ACOR

AUSTRALIAN COUNCIL OF RECYCLERS INC

THE VOICE OF THE RECYCLING INDUSTRY

Waste Generation and Resource Efficiency
Productivity Commission
Locked Bag 2
Collins Street East, Melbourne, Vic, 8003

8th February 2006

Dear Commissioner Weickhardt,

The Australian Council of Recyclers (ACOR) appreciates the opportunity to make this written submission to the Inquiry into Waste Generation and Resource Efficiency.

Australia's current consumer choice revolution and growth in wealth has created a massive increase in the disposal of redundant goods, with an associated increase in waste diversity, toxicity and complexity. This has a negative impact on the viability of recovery of consumer durable goods, food, packaging, clothing, commercial and industrial goods, and building construction materials. It is vital that governments provide the leadership required to replace this 'take-make-waste' pattern with a more sustainable mode of consumption, reuse and recycling.

Governments across Australia and around the world have recognised the unsustainability of current consumption patterns, and have either adopted ambitious targets for reducing waste to landfill or adopted Zero Waste policies. However, progress has effectively stalled in many Australian jurisdictions, because the 'low hanging fruit' of easy recycling has been picked and recycling from the remaining mixed streams is considered more expensive than disposal.

Some state governments have encouraged recycling through the sensible application of waste levies, but this becomes problematic when levies are boosted to increase tax revenue without regard for accurately reflecting the environmental externalities of disposal. Losing the link to environmental externalities could discourage some current recycling practices and encourage inefficient recycling in other areas.

The time is overdue for abandoning the focus on waste management and addressing the sustainable management of our resources. This paradigm shift calls for the cessation of ad hoc waste programs and the implementation of technology and infrastructure that sustains resources in the economy rather than disposing of them into the environment. We need to not only value 'goods', but also the recycling and recyclability of these goods.

A recent cover story in The Economist, entitled 'Rescuing environmentalism (and the planet)', advocated three things needed for a new market based green revolution:

- 'Get the price right' for the services of nature;
- Develop the information that is required to set prices correctly; and
- Embrace the concept of cost-benefit analysis (recognising that some things in nature are irreplaceable).

ACOR would also add: develop the planning and infrastructure required to deliver sustainable outcomes; as well as a number of associated recommendations in the attached paper.

ACOR members currently reprocess and recycle over 11.3 million tonnes of material annually otherwise destined for landfill. Our members are increasingly coming under pressure to abandon recycling opportunities as these cannot be accessed economically within the existing waste policy and associated regulatory framework. Continuing to value recycled commodities only on the basis of their secondary material market value will not create the sort of conditions necessary to lift resource recovery levels.

It is imperative that financial rewards are attached to recycling outcomes, based on the ‘true’ eco-service benefits provided by resource recovery. These eco-service benefits include waste avoidance, greenhouse gas reduction, energy savings, material resource provision, fossil fuel replacement, soil formation, land and water pollution prevention, human illness prevention, and social amenity preservation. At present eco-service benefits are enjoyed by the community for no charge.

The reason that government waste targets have not been achieved is because recyclers receive no recompense for the true value of their recycling services. There will only be minor improvements in recycling services and resource sustainability until this underlying ‘market failure’ is fixed.

ACOR considers the present variability of waste legislation within Australia not conducive to further investment and uniform levels of service provision. As a first step in delivering improved outcomes for waste generation and resource efficiency, ACOR is calling for the implementation of a coherent and national resource management strategy to replace existing waste management strategies.

A national strategy of ‘maximum resource recovery and continuous improvement in resource efficiency’ would seek to value resource recovery eco-services, create mechanisms to overcome existing market failures, financially reward eco-service provision, improve data collection, improve planning and provision for recovery infrastructure, further develop national standards for recycling products and establish a fund for resource recovery industry development.

ACOR estimates that implementing this strategy has the potential to deliver $912 million of commodity inputs, between 5,000 and 9,000 jobs, and in excess of $3.5 billion of associated eco-services. However, unless required changes are co-ordinated at a national level this opportunity will be lost.

We welcome this inquiry and trust that the Commission will take on board the following practical recommendations for removing the impediments to the economic viability of recycling, improving the efficiency of service delivery and revitalising resource recovery in Australia.

Yours faithfully,

Anne Prince
CEO

AUSTRALIAN COUNCIL OF RECYCLERS INC
the voice of the recycling industry

Productivity Commission

Inquiry into Waste and Resource Efficiency

Submission

by

Australian Council of Recyclers

February 2006

Introduction to ACOR

The Australian Council of Recyclers (ACOR), established in 1983, is Australia's peak industry association representing companies involved in recovering secondary resources. ACOR's mission is to maximise resource recovery and achieve the highest resource order of Australia's recovered materials. Our guiding principles to achieve our mission include:

1. *To encourage governments, industry and the community to take actions that promote resource recovery, recycling and optimise the profitable recovery and recycling of secondary materials.*

2. *To facilitate the removal of barriers to economic and sustainable recycling and promote changes to legislation and government policies where such changes will benefit members*

3. *To encourage uniformity of government policy nationally in relation to resource recovery and recycling and promote policies which are non prescriptive in nature and equitable in outcomes in order to open up opportunities to effectively reintroduce secondary materials for reuse.*

4 *To maximise the opportunity of substituting recycled materials for virgin raw materials and closing the recycling loop through members producing a range of quality recycled raw materials, in accordance with locally and internationally recognised and developed materials specifications.*

In summary, we seek to encourage governments, industry and the public to take actions that advance the optimal use of Australia's secondary materials and to facilitate the removal of barriers that hinder effective recycling and reprocessing. Through our members reprocess more then 11.3 million tonnes of material and directly employ over 5,000 people in resource recovery activities.

Current ACOR membership spans the following sectors:- aluminium, batteries, cardboard, computers, construction and demolition material, electronics, ferrous and non-ferrous metals, glass, mobile telephones, mobile garbage bins, paper, newsprint, plastics – HDPE, LDPE, LLDPE, PET, PVC , tyres and whitegoods.

ACOR's members include:

ACI Packaging
Alcoa Rolled Products Australia
Alex Fraser Group
AMCOR Paper Recycling
Australian Vinyls
Bluescope Steel
Boral Recycling
Fisher & Paykel
Global Renewables Ltd
Norske Skog
Norstar Recylers
ResourceCo
Sell and Parker
Sims Group
Smorgan Steel
SULO
Visy Recycling.

ACOR welcomes the objective of the inquiry into waste generation and resource efficiency in Australia (the Inquiry), namely:

'… to identify policies that will enable Australia to address market failures and externalities associated with the generation and disposal of waste, including opportunities for resource use efficiency and recovery throughout the product life-cycle (from raw material extraction and processing, to product design, manufacture, use and end of life management).'

This objective is in line with ACOR's national policy of ensuring maximum resource recovery and continuous improvement in resource efficiency. We trust our comments will assist the Productivity Commission in meeting one of its policy guidelines of ensuring that Australian industry develops in ecologically sustainable ways (Attachment 1).

Resource Recovery and Resource Efficiency

ACOR supports a net benefits approach to choosing optimal resource recovery options (reuse, direct recycling, indirect recycling and energy recovery), to deliver resource efficiency outcomes but only if improved valuation methods are used in this assessment. Currently, recycling is constrained by a net benefits approach as it relies almost exclusively on commodity prices as the indicator of value. This approach:

- does not value the positive eco-services that are provided by resource recovery
- does not account for negative externalised costs of waste disposal technologies.

To move forward in an environment of increased waste complexity, variability of materials and volatile commodity prices, resource efficiency needs to take into account the society-wide investment in materials and energy during the three major stages of a product's life cycle (pre-consumer, consumer and post-consumer). This differs from the current simplistic definition of improved resource efficiency as reducing waste associated with a given product or resource. A society can only become more resource efficient when it maximises the return on material and energy investments made across a product's life cycle (Attachment 2).

Measuring resource efficiency necessitates a multi-criteria approach, but the best current data relates only to landfill diversion. Landfill diversion is a useful but crude measure of progress toward sustainability, because it does not discriminate between the benefits of keeping different materials out of landfills (compare the impacts of inert materials against hazardous materials). Better metrics might relate to categories of materials recycled but ideally should relate primarily to national strategy goals. Ultimately these goals need to be expressed in a way that relates to ecosystem services.

Landfill diversion or recycling rates have been useful indicators of our wastefulness. However, measuring eco-services, through ecodollars, conservation of embodied energy, or CO_2 emissions, would be a step towards metrics that are more fully related to life cycle impacts.

Other resource efficiency metrics and improvements will take longer, but are nevertheless important.

These include:

- amounts of virgin and recycled materials used in manufacture
- recycled content and embodied energy (similar to the energy and water ratings) within a given product
- totals of recycled content used and embodied energy at a state/territory and national level (this would allow comparisons of economic output per unit of resource input).

The purpose of these resource efficiency metrics is to better inform the net benefits approach to determining resource recovery options. In this way policy settings can be fine tuned to achieve higher resource value outcomes, contributing to continually improving levels of resource efficiency within society.

Improved valuation methods and metrics will create the situation where increased levels of resource efficiency always increase net benefits to society. The need for improved valuation mechanisms highlights the current market failure, which has delivered an over-provision of disposal and an under-provision of resource recovery.

Market Failure – Exclusion of Resource Recovery Eco-Service Benefits

The over-provision of disposal operations and under-provision of resource recovery services is a result of allowing resource recovery to develop in a distorted 'free market' that does not value 'eco-services'. This market failure can only be overcome by policy intervention that ensures the true valuing of 'eco-services' provided by the resource recovery sector, and that allows this sector to be adequately recompensed through a variety of mechanisms for the saved primary resources, energy savings, methane emissions, land pollution, leachate generation, human health and ecosystem impacts (amongst others) it provides (Attachment 3).

Use of the Ecodollar concept allows the valuing of these eco-services. Ecodollar estimates provide a dollar value based on:

- avoided water and air pollution
- avoided global warming potential
- resource conservation of mineral, forestry and water resources
- resource conservation benefits from composting and benefits from avoided solid waste (Attachment 4).

The overprovision of disposal services results in some 19 million tonnes of potential resources being wasted each year (see Attachment 5 for contributing calculations).

Using NSW estimates as a proxy for the national composition of disposed materials, the overprovision of disposal services destroys the opportunity to provide:

- in excess of $3.5 billon of eco-services to Australian society each year
- the annual recovery of $912 million of commodity value
- the annual recovery of 68,400 giga-watt hours (GWh) of embodied energy
- the direct creation of between 5,000 and 9,000 jobs (based on the amount of current employment within ACOR).

Further detail of these estimates is given in the table overleaf (see also Attachment 5 for further information). (Note that this assessment is on the conservative side as it does not include any value from 'Other' due to the uncertain material composition, likely to comprise a mix of all material types. This category accounts for nearly one third of material disposal.)

Commodity	***Tonnes Sent to Disposal***	***Commodity Value***	***Embodied Energy (GWh)***	***Eco$* Value**
Paper	2,166,000	$151,620,000	21,900	$866,400,000
Glass	327,000	$23,544,000	1,200	$65,400,000
Aluminium	133,000	$199,500,000	6,300	$399,000,000
Ferrous	545,000	$40,875,000	4,800	$436,000,000
Plastic	1,228,000	$368,400,000	30,700	$1,228,000,000
Garden Organics	2,203,000	$44,060,000	300	$242,330,000
Food	2,248,000	$44,960,000	1,400	$314,720,000
Timber	944,000	$9,440,000	900	$75,520,000
Soil, Rubble, Concrete	2,953,000	$29,530,000	900	$59,060,000
Other	6,253,000	n/a	n/a	n/a
Total	19,000,000	$911,929,000	68,400	$3,686,430,000

ACOR supports an approach to economic efficiency that seeks to deliver the maximum value return (including social and environmental values) per unit of investment. In order to determine optimally efficient solutions, valuation mechanisms need to account for these additional values.

The above analysis demonstrates that the value provided by the resource recovery sector comprises not only the commodity value of recovered materials, but also savings in embodied energy and the provision of eco-services. However, the resource recovery sector will not be able to finance the delivery of these benefits unless they are recognised through mechanisms that directly benefit the recovery sector.

To do otherwise, will result in the resource recovery sector being forced to only concentrate on commercial value within a distorted marketplace. This will discourage increased recycling and service delivery and will force the sector to ignore the higher waste/lower recovery materials and 'hard to treat' items that are fundamental to increasing current recovery rates. State Governments will lose the opportunity to deliver on projected waste targets, and the capacity of the environment to deliver services for future generations will continue to decline. This is far from an optimal result and highlights again the underlying contributing market failure.

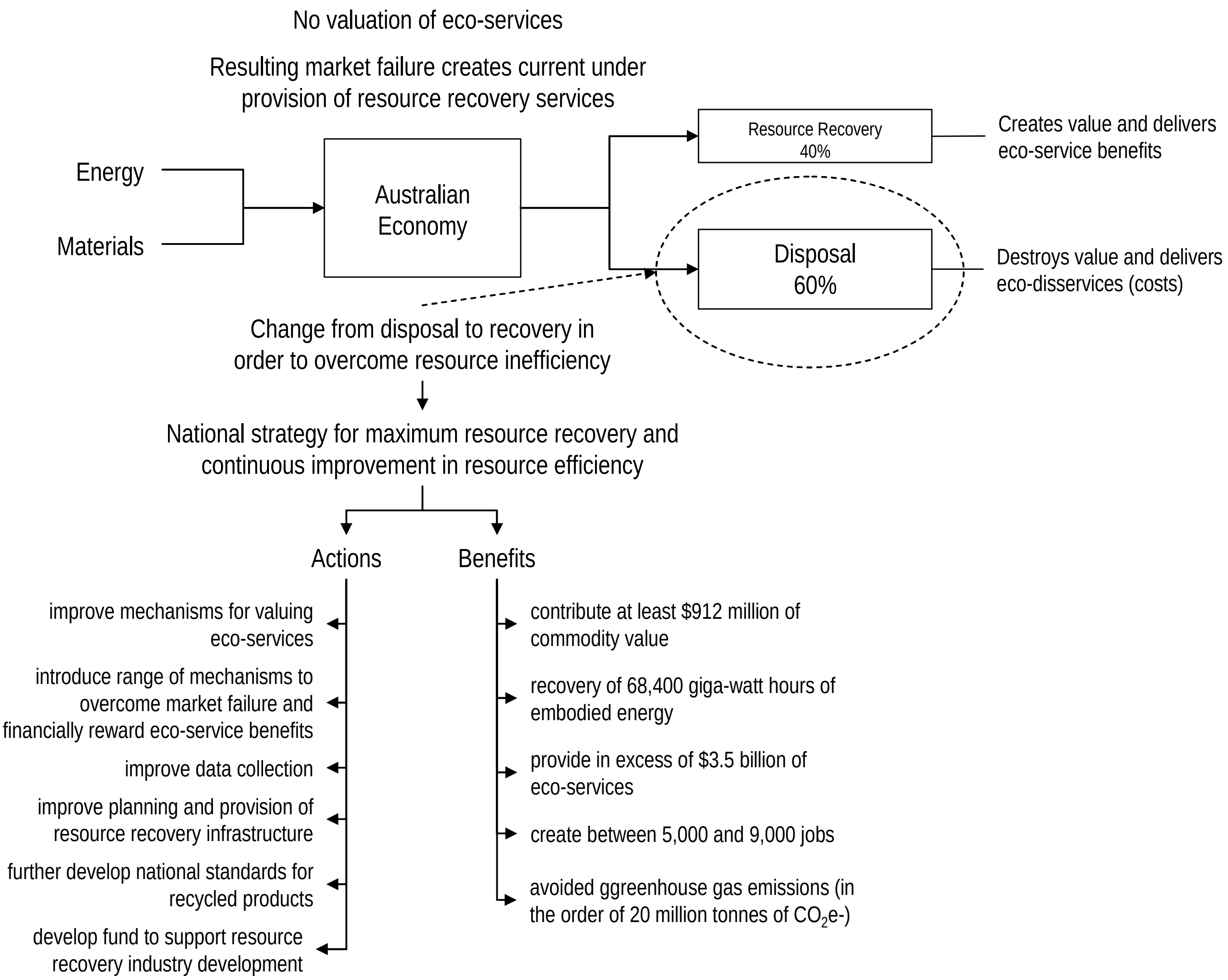
'Optimal approaches for resource recovery and efficiency and waste management'[1] should maximise resource recovery and have no place for any form of 'properly constructed and managed landfills and other types of waste disposal in Australia'[2] when the resources can be practically recovered. Regardless of the number of extractive voids requiring rehabilitation in Australia, disposal presents a negative

[1] Inquiry into Waste Generation and Resource Efficiency – Terms of Reference #1

[2] Productivity Commission Issues Paper – Waste Generation and Resource Efficiency, page 20, http://www.pc.gov.au/inquiry/waste/issuespaper/waste.pdf

return on the inherent material and energy investments within products and creates an enduring legacy of eco-disservices (including the long term pollution of the extractive void that was 'rehabilitated'). When environmental externalities are taken into account, any form of disposal is a sign of inefficiency within the economy and highlights areas where improvements must be made.

Adopting a national strategy of maximum resource recovery and continuous improvement in resource efficiency (as shown in the figure overleaf) has the potential to contribute to the economy at least $912 million of commodity value, recover 68,400 giga-watt hours of embodied energy and provide in excess of $3.5 billion of eco-services, in addition to between 5,000 and 9,000 jobs.



Further explanation of ACOR's recommendations to encourage optimal resource efficiency and recovery are presented in the following section.

ACOR Recommendations

This Inquiry into Waste Generation and Resource Efficiency comes at a time when public interest and support for improved environmental outcomes is high throughout Australia. The Productivity Commission has the opportunity to increase economic output, improve environmental outcomes and meet community expectations through the development of a coherent national strategy for improved resource recovery and resource efficiency that is implemented by all states and territories.

The Inquiry also offers the chance to engage directly with the sustainability agenda to deliver resource recovery and efficiency for the long term, a superior option to lurching from one crisis to another as landfill space fills up and communities oppose the establishment of new disposal facilities.

ACOR recommends the following actions to directly support a national policy framework of maximum resource recovery and continuous improvement in resource efficiency.

ACOR Recommendation #1

Adopt a national strategy of 'maximum resource recovery and continuous improvement in resource efficiency'

To date there has been a fragmented response to waste policy issues by Australian governments, with differing levels of service delivery amongst almost 700 local government authorities, varying targets and regulation amongst states and territories and no current national coordinating strategy. Furthermore, while some state agencies are developing sophisticated yet sensible approaches to the sustainability challenges modern day society present (for example greenhouse issues), there are other instances where departments avoid engaging with the complexity of the sustainability debate (for example over simplification in waste regulation). There are also instances where state departments work at cross purposes to others, for example infrastructure planning and waste policy.

This lack of coordination directly undermines opportunities to maximise resource recovery and improve the resource efficiency of Australian society as a whole. A new approach is needed to consolidate gains made to date and to further accelerate progress in resource recovery and resource efficiency.

ACOR is calling for a national strategy for resource recovery, as opposed to waste disposal, that seeks to maximise the recovery of resources while continuously improving resource efficiency.

This strategic approach contains the following aspects:

- improved mechanisms of valuation that account for resource recovery eco-services and disposal disservices
- net benefits approach to determine the most appropriate resource recovery option (reuse, direct recycling, indirect recycling and energy recovery) based on valuation of eco-services
- removal of ineffective waste 'hierarchy' (a net-benefits approach that internalises externalities will ensure optimal outcome)
- increased resource recovery at a level that provides the greatest return on materials and energy investments embodied within 'waste'
- removal of any validation for disposal as a management option

- identification of areas where strategy and technology development are required
- increased efficient delivery of net benefits to society as a whole.

This national strategy requires improvements in the measurement of resource efficiency at a national, state and territory level to move beyond a measurement based on waste disposal from a single product or commodity stream. Resource efficiency could then be used to measure progress towards sustainable resource recovery and to identify where improvements in recovery amounts, levels of recycled content and phasing out of disposal options for certain products and material streams should be made, in line with the goal of continuous improvement.

Appropriate advisory bodies should also be developed to allow governments to effectively engage with the resource recovery industry and gain advice on improving the recovery of certain materials.

Importantly, a national strategy will ensure a unified response across Australia, ideally with standardised waste regulations that are applied across the board with no exceptions for 'small sized' operations that exploit loopholes to operate with no licences. This will assist in keeping the associated costs of resource recovery, for example licensing and reporting, to a minimum.

ACOR Recommendation #2

Improve methods of valuation to include eco-service benefits provided and disposal disservices prevented by resource recovery

In order for a net benefits approach to resource recovery and efficiency to operate effectively, there is a need for accurate accounting of all benefits and costs. In the Productivity Commission Issues Paper December 2005, it was claimed that 'benefits of disposing waste to landfill can include avoiding the need to resort to more costly alternatives'. This statement could only be true if all costs and benefits had been internalised into the assessment, with due consideration also given to community reaction and demands. Presently this is far from the case and improved methods of valuation that include eco-service benefits and disposal disservices are required. The logical long term impact of landfilling is that resources end up mixed in uneconomic concentrations and spread all over Australia. If nothing else, this is an intergenerational inequity.

In this submission ACOR has presented the eco-dollar method of valuation in order to demonstrate the magnitude of eco-services that are provided through resource recovery, and conversely the size of the opportunity that is lost through a reliance on disposal. Other methods of valuation could be developed, for example:

- expanding and refining the eco-dollar concept
- using an approach more closely based on ISO 14040 – Life Cycle Assessment
- basing the valuation purely on global warming potential, or CO_2 emissions.

An approach based on greenhouse gases could lead to a strategy of processing all materials prior to disposal to ensure that they were biologically inactive, and would also provide an opportunity to recover all metals, which have a high embodied energy content. This option would be a positive step in the right direction and could be further refined over time.

The importance of improving methods of valuation cannot be overstated as the present failure to account for externalities is causing a market failure that over-provides disposal disservices and under-provides resource recovery eco-services.

ACOR Recommendation #3

Apply mechanisms at a national level to overcome market failure and address the imbalance between disposal services and recovery options

With mixed wastes, it is in general artificially cheaper to waste the commodity value and embodied energy of materials than to return materials as secondary resource inputs into the economy. Because there is no reward for the eco-services provided by resource recovery, it is not profitable to recover resources from the more highly-mixed waste streams. Self funding mechanisms are required to overcome this market failure and reward the eco-service benefits provided by resource recovery.

There are many mechanisms that can be used to address current market failures that support the generation and disposal of waste. Those favoured by ACOR are presented below:

3.1. Extended Producer Responsibility (EPR) and Product Stewardship (PS) schemes for specific products

EPR and PS schemes can be effective mechanisms to recover select product types. There are many examples of schemes in operation or under development in Australia, including (amongst others):

- the Used Oil Stewardship Program
- the National Packaging Covenant
- development of a national approach for recycling of tyres and electronics.

Approaches could include the implementation of 'deposit' legislation applied to both materials and complex products to facilitate multi-material processing and recovery or an EPR/PS payment at point of sale, with graduated benefit payments made on the sale of recycled commodity, relative to highest resource value and scaled according to the delivery of eco-service benefits.

ACOR supports across the broad deposit schemes such as advance disposal or recycling fees but does not support restricted CDL or deposits schemes applied in a partial manner.

There are many opportunities to develop additional EPR/PS schemes, however these must be done on a national basis. Resource recovery statistics become readily available under such schemes and can be used to benchmark manufacturers and encourage resource efficiency in product lines.

3.2. ***Market Based Instruments (MBIs) such as tradeable certificates***

MBIs such as tradeable certificates have the following advantages:

- can be applied to broader material types or waste streams
- act to directly increase resource recovery
- address the materials that EPR and PS schemes do not cover

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- have existing Australian parallels such as Renewable Energy Certificates or NSW Greenhouse Gas Abatement Certificates.

The principle of recognising and rewarding the eco-service benefits that resource recovery provides should be starting point for an MBI, whatever the chosen mechanism.

3.3. ***Standardisation of waste levies across Australia***
Waste levies act as a final disincentive to disposal for those products and materials not captured under EPR/PS and tradeable certificate MBIs. However, undifferentiated levies used primarily to raise revenue (as applied in NSW) have the following consequences:

- do not differentiate on the basis of environmental impact (for example the same levy is applied to one tonne of concrete as to one tonne of electronic scrap, although the environmental impact is markedly different)
- do not directly increase or reward recycling as they act only to punish waste disposal
- represent a 'bottom line' cost to recyclers for the management of recycling residues
- may decrease recycling of commodities that are currently only marginally economic (for example the recycling of cars in rural and regional locations) and hence reduce potential eco-service benefits
- act as an economic disincentive for innovative improvements in recovery where it is currently either technically impossible or uneconomic
- carry the risk of increased illegal dumping and other litter
- requires additional regulatory authority with the legal ability to prosecute offenders.

As part of the standardisation of levies it is imperative that monies raised through levies are hypothecated to support resource recovery and to ensure that recycling operations are not negatively impacted through increased costs. The NSW levy is uniformly imposed on all forms of waste to landfill (no matter what their environmental impact) on the basis of simplicity of administration, which will almost certainly lead to adverse environmental outcomes.

3.4. ***Phasing in of disposal bans on certain materials, products or waste streams***
A progressive phase-in of disposal bans for materials with high levels of eco-disservices, combined with an accompanying penalty payment for non compliance would act to improve technology developments and attract investment in resource recovery.

3.5. ***Apply similar subsidies as for virgin primary resources***
There are many subsidies available to primary resource producers including (amongst others):

- diesel excise exemption
- low cost electricity
- tax breaks

- accelerated depreciation
- permission to dispose of materials on-site with no penalty.

These subsidies, to an estimated $5.7 billion per year,[3] put secondary resources at a competitive disadvantage and should be extended to apply to resource recovery.

3.6. ***Inclusion of process heat in support for renewable energy*** Many Energy from Waste opportunities rely on the provision of process heat, for example the use of process engineered fuels in cement kilns. These opportunities are placed at a competitive disadvantage to options that produce electricity, even though energy recovery as process heat is more thermally efficient than electricity generation. Process heat is excluded from initiatives such as the Mandatory Renewable Energy Target, where Renewable Energy Certificates (RECs) can only be created from electricity generation. Additional support for 'process' Energy from Waste is required to support the positive eco-service contribution it can make to renewable energy.

3.7. ***Promotion of 'Design for Recovery'*** *to product designers and manufacturers*
Decisions made at the point of product design and manufacture can greatly influence the opportunities for resource recovery at a product's end-of-life. However there is no feedback loop with designers to influence product design. Required activities include:

- an education programme (at a minimum)
- rewards for products designed to facilitate resource recovery
- penalties for those manufacturers with products unable to be recovered.

As a starting point to investigating the range of mechanisms that could be employed to overcome current market failures, ACOR suggests an examination of schemes in operation in the United Kingdom and an assessment of their suitability for rewarding eco-services in the Australian context. For example:

- Landfill Allowance Trading Scheme (LATS)
- Packaging Recovery Notes (PRN)
- differentiated landfill tax on the basis of whether the material is biologically active or inactive
- Aggregates Levy.

[3] Nolan ITU 2001 'Independent Assessment of Kerbside Recycling' http://www.packcoun.com.au/NPC-FINAL-01.PDF

ACOR Recommendation #4

Improve data collection for determining resource efficiency

Australia does not yet have sufficient data quality to support informed business decisions across all resource recovery sectors.

Accurate information is needed to support an informed decision process for the future of the industry, for example, in setting priority areas for Extended Producer Responsibility and Product Stewardship schemes, identifying infrastructure investment opportunities and measuring progress made in resource efficiency.

We also need to measure our levels of waste generation and disposal against other countries so that best practice performance can be identified and achieved (while noting that international strategies may not be directly applicable in the Australian context).

States and territories should report on the basis of a common methodology for data collection, which should include:

- volumes and types of waste disposed of to landfill or other disposal technologies (including the removal of 'Other' as a reporting category)
- volumes and types of resource recovery
- data reported in tonnes, as opposed to percentages, as increasing recovery percentages can hide increasing disposal volumes if combined with increases in the rates of waste generation
- disaggregation of 'mixed' material recovery, for example identification of the composition of mixed bales of plastics being exported for 'recycling'.

The volumes of materials recovered and disposed of are only part of the resource efficiency equation. As improvements are made in developing resource efficiency metrics, so too should data collection improve to keep track. Additional information required includes:

- volumes of virgin and recycled materials used in manufacture
- measurements of recycled content and embodied energy (similar to the energy and water ratings) for given product and also at a state/territory and national level
- time series comparisons of economic output per unit of resource input to track progress made in improving resource efficiency.

ACOR Recommendation #5

Improve planning for and provision of infrastructure for resource recovery

Resource recovery has many elements that can be characterised as a public good. In a similar fashion to the provision of other services like roads, electricity, parks, hospitals, ports and water, resource recovery requires planning support to facilitate infrastructure provision. Presently planning permission is a serious regulatory barrier preventing greater achievements in resource recovery by ACOR members. It is well known within the resource recovery industry that participation rates in recycling decrease exponentially with increases in distance to a facility. Hence recovery facilities need to be located close to the areas of material arisings.

Work to overcome this barrier should include:

- creation of dedicated areas on zoning maps for resource recovery
- appropriate servicing for resource recovery areas by road, sea and/or rail and with access to utilities and adequate buffers to prevent impacts on neighbours
- simplified and fast tracked development application and consent modification processes
- protection of existing resource recovery facilities from future, possibly incompatible use arrivals into the locality.

The importance of setting aside adequate land resources for resource recovery cannot be overemphasised.

ACOR Recommendation #6

Development of national standards for recycled products

Recovered resources are often discriminated against on the basis of being 'recycled', rather than being assessed on their performance. This is a significant barrier to local market growth. The development of national standards to assure secondary resource performance and allow comparison with other commodity choices are needed to overcome this barrier. The work begun by ACOR on the development of standards for recyclable materials needs to be extended across all significant material types.[4]

Also required is a change in tender evaluation practices by local government to allow the meeting of material specifications on the basis of performance, as opposed to being a 'virgin' material. Being prescriptive on performance is naturally the consumer's right, however there should exist an equal opportunity for secondary resources to compete on performance. This is especially the case where recycled content can outperform competing domestic and imported resources, but is not chosen because of 'waste' connotations. All materials should be selected on their ability to confirm to a performance specification.

ACOR Recommendation #7

Development of a fund to support resource recovery industry development

All of the major primary production industries have benefited from decades of government support in the form of grant programmes, funding support for research and development corporations, university research programmes and cooperative research centres. Compared to this the level of industry development support for resource recovery at a national and state level has been negligible.

ACOR recommends that a fund be established to support technology and innovation development within the resource recovery industry, similar in operation and scale to the support given for renewable energy. This is an essential 'level playing field' requirement for resource efficiency in Australia and would need to be under the control of a multi-interest board and subject to independent audit.

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[4] Please see www.acor.org.au/materials.html for more information on material specifications developed by ACOR for paper, aluminium, glass, plastic and steel.

To complement the operation of this fund and as a separate initiative, it is recommended that a Resource Recovery Research and Development Corporation be established, to work towards the advancement of a profitable, competitive and sustainable resource recovery industry that contributes to Australia's resource efficiency.

List of Attachments

Attachment 1 - Context of Sustainability

Attachment 2 - Value Chain, Resource Efficiency and Highest Resource Value

Attachment 3 - Resource Recovery Eco-Services and Disposal Disservices

Attachment 4 - Value of Eco-Services Provided and Eco-Disservices Prevented

Attachment 5 - Impacts Arising from the Overprovision of Disposal Disservices

Attachment 6 - Definition of Key Terms

Acknowledgement

ACOR acknowledges the assistance provided by Warnken ISE in preparing this submission.

Attachment 1

Context of Sustainability

The broad policy guidelines covering the Productivity Commission's work are contained in its legislation (Productivity Commission Act 1998). One of these guidelines is to 'ensure Australian industry develops in ecologically sustainable ways'.[5]

Terms such as 'sustainability', 'sustainable development', 'ecologically sustainable development' (ESD), 'triple bottom line' (TBL) and 'corporate social responsibility' (CSR) have been used (and misused) by corporations, governments and environmental NGOs alike to further their cause. Perhaps the most widely used definition describes sustainable development as meeting current needs without compromising the ability to meet those of the future.[6]

Australia's National Strategy for Ecologically Sustainable Development (ESD) defined ESD as 'A pattern of development that improves the total quality of life both now and in the future, in a way that maintains the ecological processes on which life depends'.[7]

It is generally agreed that sustainability encompasses the three core elements of environment, society and economics as shown in the figure below.

There are few who would argue that we live in a sustainable society. Many changes need to be made by business, governments and individuals before accelerated progress to this goal can be realised.

The current sustainability agenda is driven by 'crisis management' events of global warming. The majority of debate within this agenda surrounds not whether change needs to occur (this is a given), but the targets and methods (or pathways) for meeting these targets.

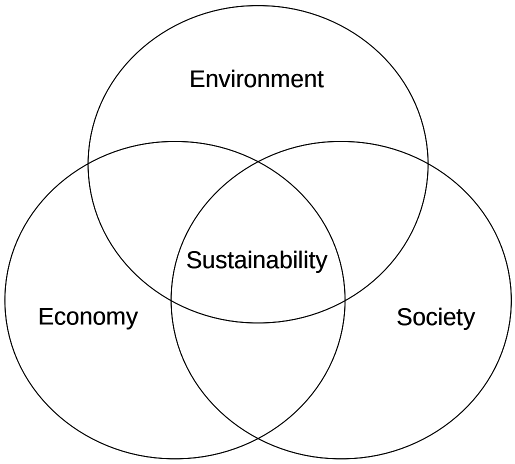

Figure – Main elements within the sustainability concept

One of the central challenges that sustainability presents to our western economies is how to change the dominant linear approach to production and consumption that results in unacceptably high levels of waste generation and a correspondingly low amount of resource efficiency.

One way to operationalise the principles of sustainability is to use nature as a model when designing systems of production and consumption. This is also known as biomimicry, which is the design of products and processes on the basis of understanding the functions of natural organisms and ecosystems and applying these lessons to the mode of manufacture and operation of the product.

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5 Productivity Commission Operating Principles and Policy Guidelines - http://www.pc.gov.au/commission/principles.html

6 'Our Common Future' (1987), otherwise known as the Bruntland Report, cited in 'Towards Earth Summit 2002: Briefing Paper', http://www.earthsummit2002.org/Es2002.PDF

7 Steering Committee for the National Strategy for Ecologically Sustainable Development (1992), - http://www.deh.gov.au/esd/national/nsesd/strategy/index.html.

Industrial Ecology applies these biomimetic principles on a macro scale, and provides a framework based on the operation of natural systems to both assess the impacts of industry and technology on the environment, and to design industrial systems that reduce these impacts. For example, the modification of manufacturing processes and the development of new businesses so that residues from one manufacturing operation are used as material inputs for another. Under this approach, as in nature, there is no room for disposal. Disposal is an indication of poor system performance and is ultimately unsustainable.

Implementing 'nature as model' thinking and completing the move to cyclical patterns of production and consumption requires a technology intervention to convert end-of-life 'wastes' into material and energy products ready to be assimilated back into the economy, as shown in the figure below. In Australia these technology interventions are provided in the main part by ACOR members.

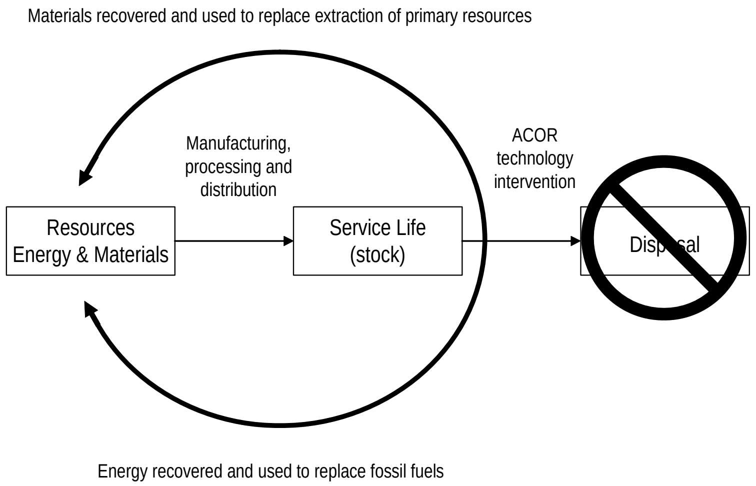

Figure – Technology intervention by ACOR members creates cyclical flow of materials and energy

In order to maximise resource recovery and achieve the highest resource value of Australia's secondary materials, an increasingly sophisticated system of 'reverse distribution' is required. This system in turn needs appropriate policy settings, planning for and provision of infrastructure and elimination of market failures arising from externalised costs that provide an unwarranted competitive advantage to disposal options.

Attachment 2

Value Chain, Resource Efficiency and Highest Resource Value

The supply chain traditionally refers to the linear flow of physical resources from extraction through manufacturing, assembly service life and to final disposal. This is contrasted with the 'value chain', which includes any element that can add, retain or subtract value from a product, from point-of-initiation to end-of-life management.[8] The value chain, in addition to physical material flows, also incorporates flows of energy, finance and environment impacts, combined with flows of information, ideas and decisions. Furthermore, 'value' incorporates environmental and social values, in addition to economic considerations.

The value chain can be divided into three elements including pre-consumer, consumer and post-consumer (see figure below). At the pre-consumer stage, resource efficiency refers to the usage of materials and energy to manufacture a given product. A product is said to be more resource efficient when less physical and energy resources are used in manufacturing and the same level of functionality is maintained.

Overall resource efficiency is also affected by the use (or mis-use) of products during their service life. This aspect of resource efficiency, while important, is beyond the scope of the Waste Generation and Resource Efficiency Inquiry and has not been addressed here.

The post-consumer end-of-life management choice determines the fate of the resource value of 'invested' physical materials and energy. The resource efficiency of our society as a whole is greatly determined by post-consumer outcomes, that is, the value returned to the economy through the resource recovery of embodied material and energy investments. Disposal always gives a zero return on investment.

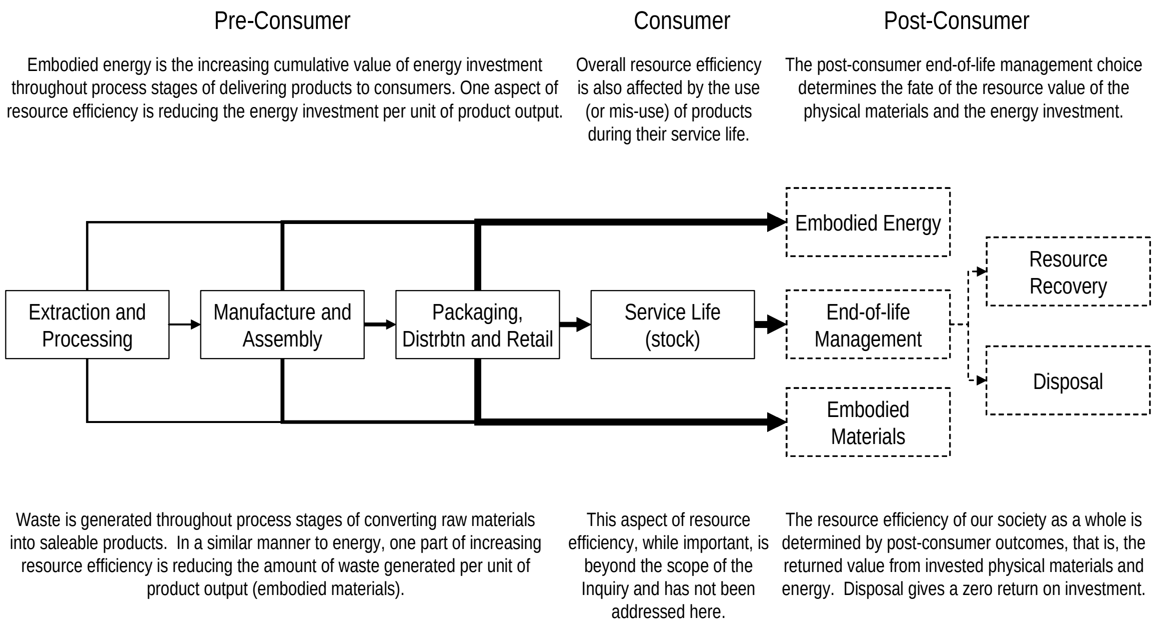

Figure – Resource efficiency of material and energy flows throughout a product's life cycle

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[8] For a discussion on value chain considerations related to waste generation and resource efficiency see Warnken ISE (2004) 'Market Based Instruments and Sustainable Resource Recovery' (http://www.tec.org.au/member/tec/projects/Waste/mbir1.html - pg 30-31) and GHD & Warnken ISE (2005) 'Discussion Paper on the Theoretical Concepts and Potential Surrounding Extended Producer Responsibility and Product Stewardship' (http://www.wmaa.asn.au/efw/task36.pdf - pg 18-23).

The goal of resource efficiency is to maximise the return on material and energy investments made in manufacturing products. The pre-consumer aspects of this equation relate to reducing energy usage, material inputs and waste generation per unit of production output. The post-consumer aspects of the resource efficiency equation relate to recovering resources at their highest resource value, which is a net benefit approach to determining resource recovery options.

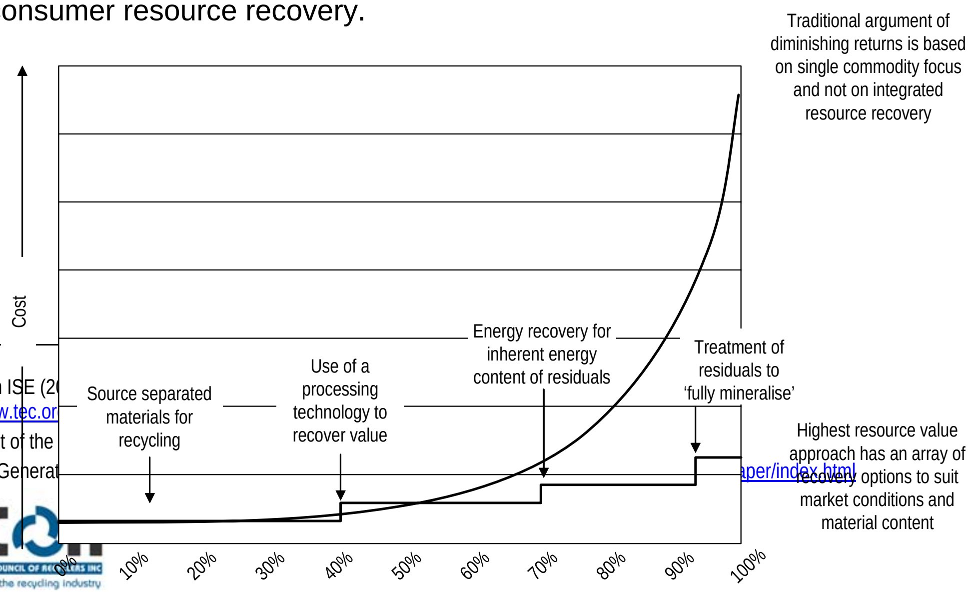
Highest resource value is a net benefit approach on the basis of environmental, social and economic values. Consideration needs to be given to the recovery options for the material in question, their commercial status and accessibility, the economic, environmental and social case for available and accessible recovery options and the prevailing local conditions (for example, drought, energy shortage, saline soils etc).[9]

This approach has an immediate connotation of maximising the good (value adding) and minimising the bad (lost value and pollution) for recycling options. While difficult to quantify, highest resource value choice is immediately obvious in some instances, for example using recovered 100 year old hardwood beams for furniture manufacture as opposed to energy generation. Highest resource value is also seen in action in the Australian Product Stewardship for Oil (PSO) Program that has a scaled series of PSO benefits that are paid on the basis of producing a higher value recovered oil product.[10]

Applying highest resource value thinking at a regional level counters the law of diminishing returns as an excuse for increased waste disposal. This law states that increased rates of recycling become progressively more expensive. For example, increasing the rate of recycling of newsprint beyond current levels will incur additional capital and running costs, as well as creating increased contamination levels associated with the recovered newsprint. This reasoning leads to the conclusion that 'increasing the rate of recycling will not necessarily be environmentally or economically sensible'.[11]

However, this argument only holds when considering the direct recycling of a single commodity, as shown in the figure below. Highest resource value principles will select a different resource recovery option that fits the given circumstances. These options include reuse, direct recycling, indirect recycling and energy recovery.

'Maximum resource recovery' can be achieved when all that is left from an array of various recovery technologies is 'fully mineralised' materials (that is, no longer biologically active or leachable) that have as their highest resource value the remediation of quarries and other voids needing rehabilitation. In this way an optimal level of resource efficiency can be delivered to society on the basis of integrated post-consumer resource recovery.



9 Warnken ISE (2… (http://www.tec.or…

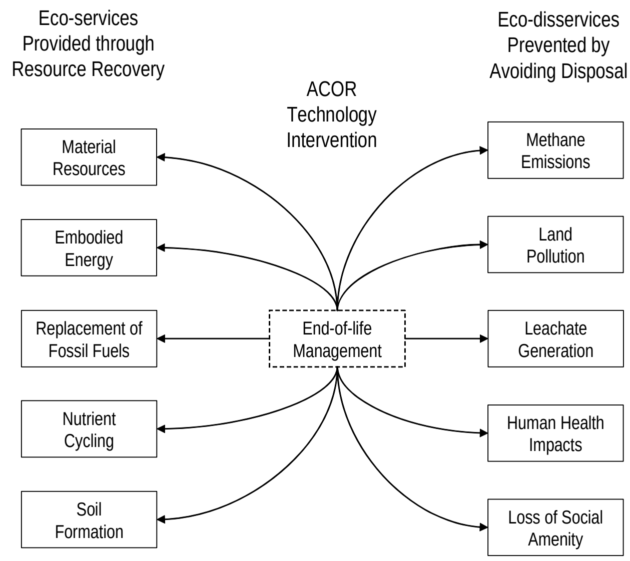
10 For a list of the …

11 'Waste Generat… …aper/index.html

Attachment 3

Resource Recovery Eco-Services and Disposal Disservices

The technology interventions provided by ACOR members at a product's end-of-life disrupt the linear flow of resources and energy into landfill. Recycling provides economic benefits by returning to the economy a range of material and energy inputs; creates a significant amount of employment; provides a range of eco-services based on the flow on effects of reduced energy usage and material substitution; and prevents a number of eco-disservices from occurring by preventing pollution.



The eco-services provided by the Australian resource recovery industry (see opposite figure) occur regardless of financial impacts. These eco-services include the provision of material resources, high embodied energy content, non-fossil fuels nutrient cycling, soil formation and cultural value. The eco-disservices prevented by resource recovery include the emission of methane, pollution of land, generation of leachate, impacts on human health, and overall loss of social amenity. The table below summarises the case for the eco-services provided by resource recovery.

Table – Summary of eco-services provided through resource recovery

Eco-service	*Description*
Provision of material resources	By recovering secondary resources and processing these into material inputs for manufacturing there is a reduced demand for primary resources, which slows the rate of resource depletion. Secondary resources also prevent the associated pollution arising from primary resource extraction, processing and refining.
Recovery of embodied energy	Embodied energy refers to the cumulative energy used along the supply chain to transform a raw material into a final product. Recycling captures that embodied energy and lowers the energy requirements for products with recycled content, reducing energy demands at a societal level and increasing the overall energy efficiency of manufacture.

Replacement of fossil fuels	The recovery of inherent energy (calorific value) from those materials unsuitable for recycling directly or indirectly into other products, has the benefit of displacing fossil fuels. Australia's electricity supply is dominated by fossil fuels including black coal, brown coal and gas. These fossil fuels are responsible for approximately one-third of all of Australia's GHG emissions.
Nutrient cycling	The processing of organic materials such as food and garden materials into fertiliser and compost products returns valuable nutrients to the soil.
Soil formation	As a continent Australia has very little top-soil and what is present has taken thousands of years to develop. Processing excavated soil from construction sites and garden organics can produce a top-soil product.
Prevention of methane emissions	The anaerobic decomposition of bio-degradable material in landfills produces methane (amongst other gases). Methane is a greenhouse gas with a global warming potential 21 times that of carbon dioxide. Even the best landfill gas collection systems in the world will not recover all of the methane. Furthermore, fugitive methane emissions will continue to be released long after the landfill is closed, and any attempts to 're-mine' old landfill sites will incur a significant carbon loading when any trapped methane is released.
Prevention of land pollution	There are no benefits arising from disposal as disposal returns no value from embodied material and energy investments within 'wastes'. The indiscriminate disposal of materials creates a variety of legacy problems. Closed landfill sites are not 'geologically' sound and will continue to subside over time, reducing future land use options. There is a need to rehabilitate extractive voids, however this should be done with materials that have civil applications as their highest resource value and are fit-for-purpose, that is compactable, inert and unlikely to leach.
Prevention of leachate generation	Leachate refers to water that has percolated through waste in landfills and become contaminated. Leachate contains soluble substances including chemicals and heavy metals, in addition to particles and micro-organisms and can potentially contaminate water bodies if not properly captured and treated.
Mitigation of human health impacts	The operation of disposal facilities presents a number of human health impacts related to air, land and water pollution, in addition to the creation of dust, air-blown litter, breeding grounds for vermin and toxic fumes (in the case of landfill fires).
Preservation of social amenity	The combined impacts of disposal facilities results in a loss of social amenity. No community wants to host a waste dump. Conversely there is widespread community support for resource recovery outcomes.

Attachment 4

Value of Eco-Services Provided and Eco-Disservices Prevented

In January 2001 an Independent Assessment of Kerbside Recycling performed by consultants Nolan ITU (now Hyder Consulting), SKM Economics and EnvirosRIS was published by the National Packaging Council.[12] This report provided an indication of the environmental costs and benefits associated with recycling a bundle of kerbside collected materials and derived estimates of the 'eco-dollar' net benefit for individual materials. This methodology was also used to inform a discussion paper on Rewarding Recycling: Eco-Services from the Resource Recovery Industry - A Market Based Approach, also by Nolan ITU (now Hyder Consulting).

Eco-dollar estimates provide a dollar value estimate of the eco-services provided by resource recovery based on avoided water and air pollution, avoided global warming potential, resource conservation of mineral, forestry and water resources, resource conservation benefits from composting and benefits from avoided solid waste.[10] The indicative eco-dollar values of recycling a variety of materials is presented in the table below.

Table – Summary of eco-dollar benefits from material recycling[13] (or of eco-value lost if sent to disposal)

Commodity	*Eco$/t*
Paper	400
Glass	200
Aluminium	3,000
Steel Cans	800
High Density Polyethylene (HDPE)	1,000
Polyethylene Terepthalate (PET)	1,000
Garden Organics	110
Food	140
Timber	80

Another way of expressing the eco-dollar equation is to note that for every tonne of aluminium disposed of to landfill there is an estimated loss of $3,000 of eco-service benefits that could have been provided to Australian society through resource recovery.

The lack of accounting for the eco-services provided by resource recovery is a market failure that has resulted in the under provision of recycling services and the overprovision of disposal disservices.

[12] http://www.packcoun.com.au/NPC-FINAL-01.PDF

[13] Rewarding Recycling: Eco-Services from the Resource Recovery Industry - A Market Based Approach, prepared by Nolan ITU (now Hyder Consulting) for ACOR

Attachment 5

Impacts Arising from the Overprovision of Disposal Disservices

It is often argued that most environmental pollution, natural resource depletion and disruptions to ecosystem services are caused by market failure, in particular the ability of firms to gain a competitive advantage by externalising the costs of their pollution onto the environment and community.[14] This results in an over provision of primary resources and an under provision of secondary resources.

Additionally the inability of eco-service providers to gain financial reward makes competing against disposal difficult. Again, the result of this market distortion has resulted in an under provision of resource recovery services and an over provision of disposal disservices. The current distorted market place is one that encourages and financially supports waste companies and actively works against resource recovery operations. This is demonstrated by the current levels of waste generation and subsequent disposal in Australia, presented in the table below.

Table – Impact of market failure: over provision of disposal

Jurisdiction	*Total Waste Disposal (t)*	*Total Recycled (t)*	*Total Waste Generated (t)*	*Rounded Population[15]*	*Waste Disposal per capita (t)*
New South Wales[16]	6,341,000	5,828,500	12,169,500	6,715,000	0.944
Victoria[17]	4,460,000	4,010,000	8,470,000	4,950,000	0.901
Queensland[18]	3,866,278	992,493	4,858,771	3,840,000	1.007
Western Australia (Perth)[19]	2,540,805	134,250	2,675,055	1,970,000	1.290
South Australia[20]	1,006,000	2,147,000	3,153,000	1,530,000	0.658
Tasmania[21]	497,000	n/a	497,000	480,000	1.035
Australian Capital Territory[22]	208,390	500,279	708,669	325,000	0.641
Northern Territory Darwin)[23]	82,500	10,000	92,500	200,000	0.413
Total	**19,001,973**	**13,622,522**	**32,624,495**	**20,010,000**	**0.950**

[14] See Warnken ISE (2004) 'Market Based Instruments and Sustainable Resource Recovery' (http://www.tec.org.au/member/tec/projects/Waste/mbir1.html) for a discussion on externalities within the context of resource recovery.

[15] http://www.abs.gov.au/ausstats/abs@.nsf/lookupMF/8CA5022B2135F162CA256CD0007BEE2202-03

[16] http://www.resource.nsw.gov.au/data/strategy/Progress%20report_web_inc%20cover_V2.pdf

[17] 00-01 http://www.ecorecycle.vic.gov.au/asset/1/upload/TZW_-_Appendix_A_-_Supporting_Analysis_to_the_Strategy_&_Plan_(2003).pdf

[18] 01-02 http://www.epa.qld.gov.au/register/p01258cg.pdf

[19] 03 http://portal.environment.wa.gov.au/pls/portal/docs/PAGE/DOE_ADMIN/POLICY_REPOSITORY/TAB1144266/1862_STRATEGIC_WASTE_0308.PDF and http://www.wastewa.com/Uploads/Images/Waste%20to%20Landfil%20-%20Perth%20Metropolitan%20Region.pdf for recycling estimate

[20] 03 http://www.zerowaste.sa.gov.au/pdf/0510_strategy_background.pdf

[21] 04 personal communication Mark Cretney DPIWE 2005

[22] 03-04 http://www.nowaste.act.gov.au/styles/landfillgraphpdf.pdf and http://www.nowaste.act.gov.au/styles/actresourcerecovery.pdf

[23] 04 personal communication Anegelika Hesse Darwin City Council 2005

Notwithstanding gaps in data (such as missing recycling data from Tasmania, metropolitan data acting as a proxy for Western Australia and Northern Territory, and a likely under reporting of waste generation in Queensland), there are some 19 million tonnes of urban waste materials disposed of each year, representing nearly 60% of waste generation.

Disposal is essentially a value destroying activity. Disposal is contrasted against resource recovery activities that are focused on quality and use technology interventions to manufacture saleable commodities. The goal of recycling is the extraction of maximum resource value from materials that previously were wasted. This contribution to a loss of resource efficiency at a society level can be estimated as the market commodity value of materials wasted, the lost energy investment (embodied energy) and the lost eco-dollar benefits. The impacts of the market failure perpetuating this loss of value to Australian society are presented in the table below.

Table – Summary of lost value arising from the disposal of materials in Australia

Commodity[24]	*Tonnes Sent to Disposal*[25]	*Commodity Value*[26]	*Embodied Energy*[27] *GWh)*	*Eco$* Value[28]
Paper	2,166,000	$151,620,000	21,900	$866,400,000
Glass	327,000	$23,544,000	1,200	$65,400,000
Aluminium	133,000	$199,500,000	6,300	$399,000,000
Ferrous	545,000	$40,875,000	4,800	$436,000,000
Plastic	1,228,000	$368,400,000	30,700	$1,228,000,000
Garden Organics	2,203,000	$44,060,000	300	$242,330,000
Food	2,248,000	$44,960,000	1,400	$314,720,000
Timber	944,000	$9,440,000	900	$75,520,000
Soil, Rubble, Concrete	2,953,000	$29,530,000	900	$59,060,000[29]
Other[30]	6,253,000	n/a	n/a	n/a
Total	**19,000,000**	**$911,929,000**	**68,400**	**$3,686,430,000**

24 Due to a lack of disaggregated data on a national basis, NSW estimates have been used as a proxy for the waste disposal composition for all of Australia, and so these estimates are presented for illustrative purposes only - http://www.resource.nsw.gov.au/data/strategy/Progress%20report_web_inc%20cover_V2.pdf

25 Combined available estimates from State and Territory sources as calculated in the preceding table and rounded to nearest 10,000 tonnes

26 Hyder Consulting 2005, 'Rewarding Recycling: Eco-Services from the Resource Recovery Industry - A Market Based Approach', prepared for ACOR

27 Rounded to the nearest 100 giga-watt hours (GWh – 3,600 giga-joules (GJ) – 1 GWH). Source data from Technical Manual Design for Lifestyle and the Future (2004) - http://www.greenhouse.gov.au/yourhome/technical/fs31.htm and Centre for Building Performance Research (1995) - http://www.vuw.ac.nz/cbpr/documents/pdfs/ee-coefficients.pdf. In GJ/tn, Paper = 36.4, Glass = 12.7, Aluminium = 170, Steel Virgin = 32, Plastics General = 90, Garden Organics – air dried sawn hardwood used as proxy = 0.5, Food from http://www.steppingforward.org.uk/tech/compbycomp.htm conservative average of Pulses 5, Cereals 4, Starchy root 2, Vegetables 1, Fruits 1, Eggs 1 = 2.3, Timber average of Kiln dried sawn softwood 3.4, Kiln dried sawn hardwood 2.0, Air dried sawn hardwood 0.5, and Particleboard 8.0 = 3.5, Soil, Rubble, Concrete average of local stone 0.8, sand 0.1, concrete ready mix 17.5MPa 1.0 and clay bricks 2.5 = 1.1.

28 Hyder Consulting 2005, 'Rewarding Recycling: Eco-Services from the Resource Recovery Industry - A Market Based Approach', prepared for ACOR

29 A surrogate estimate has been used for the eco-dollar benefits of soil, rubble and concrete from Triple-Bottom-Line Assessment of Global Renewables UR-3R Resource Recovery Technology - http://www.nolanitu.com.au/__data/page/10/3BL_Assessment_of_UR3R3.pdf - values used were for avoided landfill amenity & intergenerational equity values of $9.35 per tonne for metropolitan centres and resource conservation of sand mineral resources of $10.37 per tonne, rounded to give $20 per tonne.

30 Note that the above assessment does not include any value from 'Other' due to the uncertain material composition, likely to comprise a mix of all material types. This category accounts for nearly one third of material disposal. This means that the benefits outlined above are a conservative estimate based on the value of two thirds of waste material flows.

The 19 million tonnes of materials disposed of represents a significant loss of value including an estimated:

- $912 million in material commodity sales
- 68,400 giga-watt hours (GWh) of embodied energy, which is equivalent to almost one third of electricity generation in Australia[31] (although note that embodied energy includes other energy sources other than electricity, for example solid and liquid fuels)
- more that $3.5 billion of eco-service benefits
- 5,000 to 9,000 jobs.[32]

[31] Total electricity generation in Australia 2003/04 approximately 213,000 GWh - http://www.esaa.com.au/store/page.pl?id=1581

[32] ACOR currently employs more than 5,000 people in the recovery of 11,300,000 tonnes of resources. A similar amount of labour would be necessary to recover all of the material components currently going to disposal – excluding the 'Other' amount of 6,253,000 tonnes. To recover these materials as well, based on current employment levels, an additional 4,000 employees would be needed.

Attachment 6

Definition of Key Terms

Commercial and Industrial (C&I) Waste	Waste materials generated from fixed point sources related to manufacturing, wholesale, retail, professional services and administration sectors. C&I along with C&D and MSW make up urban waste.
Construction and Demolition (C&D) Waste	Waste materials generated from construction and demolition activities both on a large scale (high rise) and a small scale (residential housing). C&D along with C&I and MSW make up urban waste
Direct Recycling	Recycling waste materials into resources for use in manufacturing a new product within the same supply chain (also know as closed loop recycling). For example recycling a PET plastic bottle into a new PET plastic bottle.
Economic Efficiency	Economic efficiency refers to an optimal balance between production and consumption achieved where the cost of producing an additional unit of production or service (marginal cost) is equal to the price the market is willing to pay. Economic efficiency can also refer to maximising the value of outputs from resources, achieving the lowest cost of production, or from a policy perspective, returning the greatest social or environmental benefits for the least social or environmental costs. In the context of waste generation and resource efficiency three approaches to economic efficiency are identified on a cost, commodity and value basis. Firstly, using cost as the starting point, economic efficiency in waste generation would occur when the cost of avoiding or recovering a unit of waste is equal to the cost of landfill disposal. If landfill is artificially cheap then resource recovery and waste avoidance will be underprovided, while if landfill is artificially expensive, then recovery services will be overprovided. The key issue here is the pricing of landfill. Secondly, using commodity prices for recycled materials, economically efficient levels of recycling occur when the cost of delivering an additional unit of recyclate is equal to the price the market is willing to pay. However, the market could be artificially depressed through a lack of competition, or pegged against primary resources with externalised costs of production and financial subsidies to support production. Once again the issue of pricing is key, this time in ensuring that competing products do not have an unfair competitive advantage. Thirdly, arguing from a value approach, economic efficiency is achieved by calculating per unit value returns from a range of different investment options. For example, the value returned by sending materials to disposal (arguably zero or negative) versus the value returned through resource recovery (commodity, embodied energy and eco-dollars). If these values are not identified and brought to account in the policy making setting, an underinvestment in resource recovery services will result in a net loss of value to society.
Ecodollars	Ecodollar estimates are a means of converting the eco-services benefits provided by resource recovery into a dollar value estimate. The methodology is based on valuing avoided water and air pollution, avoided global warming potential, resource conservation of mineral, forestry and water resources, resource conservation benefits from composting and benefits from avoided solid waste. Converting these values into a dollar 'indicator' allows more direct comparison with traditional cost-benefit assessments.

Eco-services	Ecosystem services (eco-services) are the range of services provided by the ecosystem (biosphere), including atmosphere and climate maintenance, water regulation and supply, biodiversity and genetic resources, soil formation, raw materials, and food production. Here eco-services denote the positive contributions to ecosystem operation made by resource recovery activities.
Energy from Waste	Energy from Waste (EfW) is the recovery of the calorific value of a waste material through a range of technology processes such as combustion, anaerobic digestion, gasification and carbonisation. EfW seeks to maximise the recovered energy as the primary purpose of the operation as opposed to incineration, which has the destruction of waste materials as the primary purpose.
Indirect Recycling	Processing waste materials into resources for use in manufacturing a new product within a different supply chain (also know as open loop recycling). For example recycling a PET plastic bottle into a new 'poly-fleece' jacket.
Market Based Instruments MBIs	Market based instruments (MBIs) seek to harness market forces to assist in meeting a desired environmental goal. Such instruments include charges, fees and taxes, market creation (such as the establishment of tradeable permits/certificates), subsidies, deposit/refunds and improving the operation of the market through non-financial means, such as information provision. Here MBIs are used to identify tradeable permit and certificate schemes.
Market Failure	The operation of western economies is predicated on assumptions of perfect ‘free-market’ competition. When a market is not perfectly competitive, it is said to have suffered 'market failure'. Some contributing causes of market failure include monopolistic power (small numbers of buyers and sellers), influences of branding on purchase decisions, locational or geographic commercial advantages, barriers to industry entry, other 'non-price' advantages (eg. from excessive advertising), price fixing, incomplete or imperfect knowledge, public goods and the presence of externalities. It is often argued that most environmental pollution, natural resource depletion and disruptions to ecosystem services are caused by market failure, in particular the ability of firms to gain a competitive advantage by externalising the costs of their pollution onto the environment and community.
Municipal Solid Waste (MSW)	Waste materials that are primarily generated from the domestic sector and are collected in household garbage, recycling, garden organics and Council clean-up collections (for bulky household waste such as appliances and furniture). MSW also includes other types of waste such as household hazardous waste and waste generated from local Council operations, for example waste from street sweeping, litter bins and parks. MSW along with C&I and C&D make up urban waste.

Resource Efficiency	A notional measurement of the materials and energy used to manufacture products. Resource efficiency can be applied at a single product level and also at a whole of society level. A product is said to be more resource efficient when less physical and energy resources are used in manufacturing and the same level of functionality is maintained. A society is more resource efficient when it maximises the return on material and energy investments made in manufacturing products by recovering their highest resource value at end-of-life. Also known as resource productivity, the concept is contrasted against labour productivity, which has been driving the focus of industrialised economic development, namely the increased production per unit of labour. Labour productivity is associated with increased resource and energy intensity and has been over provided in many western economies because subsidies to primary resources and externalised costs have kept resource prices artificially low.
Resource Recovery and Recycling	The process of transforming wrong time/place materials (waste) into right time/place resources (value) through a range of technologies (processes, practices and procedures). The 'new' products result from reuse, direct recycling, indirect recycling and energy from waste. Here the terms resource recovery and recycling are used interchangeably.
Re-use	Re-use refers to taking waste materials or products and re-using them in their same form for the same or similar function, with minimal or no processing.
Urban Waste	Urban waste is a grouping term referring to all waste generation within an urban context (MSW, C&I and C&D), as opposed to agriculture, mining or other primary resource activities. Urban waste materials are created both during pre-consumer activities - as by-products from production, manufacturing and sometimes distribution - and during the post consumer phase, which includes fast moving consumer goods, end-of-life appliances and other unwanted materials discarded by the consumer or resident.
Waste Generation	Waste generation refers to the total amount of materials that have no further use to the current owner and thus present as a problem requiring removal. Total amounts of waste generated in any given region are calculated as the total waste disposed, plus the total amounts of materials recycled (net of any residue requiring disposal).
Waste Management Hierarchy	The waste management hierarchy is a well known public policy 'mantra' built around the three 'Rs' of reduce (or avoid), reuse, and recycle. Variations include the addition of reprocessing, recovery of energy and treatment. Preference is given to avoidance in the first instance and disposal as a means of last resort. Difficulties arise when the hierarchy is used as an implementation plan for sustainable resource recovery, as a linear interpretation of the hierarchy is unlikely to consistently yield the most sustainable outcome.

ACOR

AUSTRALIAN COUNCIL OF RECYCLERS INC

THE VOICE OF THE RECYCLING INDUSTRY

Rewarding Recycling: Eco-Services from the Resource Recovery Industry -

A Market Based Approach

Discussion Paper

December 2005

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REF: NS03012 (4135-02)

Document History and Status

Issue	Status	Date	Project Manager	Reviewer
1.1	Draft	17.05.2005	Hannes Partl	Peter Shmigel
1.2	Final	7.05.2005	Hannes Partl	Peter Shmigel
1.3	Revised	20.09.2005	Hannes Partl	
1.4	Revised Final	12.10.05	Hannes Partl	Peter Shmigel
1.5	For Publication	2.12.2005	Hannes Partl	

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FOREWORD

In a perfect world, there would be no waste. Products and materials reaching the end of their useful lives, would still have sufficient intrinsic 'value' embedded in them to cover the costs of collection, dismantling and reprocessing to ensure their conversion into some sort of useful, new product. The reality is, the 'gap' between what is recovered from the waste stream and what creates the waste stream, grows larger by the day and is heading in an unsustainable direction as wealth grows.

Governments have recognised community concerns with unsustainable resource use and waste disposal, and have sought to reduce waste to landfill by various programs and sometimes the imposition of levies on landfill disposal. These are designed to make waste disposal less economic, but they sometimes have the unintended side effect of also making recycling less economic.

ACOR's position is that the best way to increase recycling is primarily to reward recycling. This report is designed to demonstrate some ways this might be done.

The level of recycling currently achieved is largely a result of the competition of recovered resources against equivalent virgin materials in the market for use in new products. With the vagaries of the operation of commodity markets, there is a need to support recovered resources whenever market conditions become adverse, so as to maintain resource recovery performance. The best way to support these commodities is to internalise and capture the 'value' currently being given away for free to our community when these resources are recovered – the "Eco-Service". Essentially, there is a need for a market-based approach to valuing these environmental services and returning this to the sector to drive the delivery of even more ambitious resource recovery targets.

Rewarding recycling requires the establishment of a market for environmental services in the Resource Recovery Industry Sector. Such a market would provide the conditions necessary to meet government recycling targets and would encourage viability at the ambitious resource recovery levels adopted by Government.

Australian Council of Recyclers (ACOR), December 2005

EXECUTIVE SUMMARY

Introduction

There is a growing need for the establishment of a *market for environmental services* in the Resource Recovery Industry. Such a market would provide the conditions needed to enable government recycling targets to be met and would encourage viability in a struggling industry sector. The need for market-based initiatives is evidenced by:

- The substantial environmental and community benefits that result from recycling;
- The continued externalisation of environmental costs in virgin material extraction and waste disposal;
- The need to improve market conditions in the recycling industry especially to drive the processing of mixed waste streams and composite products;
- The lack of a clear implementation plan to ensure resource recovery targets can be achieved; and
- Recent openness of governments around the world towards market based solutions.

Substantial environmental benefits are generated from resource recovery, including greenhouse gas abatement, natural resource conservation, and pollution reduction. In 1999/2000, the monetarised value of the environmental benefits arising from kerbside recycling in Australia was calculated to be over $420 million per year. This environmental value is substantially higher than the financial cost of recycling.

ACOR believes there is a growing need to review the regulatory and market-based platform on which the sector operates. Improving the level of activity in the recycling sector to reduce the level of activity in the disposal sector requires improving the economic framework for recycling.

Objective

This report was commissioned by ACOR to initiate a discussion on how to address the imbalance between current commercial realities in the resource recovery industry and future waste diversion targets. An indicative set of figures on current and future waste and recycling streams, costs and benefits should also be established.

Substantial Environmental and Social Benefits

When materials are recycled, the environmental benefits are not restricted to savings in landfill space and reduced emissions, but include all other environmental life cycle benefits associated with using recycled rather than virgin resources. The use of recycled materials avoids the impacts associated with virgin resource extraction and refining and commodity material manufacture.

The net environmental benefit of different waste management services has been valued in monetary terms using the Nolan-ITU environmental economic valuation ('Ecodollar') model. The model was originally developed for the Independent Assessment of Kerbside Recycling (Nolan-ITU, 2001) which included a Life-Cycle Assessment (LCA) of Australia's kerbside recycling system.

Current and Future Quantities Recovered in NSW

The NSW State Waste Strategy has set the following targets for waste reduction by 2014:

Municipal Wastes:	66%
C&I Wastes:	63%

In 2002/03, ***municipal waste generation*** in NSW amounted to 3.3 million tonnes, with recovery of almost 1.2 million tonnes, or 35%. The five major contributing materials (representing 99.7% of total recovery) were garden organics, paper & cardboard, glass, plastic and ferrous metal. In total, these materials made up 2.3 million tonnes, or 69%, of the total municipal waste stream in 2002/03.

The current NSW Waste Strategy assumes no growth in waste generation, but based on population and GDP growth the total municipal waste quantity is projected to increase to just over 4.5 million tonnes by 2014. From these projected waste quantities and assuming the State waste diversion target for 2014, the quantity of recycled material needing to be recovered would be around 3 million tonnes. Of this, garden organics and food contributes 61%, paper & cardboard almost 23% and glass 8%.

In 2002/03, ***C&I waste generation*** amounted to 4.2 million tonnes, of which 33%, or 1.4 million tonnes, was recycled. Somewhat different to municipal waste, the materials contributing most to C&I recycling were ferrous metals, paper & cardboard, garden organics, other recyclables and timber. These materials made up 91% of the C&I recovery and 67% of the total C&I waste stream in 2002/03.

With the projected waste quantities and assumed recycling rates for 2014, the recycled C&I quantity would amount to 3.6 million tonnes, i.e. 63% of the 5.7 million tonnes of the total future C&I waste stream. Paper & cardboard recovery would amount to 1.3 million tonnes, or 36% of total materials recovered. Ferrous metals contribute 24%, plastics and garden organics 13% and 10% respectively, and timber 8%.

The projected additionally available recyclable material in 2014 for municipal and C&I materials is shown in Figure I. As can be seen, paper & cardboard is the C&I material category with the highest additional recovery, more than 860,000 tonnes. The corresponding material for the municipal sector is garden organics with 650,000 additional tonnes. The C&I sector provides the largest potential for additional recovery for all material except for glass, garden organics and food recyclables.

Hyder Consulting

ACOR Australian Council of Recyclers Inc — the voice of the recycling industry

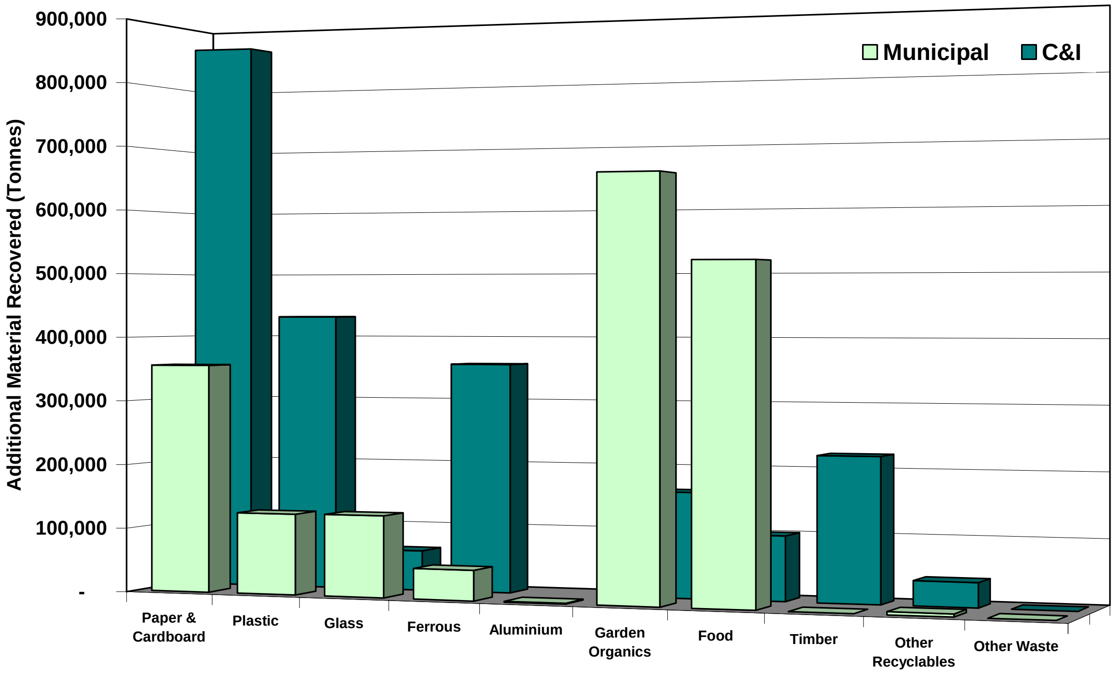


Figure I: Additional Recyclable Municipal and C&I Waste in 2014

Overall Costs and Benefits

Tables I and II show the overall costs and benefits of increasing recycling to match State Government diversion targets, taking account of both the marginal financial costs of increased recycling and the associated monetarised environmental benefits. Here the monetarised environmental benefits have been assigned as only 20% of those estimated using the Nolan-ITU environmental economic valuation ('Ecodollar') model.

The results illustrate that – should recyclers/reprocessors be able to benefit from only a small proportion (here: 20%) of the estimated environmental value provided as part of their service, this would be more than sufficient to compensate for increased financial costs and hence provide significant incentive to achieve the stipulated diversion targets.

As shown in the tables below, the additional environmental benefit for municipal waste is estimated at $96 million and for C&I waste at $225 million using the '20% environmental value'. This results in an overall estimated net benefit of $29 million and $164 million respectively for these two sectors. Note that the actual total estimated environmental value (100%) of such an increased material recovery amounts to approximately $480 million (Municipal) and $1.1 billion (C&I).

Table I: Overall Cost-Benefits from Municipal Recycling in 2014

Material	Additional Recycling (t/yr)	Marginal Cost ($)	Eco-Benefits (20%)	Overall Cost-Benefit [1]
Paper & Cardboard	356,000	-$3,557,000	$28,454,000	$32,011,000
Plastic	126,000	-$628,000	$25,126,000	$25,754,000
Glass	126,000	-$632,000	$5,057,000	$5,689,000
Ferrous	47,000	-$468,000	$7,486,000	$7,954,000
Aluminium	1,000	-$12,000	$694,000	$706,000
Other Recyclables	5,000	$234,000	- [1]	-$234,000
Subtotal	***660,000***	***$5,063,000***	***$66,817,000***	***$71,880,000***
Garden Organics	650,000	$19,508,000	$14,306,000	-$5,202,000
Food	518,000	$51,786,000	$14,500,000	-$37,286,000
Subtotal	***1,168,000***	***$71,294,000***	***$28,806,000***	***-$42,488,000***
Total	**1,630,000**	**$66,231,000**	**$95,623,000**	**$29,392,000**

[1] No ecodollar value applied due to lack of characterisation

Table II: Overall Cost-Benefits from the C&I Recycling in 2014

Material	Additional Recycling (t/yr)	Marginal Cost ($)	Eco-Benefits (20%)	Net Cost-Benefit
Paper & Cardboard	863,000	$17,267,000	$69,069,000	$51,802,000
Plastic	431,000	$12,943,000	$86,288,000	$73,345,000
Glass	62,000	$1,239,000	$2,478,000	$1,239,000
Ferrous	357,000	$10,715,000	$57,144,000	$46,429,000
Other Recyclables	38,000	$1,895,000	-	-$1,895,000
Subtotal	***1,752,000***	***$44,059,000***	***$214,979,000***	***$170,920,000***
Garden Organics	163,000	$4,075,000	$3,586,000	-$489,000
Food	100,000	$8,008,000	$2,803,000	-$5,205,000
Timber	223,000	$4,459,000	$3,567,000	-$892,000
Subtotal	***486,000***	***$16,542,000***	***$9,956,000***	***-$6,586,000***
Total	**2,238,000**	**$60,601,000**	**$224,935,000**	**$164,334,000**

The Way Forward - Recognising Eco-Service Value.

The preliminary analysis discussed in this report has demonstrated:

- The very substantial amount of additional recovery and recycling of materials from both the domestic and the C&I waste streams necessary to achieve the government's targets;
- The need to establish both sorting and beneficiation infrastructure to deliver the increased resource recovery;
- The significant environmental benefits of increased resource recovery;
- A methodology to quantify these environmental benefits on an individual material basis (with examples given); and
- The substantial financial costs associated with additional resource recovery.

The appraisal of MBIs in the context of waste and resource recovery in Australia - and in NSW in particular where large quantities need to be diverted from landfill if State Government targets are to be achieved - has shown the following:

- Whilst waste disposal and recycling may be the focus points for MBI implementation, application of instruments to upstream economic activities to directly affect resource use is also likely to be an important part of an overall framework. Upstream MBIs targeting manufacturers and producers are only achievable as a national scheme. (It should be noted that the level of subsidies provided in Australia to virgin material usage still greatly exceeds any support for competing non-virgin or recycled materials.)
- A landfill levy scheme with a much more aggressive and some would argue realistic levy (increase by about $25 per tonne of waste) would provide noticeable incentives for additional waste diversion / resource recovery but would need to be implemented along with rewards for recycling in order to avoid reducing the level of recycling of some mixed streams (where larger components of residue material require landfilling after the recovery operation).
- A 'combination MBI' with downstream focus as well as 'ecoservice recognition' could be implemented in NSW and, over time, expanded into a national model.
- The level of 'ecoservice recognition' could be developed from an initial set of programs for infrastructure funding (mainly of recycling facilities, reprocessing (beneficiation) plants and AWT technologies for unrecoverable mixed putrescible waste) to a scheme compensating for the provision of an environmental service based on the actual benefits ('recycling credits') delivered on a material specific basis.

The waste management and resource recovery sector certainly has significant potential for the effective use of market based instruments as they are seen to offer efficiency benefits over direct regulation and effectiveness benefits over voluntary agreements. It would be an over simplification, however, to assume that MBIs and the creation of markets can completely solve the challenges that the waste management industry confronts.

The practicalities of implementation and the lack of full trading markets suggest that an instrument "package", involving more sophisticated regulation combined with negotiated agreements and well designed MBIs, is likely to be the most effective framework to meet the range of stakeholder objectives in the sector.

1 INTRODUCTION

1.1 Background

There is a growing need for the establishment of a *market for environmental services* in the Resource Recovery Industry. Such a market would provide the conditions needed to enable government recycling targets to be met and would encourage viability in a struggling industry sector. The need for market-based initiatives is evidenced by:

- The substantial environmental and community benefits that result from recycling;
- The continued externalisation of environmental costs in virgin material extraction and waste disposal;
- The need to improve market conditions in the recycling industry especially to drive the processing of mixed waste streams and composite products;
- The lack of a clear implementation plan to ensure resource recovery targets can be achieved; and
- Recent openness of governments around the world towards market based solutions.

Substantial environmental benefits are generated by resource recovery activities including greenhouse gas abatement, natural resource conservation, and pollution abatement. The monetarised value of the environmental benefits arising from kerbside recycling in Australia in 1999/2000 has been valued at over $420 million per year. This environmental value is substantially higher than the financial cost of recycling.

The resource recovery and reprocessing industry in Australia is experiencing a number of issues that impede growth in this sector. These are summarised below:

- Diminishing economic returns for additional materials recycled;
- Continued debate on policy alternatives;
- Volatility in the recycled commodity market;
- Government intervention, as part of environmental market reform, that has largely served to increase cost pressures on the sector (landfill levy, increased environmental standards for recycling facilities), not reduce them; and
- Government strategies for landfill diversion have largely focused on the "low hanging fruit" of easily source separated streams. The remaining waste streams are not easily separated or recycled and will require sophisticated sorting and beneficiation processes to convert these waste materials into substitutes for virgin materials.

Without making recycling viable at the level of resource recovery planned, increases in recycling will remain a paper target. There is a growing need to review the regulatory and market-based platform on which the sector operates.

If government targets for resource recovery are to be met, a substantial increase in the recovery and processing of some commodity materials will be required. There has been some scrutiny of these targets by environmental and industry NGOs and the Total Environment Centre has reported that, "landfill levies have resulted in greater recovery … of construction and demolition materials, however the overall flows of Municipal Solid Waste and Commercial and Industrial waste have not been greatly impacted[1]".

Market reform is now needed to ensure resource recovery targets are effectively met. Reform initiatives are compatible with policy objectives set by the *Protection of the Environment Operation Act, 1997* and its review in July 2003 and with National Competition Policy. In fact, National Competition Policy requires that competition should only be restricted if the benefits to the community as a whole outweigh the costs. As this has been shown to be true for recycling, there is a sound case for correcting the market so that negative environmental externalities of production and disposal do not continue to distort the market and cause discrimination against recycled goods.

1.2 Objectives

This report was commissioned by ACOR to initiate a discussion on how the imbalance between current commercial realities in the resource recovery industry and the future waste diversion targets could be addressed. An indicative set of figures on current and future waste and recycling streams, costs and benefits should be established so as to be able to:

- Establish and present an indicative summary of five major recyclable materials currently being recycled and currently being disposed of to landfill;
- From previous work, establish a *confidential* indicative economic value of the environmental benefits of recycling these materials – it is understood that this value is for modelling purposes only;
- Provide an indicative estimate of the financial cost / benefits of increasing the quantities of material diverted from the MSW and C&I waste stream for the purposes of recycling[2], assuming a 66% recovery target;
- Establish a broad estimate of what the environmental benefits would be, based on the above quantities;
- Develop, in principle, two or three mechanisms by which the initial pool of cash necessary to kick off a system such as an EcoService Fee could be raised; and
- Summarise the above in a brief report and PowerPoint presentation.

[1] Workshop on Market Based Instruments and Sustainable Resource Recovery (March, 2005)
[2] In order to achieve/slightly exceed targets as set out in the NSW Waste Strategy

2 SUBSTANTIAL ENVIRONMENTAL AND COMMUNITY BENEFITS

When materials are recycled, the environmental benefits are not restricted to landfill space and emissions saved, but include all other environmental life cycle benefits associated with using recycled rather than virgin resources. The use of recycled materials avoids the impacts associated with virgin resource extraction and refining and commodity material manufacture. These impacts include the avoided air and water pollution, resource depletion savings, energy and greenhouse gas abatement benefits and reduced solid waste. Collection and processing of recovered materials requires energy and can release pollutants to the environment, but the net impact has been shown to be considerably lower than the environmental savings associated with recycling (Nolan-ITU 2001; RMIT, 2003 & DEC, 2005).

The net environmental benefit of different waste management services has been valued in monetary terms using the Nolan-ITU environmental economic valuation ('Ecodollar') model. The table and graph below, Table 2-1 and Figure 2-1, provide valuations for different resource recovery functions, expressed as "environmental balance" or the difference between the environmental benefit and the environmental cost for each function. The model was originally developed for the Independent Assessment of Kerbside Recycling (Nolan-ITU, 2001) which included a Life-Cycle Assessment (LCA) of Australia's kerbside recycling system. All values given are based on a limited range of pollutants and are based on conservative estimates.

Table 2-1: Environmental Valuation of Resource Recovery Functions

Waste Activities	Environmental Balance ($/t)	Reference
Commodity Recycling (basket)	> 400	Independent Assessment of Kerbside Recycling (NPC)
Organics Recycling (basket)	> 120	TBL Assessment of Domestic Garden Organics Management (DEC) (2005) [1)]
AWT (MBT and WTE)	> 100 [2)]	RMIT (2003) DEC & PNEB (2004)
Advanced Reprocessing	230 [3)]	National Benefits Study Global Renewables (2004)

1)…Finalised 2004, published 2005

2)…Partial valuation only due to limited scope

3)…Extended LCA and environmental economic modelling not available previously

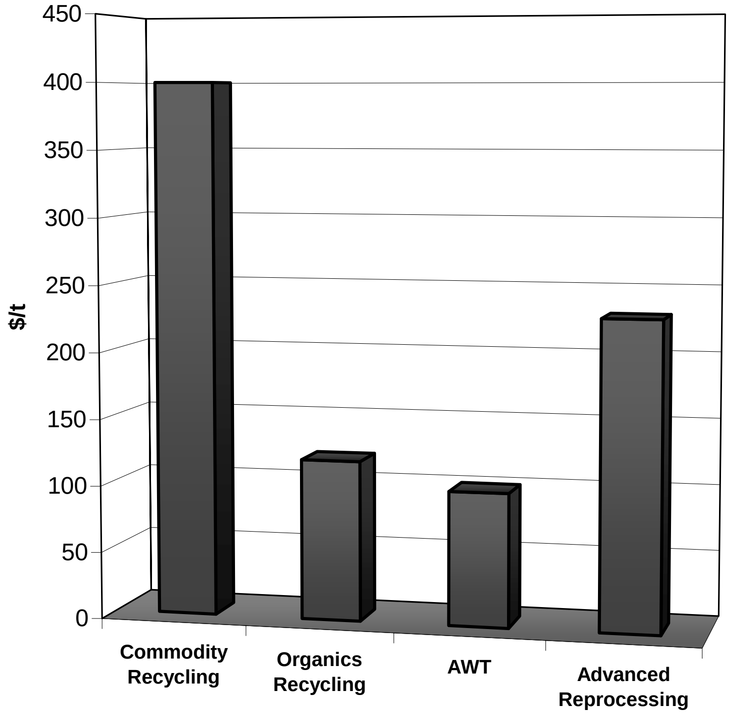


Figure 2-1: Indicative Environmental Values of Resource Recovery Functions

It is noted that all studies from which environmental values ("Ecodollars') have been derived were undertaken for a specific purpose and have their limitations and qualifications. The values presented here should therefore be seen as being strategic in nature and based on existing data sets and methodologies. Economic valuation of environmental gains and impacts (as applied for this impact assessment) aims to aggregate complex information in a more meaningful way. This approach is particularly challenging, as it implies a seemingly definitive assessment of systems that are dynamic and indeterminate. On balance, however, the approach is increasingly being accepted for use in environmental decision making in Australia. In this context, it is important to note that the final dollar valuation is not intended to represent actual environmental benefits but rather to indicate the relative significance of environmental results for different targets and financial costs.

Recycling also has the potential to deliver significant economic and social benefits in NSW. Local employment has been shown to benefit from increased recycling. In addition, the use of recycled materials results in financial multiplier savings associated with import replacement and local industry development.

For the purpose of this report, the per tonne value for recyclate as collected in the Australian kerbside system was derived from the Independent Assessment of Kerbside Recycling. This report, which was subjected to extensive peer review, established a costs and benefits of kerbside recycling in Australia for a "basket" of recyclables. From this 'basket value', figures for individual materials were derived through a combination of energy and resource inputs. This was done to give a first, rough indication of individual values; however, it is emphasised that these should only be seen as *preliminary estimates* to be used for discussing the principles of a market based system using ecological (environmental) values/services. Rounded values are given in Table 2-2.

The authors note that the environmental values of ***individual*** *materials are not of sufficient scientific rigour to be used as the basis for a trading or compensation system. There is consensus between the authors and ACOR that, should ways be identified to use these environmental economic values as the basis for some market based system, a substantial scientific and peer reviewed study would be required to confirm the actual values for individual commodities.*

Table 2-2: Indicative Ecodollar Values

Commodity	Eco$/t	20% Value for Market Models
Paper	400	80
Glass	200	40
Aluminium	3,000	600
Steel Cans	800	160
HDPE	1,000	200
PET	1,000	200
Garden Waste	110	22
Food Waste	140	28
Timber	80	16

While the efficiency of most Australian waste management systems makes waste from household and business activity increasingly "out of sight and out of mind" for many members of the community, waste management is nevertheless likely to become more relevant to the broader community going into the future for several reasons.

First, the increasing application of full (external) costs to landfill disposal – both in NSW and across Australia - is likely over time to increase the financial cost for waste management. The community will be exposed to this in the form of Council rates and charges. Secondly, the desire and drive for environmental protection, including resource conservation and greenhouse gas abatement, is likely to increase as more scientific evidence comes to light. Finally, the development of new technologies in the waste management sector will also create community debate and interest.

It is interesting to note that the *Federal Treasurer, Peter Costello*, has recently recognised "sustainability in respect of the environment and the use of resources and energy" by listing it in his top three priorities (WME, 2005) when talking about the forthcoming budget.

Although it is beyond the scope of this report to quantify either social or wider (macro-) economic benefits, it is likely the recycling and reprocessing industry achieves additional 'triple-bottom-line' benefits as listed below:

- Jobs created with both social and economic implications;
- Products and service created / GDP;
- Taxes paid by the recycling industry and multiplier effect;
- Social / community benefits such as jobs for disadvantaged people in a contracting industrial situation, jobs in socio-economically poorer areas, more sustainable replacement / domestic industries etc; and
- Indirect value of products and services needed as a result of those companies that supply to or provide goods and services to the recycling industry ('multiplier effect').

3 CURRENT AND FUTURE RESOURCE RECOVERY IN NSW

The Department of Environment and Conservation NSW (formerly Resource NSW) has in the State *Waste Avoidance and Resource Recovery Strategy 2003* set up overall targets for resource recovery in year 2014. The municipal sector is to achieve 66% recovery, the C&I sector 63% and finally the C&D sector 76% recovery.

These targets for the Municipal and C&I sectors have been assumed for this study to estimate the improvements necessary. The financial year 2002/03 was nominated as the baseline year, and 2014 as the target year. The progress report *Waste Avoidance and Resource Recovery in NSW* (DEC NSW, 2004) documents the total waste generation in NSW with a break up between recycling and disposal for the year 2002/03. The 2014 figures are calculated based on an annual population growth[3] of 0.089% per annum in the state and 1.88% per annum growth in GDP (population adjusted[4]).

3.1 Municipal Solid Waste

The municipal waste stream in NSW amounted to 3.3 million tonnes in 2002/03 with a recovery of almost 1.2 million tonnes, or 35%. Table 3-1 provides a summary of MSW generated, disposed and recycled in NSW. The five major materials contributing to the recovery (total of 99.7% of recovery) are garden organics, paper & cardboard, glass, plastic and ferrous metal. In total, these materials made up 2.3 million tonnes, or 69%, of the total municipal waste stream in 2002/03.

Future recovery rates for each material were chosen to achieve an overall recovery rate of 66% as per the State target. The practicability of recovering individual materials was also being considered. It is noted that a major proportion of 'recovery' (particularly organics) is likely to be achieved through Alternative Waste Technologies (AWT). The nominated recovery rates should therefore not be seen as definitive figures but merely a means to achieve the objective of this exercise i.e. to provide an indicative estimate of potential benefits available from increasing resource recovery. The materials with the highest *future* recovery *potential*, garden organics and food waste are the most significant due to their high generation rates and their current (51% and 0% respectively) recovery rates. In 2002/03 almost 1.3 million tonnes of these organic materials were disposed of to landfill. It is noted that, in theory, full recovery of garden and food wastes would increase the recovery rate for municipal wastes from the current 35% to 73%.

[3] Population figures derived from ABS Statistics (2003).

[4] Reserve Bank of Australia (2004).

Paper & cardboard also shows significant potential for improvement even though the recovery rate is already the second highest of the municipal materials, 56%. However, still over 260,000 tonnes of paper & cardboard were disposed of in 2002/03. A further large percentage increase in recovery is possible for plastics as the current recovery rate is only 18%, with a quantity of non-recycled plastic of about 114,000 tonnes. The fifth most important material in terms of additional recycling potential is glass, with a further recycling potential of 81,000 tonnes in 2002/03. The 'importance' of materials in terms of additional recovery potential is illustrated in Figure 3-1.

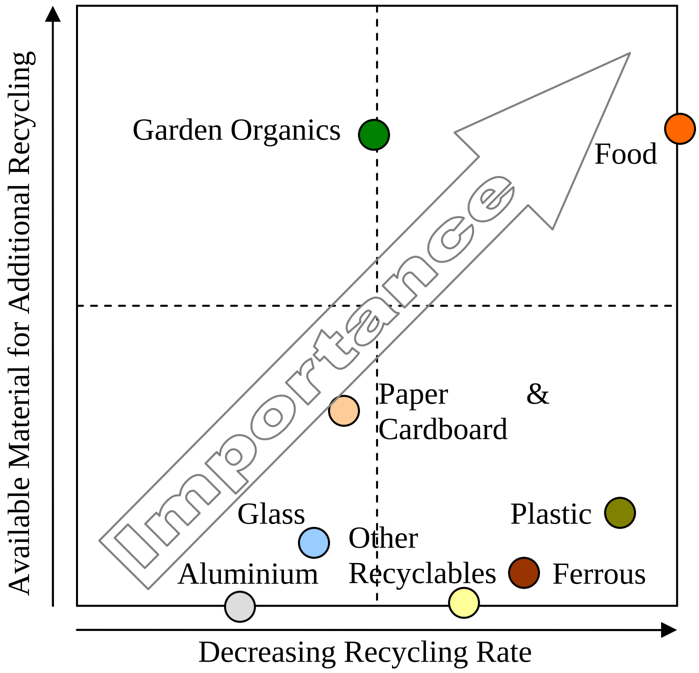


Figure 3-1: Indication of Potential *Municipal* Recovery Improvement

12% of MSW is classified as other waste, which comprises mixed and contaminated waste that for different reasons is not currently recyclable.

The total waste quantity is projected to amount to just over 4.5 million tonnes by 2014 based on the population and GDP assumptions discussed above. From these projected waste quantities and assumed target recycling rates for 2014, the quantity of recycled material is around 3 million tonnes. Of this, garden organics and food contributes 61%, paper & cardboard almost 23% and glass 8%.

Table 3-1 and Figure 3-2 give an overview of the total municipal waste and recycling quantities in 2002/03 and those projected for 2014.

Table 3-1 Municipal Waste Recovery in NSW in 2002/03 and 2014 (t/yr)

Material	2002/03			2014		
	Total Waste	Recycling	Recycling Rate	Total Waste	Recycling	Recycling Rate
Paper & Cardboard	601,000	337,000	56%	814,000	692,000	85%
Plastic	139,000	25,000	18%	188,000	150,000	80%
Glass	207,000	126,000	61%	280,000	252,000	90%
Ferrous	57,000	15,000	26%	77,000	62,000	80%
Aluminium	3,000	2,000	73%	4,000	4,000	80%
Garden Organics	1,280,000	651,000	51%	1,734,000	1,301,000	75%
Food	637,000	-	0%	863,000	518,000	60%
Other Recyclables	8,000	2,000	21%	10,000	6,000	60%
Other Waste	395,000	-	0%	535,000	-	0%
Total	**3,326,000**	**1,156,000**	**35%**	**4, 507,000**	**2,985,000**	**66%**

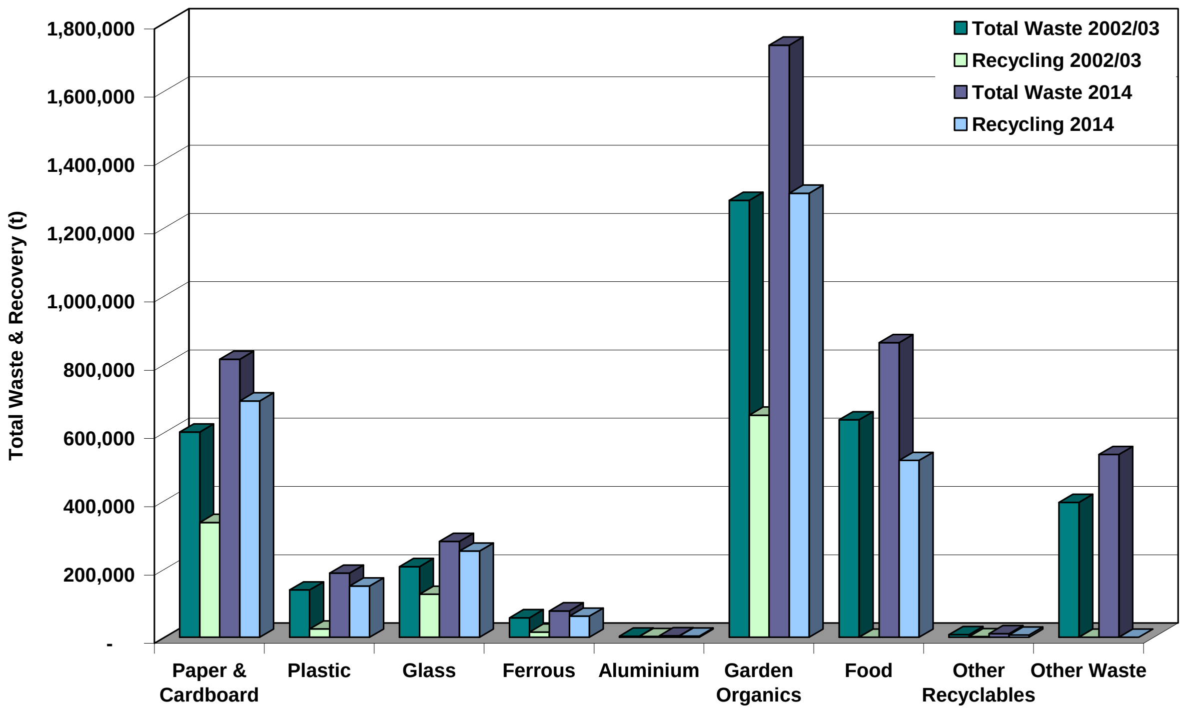


Figure 3-2: Total Municipal Waste (Garbage) and Recycling in 2002/03 and 2014

3.2 Commercial & Industrial Waste

Actual C&I waste disposal and recovery figures for 2002/03 and estimates for 2014 are presented in Table 3-2. The current figures are taken from the *Waste Avoidance and Resource Recovery in NSW* (DEC NSW, 2004) report. This report states that the category 'other waste' makes up 1,558,000 tonnes or 37% of the total C&I waste stream. This figure, the result of a large scale C&I waste audit undertaken by DEC in 2003, appears to include loads, or parts of loads disposed to landfill which were not classifiable for a number of reasons (e.g. bags and other visual obstructions etc.). For the purpose of this report, and because of the need to meet the recycling targets by defined materials, we have assumed that 15% or 630,000 tonnes of the total C&I waste stream is actual 'other' or unclassifiable' waste. The remaining almost 930,000 tonnes (of the original 'Other Waste') we have allocated proportionally to defined waste categories.

In 2002/03, the total C&I waste stream amounted to 4.2 million tonnes of which 33%, or 1.4 million tonnes, were recycled. Somewhat different to municipal waste, the materials currently contributing most to C&I recycling are ferrous metals, paper & cardboard, garden organics, other recyclables and timber. These materials make up 91% of the C&I recovery and 67% of the total C&I waste stream in 2002/03.

The materials in the C&I waste stream with the highest *additional* recovery potential are paper & cardboard, plastic, ferrous metals, timber and garden organics, see Figure 3-3. In 2002/03, 1.9 million tonnes of these five waste types were disposed of[5], with paper & cardboard alone amounting to 760,000 tonnes, or 40%. As with the municipal waste, plastic is the category with the lowest recycling rate, 8%. The highest recovery rate (63%) is currently achieved for ferrous metals.

[5] Difference between column 'Generated' and column 'Recycled'

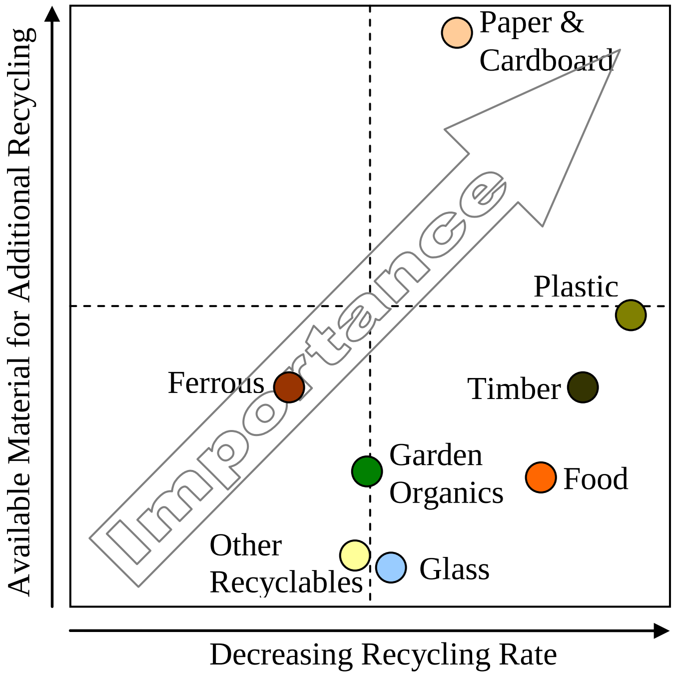


Figure 3-3: Indication of potential C&I Recovery Improvement

For the 2014 projections, the same approach has been applied as for MSW, i.e. selection of recovery rates for each material that reflects its recovery potential and that results in an overall recovery of around 63%. With the projected waste quantities and assumed recycling rates for 2014, the recycled C&I quantity would amount to 3.6 million tonnes, i.e. 63% of the 5.7 million tonnes of the total future C&I waste stream. Paper & cardboard recovery would amount to 1.3 million tonnes, or 36% of total materials recovered. Ferrous metals contribute 24%, plastics and garden organics 13% and 10% respectively, and timber 8%.

The total C&I waste and recycling quantities in 2002/03 and 2014 are presented in Table 3-2 and Figure 3-4.

The projected additionally available recyclable material in 2014 for municipal and C&I materials is also shown in Figure 3-5. As can be seen, paper & cardboard is the C&I material category with the highest additional quantities, more than 860,000 tonnes. The corresponding material for the municipal sector is garden organics with 650,000 additional tonnes. The C&I sector provides the largest potential for additional waste recovery for all material except for glass, garden organics and food recyclables.

Table 3-2: C&I Waste Recovery in NSW in 2002/03 and 2014 (t/yr)

Material	2002/03			2014		
	Total Waste	Recycling	Recycling Rate	Total Waste	Recycling	Recycling Rate
Paper & Cardboard	1,191,000	428,000	36%	1,614,000	1,291,000	80%
Plastic	430,000	35,000	8%	582,000	466,000	80%
Glass	99,000	45,000	46%	134,000	107,000	80%
Ferrous	791,000	500,000	63%	1,071,000	857,000	80%
Garden Organics	374,000	192,000	51%	506,000	354,000	70%
Food	215,000	46,000	21%	291,000	146,000	50%
Timber	334,000	49,000	15%	452,000	271,000	60%
Other Recyclables	135,000	72,000	53%	183,000	110,000	60%
Other Waste	630,000	-	0%	853,000	-	0%
Total	**4,200,000**	**1,365,000**	**33%**	**5,687,000**	**3,602,000**	**63%**

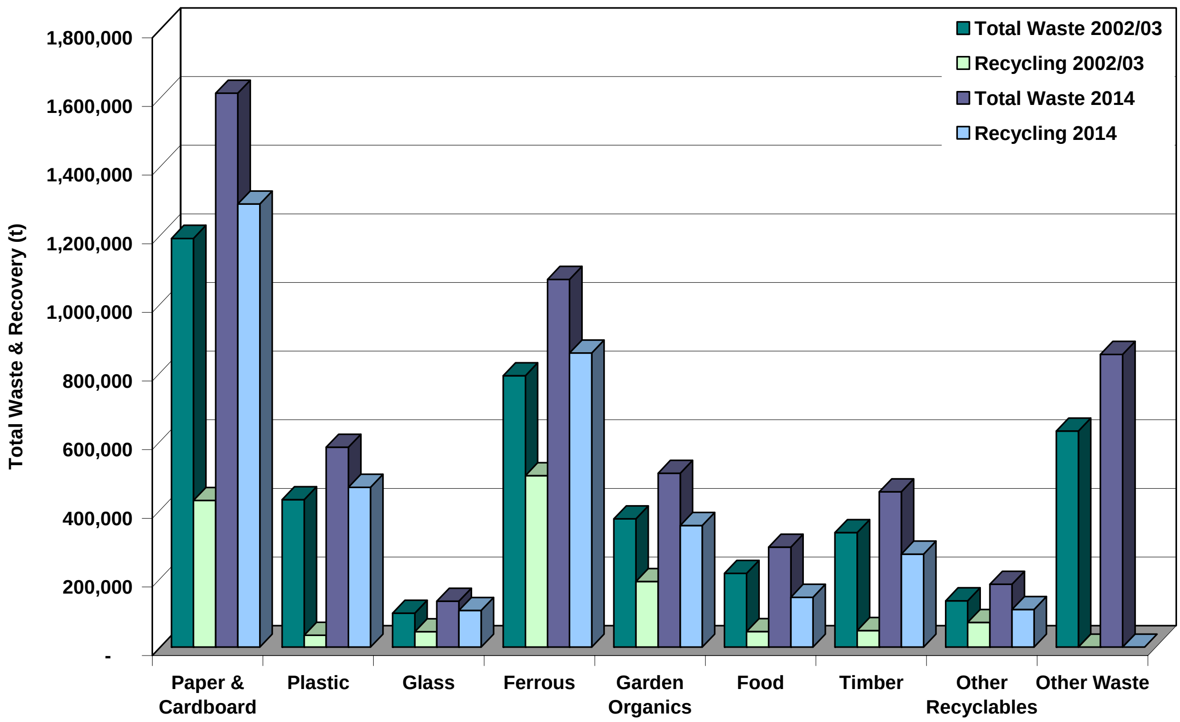


Figure 3-4: Total C&I Waste and Recycling in 2002/03 and 2014

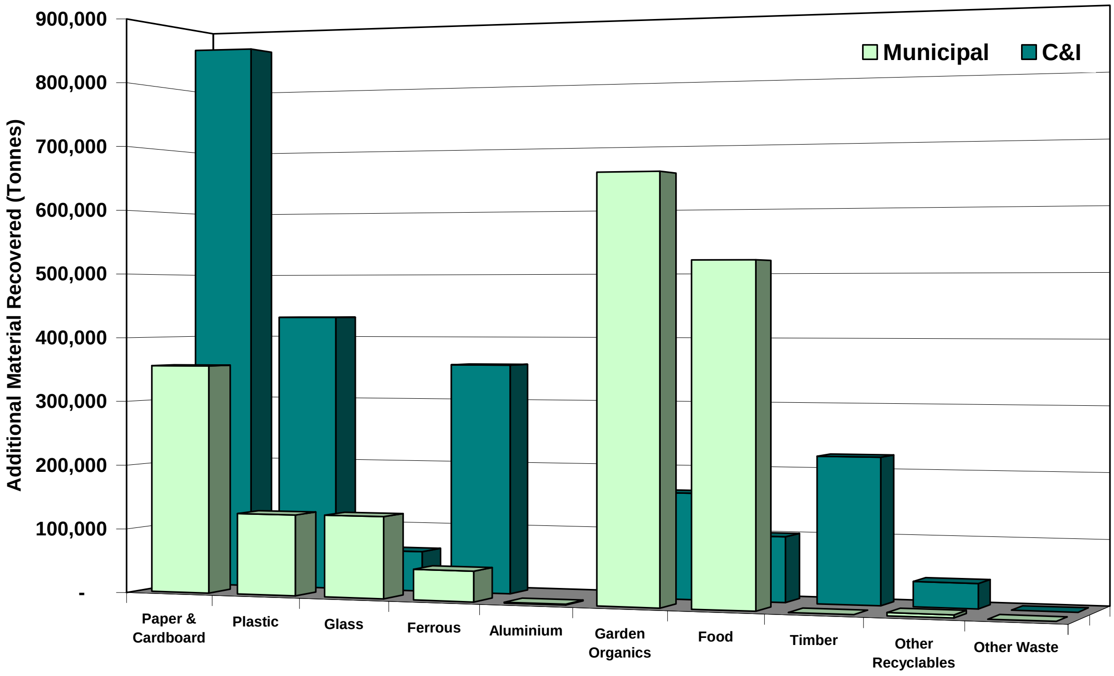


Figure 3-5: Additional Recyclable Municipal and C&I Waste in 2014

4 FINANCIAL COSTS

Recovery of additional quantities of materials from the waste stream comes at additional costs i.e. the costs of collection, transport and sorting are higher than the revenue achieved from sale of the reprocessed product. However, for those materials currently already collected through the (municipal) kerbside recycling system the marginal costs i.e. costs of handling incremental quantities will not necessarily go up but in fact may even reduce due to economies of scale within the capacity of the current system (EPHC, 2005).

4.1 Diminishing Returns

The actual (net) cost per tonne of material recovered and recycled may vary depending on how much of that material is already being recycled. In other words, beyond a certain level of recovery the unit costs of additional material recycled is likely to increase disproportionately. This phenomenon of 'diminishing returns' can occur for the following reasons:

- Greater costs in separating (at source) additional quantities;
- Greater costs in separating materials from a mix (i.e. it is easier to separate the first 30% of a material than the second 30%, and it may be (almost) impossible to recover 100%;
- Costlier, more sophisticated sorting and beneficiation processes to pre-process recycled materials containing contaminating residues (eg ink in newsprint, ceramics in glass, plastics in steel); and
- Increase in materials (components, composites etc.) that are recovered but cannot be recycled. Disposal of increasing amounts of these 'rejects' per unit of material recovered invariably adds to the costs of recycling.

These 'diminishing returns' must also be considered in the estimated marginal cost of recovering additional quantities of recyclables. However, the difficulty is that the marginal cost of recycling varies greatly with material type and recovery rate. The principle of diminishing returns is demonstrated in Figure 4-1. The closer the recovery gets to 100% the harder and more expensive it will be to increase the actual (recovery and recycling) performance.

To determine the specifics for each relevant material a market intelligence survey for each stream would be necessary. This is far beyond the scope of this project. Therefore, the Diminishing Returns factor has not been directly incorporated into the cost estimates by way of a mathematical formula however, it is an integral part of the industry estimates (see Section 4.2).

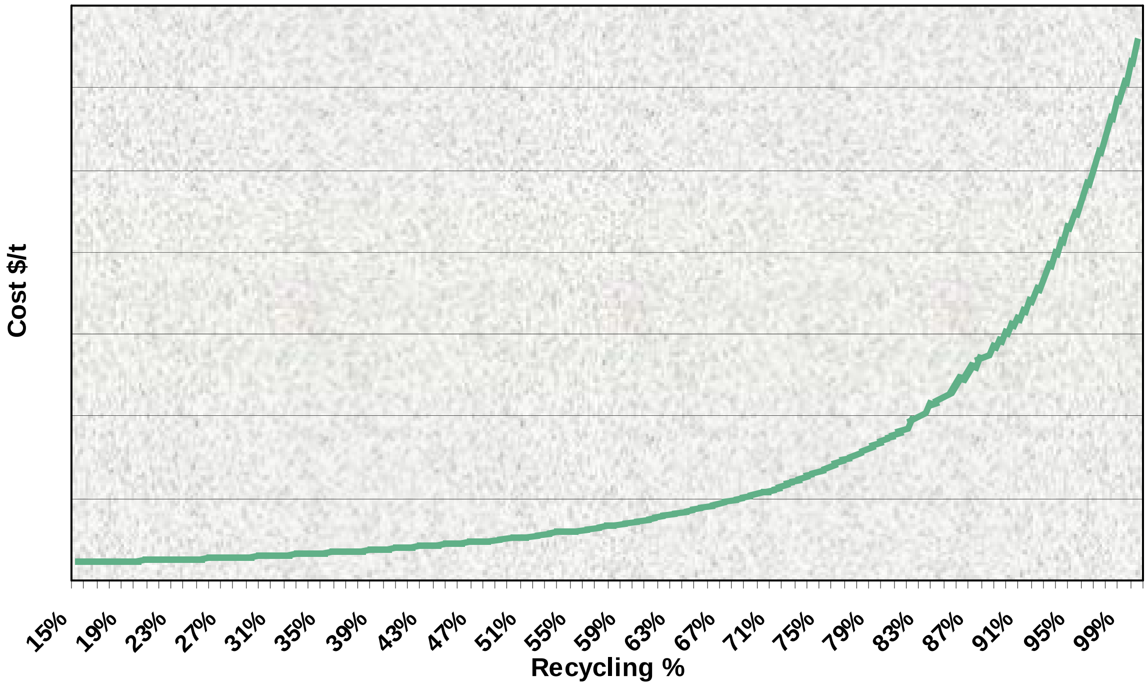


Figure 4-1: Change in Marginal Cost with Increased Recovery Rate (Example)

4.2 Industry Estimates

In the absence of real data on marginal costs, Nolan-ITU - now part of Hyder Consulting - agreed with ACOR representatives on a methodology for establishing a first pass approximation for the marginal costs of each recyclable material. It must be stressed that these estimates are based on a "best guess" assumptions by industry participants, not on actual data. A considerable amount of additional work would be required to confirm these estimates and such work was beyond the scope of this study. Based on general industry experience, the net costs for municipal recycling materials have been assumed over a range from -$10 for paper & cardboard to $100 per tonne for food recycling. The corresponding range for C&I waste components is from $20 per tonne for timber to $80 per tonne for food. It is stressed that these figures are marginal (or incremental) unit costs for the purpose of providing indicative estimates of the additional financial cost likely to be incurred in recovering the recyclables. Note that the value of the additional materials recovered for recycling, and avoided landfill costs, have been taken into account and are incorporated in these figures.

The tables are also divided into 'organics' and 'recyclables' to give a better indication of cost estimates more closely related to ACOR member activities (i.e. 'dry' recyclables), to highlight that recovery and management of (food) organics is likely to incur higher costs per unit recovery and is therefore a substantial contributor to overall costs, in particular in the municipal sector.

Table 4-1: Costs of Additional Municipal Material Recovered in 2014

Material	Additional Material Recovered (t)	Marginal Cost ($/t)	Total Marginal Cost ($)
Paper & Cardboard	356,000	-$10	-$3,557,000
Plastic (rigid)	126,000	-$5	-$628,000
Glass	126,000	-$5	-$632,000
Ferrous	47,000	-$10	-$468,000
Aluminium	1,000	-$10	-$12,000
Other Recyclables	5,000	$50	$234,000
***Subtotal* [1)]**	***660,000***		***-$5,063,000***
Garden Organics	650,000	$30	$19,508,000
Food	518,000	$100	$51,786,000
Subtotal	***1,168,000***		***$71,294,000***
Total	**1,828,000**		**$66,231,000**

[1)] These figures include avoided waste collection and disposal costs. For example, current MRF costs (incorporating revenue from product sale) in Sydney are significantly lower than costs of disposal to landfill.

Table 4-2: Costs of additional C&I material recovered in 2014

Material	Additional Material Recovered (t)	Marginal Cost ($/t)	Total Cost ($)
Paper & Cardboard	863,000	$20	$17,267,000
Plastic	431,000	$30	$12,943,000
Glass	62,000	$20	$1,239,000
Ferrous	357,000	$30	$10,715,000
Other Recyclables	38,000	$50	$1,895,000
Subtotal	***1,752,000***		***$44,059,000***
Garden Organics	163,000	$25	$4,075,000
Food	100,000	$80	$8,008,000
Timber	223,000	$20	$4,459,000
Subtotal	***486,000***		***$16,542,000***
Total	**2,238,000**		**$60,601,000**

4.3 Market Value

ACOR members requested that the actual market value of additional materials recovered should also be presented in this report. The recycled commodity prices range from $10 per tonne for timber to around $1,500 per tonne for aluminium. The total values of potential increases in recovery are $100 million for the municipal material and $229 million for the C&I material, see Table 4-3. The market values are presented to illustrate that there is a substantial financial value in recovering these materials thereby maintaining them in the economy rather than losing them to landfill. It is emphasised that these values (i.e. the revenues from recovered product sales) are already incorporated in the above financial cost estimates.

Table 4-3 Value of additional material recovered in 2014

Material	Value ($/t)	Municipal Recycling		C&I Recycling	
		Additional Material Recovered (t)	Value of Material Additionally Recycled ($)	Additional Material Recovered (t)	Value of Material Additionally Recycled ($)
Paper & Cardboard	$70	356,000	$24,897,000	863,000	$60,435,000
Plastic	$300	126,000	$37,689,000	431,000	$129,432,000
Glass	$72	126,000	$9,103,000	62,000	$4,461,000
Ferrous	$75	47,000	$3,509,000	357,000	$26,786,000
Aluminium	$1,500	1,000	$1,735,000	-	-
Other Recyclables	$10	5,000	$47,000	38,000	$379,000
Subtotal		***660,000***	***$76,980,000***	***1,752,000***	***$221,493,000***
Garden Organics	$20	650,000	$13,005,000	163,000	$3,260,000
Food	$20	518,000	$10,357,000	100,000	$2,002,000
Timber	$10	-	-	223,000	$2,229,000
Subtotal		***1,168,000***	***$23,362,000***	***486,000***	***$7,491,000***
Total		**1,828,000**	**$100,342,000**	**2,238,000**	**$228,985,000**

5 OVERALL COSTS AND BENEFITS

This section provides an estimate of the environmental benefits gained from resource recovery expressed in ‘Ecodollars’. The authors note that these estimates are strategic in nature and provide an insight to the benefits potentially available. They are based on a substantial amount of work done in life-cycle assessment by both RMIT and Nolan-ITU, and on additional work undertaken by Nolan-ITU in the development of its environmental economic valuation model which was established to provide one single (and ‘Australianised’) indicator for environmental performance.

Table 5-1 and Table 5-2 list the ‘environmental’ values (here: 20% if the actual environmental value), together with the marginal; costs of recovering and recycling the materials necessary to achieve the State targets.

Note that the overall cost-benefits listed are based on a 20% valuation of the environmental benefits. The 20% have been selected for three reasons:

1) To highlight that even a 20% compensation of the ‘Ecoservice’ would be sufficient to provide the commercial incentives for increased recycling to achieve a 66% target;

2) To provide an order of magnitude of funds necessary (or costs incurred, depending which model is chosen) to make it work; and

3) To provide extremely conservative estimates.

The results illustrate that – should recyclers/reprocessors be able to benefit from a proportion (here: 20%) of the estimated environmental value provided as part of their service, this would be more than sufficient to compensate for increased financial costs and, hence, be a great incentive to achieve the stipulated waste diversion targets.

As is shown in the tables below, the additional environmental benefit’ for municipal waste is estimated as $96 million and for C&I waste as $225 million using the ‘20% environmental value’. This results in an estimated net cost-benefit of $29 million and $164 million respectively for these two sectors. Note that the actual total estimated environmental value (100%) of such an increased material recovery amounts to approximately $480 million and $1.1 billion respectively.

Table 5-1: Overall Cost-Benefits from Municipal Recycling in 2014

Material	Additional Recycling (t/yr)	Marginal Cost ($)	Eco-Benefits (20%)	Overall Cost-Benefit [1]
Paper & Cardboard	356,000	-$3,557,000	$28,454,000	$32,011,000
Plastic	126,000	-$628,000	$25,126,000	$25,754,000
Glass	126,000	-$632,000	$5,057,000	$5,689,000
Ferrous	47,000	-$468,000	$7,486,000	$7,954,000
Aluminium	1,000	-$12,000	$694,000	$706,000
Other Recyclables	5,000	$234,000	- [1]	-$234,000
Subtotal	***660,000***	***$5,063,000***	***$66,817,000***	***$71,880,000***
Garden Organics	650,000	$19,508,000	$14,306,000	-$5,202,000
Food	518,000	$51,786,000	$14,500,000	-$37,286,000
Subtotal	***1,168,000***	***$71,294,000***	***$28,806,000***	***-$42,488,000***
Total	**1,630,000**	**$66,231,000**	**$95,623,000**	**$29,392,000**

[1] No ecodollar value applied due to lack of characterisation

The environmental benefit per material type is presented in Figure 5-1. The graph illustrates that paper & cardboard, plastic and ferrous metals are the materials with the highest potential environmental gains through recovery in the C&I sector, and paper & cardboard, plastic and organics in the municipal sector.

Table 5-2: Overall Cost-Benefits from the C&I Recycling in 2014

Material	Additional Recycling (t/yr)	Marginal Cost ($)	Eco-Benefits (20%)	Net Cost-Benefit
Paper & Cardboard	863,000	$17,267,000	$69,069,000	$51,802,000
Plastic	431,000	$12,943,000	$86,288,000	$73,345,000
Glass	62,000	$1,239,000	$2,478,000	$1,239,000
Ferrous	357,000	$10,715,000	$57,144,000	$46,429,000
Other Recyclables	38,000	$1,895,000	-	-$1,895,000
Subtotal	***1,752,000***	***$44,059,000***	***$214,979,000***	***$170,920,000***
Garden Organics	163,000	$4,075,000	$3,586,000	-$489,000
Food	100,000	$8,008,000	$2,803,000	-$5,205,000
Timber	223,000	$4,459,000	$3,567,000	-$892,000
Subtotal	***486,000***	***$16,542,000***	***$9,956,000***	***-$6,586,000***
Total	**2,238,000**	**$60,601,000**	**$224,935,000**	**$164,334,000**

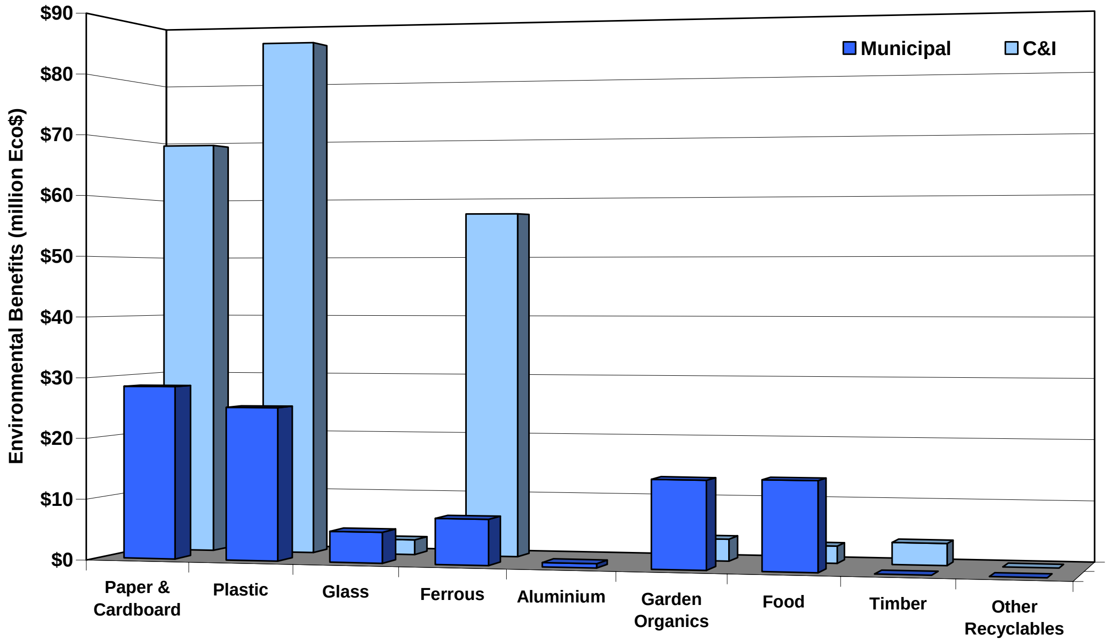


Figure 5-1: Environmental Benefits from Projected Additional Recycling in 2010

To complete the information, and a baseline for comparison with the *projected* tonnes, Table 5-3 provides an indication of the *current* situation. As can be seen, the total (municipal and C&I) recovery in 2002/03 amounted to 2.5 million tonnes. The actual value of the recycled materials amounts to $145 million, with paper & cardboard and ferrous metals being the main contributors. Further, the Eco-benefits are greater than $180 million.

Table 5-3: Total Financial and Environmental Value of Municipal *and* C&I Material Recovered in *2002/03*

Material	Recovered Material (t)	Financial Value ($)	Environmental Value (20%)
Paper & Cardboard	764,000	$53,480,000	$61,120,000
Plastic	59,000	$17,700,000	$11,800,000
Glass	171,000	$12,312,000	$6,840,000
Ferrous	515,000	$38,625,000	$82,400,000
Aluminium	2,000	$3,605,000	$1,442,000
Other Recyclables	74,000	$736,000	$0
Subtotal	***1,585,000***	***$126,457,000***	***$163,602,000***
Garden Organics	842,000	$16,840,000	$18,524,000
Food	46,000	$910,000	$1,274,000
Timber	49,000	$485,000	$776,000
Subtotal	***936,000***	***$18,235,000***	***$20,574,000***
Total	**2,521,000**	**$144,692,000**	**$184,176,000**

6 THE WAY FORWARD

The preliminary analysis in the previous sections of this report has demonstrated:

- The very substantial potential for improved recovery and recycling of materials from both the domestic and the C&I waste streams;
- The significant environmental benefits of increased resource recovery;
- A methodology to quantify these environmental benefits on an individual material basis (with examples given); and
- The substantial financial costs associated with additional resource recovery.

The cost barrier to reaping the potentially large environmental benefits - and to achieving any significant progress towards the NSW State Waste Strategy targets - could be addressed by establishing a market for environmental services. This section:

- Provides some examples of the various stages of, and infrastructure required for, resource recovery which emphasises the need for favourable economic conditions as a prerequisite for investment in this infrastructure;
- Provides an introduction to market based approaches to overcoming the cost barrier to increased resource recovery and facilitating the achievement of targets identified in the State Waste Strategy; and
- Discusses potential models for economic incentives for extended "eco-services" (i.e., greater resource recovery) and, consequently, Strategy target achievement.

6.1 Infrastructure and Return on Investment

Contrary to the beliefs of some, resource recovery of additional quantities of (what is currently) waste comes at an additional cost, particularly resource recovery from industry and commerce where no uniform system (such as kerbside recycling for residential premises) is established. The Regulatory Impact Statement (RIS) on the Revised National Packaging Covenant[6] states:

"The fact is that it is economics and not environmental sentiment that drive buying decisions in the workplace. Hence, it can be assumed that all easily recoverable materials ('low hanging fruit' i.e. those materials from those businesses where recycling does not add to the costs of running the business) are already recovered for recycling. This in turn implies that any increased quantities can only be recovered at an additional cost."

[6] Nolan-ITU (2005): Consultation Regulatory Impact Statement (RIS) on Revised National Packaging Covenant, for Environment Protection and Heritage Council.

At the same time, additional resource recovery requires **significant additional infrastructure**. This infrastructure will only be provided by industry: a) where there is security of supply of material, and; b) if there is a good chance for reasonable profitability and long term return on capital. Increased recycling requires increased beneficiation infrastructure as well as collection and sorting infrastructure. Without this beneficiation infrastructure, additional recycled material quantities is likely to be more dependent on export commodities markets. Equipping Australian manufacturing to use recycled inputs means that we are "closing the loop" in Australia no matter what the export market conditions are.

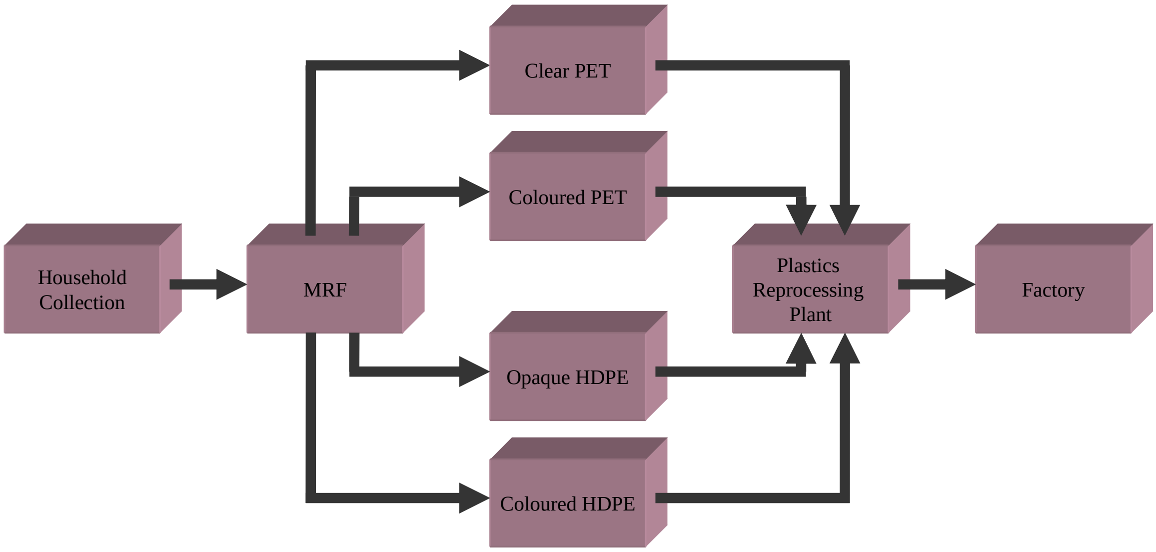
Below are some brief examples which describe the value chain in resource recovery and reprocessing, and indicate the magnitude of infrastructure investment in order to highlight the issues of long term return on capital including security of supply.

More than 40 types of **plastics** are being used with different properties depending on application. Up to 30 percent of these plastics are used in food packaging. The types of plastics that are most commonly recycled in Australia are PET, HDPE, LDPE and PVC. Most plastics are not compatible when mixed which means they must be separated before being reprocessed.

Coca-Cola Amatil

By 2002, Coca-Cola Amatil (CCA) had invested more than $100 million in the construction of PET bottle manufacturing, including a national PET reformation plant at Prestons in the south-western Sydney. This represented the largest investment ever in PET manufacturing and recycling in Australia[7] and included an unprecedented reformation process which produces recycled content PET of food grade quality. During the process, it is possible to rejuvenate the post-consumer PET material back to the quality and flexibility of virgin resin. This creates the ability to increase or decrease the percentage of recycled content without making any mechanical changes to the preform manufacturing process. (It should be noted that Visy purchased CCA's program and assets in 2004.) A flow chart illustrating the path from post consumer waste plastics to new plastic products is shown below.

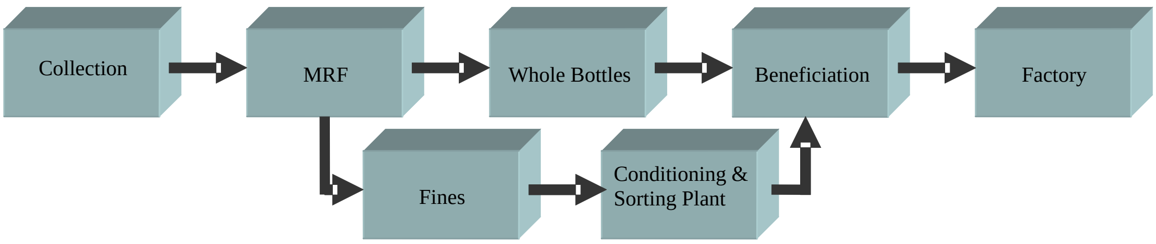
[7] Australian Council of Recyclers. (2002). National Packaging Covenant Action Plan March 2001 - March 2002 Report.



Visy

In the late 1990s, Visy established a kraft paper and pulp mill using predominantly wood waste and recovered **paper and cardboard** as feedstock in Tumut, NSW. The capital expenditure for this plant was approximately $450M. It is understood that the plant will be extended in the near future.

It is important to note that, for many of resource recovery processes, beneficiation (or value adding) steps are required between the initial separation of collected materials and their remanufacturing into new products. One example is glass, which is initially separated from other recyclables in a Materials Recovery Facility (MRF) and then sorted into the three types - clear, green, and amber. In a beneficiation plant, the colour sorted glass is placed into a hopper and fed onto a conveyor belt which passes under a magnet that removes bottle tops and other metals. In a number of other steps, smaller contaminants such as ceramics, other metals, and labels are also removed. Finally, the recovered glass (known as cullet) is crushed and sent to a glass manufacturing plant to make new bottles and containers.



Metal

Metal recycling is another activity undertaken by a number of companies, including BHP Steel, Metalcorp, Sims, Smorgons. Most of the metals are sourced from commercial and industrial premises. The separation of ferrous and non-ferrous components is an example of the steps necessary to convert these metals back into quality products. The photograph below shows such a separation unit.

6.2 Market Based Instruments in Waste Management and Resource Recovery

6.2.1 Background

The integration of environmental policy into overall governmental policies is gathering momentum in OECD countries. There is an emerging shift from an essentially regulatory approach towards more flexible approaches, including negotiated, voluntary agreements and the increased use of more market based economic instruments. The international conference *Environmental Policy and Sustainable Development*, organised by the National Europe Centre in Australia in late 2003, is testimony to the exploration of these policy themes.

In the waste policy debate, “economic instruments” and “market based instruments” have become frequently used terms. There is a general acceptance that they are policy levers that can create incentives to alter behaviour and reduce environmental impacts. Market based instruments (MBIs) are anything but new, and have affected the way economies use resources and manage environmental goods since the very first imposition of taxes.

MBIs occupy the middle ground between voluntary agreements and command-and-control approaches. In the waste arena, they are designed to provide financial signals and/or incentives to reduce waste and/or increase the level of re-use/recycling[8]. The instruments can be designed either to directly affect the *price* (e.g., landfill levies) or the *quantity* of an activity (e.g., tradeable recycling certificates). They are potentially a way to "make recycling pay" rather than just "make waste disposal hurt". Price based instruments seek to internalise environmental costs into the price of goods and services through the imposition of charges or taxes, or through subsidies for environmental benefits of resource recovery. Quantity based instruments create tradeable rights or alter existing rights to environmental resources or to the degradation of environmental assets.

Apart from a number of earlier studies (some of which are mentioned earlier in this report), an investigation of the potential for MBIs to promote sustainable resource recovery in Australia was published last year[9]. Following the release of this report, a workshop was held with most stakeholders in the NSW waste and resource recovery industry. The outcomes of the workshop are documented (and further developed) in an Addendum to that report[10]. As discussed by stakeholders, two different points of focus for MBIs were identified in principle:

- Upstream Focus (burden on product manufacturers); and
- Downstream Focus (burden on waste generators/waste disposers).

These two MBI models are briefly outlined below. A 'midstream' approach (encompassing both upstream and downstream activities) has also been considered elsewhere, but has usually been discounted due to the perceived complexity of administering such a scheme.

6.2.2 Two Feasible Models

a) Tradable Permits as an Upstream MBI

This model is based on the setting of material specific targets for manufacturers. A minimum target could be set for all manufactures and importers for the use of recycled content material in their products. Manufacturers and importers using virgin material and no recycled content material in their products would have to purchase certificates from manufacturers exceeding the minimum usage target, i.e., recyclers/reprocessors holding surplus certificates (see Figure 6-1).

The outcome of such a program would be both direct and indirect. On a direct basis, there would be additional cash flow to the recycling industry. On an indirect basis, recycled materials would become more competitive and attractive. These outcomes would in turn stimulate increased recycling activity and progress toward environmental and social goals.

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[8] Definition taken (and adapted) from: Environment Australia April 2003 – *The Potential of Market Based Instruments to Better Manage Australia's Waste Streams.* (McLennan Magasanik and BDA Group)

[9] Total Environment Centre, in association with Warnken Industrial and Social Ecology (2004): Market Based Instruments and Sustainable Resource Recovery.

[10] Total Environment Centre, in association with Warnken Industrial and Social Ecology (2005): Scenario Development: Market Based Instruments and Sustainable Resource Recovery.

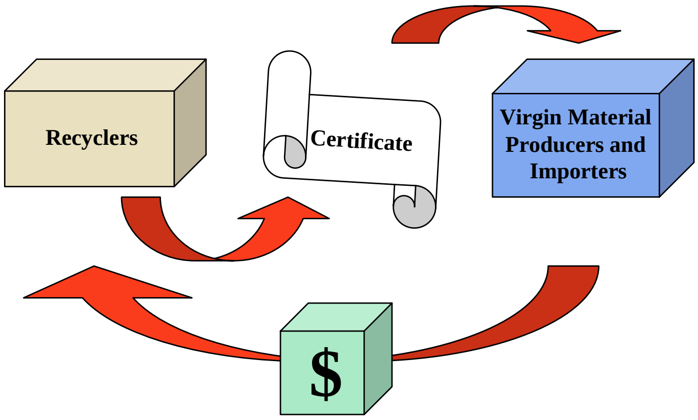

Figure 6-1: Upstream MBI

A slight variation of this model is the UK's Packaging Waste Management Scheme, which requires every company in the packaging supply chain to obtain certificates to show that an appropriate tonnage of material has been reprocessed to meet the company's recovery and recycling obligations. Surplus certificates can be traded; the resale value of the certificates is intended to give reprocessors a further incentive to expand capacity.

However, this type of system brings with it issues requiring careful consideration, such as:

- Equity and feasibility in setting targets (e.g., how to set targets for highly specific materials beyond broader areas such as "paper"?);
- Technical limitations to recycled content usage;
- Verification of recycled content usage levels;
- The fact that such a system can only be implemented on a national basis; and
- The level of administration required, particularly with material - and perhaps even product - specific targets to be set and monitored.

b) A Downstream MBI - The Landfill Allowance Trading Scheme

As an alternative to the above scheme, a 'downstream' system could be used which focuses on waste disposal. In this case, all landfills in a given geographical region (State-wide or otherwise) are, allowed to receive an identified quantity of material, e.g., a net cap of material permitted to go to landfill is established. (The net cap figure would be based on average landfill disposal quantities for a set number of previous years.) Thereafter, proportionate or individual caps are established for individual landfills and a regime that penalises excess tonnes is applied.

As a result of the net cap on the amount of material being landfilled (e.g., reducing the supply of available landfill capacity), the cost of disposal prices will increase. This will in turn make the diversion of material away from landfill and into recycling a more competitive and attractive proposition, e.g., increased demand for alternatives to landfill disposal). Landfills receiving less material than their caps would get surplus allowances or certificates which can be sold to landfills receiving more waste than their caps. If a landfill has or diversifies to have a recycling system in place, additional certificates can be generated and sold on the market. But these certificates should only be created through a central "clearing house" so that opportunities to rort the scheme are reduced. Optionally, certificates can also be saved for future years or borrowed from future allowances (e.g., up to a limit of 5 percent as in the UK LATS scheme).

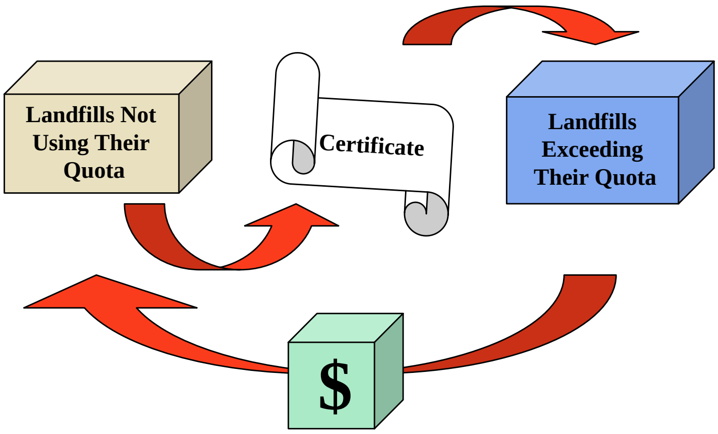

Figure 6-2: Downstream MBI

The advantages of such a system are that it is comparatively easy to define and identify liable parties, easy to administrate, and easy to measure.

The main disadvantage of this model is that it may be extremely difficult to put individual caps on landfillers who have previously obtained approvals from the regulator for a maximum (annual) tonnage to be landfilled, e.g., approvals not inherently linked to broader environmental and/or social goals. An alternative here might be that in order to dispose of waste, landfillers must purchase recycling certificates in a set proportion from a central clearing house in order to be able to dispose without penalty. Thus, to achieve a target of 50% diversion, a landfill would have to purchase one resource conservation certificate for every tonne of waste disposed; for a diversion of 66%, the landfill would have to hold two certificates for every tonne of waste disposed.

6.3 Revised Landfill Levy and Recognition of 'Eco-Service' Value

Given what has been suggested above, it is fair to pose the question: would it not be easier to simply raise the tax on landfill disposal? Or, why bother with the complexity of certificates and their trading?

Indeed, an increasing number of societies are imposing taxes on landfill disposal (or 'landfill levies') with aims related to those of other MBIs:

- To internalise uncosted environmental burdens and provide compensation for potential future rehabilitation costs borne by future generations; and
- To make waste disposal more expensive in order to improve the economics of recycling or energy recovery.

However, the problem with simply increasing landfill levies is that, while it is likely to create a market 'push' (i.e., materials being diverted away from landfills), it provides no market 'pull' in the form of an economic incentive or signal to manufacturers to domestically use recycled content material and capture the environmental benefits of their use in Australia. Indeed, an increased landfill levy could have the effect of simply increasing the export of collected materials to reprocessing applications overseas. Worse, high landfill levies will discourage the recycling of mixed waste streams with relatively higher residue rates that might have been economically recycled at lower levy settings. Effectively, a landfill levy is not designed and does not recognise the provision of additional environmental benefits through domestic resource recovery activity.

Therefore, it is recommended that revenue raised from any revised landfill levy also be (partially) used to recognise recyclers/reprocessors for environmental benefits derived from their activities – something which is currently not the case as recyclers have to struggle to compete with virgin material products.

Such an approach would provide the necessary 'pull' component in the waste management/recycling equation. Depending on the details and sophistication of how this recognition is provided, such a scheme could be capable of going beyond the blunt and deceptive 'per tonne waste diverted from landfill' principle in that any payments would consider the environmental relevance of the materials recovered.

As an example, a proportion (say, 20%) of the estimated net (monetised) environmental benefit of recycling (as discussed in Section 2) could be paid for additional tonnes recycled. The actual value varies according to both the material type and characteristics of the secondary product. The credit may initially be capped. However, the full externality should ultimately be recognised by the market. In the model presented here, these 'credits' would have to be fully funded through the Section 88 levy.

Similarly, a differentiated waste disposal levy could be introduced that captures more fully the negative externality of landfill[11].

Although beyond the scope of this study to analyse the required disposal levy increase and the workings of such a scheme in detail, it is estimated that the levy increase would need to be in the order of $20 - $25 per tonne if it is to fully fund the required increase in the level of recovery. In other words, if the landfill levy goes up by this amount and (most of) this increase is hypothecated (used to provide financial incentives for resource recovery), the current levy could continue to flow into consolidated State revenue.

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[11] This is generally done through a differentiation between 'putrescible and non-putrescible waste.

6.4 Conclusions on MBI Schemes

Current market conditions do not reflect environmental costs and do not financially reward recycling systems that provide environmental and socio-economic benefits.

The research into economic and market based instruments for solid waste management that has taken place in the last decade has not led to a conclusive framework for the application of MBIs. Nonetheless, a number of key implementation themes have emerged which are relevant to this report:

- Hypothecated revenue appears to offer the advantage of facilitating both market and behavioural change, as well as providing seed finance for development projects in the sector. (This was expected to occur in NSW through the Waste Minimisation and Management Act 1995. However, as no major infrastructure projects have ever been supported through the Section 88 levy and any hypothecation from it, potentially available funds have been redirected into consolidated state revenue. In turn, the opportunity for market and behavioural change has been lost.)

- Increased economic valuation of environmental costs and benefits, and the development of more robust and transparent corporate environmental reporting and accounting systems, will assist in the development and uptake of effective MBIs.

- There is a need for national approaches to the implementation of MBIs, but also allowance for local schemes to operate within national frameworks.

The appraisal of MBIs in the context of waste and resource recovery in Australia - and in NSW in particular where large quantities need to be diverted from landfill if State Government targets are to be achieved - has shown the following:

- Whilst waste disposal and recycling may be the focus points for MBI implementation, application of instruments to upstream economic activities to directly affect resource use is also likely to be an important part of an overall framework. Upstream MBIs targeting manufacturers and producers are only achievable as a national scheme. (It should be noted that the level of subsidies provided in Australia to virgin material usage still greatly exceeds any support for competing non-virgin or recycled materials.)

- A landfill levy scheme with a much more aggressive and some would argue realistic levy (increase by about $25 per tonne of waste) would provide noticeable incentives for additional waste diversion / resource recovery.

- A ‘combination MBI’ with downstream focus as well as ‘ecoservice recognition’ could be implemented in NSW and, over time, expanded into a national model.

- The level of ‘ecoservice recognition’ could be developed from an initial set of programs for infrastructure funding (mainly of recycling facilities, reprocessing plants and AWT technologies for unrecoverable mixed putrescible waste) to a scheme compensating for the provision of an environmental service based on the actual benefits (‘recycling credits’) delivered on a material specific basis.

The waste management and resource recovery sector certainly has significant potential for the effective use of market based instruments as they are seen to offer efficiency benefits over direct regulation and effectiveness benefits over voluntary agreements. It would be an over simplification, however, to assume that MBIs and the creation of markets can completely solve the challenges that the waste management industry confronts.

The practicalities of implementation and the lack of full trading markets suggest that an instrument "package", involving more sophisticated regulation combined with negotiated agreements and well designed MBIs, is likely to be the most effective framework to meet the range of stakeholder objectives in the sector.

A possible framework to commence such a scheme capable of refinement and extension into a national framework is presented in this report on the basis of the current situation in NSW.

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