-\$50	\$100-\$700, average \$200	\$200
Steel	\$35-\$50	\$10-\$70 purchase cost for merchant, + \$60 transport/collect.	\$130
Composting	\$35-\$50	\$17-\$45 1987 estimate	No real market developed yet

¹³ Industry Commission (1991b) *Recycling Volume II: Recycling of Products*. Report No. 6/1991

MATERIAL	COST OF LANDFILL DISPOSAL PER TONNE	COST OF COLLECTION PER TONNE	PRICE PAID BY MANUFACTURER TO COLLECTOR/TONNE
PET Plastic	\$35-\$50	\$189-\$1,203	\$700 stated price, \$494 average
HDPE Plastic	\$35-\$50	\$300-\$800	\$250-\$350 stated price, \$239 average price

From the figures shown in Table 4, it does not appear to be financially prudent to conduct recycling programs as they now operate. The National Kerbside Recycling Strategy recognises this, and suggests that State governments need to work with industry and local councils to ensure that losses are shared on an equitable basis, especially during the development phase of a recycling program. The bottom line is that dumping recyclables into landfill is the cheaper option, and at least one manufacturing association believes this to be the best option for their product.¹⁴ However, as indicated, landfill waste disposal prices do not reflect the real cost of waste disposal, and do not take into account the rapid filling up of landfill space and the need to source new landfill sites.

The environmental costs of landfill include leachate and heavy metal contamination, the generation of methane, the release of CFCs, odours and litter, noise and traffic congestion and disease transmission by pests. The full disposal cost of landfill is then extremely difficult to estimate. However, the Industry Commission recognises that under pricing of disposal can lead to increased waste, greater amounts being disposed of, and fewer materials being recycled than would be optimal.¹⁵

Operators of waste depots in the Sydney metropolitan area must pay the NSW state government a waste levy of \$4.20 for every tonne of waste that is received at their depot. This levy funds the Council Recycling Rebate Scheme which pays metropolitan councils \$20.00 for every tonne of glass, paper and PET containers that are recycled. The rebate scheme began in 1991 and is

¹⁴ Mr Gerard van Rijswijk, Executive Director of the Association of Liquidpaperboard Manufacturers, suggested that, with collection costs of liquidpaperboard cartons up to \$700/tonne, it makes better sense to landfill it. He also suggested that Councils look at the opportunity cost of recycling programs.

¹⁵ Industry Commission (1991a) *op. cit.* p.42.

designed to help Councils establish recycling programs. The majority on the NSW Parliamentary Joint Select Committee on Waste recognised the success of the scheme in establishing programs and recommended that the rebate be extended to other recyclable materials such as industrial, building and organic waste.¹⁶

VIABILITY OF KERBSIDE COLLECTION

There are now so many different types of recyclable post-consumer and industrial waste that the cost of recycling is greatly dependent on the collection method. Metropolitan areas in New South Wales have historically developed kerbside household collection of recyclables, and today many Councils provide crates for this purpose. Councils have tendered out recycling contracts, with the successful tenderer often being a small business person with a truck going around the contract area with a driver and two other workers collecting the recyclables. The materials are separated on the truck, so that there is often only room for paper, three colours of glass and a PET bag hanging off the end. This operation tends to be expensive, and limits the number of types of recyclables that can be collected. For instance, other forms of plastic such as milk bottles, steel, aluminium cans and milk cartons are not collected or are collected at some expense.

Key factors in the viability of this style of kerbside collection scheme are participation and recovery rates. Efforts to increase these rates include education and physical incentives such as provision of special bins or crates, convenience of location and frequent and reliable collection.¹⁷

Studies have also shown that there is a correlation between garbage bin size, waste generation and recycling performance.¹⁸ The smaller the garbage bin, the greater the recycling performance and the total waste stream is smaller. Recycling performance and waste diversion rates appear to be related to frequency of recycling collections, the more frequent the service the greater

¹⁶ New South Wales Parliament (1993) *Joint Select Committee Upon Waste Management* (L. Kernohan, Chairman). See Recommendation 19, p.27. Note that an alternate recommendation was proposed by non-government members as "The Minister for the Environment direct the EPA to draft proposals for legislation to make industry take financial responsibility for its wastes."

¹⁷ Metropolitan Waste Disposal Authority (1988) *NSW Recycling Status and Opportunities*.

¹⁸ Recycle NSW (1993) *Garbage Bin Analysis and Recycling Audit*. A Research Project by Recycle NSW.

the product yield.¹⁹ Of equal importance is the quality of the collection service, which minimises cross-contamination of recyclables. For instance, paper mills are increasingly refusing paper waste that is contaminated with glass, arising from paper and other recyclables mixed in the same bin. This cross-contamination, due to the use of outmoded technology at the kerbside collection point, may result in up to 30% of collected recyclables ending up in landfill and jeopardising markets for recyclables.²⁰

Because of the constraints of the collection system as described above, the recycling rates of many of the "extra" collectables such as milk cartons are very low. Industries attempting to meet their recycling commitments are forced to supply alternative methods, such as provision of recycling points at certain service stations. This means that collection rates are much lower than if a kerbside service was provided.

AT A GLANCE - THE STATE OF RECYCLING IN NSW²¹

Of the 177 local councils in NSW:

- 96 provide kerbside recycling collection services (many of these councils also provide drop off services)
- 50 provide drop-off recycling facilities
- 22 provide no recycling service at all

Of the 96 kerbside services:

- 70 are provided on a weekly basis
- 7 are fortnightly
- 6 are monthly.

¹⁹ Puplick, C and A. Kirk (1994) *Completely Wrapped, 1994 Update. Packaging, Waste Management and the Australian Environment.* Packaging Foundation of Australia.

²⁰ Anon. (1994) "Paper mills say no to recycled paper" in *Waste Management and Environment* Vol. 5 No. 6.

²¹ Skinner, P.(ed) (1994) *Kerbside Quarterly.* Vol 4. No. 1. September 1994.

The remainder have different schedules for different items, eg, glass and cans collected weekly, paper monthly.

- 68 of the 96 councils with kerbside recycling provide residents with containers

In regional areas, with smaller population densities, it generally makes economic sense not to have a kerbside collection service but a number of collection points, such as within supermarket carparks. In this case, much of the cost of transport is born by the consumer rather than the collector. It is also worth noting that the energy saved and amount of pollution reduced by recycling may be negated by the energy required for households to make a special drive to the recycling collection centre. Ideally then, recyclables would be returned to collection centres that are conveniently placed in often visited locations.

Kerbside collection of recyclables is becoming more sophisticated, leading to reduced costs and greater participation rates and yields. For instance, all residents of Canberra have recently been supplied with a mobile garbage bin (MGB) purely for recyclables. With a divider separating the bin into half, one side is used for paper, the other for all other recyclables. The bin is emptied once per fortnight, and the materials taken to a plant where the recyclables are separated. Cross contamination is kept at a minimum and all recycled material is sold back to the various manufacturers.²²

The collection and processing of recyclable materials will only ever be economic when there is a demand or market for the recycled product. If there is no purchasing of products made from recycled materials, then mountains of recyclable material will result, similar to what used to happen to waste paper. The removal of recyclables from the waste stream to reduce waste by 50% will result in the need for the following additional markets in recyclables in Sydney alone by the year 2000.

²² Schmidt, T. (1994) "BFI Commence Canberra's Full Domestic Recycling Kerbside Contract and Open New Recyclery" in *Waste Disposal and Water Management in Australia*, Vol. 21, No. 6.

Table 5 - Estimated additional markets required for recycled products in Sydney by the year 2000²³

PRODUCT	TONNES PER ANNUM
Newsprint	60,000
Paper	300,000
Glass	80,000
Metal	160,000
Plastic	110,000
Non-degradable solids	238,000
Timber	30,000
Garden	380,000
Food	180,000
Total	1,538,000

It is clear that much work needs to be done to develop and promote new markets that utilise recycled materials. This is discussed in the final part of the paper.

The NSW Environment Protection Authority is presently conducting a kerbside recycling costs and benefits study which will contribute financial and economic information on recycling services. Due for release in 1994, the study is now not expected to be complete before the end of April 1995.

PART II RECYCLING PROCESSES

NEWSPRINT AND PAPER PRODUCTS

Australia consumes 2.8 million tonnes of paper annually, approximately 15% of which is not available for recycling, resulting in 2.4 million tonnes of paper that can be recycled.²⁴ With around a quarter of waste from the community and commercial premises comprised of newsprint and paper products, this is a significant contributor to landfill.

²³ "Keeping waste under wraps." *Australian Environment Review*. Vol.8, No.11, 1993.

²⁴ Industry Commission (1991b) *op. cit.* p.107.

Paper is a matrix of fibres in sheet form. The basic raw materials for making paper include timber and waste paper, although other forms of fibre can also be used such as hemp. In their natural state these fibres are held together by lignin, and to prepare these materials for paper manufacture these fibres need to be separated and refined by pulping.²⁵ With no recycled component up to 17 trees can be used to make 1 tonne of paper.

Whilst pulp from waste paper is widely used in paper manufacturing, there are limits on the amount of waste paper pulp able to be used. This limit is determined by:

- the extent of contamination of recycled paper with non-fibrous materials - increased contamination increases processing costs
- the grade of paper to be manufactured - mixed or lower quality waste paper can only be used in the production of low quality products
- the strength of paper - paper tear strength is determined partly by the length of the fibres and if mixed waste paper is used a lower strength paper is obtained as the fibres are shorter.²⁶ Each time paper is recycled it loses its strength, which is why the best paper for recycling is high quality office paper. The more high grade paper that is used the stronger the recycled pulp will be, and consequently less virgin material will be required.

In Australia the newspaper industry uses between 550,000 and 650,000 tonnes of newsprint every year, 400,000 tonnes of which are produced domestically by Australia's only newspaper manufacturer Australian Newsprint Mills.²⁷ Until recently no newsprint contained a recycled component. In early 1994 Australian Newsprint Mills opened Australia's first newsprint recycling facility in Albury, NSW. The mill will recycle 65,000 tonnes of newspapers and magazines a year into newsprint containing 25% recycled fibre.²⁸ By 1996, the company expects to increase the quantity recycled to 160,000 tonnes, which is over 20% of the country's discarded newsprint. Approximately 44%

²⁵ Australian Environment Council (1987) *Paper Recycling in Australia*.

²⁶ *Ibid*, p.4.

²⁷ Publishers National Environment Bureau (ND) *The facts about newspapers and the environment*.

²⁸ Jinman,R. "Mill to recycle half our newsprint." *The Australian*. 12 March 1994, p.2.

of the nation's old newsprint is now recycled, either into newsprint as above or packaging and cardboard.

About 90% of the paper collected for recycling in Australia is used for the pulp and paper industry. Most of the rest is exported. The recycled pulp is substituted for virgin pulp in the manufacture of liner boards, packaging materials and cartons. About 35 000 tonnes of wastepaper are used annually in the production of writing and printing papers. High quality office waste paper is used to produce a range of printing and writing papers, including some 100% recycled paper.²⁹

The paper collection industry has suffered ups and downs in the market over the last few years. As kerbside recycling participation rates grew quickly, an oversupply of old newsprint developed, prices fell making it uneconomic to collect. With a de-inking plant now in operation, and newsprint containing up to 25% recycled paper, there is now a market for newsprint so prices should stabilise.

The Industries Assistance Commission conducted an audit of the costs and benefits of recycling wastepaper. They determined that private costs and benefits are at the heart of commercial decisions to recycle wastepaper, although there are certainly public costs of not recycling such as waste disposal. Labour, petroleum and transport capital costs are the main private costs of wastepaper collection. These costs are high because of Australia's low population density. Collection and sorting costs are about \$50 to \$70 per tonne for newsprint, with transport costs of \$20 to \$42 tonne.

The benefits of recycling wastepaper include energy savings, the use of less wood and less tip space.³⁰ It requires between 40 - 60% less energy to make pulp from waste paper than from virgin sources.³¹

GLASS

Approximately eight percent of the domestic waste stream is comprised of glass, comprising glass containers, including glass jars and beer and soft drink beverage containers. In 1993, 110,000 tonnes of glass were recycled in NSW,

²⁹ Industry Commission (1991b) *op. cit.* p.110

³⁰ *Ibid* p.112.

³¹ Charles, B. (1991) *op. cit.* p.5.

which is a 24 percent increase over 1992.³² This increase can be attributed to an increase in kerbside recycling.

There are numerous advantages in recycling glass. Approximately 50% less energy is required to make glass from 100% cullet than from raw materials. It takes 1.1 tonnes of sand, limestone and soda ash to make one tonne of glass. With the greater use of cullet these amounts are all reduced. There are also savings in resource use, so less mining of sand and limestone is required, reducing the environmental problems of these activities. There may be lower costs and aesthetic benefits from less litter, with possible savings from fewer injuries and bushfires from dumped glass.³³ There are, of course, benefits in reducing the amount of materials going to landfill.

Costs of recycling glass include collection from households, sorting and cleaning, including energy costs, and transport of cullet to manufacturing plants. The Litter and Recycling Research Association states that in Sydney the costs of collection exceed the value of non-refillable glass soft drink containers by about 1.35 cents per large bottle and 0.5 cents per small bottle (based on the collection cost for used glass for recycling of \$113 tonne and value of cullet of \$90 tonne).³⁴

PLASTICS

Plastics consist of polymers, which are compounds formed from repeated units of smaller molecules. Derived from petroleum resources, plastics of different strength, weight and durability result from changing the manufacturing process. It is the ability to change or add to the structure of the polymers that gives plastic manufacturers the chance to make a wide range of products, with myriads of uses. The different types of plastic and their uses are indicated below:

- Low density polyethylene (LDPE) shopping bags and food wraps
- High density polyethylene (HDPE) milk bottles, detergent/shampoo bottles

³² Burnett, J. (1994) "Recycling as a means of meeting waste minimisation targets." in *Waste Management and Environment*. Vol 5, No.5.

³³ Industry Commission (1991b) *op. cit.* p.70

³⁴ Industry Commission (1991b) *op. cit.* p.72.

- Polypropylene (PP) labels, ice cream containers, some bottles
- Polystyrene (PS) and expandable polystyrene (EPS) EPS used for meat trays, disposable cups, produce trays and boxes
- Polyethylene terephthalate (PET) bottles, mainly soft drink
- Polyvinyl chloride (PVC) bottles.

Plastics comprise 8% of council waste and 12% of commercial wastes. The number of different types of plastic available means that individual polymers, which must be recycled separately, are smaller components of the waste stream. The polymers that are most easily recycled include PET, HDPE, Vinyl and Polystyrene. The use of recycling codes assists the process of recycling, but 15% of the plastics in the waste stream have no code.³⁵ With such a variety of plastics available and used as packaging, consumers can easily contaminate collection pools with the wrong sort of plastic.

Smorgons Consolidated Industries, with 50% of the PET market, expects to make over 400 million PET bottles in 1994-95. PET bottles have taken over much of the beverage drink market, with 500ml PET container taking market share from the smaller but heavier 300ml glass bottle made by ICI and the 375ml aluminium can.³⁶ Plastics comprise only a small proportion of the waste stream, however, studies have shown that people consider plastics to have a higher profile due to their lack of biodegradability and apparent dominance in litter.³⁷ For this reason, the plastics industry is keen to support litter and recycling research, in an attempt to minimise criticism of their industry and avoid government legislation/intervention.

Plastics are very cheap, which is one of their attractions for the packaging industry, but this also means they have little residual value. Hence the economics for recycling need to be closely examined. New research by Smorgon has enabled them to recycle 100% of PET material back to its original constituents, (although the recycled component of new PET bottles is sandwiched between two virgin layers of PET, so that some virgin material is always going to be necessary). There is also growing potential for recycled

³⁵ Burnett, J.(1994) *op. cit.* p.55.

³⁶ Thomas, T. (1994) "Smorgan bounces back with renewed vigour." *Business Review Weekly*, 9 May 1994.

³⁷ ABMG Granville TAFE (1993) *Plastic Waste Management*.

plastic to be used for wood substitute, carpets and other textiles.³⁸

The Plastic Industries Association claims that a recycling rate of 22% for PET bottles has been achieved for 1993, and approximately 20% of HDPE milk, cream and juice bottles are collected for recycling.³⁹

The economics of plastic recycling is dependent upon method of sorting, the amount of sorting required if there is lots of contamination and desired quality for collected material. Infinite recycling is impossible due to degradation of material. For least cost operation, plastic materials should be made of only one type of polymer, have minimal contamination and segregated from containers comprised of other types of plastic.⁴⁰

The available data on the costs of collecting and sorting plastic for recycling vary greatly. In a review of costs the Bureau of Industry Economics noted the following ranges: with a variety of plastics added to an existing kerbside collection with a crate was \$189.20/tonne; real collection costs of PET to be \$1,203/tonne and for HDPE \$1,293/tonne; collecting sorting and baling of HDPE varies from \$300 - \$800/tonne. Costs vary according to type of container used for kerbside collection and the frequency of collection. The most cost effective option appears to be the 240 litre bin collected by a single operator on a fortnightly basis.⁴¹

BIODEGRADABLE PLASTIC - AN UPDATE⁴²

With fears that the environment was being over-polluted with plastic, several years ago there was great fanfare as supermarkets introduced photodegradable plastic carry bags. The bags were made of the normal ethylene with an additive, so that the plastic would break down in sunlight into their constituent

³⁸ *Ibid*, p.47.

³⁹ Commonwealth of Australia Bureau of Industry Economics (1994) *Plastics Recycling: Economic issues and implications*. Research Report No. 61. Australian Government Publishing Services.

⁴⁰ Commonwealth of Australia Bureau of Industry Economics (1994) *op. cit.* p.26.

⁴¹ Commonwealth of Australia Bureau of Industry Economics (1994) *op. cit.* p.34.

⁴² Anon. (1994) "Starch based biodegradable polymers now on the market." in *Waste Disposal and Water Management in Australia* Vol. 21, No. 6.

pieces. This meant that there were lots of small pieces of ethylene blowing around in the environment. However, the bags were soon taken out of circulation as they didn't really seem to live up to their promise.

A new type of plastic developed in Italy has recently been released in Australia. Mater-Bi is a biodegradable thermoplastic polymer based not on petroleum products like normal plastic, but on cornstarch. The manufacturers claim that the plastic is fully biodegradable in biologically active environments such as composting facilities and sewage treatment plants. A Mater-Bi plastic bag is said to decompose more than 70% in forty days.

The producers suggest that plastic items of a disposable nature, packaging, gloves and stationery can all be produced with this biodegradable plastic. For instance, fast food containers left behind in takeaway food shops, usually contaminated with food scraps and thrown into landfill, can all be placed in the one bin which can be collected for composting. Another use could be for household green waste composting collection bags. The bags, full of compostable material, can be placed onto the compost heap without the constraints of emptying crates or normal plastic bags.

Whilst this new type of plastic sounds promising, the cost is approximately four times greater than normal plastic. Normal ethylene costs \$2.00 - \$2.40 per kilogram of resin, Mater-Bi resin costs \$7.20 - \$8.50 per kilogram.

COMPOSTABLE WASTE

With up to 46% of Council waste comprised of wood/garden and food waste, the potential for reducing the organic waste stream is great. The EPA has determined that for a 50% reduction of domestic waste by the year 2000, 75% of garden material and 35% of food waste must be composted annually.⁴³

Composting can be done by individuals and households, on a municipal basis or by the Waste Service/private firms. The National Waste Minimisation and Recycling Strategy recognises that a key barrier to large scale composting is the lack of clear standards and guidelines on compost processes and products.⁴⁴ The NSW EPA is expected to release for comment a draft Green Waste Strategy during February 1995 which suggests ways to overcome these and other economic and regulatory barriers.

⁴³ New South Wales, Parliament (1993) *Joint Select Committee Upon Waste Management* (L. Kernohan, Chairman).

⁴⁴ Commonwealth Environment Protection Agency (1992) *National Waste Minimisation and Recycling Strategy*.

Sewage sludge is already composted in Sydney. 260 dry tonnes/day (DT/D) of sludge flow through Sydney Water sewage treatment plants, of which 193 DT/D (73%) is captured. Of this amount, 69% of the captured sludge is beneficially used.⁴⁵ This supply of sludge is important, as much of the organic waste collected by councils is very high in carbon content, but low in nitrogen. For efficient composting, nitrogen is important, and an excellent source of nitrogen is sewage sludge, making sludge an excellent partner in council composting programs. Problems occur when the sewage sludge is contaminated with heavy metals and other toxics. This creates an extra impetus for Sydney Water to reduce the amount of these substances entering the sewage system. Other projects incorporating sewage sludge include a new brick made from sludge and fly ash from power stations. These bricks, recently developed by engineers from Wollongong University, are said to look and feel exactly like an ordinary brick, yet are 20% lighter and 20% stronger. Seventy percent of the brick is made from recycled waste, the rest from clay.⁴⁶

To avoid contamination of council green waste, separation of organics is best achieved by households and individuals. Trials conducted in Sydney over the last 12-18 months have shown that the majority of the public is willing to participate in recycling green waste when provided with adequate information and separate collection bins.⁴⁷ The NSW Parliament's Select Committee on Waste was given the example of Seattle in the USA where green waste is banned from the rubbish bin. A three tiered pricing structure is in place; households are charged US\$2 per month for kerbside collection of separated organics which is a lower cost than the cost for mixed waste collection, or organic waste can be delivered to a transfer station and have it separated out there for US\$4 per passenger vehicle, or the householder can home compost where a free bin and technical advice is provided. This program has reduced the amount of green material in the waste stream from 17.1% in 1988 to 2.8% in 1990.

The NSW Parliament's Select Committee on Waste made five recommendations in regard to organic wastes. These are:

⁴⁵ Vincent, D and E. Munoz (1994) *Residuals, Closing the Loop*. An Initial Report for comment prepared for the Water Board as part of the Sydney Water Project. Friends of the Earth.

⁴⁶ Macey, R. (1995) "New sewage bricks-for those big jobs." in *The Sydney Morning Herald*, 9 February 1995, p.5.

⁴⁷ New South Wales, Parliament (1993) *Joint Select Committee Upon Waste Management* (L. Kernohan, Chairman). p.49.

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- Recommendation 39: Priority should be given to diversion of organic waste from landfill.
 - Recommendation 40: Composting be strongly encouraged and mandatory exclusion of garden waste from landfill to occur from January 1997.
 - Recommendation 41: State government to develop standards and quality control criteria to foster market creation for compost products.
 - Recommendation 42: The waste collection pricing structure should provide householders with a financial incentive to undertake home composting or organic waste source separation.
 - Recommendation 43: A rebate scheme similar to the Council Rebate Scheme be applied in the short-term to encourage the establishment of the organic waste industry.

Communities can play a significant role in the composting process. For example, with Department of Education and Training funding two Melbourne Local Councils have taken on a Landcare and Environment Action Program (LEAP) project. Comprised of 15 local people in the age bracket 15-20 years, the LEAP project involved students learning how green waste from local gardens can be turned into high quality compost and marketed back to the local community.⁴⁸

If composting is to succeed, reliable long term markets need to be developed. Whilst households comprise a suitable market for compost, it is thought that nurseries, landscape gardeners and councils will take a large proportion of the product. One of the problems with compost is that organic waste can incur high collection costs but produces a relatively low value product. This may be one reason why composting of organics has been very slow to develop in Australia.⁴⁹ A Metropolitan Waste Disposal Authority Working Party found in 1987 that it costs about \$45.00 per tonne to operate a 200tonne/day composting plant. However, with two working shifts a day, and resultant

⁴⁸ Rance, C. (1994) "Teenagers tackle green-waste problem in Doncaster." *Melbourne Age* 10 September 1994.

⁴⁹ Australia, Parliament (1994) *Waste Disposal. A Report from the Senate Select Standing Committee on Environment, Recreation and the Arts*. Canberra.

increase in compostable material, costs may be reduced to \$17.00 per tonne.⁵⁰

LIQUID PAPERBOARD PACKAGING

Liquid paperboard or plastic coated paper is widely used in beverage packaging such as long life milks, Tetra-paks and other liquids. Cardboard milk cartons and similar have an internal and external cover of polythene (similar to plastic wrap) to provide waterproofness, whilst the long life cartons also have a layer of aluminium foil layer internally which acts as an oxygen barrier to prevent food spoilage. Less than one percent of the waste stream is liquid paperboard. Whilst liquid paperboard has lost some market share to plastic milk bottles, other markets such as soy products and flavoured milk have been increasing.⁵¹

All liquid paperboard cartons can now be recycled into office and copy paper by Australian Paper at their Shoalhaven mill in NSW. During the pulping process, the polyethylene and aluminium layers are filtered off before the paper pulp is added to the production line. The manufacturers of liquid paperboard have accepted a national target of a 20% reduction in the amount of paperboard going to landfill by the end of 1995. However, as discussed this is unlikely to be achieved in NSW due to the nature of the kerbside collection service currently operating in the majority of Council areas. In an attempt to increase collection rates all liquid cardboard containers may be returned to certain service stations where receptacles are provided. As new co-mingled kerbside collection services come on-stream in NSW, the collection rate of liquid cardboard is likely to increase.

ALUMINIUM

Aluminium is a component of household waste in such forms as beer and soft drink cans, used building materials and other consumer durables. It comprises only 1.5% (by weight, more by volume) of household waste although two-thirds of this consists of used beverage cans.⁵²

Aluminium produced from melting down scrap is known as secondary aluminium. As metals have a long life span, especially for uses in cars and

⁵⁰ Metropolitan Waste Disposal Authority (1987) *Composting and Sydney's Waste*. Working Party on Composting.

⁵¹ Burnett, J. (1994) *op. cit.* p.56.

⁵² Industry Commission (1991b) *op. cit.* p.1.

buildings, it is difficult to determine the annual consumption of aluminium and recycling rates. The Industry Commission determined that Australia has an aluminium recovery rate of 31% in 1989/90, greater than the world average of 25%.⁵³

What is easier to determine is the recovery rate of used beverage cans (UBC). Aluminium can recycling schemes in Australia commenced and have been going strongly since the 1970's. Unlike other household recyclables, used beverage cans are one of the few items that pay cash to people at collection centres, which may be responsible for their high return rate. The recovery rate of UBC is 62%, which is one of the highest in the world.

There are substantial benefits recycling aluminium. Each tonne of aluminium recycled saves about 5 tonnes of bauxite, and the smelting of secondary aluminium requires only 5% of the energy required to produce an equivalent amount from raw materials. However, the energy used in collection and transport of UBC and other scrap aluminium from remote centres may offset this energy saving. Members of the public receive about 60c/kg of aluminium at collection points, the merchant's margin is 30c/kg so that the cost to the manufacturer to receive recycled aluminium is 90c/kg. The value of the metal is \$2-\$3 per kilogram.⁵⁴

STEEL

Steel, and especially steel cans, is another one of those recyclables that have not been collected from the traditional kerbside services, but are included in new co-mingled recycling programs. It is estimated that an average 13.8 kilograms of small steel and cans are disposed of each year per person in major cities.⁵⁵ This means that a city the size of Sydney with 3.5 million people dispose of approximately 48,300 tonnes of steel scrap each year. At present, most of this goes into landfill. Steel cans must be washed before collection for recycling to avoid contamination.

All new steel products produced by BHP include around 20% recycled steel (the Sydney Rooty Hill plant uses 100% recycled steel) so that there is a ready

⁵³ *Ibid* p.3.

⁵⁴ *Ibid* p.13.

⁵⁵ Industry Commission (1991b) *op. cit.* p.37.

market for all the cans that can be collected.⁵⁶ Whilst the industry has agreed to a national recycling target rate of steel cans of 25% by the end of 1996, present recycling rates in NSW are quite low but increasing as new recycling services begin.

The benefits of recycling steel include energy savings, the energy cost is 20% of that of smelting virgin materials, reduced use of raw materials, savings in pollution output from smelting virgin materials and savings of waste disposal. Whilst it costs the steelmaker \$130 per tonne of scrap steel, the value of the metal as finished product is \$600 per tonne.⁵⁷

DEMOLITION WASTES

Demolition wastes account for 15% of the waste stream, with approximately two million tonnes of demolition waste going to landfill every year. The bulk of this waste (50-70%) is generated from residential dwellings, where the level of recycling is generally low, with only one in ten homes reusing more than 5% of demolition material on site.⁵⁸

Demolition rubble is either crushed on site with the material compacted and used as fill for the proposed development, or transported to reprocessing sites where the final product is suitable for road aggregate base.

Disincentives to recycle demolition wastes have been identified as:⁵⁹

- the relative cheapness of raw materials
- the relative cheapness of landfill disposal
- the lack of depots and facilities for recycling demolition waste
- limited market acceptance for use of reprocessed materials

⁵⁶ Anon. (1993) "Steel can recycling a success story" in *Waste Disposal and Water Management in Australia* Vol.20, No.6.

⁵⁷ Industry Commission (1991) *op. cit.* p.42.

⁵⁸ Waste Management Authority of New South Wales (1991) *A Study of the Demolition Industry in the Sydney Region.*

⁵⁹ Waste Management Authority of New South Wales (1991) *op. cit.* p.50.

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- the lack of large operators with long term experience in both the building and demolition industries.

The NSW Waste Management Authority (as it was then known) has noted that the strongest incentives that can be applied to the construction and demolition industries are price benefits and/or penalties. Economic advantages should accrue to operators that efficiently reduce the volumes of material that are disposed of at landfill sites, and cost penalties should be applied if the mixed waste is unsuitable for reuse or reprocessing.⁶⁰

PART III INCENTIVES FOR RECYCLING

The NSW Waste Crisis Network has called for legislation to put the responsibility on industry to take back their products and recycle them. This means that industry should accept a cradle to grave responsibility for their products. The Network has called for this because whilst there has been an increase in the amount of waste being recycled, there has been no significant decrease in the amount of domestic rubbish being dumped.⁶¹ Industries do not accept sole cradle to grave responsibility for their products and believe that it is a shared responsibility with the community.⁶² Industry has stated that the success of the National Kerbside Recycling Strategy depends on the following factors being met:⁶³

- no mandatory targets
- no new legislation
- minimisation of costs
- realistic landfill charges
- local government to cover any cost gap
- a national approach

⁶⁰ *Ibid*, p. 61.

⁶¹ Cook, D. (1994) "Call for law to force recycling" *The Sydney Morning Herald*. 22 October 1994.

⁶² ANZECC (1992) *op.cit.* p.26.

⁶³ *Ibid*, p.26.

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- no mixing of paper with other recyclables
 - reliance on a high percentage (such as 95%) of households in Australian cities having a weekly kerbside collection
 - reliance on a high participation rate (such as 70%) in the kerbside collections.

The above factors, industry argues, call for a government "hands off" approach, with the community paying the bill and responsibility for recycling.

Governments have traditionally assisted in the formulation of recycling strategies, such as the National Kerbside Recycling Strategy, but have paid less attention to supporting markets of recycled materials. Recycling can only be effective and economic if there is a strong market for goods made of recycled materials. Therefore one of the best ways to ensure the success of a recycling scheme is to support markets for recycled products. One way to achieve this is for legislation to force a recycled component within newly manufactured goods, which will assist with resource conservation and promote markets for recycled materials.⁶⁴ Governments are, however, reluctant to do this.

Governments are in a good position to support recycled product markets by their sheer volume of purchasing. Recommendation 45 of the NSW Parliament's Joint Select Committee upon Waste stated: "Departments and authorities in State and Local government should adopt mandatory policies to use Australian products containing recycled Australian materials when price and quality are comparable with products made from 'virgin' materials."⁶⁵

The NSW EPA reports that an environmentally preferred government purchasing policy is currently before Cabinet. It was recently reported that the Federal government, which spends over \$300 million per year on paper and printed material, wants 90% of all paper products to be environmentally preferred.⁶⁶

⁶⁴ New South Wales, Parliament (1993) *Joint Select Committee Upon Waste Management* (L. Kernohan, Chairman). See Dissenting views section.

⁶⁵ *Ibid*, p. 54.

⁶⁶ Lewis, S. (1994) "Government red-faced over 'green' paper setback" *The Australian Financial Review*, 5 December 1994, p.3.

WASTE DISPOSAL CHARGES

As long as landfill depots accept waste at a price that does not truly reflect the cost of disposal, then recycling operations will always be economically disadvantaged. A simple way to make recycling more economically attractive would be to increase waste disposal charges to reflect the full costs of waste management.

The Industry Commission notes that recycling is a service for which many residents are prepared to pay, but Councils need to make explicit the costs and benefits of recycling programs. Likewise, industry led recycling campaigns are often not commercially viable, but are promoted for public relations reasons or to forestall state government legislation such as mandatory recycling levels or container deposit legislation.⁶⁷ The focus of much community pressure for increased recycling has been on highly visible products such as PET, PVC and HDPE bottles and newspapers, even though they form a relatively small part of the waste stream and do not create leachate problems in landfill.⁶⁸ However, these comments by the Industry Commission ignore the fact that the above materials comprise a large proportion of the visible litter stream, and that the community would like to see much of this litter off the streets and into recycling schemes.

CONSUMER INFORMATION

The market place contains such an array of goods, some with 100% recycled content, others with a proportion recycled, or some with none at all, that consumers are left confused on what is the most environmentally friendly purchase. Accurate information about recycling and recycling products is scarce. For instance, the Financial Review recently reported on the difficulties of the Commonwealth government in developing guidelines on the procurement of environmentally preferred paper products.⁶⁹ Whilst Standards Australia has developed standards for terminology of recycled paper and plastic products, much more work needs to be done in this field.

Other ways to increase consumer information is to improve labelling of products. For instance a NSW EPA survey showed that over 32% of respondents had "some idea/not to sure or not much idea at all" about how to

⁶⁷ Industry Commission (1991a) *op. cit.* p. 128.

⁶⁸ *Ibid*, p. 129.

⁶⁹ Lewis, S. (1994) *op.cit.* p.3

interpret detergent labels from an environmental viewpoint.⁷⁰ Labelling is subject to the Commonwealth Trade Practices Act and State and Territory Fair Trading Acts, which prohibit false or misleading representations and deceptive conduct.⁷¹

Schools can play a large part in educating school students and their families. For the last couple of years the School Communities Recycling all Paper (SCRAP) scheme has been operating in many schools in metropolitan Sydney. Usually when waste paper is collected for recycling, the organisation disposing of the paper receives no monetary benefit apart from decreased waste disposal costs. The organisers of SCRAP have negotiated with VISY that for every tonne of white waste paper collected by VISY from schools, 15 reams of 100% recycled paper will be returned to the school. Visy wins by increased collection quantities, schools win by receiving a monetary return via paper, and the environment wins by reducing the amount of paper going to landfill.

CONCLUSION

Governments around the world are attempting to decrease the amount of waste that is disposed of. In Australia, schemes to reduce the amount of waste going to landfill by 50% by the year 2000 have been accepted. Whilst waste minimisation schemes have proposed strategies to achieve this reduction in waste, recycling has been promoted as the saviour of our waste problem. Governments have been reluctant to act upon reducing the levels of waste, and instead have concentrated on the much easier task of promoting recycling. Because of this, some conservation groups have been campaigning for such things as container deposit legislation and other measures so that industry is responsible for its own waste. At present, multinational companies sell vast amounts of disposable packaging such as PET bottles, which the public then pays for disposal of or subsidises the cost of collection for recycling. Critics of this system claim that refillable bottles are a better alternative.

The promotion of recycling of beverage containers and paper has come at the expense of developing programs for organics composting. If waste disposal is to be reduced by half it is imperative that "green waste" recycling programs are established. With garden and kitchen waste comprising 46% of the council waste stream, the removal of this from landfill will result in considerable savings in landfill space.

⁷⁰ NSW Environment Protection Authority (1994) *Benchmark study on environmental knowledge, attitudes, skills and behaviour in New South Wales*.

⁷¹ Industry Commission (1991a) *op. cit.* p.137.

It is clear that the relatively cheap and underpriced costs of waste disposal greatly disadvantage recycling programs. If recycling is to be successful then this cost imbalance must be corrected, and greater attention be paid to the promotion of goods made of recycled materials.