TOTAL ENVIRONMENT CENTRE STATE OF WASTE SERIES: WESTERN AUSTRALIA

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EXECUTIVE SUMMARY

One component of a sustainable society is the ability to maximise recycling of materials back into the productive economy. Although Australia has not reached this level of performance, many jurisdictions have signalled their intent to radically improve by committing to the 'goal of zero' – a waste free society. Achieving this goal will require many innovative interventions. Total Environment Centre, a Sydney based NGO, is working with support from the Pratt Foundation to develop market based approaches to sustainable resource recovery. This study into the state of waste in Western Australia is one contribution to the debate at a national level.

The 'Statement of Strategic Direction for Waste Management in Western Australia: Vision and Priorities' enshrined the vision of 'towards zero waste in Western Australia'. The Waste Avoidance and Resource Recovery Bill 2006, (open for public comment until 27 November 2006), sets out the transition to a waste free society through promoting resource efficiency and reducing environmental harm, in addition to implementing a resource management hierarchy of avoidance, recovery and disposal as a last option. As part of the reform package, the metropolitan landfill levy is set to rise to $9 per tonne by 2010 for putrescible landfill, and $9 per cubic metre for inert landfills. The WA government has also committed to establishing a best practice container deposit scheme to increase resource recovery, develop local reprocessing and reduce litter.

However, there are many challenges to overcome in order to deliver desired outcomes in WA. On the basis of a 2002/03 national comparison, Western Australians generate the most waste in Australia at 2.3 tonnes per capita (approximately 4.5 million tonnes), and out of the rest of the states, come second last in recycling at 0.4 tonnes per person (approximately 0.8 million tonnes), with 1.9 tonnes per person wasted to landfill (3.7 million tonnes). This poor performance, in combination with the ambitious targets and policies set for WA, emphasises the need for innovative solutions to realise the 'goal of zero'.

One challenge is the creation of an 'industrial ecology' of infrastructure that is able to transform waste into valuable resource inputs. In a no-waste society all by-products from production and consumption need to have a beneficial use. Western Australia has a number of unique characteristics because of its richness in natural resources, relatively small population base (and hence consumer market size) and geographic isolation. Market based instruments (MBIs) offer a number of opportunities to overcome these challenges and support increased resource recovery.

The range of MBIs includes 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. Western Australia is already using the landfill levy as a means to internalise some landfill costs in the metropolitan setting. The upcoming use of container deposits is another market intervention that will embed costs of recovery into product price and support the transition to more sustainable patterns of production and consumption.

Other market based options for consideration include a UK style of Landfill Allowance Trading Scheme, establishing embodied energy savings as carbon abatement under a National Emissions Trading Scheme, and using a Resource Recovery Certificate in a similar fashion to Renewable Energy Certificates. Each option has strengths and weaknesses. The challenge is in articulating the case for intervention and in creating the political imperative for change. It is hoped that this 'State of Waste in Western Australia' report, and the associated workshop for key stakeholders, will contribute some of the impetus for intervention that delivers sustainable systems of resource recovery and a waste free society in Western Australia.

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1 INTRODUCTION

The ability to recycle a maximum amount of material back into the productive economy is an important component of a sustainable society. Unfortunately this is also a feature largely missing from the Australian economy. Each year Australians generate 34 million tonnes of waste. More than half of this waste is disposed of to landfill (19 million tonnes), representing a wasteful linear resource flow in the order of 950 kg of waste to landfill per person. Linear resource flows are unsustainable in the long term and generate undesirable environmental, social and economic impacts.

A multi-pronged approach is needed to address the problem of waste. Across Australia many jurisdictions have signalled their intent to engage with sustainable resource recovery, by committing to the 'goal of zero'. Zero waste will require many innovative interventions in the economy if the desired change is to materialise. Market Based Instruments (MBIs) can be used to support the recycling of materials back into the economy by providing incentives for sustainable resource recovery, reprocessing and remanufacture.

Total Environment Centre (TEC), a Sydney based environment NGO, published 'Market Based Instruments and Sustainable Resource Recovery' in 2004,[1] which considered the potential for MBIs to promote sustainable resource recovery in Australia. TEC, with funding from Pratt Foundation, is undertaking a national series of workshops to identify opportunities for market based interventions to fast track the transition to a 'waste free' society. As part of this consultation process, Warnken ISE has been retained to prepare a series of 'State of Waste' reports for various jurisdictions across Australia. This report is one such study into the state of waste generation in Western Australia.

1.1 Overview of Report

Following on from this introduction, Section 2 presents an overview of the policy and regulatory settings as they relate to resource recovery and waste management in Western Australia, with particular attention paid to the aspiration of living in a waste free society. Section 3 discusses the available data on waste disposed of to landfill, the amount and types of recycled materials, overall rates of waste generation and compares WA performance to the rest of Australia. Following this overview of waste generation, Section 4 examines the required interventions to achieve the 'goal of zero', including infrastructure needs, challenges from a WA perspective, the use of market based instruments and options for consideration. Finally Section 5 provides a summary and conclusion. The structure of the document is presented in Figure 1 below.

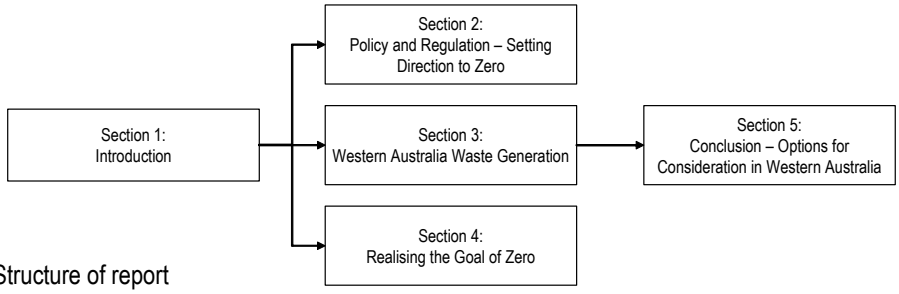

Figure 1 –Structure of report

[1] *See http://www.tec.org.au/dev/index.php?option=com_docman&task=doc_download&gid=109 for more information.*

2 POLICY AND REGULATION – SETTING DIRECTION TO ZERO

The policy settings for resource recovery in Western Australia are set by the 'Statement of Strategic Direction for Waste Management in Western Australia: Vision and Priorities'. The regulatory framework for the state will be established by the enactment of the Waste Avoidance and Resource Recovery Bill 2006, which is currently out for consultation. Part of upcoming changes include increases to the landfill levy, and the proposed introduction of container deposits. Further details on the WA Strategy and upcoming policy and regulatory changes are presented below.

2.1 Western Australia Waste Strategy

The 'Statement of Strategic Direction for Waste Management in Western Australia: Vision and Priorities' was released in September 2004 by the Waste Management Board of WA and the then Department of Environment (now Department of Environment and Conservation). This document enshrined the vision of 'towards zero waste in Western Australia', with the accompanying goal of living in a waste free society. Three key principles were suggested as part of this vision:

- prevention - to avoid the creation of waste
- recovery - to efficiently re-cover, re-treat and re-use all wastes
- disposal - to responsibly manage waste into the environment

The WA Strategy signalled a series of transitions that would need to be made, such as:

- change in focus from waste management to waste prevention by 2008
- half of collective efforts spent of waste management and half on waste prevention by 2012
- majority of effort spent on prevention by 2015
- little or no waste created that cannot be recovered by 2020.

Some of the key tools to achieve the transition to zero waste include 'product stewardship, industrial ecology, environmental justice and product lifecycle management'. While the strategy sets out the overarching direction for resource recovery in WA, the Waste Avoidance and Resource Recovery Bill 2006 provides more of the detailed actions to occur as part of the process. Also missing are a set of targets on waste generation that allow the quantification of progress (or lack thereof) towards the 'goal of zero'.

2.2 Waste Avoidance and Resource Recovery Bill 2006

The Waste Avoidance and Resource Recovery Bill 2006 was released for public comment in August, with final comments due 27 November 2006. The WARR Bill sets out the transition to a waste free society as an integral component to sustainability in Western Australia, and aims to effect the transition through promoting resource efficiency and reducing environmental harm, in addition to implementing a resource management hierarchy comprising: avoidance of unnecessary resource consumption; resource recovery (including reuse, reprocessing, recycling and energy recovery); and disposal.

The WARR Bill also makes provision for the establishment of a statutory Waste Authority responsible for strategic policy and planning and comprising broad representation and skill sets, the development of a state waste strategy with targets for waste reduction, resource recovery and waste diversion, and the administration of levy monies collected as part of the Waste Management and Recycling Fund. Also outlined in the Bill is the potential for local government to be directed to prepare waste management plans that align activities with the Waste Strategy.

Other issues addressed in the Bill include setting priority areas for Extended Producer Responsibility (EPR) each year by the Waste Authority; providing the CEO of the Waste Authority with the ability to require local government to deliver certain waste management services; and the ability to establish regulation for the management of waste collection and facilities, product stewardship, record keeping and prescribing certain offences. Certain waste provisions currently in the Environmental Protection Act 1986, the Health Act 1911, the Environmental Protection (Landfill) Levy Act 1998 and other relevant Acts were also consolidated into the Bill.

2.3 Landfill Levy Increases

Perth currently has a landfill levy of $3 per tonne for putrescible waste materials (for example food waste) and $1 per tonne for inert materials (for example bricks and concrete). Ostensibly the landfill levy serves a twofold purpose: firstly to internalise some of the externalised costs of landfill; and secondly, to make alternatives to landfill more cost competitive. As noted above, the WARR Bill sets out the use of landfill levy moneys in the proposed 'Waste Management and Recycling Fund'. In addition to the establishment of the Fund, the levy on metropolitan waste is also set to increase, as set out in Table 1.

Table 1 – Schedule for landfill levy increases in Western Australia (WMB 2006)

Date	Putrescible Landfill (Class II, III & IV)	Inert Landfill
Current	$3/tonne	$1/tonne
2006/07	$6/tonne	$3/m³
2007/08	$6/tonne	$3/m³
2008/09	$7/tonne	$5/m³
2009/10	$8/tonne	$7/m³
2010/11	$9/tonne	$9/m³

The increases were set to start on Sunday 1 October 2006. The levy is paid by all landfill operators in the Perth metropolitan area, in addition to landfills outside of Perth that receive metropolitan waste. The increase in landfill levy is likely to translate into a slightly larger increase in landfill gatefee charges, hopefully supporting the competitiveness of alternatives (WMB 2006).

2.4 Container Deposits

Container deposits refer to a refundable charge (deposit) that is placed on containers such as beverage bottles and cans, paint tins, and other forms of packaging. Consumers are refunded the deposit when the container is returned to a collection centre, which can be automated as in the case of a reverse vending machine, or run on a manual basis, often by a community group like Scouts. Usually a handling fee is also included in a container deposit scheme, effectively embedding the costs of collection into the price of a product. Container deposits are thus a good example of a user (or polluter) pays system that is able to increase resource recovery and reduce litter.

The Western Australia government signalled its intention to introduce a best practice container deposit scheme for WA in November 2005 (Edwards 2005). A special purpose Stakeholder Advisory Group was established to provide advice on the establishment of a container deposit scheme within the Western Australia context. It is anticipated that a container deposit scheme in WA would, amongst other things: double container recovery rates; reduce overall costs, assist in the development of local reprocessing capacity in WA, reduce litter and play a role in establishing collection infrastructure for other Extended Producer Responsibility Schemes (SAG 2006).

An analysis of the benefits of container deposits was undertaken for the Boomerang Alliance. This study identified that a container deposit scheme in WA would reduce waste to landfill by seven per cent; reduce litter by 25 per cent; deliver significant environmental improvements through reduced water and energy use; and deliver significant economic benefit through new business development in WA. Furthermore, strong community support for container deposits was identified, with a Newspoll survey finding that over 90 per cent of the WA population wants container deposits (West 2006).

The WA Strategy, WARR Bill, landfill levy and container deposits form part of the suite of interventions that are required to divert waste from landfill and into productive use. The state of waste generation in Western Australia, which arguably has caused the need for a policy and regulatory response, is presented in the following section.

3 WESTERN AUSTRALIA WASTE GENERATION

Waste generation is measured as the amount of materials disposed of to landfill plus the amount of recycling that occurs within a given region. Waste materials are commonly broken down into three waste 'streams' of Municipal, Commercial and Industrial, and Construction and Demolition.

Municipal waste comprises materials that are generated from the domestic sector and are collected in household garbage, recycling, garden organics and Council clean-up collections, in addition to waste materials collected by Councils as part of street sweeping, litter bins and park cleanups. Commercial and Industrial (C&I) waste includes materials generated from fixed point sources within the manufacturing, wholesale, retail, professional services and administration sectors. Construction and Demolition (C&D) covers materials generated from construction and demolition activities, both on a large scale (high rise) and small scale (residential housing), in addition to materials from landscaping and other urban based construction activities.

Data on waste generation in Western Australia is somewhat limited, a fact noted by the Waste Management Board and to be addressed through its data collection program. For example, one limitation is that disposal data is only available for metropolitan Perth. The following sections present the available data on waste generation in Western Australia.

3.1 Disposal to Landfill

There is data available on the amount of waste disposed of to landfill in the Perth Metropolitan Area between 1998 and 2004 (WMB 2005). Table 2 below presents a break down of these disposal tonnages by material type.

Table 2 – Waste disposed of to landfill in the Perth Metropolitan Area (adapted from WMB 2005)

Waste Stream	1998	1999	2000	2001	2002	2003	2004
Municipal	614,000	774,000	852,000	823,000	764,000	749,000	728,000
Commercial and Industrial	440,000	452,000	427,000	373,000	392,000	460,000	536,000
Construction and Demolition	1,553,000	1,570,000	1,464,000	1,096,000	1,385,000	1,638,000	1,513,000
Total	2,608,000	2,797,000	2,743,000	2,291,000	2,541,000	2,846,000	2,777,000

Applying the per capita waste disposal rate of Perth in 2004 of 1.9 tonnes to the rest of Western Australia gives a state disposal estimate of 3,797,000 tonnes for 2004.[2] Table 3 overleaf presents an estimated breakdown of state disposal tonnages, based on the assumption that Perth waste disposal is representative of the whole state.

[2] *Approximate population of Perth in 2004 of 1,461,600 (as calculated from the Waste Management Board website - www.zerowastewa.com.au), and population of Western Australia in 2004 of 1,998,400 from the Australian Bureau of Statistics.*

Table 3 – Estimated amounts of waste disposed of to landfill in Western Australia (extrapolated from WMB 2005)

Waste Stream	1998	1999	2000	2001	2002	2003	2004
Municipal	849,000	1,063,000	1,173,000	1,130,000	1,050,000	1,031,000	995,000
Commercial and Industrial	608,000	621,000	588,000	512,000	539,000	633,000	733,000
Construction and Demolition	2,146,000	2,157,000	2,015,000	1,505,000	1,904,000	2,254,000	2,069,000
Total	3,603,000	3,841,000	3,776,000	3,147,000	3,493,000	3,918,000	3,797,000

A trend line is difficult to establish based on existing data. For example, total waste disposed of to landfill in Western Australia in 1999 is the same amount as waste disposed on in 2004. The upcoming five years will be critical to establish whether the reduction seen in waste disposal in 2001 was part of a trend towards lower amounts of waste disposal, was caused by a decline of 1.2% in the WA economy (Gross State Product - DTF 2001), or was merely a temporary anomaly.

No information is available on the material composition of waste disposed of to landfill in Western Australia. However, national averages developed by the NSW Branch of the Waste Management Association of Australia (WMAA) have been used to approximate the material breakdown of waste to landfill in Western Australia. Indicative commodity values have also been used to provide an estimate of the financial lost opportunity of landfill and are presented in Table 4 below.

Table 4 – Estimated composition of material disposed of to landfill in Western Australia and indicative financial value for 2004 (averages from WMAA 2006 – totals may not add due to rounding)

Material Type	Tonnes	Indicative Value per tonne	Commodity Value
Paper & Cardboard	595,000	$70	$41,650,000
Glass	111,000	$72	$7,992,000
Aluminium (and other non-ferrous)	29,000	$1,500	$43,500,000
Ferrous	195,000	$75	$14,625,000
Plastic	332,000	$300	$99,600,000
Food and Garden Organics, and Wood/Timber	1,497,000	$20	$29,940,000
Concrete, sand, bricks and rubble	977,000	$15	$14,655,000
Rubber, Textiles and Other Recyclables	62,000	$10	$620,000
Total	3,797,000		$252,582,000

Table 4 shows the lost commodity value of over $250 million worth of materials wasted to landfill in Western Australia during 2004. While it is true that high transport prices and a lack of local markets can erode the value of recycled materials, the assumed commodity values used by the NSW Branch WMAA were conservative. Movements in market value are more likely to be the major determining factor of financial value for materials such as aluminium, plastics and to a lesser extent, paper and cardboard.[3]

3.2 Recycling

In 2004/05 Western Australia recycled approximately 973,000 tonnes of materials, with 243,000 tonnes coming from the Municipal stream, 321,000 tonnes from Commercial and Industrial, and 409,000 tonnes from Construction and Demolition sources (Hyder Consulting 2006a). The material composition of recycled materials is presented in Table 5 below.

Table 5 – Materials recycled in Western Australia in 2004/2005 (adapted from Hyder Consulting 2006a)

Material Type	Tonnes
Paper & Cardboard	186,000
Glass	18,000
Aluminium (and other non-ferrous)	38,000
Ferrous	239,000
Plastic	7,000
Food and Garden Organics, and Wood/Timber	148,000
Concrete, sand, bricks and rubble	334,000
Rubber, Textiles and Other Recyclables	3,000
Total	973,000

No time series information was found on levels of recycling in Western Australia, except for an analysis of dry recyclables and garden organics by Municipal Waste Advisory Council. Based on data collected since 1998, the rate of dry recyclable recycling (kerbside collection) has increased by approximately 4,000 tonnes per year and the rate of garden organics recycling has increased by approximately 7,500 tonnes per year (MWAC 2006).

Of the 973,000 tonnes of materials that are collected for recycling, 37 per cent (363,000 tonnes) are exported to overseas markets, four per cent (43,000 tonnes) are exported interstate, while the remaining 59 per cent (567,000 tonnes) are processed locally in Western Australia (Hyder Consulting 2006a).

[3] *For example, there are industry reports of trade for recycled Aluminium, recycled Plastic and recycled Office Paper at nearly double the estimates given here.*

3.3 Waste Generated

Based on the preceding analysis, the estimated amount of waste generation in Western Australia for 2004 is 4,770,000 tonnes. A breakdown of this amount by waste stream is presented in Table 6 below (a breakdown by material type is presented in Appendix 1). Western Australia recycles approximately one fifth of its waste, with the remaining eighty per cent disposed of to landfill.

Table 6 – Estimated amounts of waste generated in Western Australia in 2004

Waste Stream	Disposed of to Landfill	Recycled	Total Waste Generated	% Disposal	% Recycling
Municipal	995,000	243,000	1,238,000	21%	5%
Commercial and Industrial	733,000	321,000	1,054,000	15%	7%
Construction and Demolition	2,069,000	409,000	2,478,000	43%	9%
Total	3,797,000	973,000	4,770,000	80%	20%

3.4 Comparative Performance (based on 2002/03 Data)

Australian per capita disposal, recycling and waste generation rates provide an opportunity to benchmark performance. As shown in Table 7 below, national averages are: 0.95 tonnes of waste disposed of to landfill, 0.75 tonnes recycled, and a per capita waste generation rate of 1.7 tonnes (total tonnages are provided in Appendix 2 – note that 2002/03 data are used as this is the latest common point of comparison). The per capita rates on a state and territory basis highlight the inaccuracies of waste data in Australia. For example, there is no evidence to suggest that Queensland has a waste generation rate that is forty per cent lower, or that the Northern Territory has a waste generation rate that is nearly seventy-five percent lower, than the national average.

Notwithstanding data shortcomings, each person in Western Australia generated approximately 2.3 tonnes of waste in 2002/03 on a per capita basis (4.5 million tonnes), with 0.4 tonnes recycled (0.8 million tonnes) and 1.9 tonnes disposed to landfill (3.7 million tonnes).[4] This level of waste generation presents a number of future challenges for the 'goal of zero'.

Table 7 – Per Capita comparison of Western Australia Resource Recovery Performance (2002/03) in tonnes (derived from Hyder Consulting 2006b[5] using ABS population estimates)

Category	WA	NSW	Vic	Qld	SA	TAS	ACT	NT	AU Average
Disposed	1.9	0.9	0.8	0.7	0.8	1.0	0.6	0.4	0.95
Recycled	0.4	0.9	0.9	0.3	1.4	0.1	1.5	0.1	0.75
Generated	2.3	1.8	1.7	1.0	2.2	1.0	2.1	0.5	1.7

[4] *Total waste landfilled of 3.7 Mt divided by ABS population of Western Australia for 2004 of 1,952,300 gives 1.9 tonnes disposal per person.*
[5] *Estimates for Perth per capita disposal were used for all of WA*

3.5 Forecast Waste Generation Rates in Western Australia

The gap each year between actual waste disposed and resource recovery will grow unless both planned waste avoidance activities curb waste generation rates and innovative market based solutions are used to grow a robust recycling industry in Western Australia. Figure 2 below shows that waste generation in WA could rise to over ten million tonnes per annum by 2020, with nearly nine million tonnes of materials wasted to landfill. This 'worst case' scenario would occur where waste avoidance activities do not counter economic growth Australia (no decoupling between waste generation and economic growth).[6]

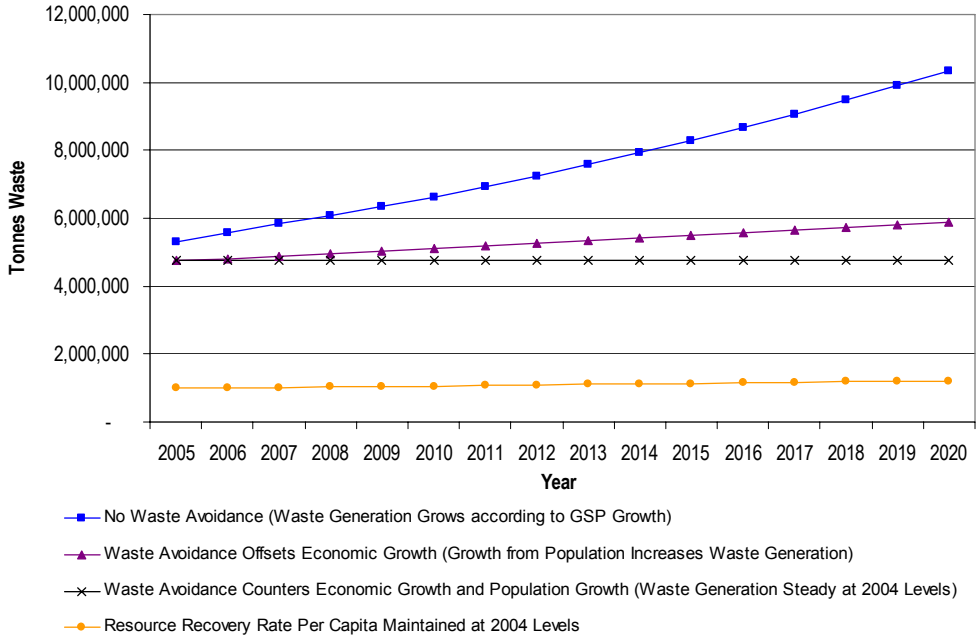

Figure 2 –Forecast waste generation rates for Western Australia

Even if waste avoidance is successful in countering an increase in waste generation from economic growth, the anticipated population increases in Western Australia will add over one million tonnes of waste generation that would need to be recycled in order to prevent an increase in the amount of waste disposed of to landfill.[7] If waste disposal to landfill is to be reduced, an increase in recovery rates over and above growth in population is required, in addition to waste avoidance efforts.

The scale of the challenge facing Western Australia is highlighted by the potential increases in waste generation, combined with the fact that Western Australians generate the most waste in Australia on a per capita basis, and out of the rest of the states, are the third worst recyclers. This poor performance, in combination with the ambitious targets and policies set for WA, emphasise the need for innovative solutions to increase the recovery of resources in WA.

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[6] *An average of the forecasted Gross State Product growth rates to 2009/2010 (4.55%) were used for years 2010 – 2020 (Source: 'Economic Forecasts for Western Australia' produced by the WA Department of Environment and Treasury, http://www.dtf.wa.gov.au/cms/tre_content.asp?ID=604), Waste generation rates were calculated as an estimate of waste generation per $million of GSP using 2003 and 2004 waste data against 02/03 and 03/04 financial years. This gave an waste generation rate of 56 tonnes per $million of GSP.*

[7] *The average per capita waste disposal rate of 1.86 tonnes in Perth between 2000 – 2004, and the state per capita recycling rate of 0.49 tonnes (derived from Hyder Consulting 2006a) was used to forecast growth in waste generation from population growth and a constant per capita waste generation rate of 2.35 tonnes. Population forecasts from the Western Australian Planning Commission were used (http://www.wapc.wa.gov.au/Publications/Table%20E7.xls?id=1203).*

4 REALISING THE GOAL OF ZERO

Western Australia has established the 'goal of zero' as part of its vision of living in a waste free society. Having set the vision, however, there remains much work to be done before desired sustainability outcomes are delivered. For example, current infrastructure for waste management must be redesigned as an industrial ecosystem that delivers resources back into the productive economy at their highest resource value. Western Australia also faces some unique challenges arising from market size and geographic location. Both tasks of transforming current infrastructure and overcoming barriers to increased resource recovery can be overcome through innovative use of Market Based Instruments (MBIs). This section explores the pathway towards zero waste and how MBIs can assist Western Australia in meeting this goal

4.1 Conceptualising the Pathway to Zero Waste

The goal of zero waste is one key element in transitioning to a sustainable economy where patterns of production and consumption are based on the principles of nature – the 'biomimetic economy'. For example, Janine Benyus (1997) in her book 'Biomimicry' puts forward nature as a model, measure and mentor, citing nine key lessons regarding the operation of natural systems, including 'nature recycles everything'.

In addition to having a sound philosophical basis, the recovery of resources for recycling is, in and of itself, a value adding activity. The value proposition of recycling to society is (ACOR 2006):

- less energy requirements for the same unit of material resource - savings in associated greenhouse gas emissions arising from energy generation through conserving embodied energy
- avoided depletion of primary resources - extends the life of given stocks
- replacement of fossil fuels - where the calorific value of materials are recovered for energy generation
- nutrient cycling - through the composting and anaerobic digestion of organic materials for application to land)
- provision of waste management services as a by-product - society still has a need to handle the bulk flows of materials that are discarded. Recycling provides this service as a by-product of recovering resource value for the economy.

The challenge of realising the 'goal of zero' revolves around the creation of an 'industrial ecology' of infrastructure that is able to transform 'waste' into valuable resource inputs. One version of this industrial ecology has been developed by the Strategic Planning and Infrastructure Group (SPIG) which resides under the umbrella of the Waste Management Association of Australia. Figure 2 overleaf identifies the key characteristics of an infrastructure able to deliver zero waste.

In broad terms materials at their end-of-life can fit into one of three categories: dry recyclables (4); organics (5); and residuals (3). For both dry recyclables and organics there is existing infrastructure and technology that can process and beneficiate collected materials.

There is, however, a requirement for ongoing development to improve recycling participation amongst business and individuals, in addition to improving output quality. It is in the recovery of value from 'residual' materials that the bulk of innovation and development is required.

Under a zero waste model, all by-products from production and consumption need to have a beneficial use. Technology and infrastructure will be required to transform residual waste (3) into its generic material types including metals (6), inert materials (7), organics / lignocellulosics (woody materials – 8) and high calorific (energy content) hydrocarbon based fractions (9). These generic recovered resources can then be recycled for new metal manufacture, used for civil works, converted into soil improvement products, and used as coal or gas replacement fuels respectively. In order to optimise this system of residuals processing it will be necessary to use Extended Producer Responsibility (Product Stewardship – EPR/PS) schemes to remove products or items with special value recovery potential, or with toxic characteristics that could disrupt residual processing (Glover and Wainberg unpublished). EPR/PS can also be used to improve recovery rates, such as with the use of container deposits.

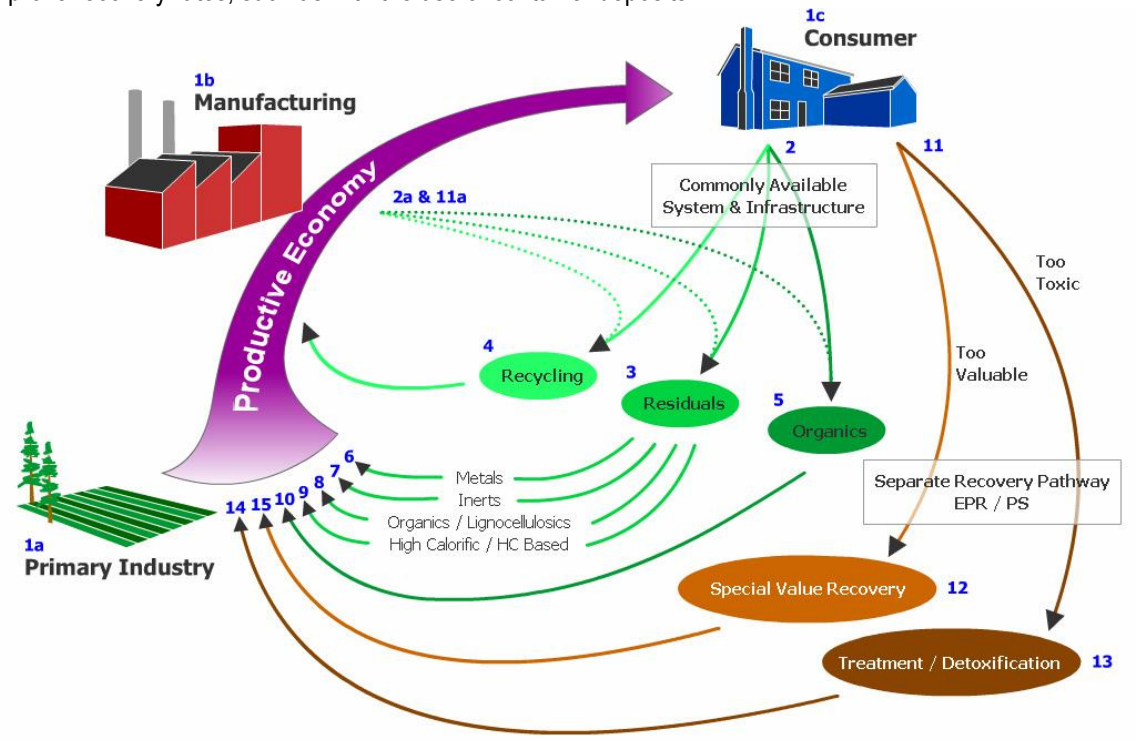

Figure 3 – Conceptualisation of infrastructure requirements for zero waste (Glover and Wainberg unpublished)

The design of such a zero waste industrial ecology in the Western Australia context would also need to address some unique system characteristics.

4.2 Unique Characteristics of Western Australia

Western Australia has a number of unique characteristics arising because of its richness in natural resources, relatively small population base (and hence consumer market size) and geographic isolation. Being a resource rich state there is perhaps downward pressure to recycle, as primary resources are relatively cheap. The small consumer market size also adds to this pressure, as the volumes of recyclate potentially available are lower than other metropolitan settings such as Melbourne, Sydney and Brisbane.

The small market size, in combination with Western Australia's large land mass (it is over 2,700 kilometres from Perth to Adelaide), create a set of challenges to the viability of resource recovery industry. The reality of these challenges are highlighted by the recent closure Amcor's cardboard recycling operations, the collapse of The Recycling Company, and the closure of the ACI (now Owens-Illinois) glass processing facility (West 2006). A further challenge is in the management of rural and regional landfills to a basic level of environmental performance, let alone influencing onsite resource recovery activities.

While the 'goal of zero' has a sound ecological, philosophical and sustainability basis, Western Australia faces a number of unique challenges to overcome the tyranny of distance and achieve some economies of scale. Market based instruments offer a number of opportunities to overcome these challenges and support increased resource recovery.

4.3 Using Market Based Instruments to Fast Track Progress to 'Zero'

Market based instruments (MBIs) can be used to harness market forces in meeting a desired sustainability goal, for example, the increased recovery of resources. The range of MBIs includes 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.

- Charges, Fees and Taxes - attempt to change the actions of companies and individuals to achieve a desired outcome. In general, environmentally related taxes are based on the 'polluter pays principle' where pollution costs are factored into manufacture and production costs. One issue to resolve is whether to charge the consumer (consumption price signal) or the producer (targets pollution abatement at source – UNEP 2004)
- Market Creation - Tradeable Permits and Certificates – a tradable 'property right' is assigned to items of that previously had no direct financial value. This action can be used to create markets in tradeable permits or certificates for damage control/reversal of environmental pollution, stewardship of natural resources and restoration of ecosystem services (Hyder Consulting 2005). Australian examples include Renewable Energy Certificates (RECs) and NSW Greenhouse Gas Abatement Certificates (NGACs). An international example directly related to resource recovery is the UK Landfill Allowance Trading Scheme (LATS) that will dramatically reduce Biodegradable Municipal Waste disposed of to landfill
- Subsidies - include tax concessions, low or no interest loans and exemptions from fees and charges to improve the financial viability of organisations undertaking desired actions intended to bring about an environmental improvement. Also involved is the elimination of perverse subsidies, those mechanisms that actively accelerate environmental deterioration, for example, any subsidies that promote the use of fossil fuels like coal, or provide an incentive for increased primary production (OECD 2001)
- Deposit/Refund Schemes - apply the principle of Extend Producer Responsibility to products and packaging by including a deposit in the purchase price of the product (usually beverage containers) but the principle can also be applied to chemical drums, paint tins and other recognisable containers). The deposit is redeemable when the container is returned either to collection depots.

A well known example is container deposit legislation (CDL) such as the 5 ¢ deposit on beverage containers in South Australia, in addition to the streamlined Californian model

- Market Friction Reduction - addresses forms of market distortion through non-financial means such as reducing transaction costs and improving information flows. Examples include ecolabelling, information and technology transfer and research programmes to facilitate market exchanges (Whitten et al 2003).

Benefits highlighted with a market based approach include (OECD 2001 and UNEP 2004):

- static efficiency – the achievement of environmental pollution abatement at the minimum cost and the equalisation of marginal abatement costs across companies
- dynamic efficiency - ongoing incentives to reduce the costs of pollution abatement, over and above meeting an arbitrary performance level
- double dividend - the realisation of both an improved environmental outcome and a reduction in other taxes such as labour taxes
- self enforcement and transparency - trading mechanisms are by necessity transparent and information on trades is more accessible than reports generated under 'command and control' regulations

These benefits are contrasted with potential limitations of a market based approach that need to be addressed in the design phase including (OECD 2001, Murtough et al 2002, Whitten et al 2003):

- institutional weaknesses - the free rider problem caused by companies not participating in an MBI programme
- legal gaps - there needs to be a legal authority that assigns the necessary property rights and enforces contracts
- strong opposing political factions - well organised and funded special interest groups may disrupt the process of establishing an MBI if it is perceived to disadvantage their financial interests
- community perception – there is the potential for MBIs to be perceived as representing the ability to pay to pollute, especially with cap and trade programmes.

For an MBI to be effective within the Australia context it would need to create a price signal that includes the post consumer management of products and packaging; reward those companies adding value through additional recovery of resources over and above baseline performance; provide an incentive to invest in reverse distribution and reprocessing infrastructure; and influence the design of products and packaging so that they fit into a planned beneficiation option at their end-of-life.

Early movers and good progress to date should be recognised and applauded, however 'laggard' industry sectors avoiding reform with tokenistic programmes should not be allowed to obstruct the progression to a more sustainable Australian economy.

5 CONCLUSION - OPTIONS FOR CONSIDERATION IN WESTERN AUSTRALIA

Western Australia is already using the landfill levy as a means to internalise some of the externalised costs of landfill. The upcoming use of container deposits is also another market intervention that will embed costs of recovery into product price and support the transition to more sustainable patterns of production and consumption. There are also other options for WA to consider in transitioning to a waste free society, including:

- a UK style of Landfill Allowance Trading Scheme (LATS) – here there would be an obligation on local government to reduce the amount of putrescible waste that was sent to landfill. A series of allowances is allocated in line with the reduction timeline. Those Councils able to exceed their diversion targets would have surplus allowances that could be traded to Councils unable to meet their obligations. The ceiling price of the allowances would be set by the price of the penalty for not having enough allowances to cover the amount of putrescible waste sent to landfill
- establishing embodied energy as a form of carbon abatement under the proposed National Emissions Trading Scheme – it is well known that recycling saves energy, especially for materials like aluminium and plastic. Recycled materials are said to have a lower embodied energy than their primary resource counterparts. Because a lower energy profile produces less greenhouse gas emissions, savings in embodied energy are a form of carbon abatement. One way to drive greenhouse gas friendly recycling would be to establish embodied energy under an emissions trading scheme, such as the proposed National Emissions Trading scheme (NETT 2006)
- Resource recovery certificates – RRCs would seek to support a sustainable resource recovery sector, similar in purpose to renewable energy certificates (RECs). There are three general areas where an RRC could be applied, Firstly upstream, creating a market pull for material inputs with recycled content; secondly downstream, creating a supply push of recovered resources; and finally a midstream approach, aiming for balance by combining supply push and market pull. Of the three options, a simplified downstream MBI applied to landfill owners/operators and requiring them to divert increasing amounts of material away from landfill toward beneficial use, has the greatest potential due to (relative) administrative simplicity (Warnken ISE 2005)

Other potential approaches include targeting elements within the packaging supply chain and establishing a recovery liability based on the amount of packaging they handle,[8] application of a levy benefit scheme for products similar in operation to the national Used Oil Product Stewardship scheme,[9] or a mechanism to reward the eco-system services of recycling, as advocated by the Australian Council of Recyclers.[10]

Each potential instrument has its own set of strengths and weaknesses, with varying impacts and benefits on participants within the recycling value chain. Perhaps the greatest challenge is in articulating the case for intervention and in creating the political imperative for change. It is hoped that this 'State of Waste in Western Australia' report, and the associated workshop for key stakeholders, will provide the needed impetus to deliver sustainable systems of resource recovery towards a waste free Australian society.

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[8] *For example Packaging Recovery Notes in the UK – see 'Packaging and Packaging Waste' at http://www.defra.gov.uk/environment/waste/topics/packaging.*
[9] *See 'Product Stewardship for Used Oil Program' http://www.oilrecycling.gov.au/program.html.*
[10] *See Hyder 2005 for more information.*

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7 APPENDICES

7.1 Appendix 1 – Summary material composition of Western Australia waste generation

Table 8 – Summary material breakdown of waste generation in Western Australia during 2004 (averages for disposal from WMAA 2006, recycling data from Hyder Consulting 2006b – totals may not add because of rounding)

Material Type	Tonnes Wasted to Landfill	Tonnes Recycled	Total Waste Generation
Paper & Cardboard	595,000	186,000	781,000
Glass	111,000	18,000	129,000
Aluminium (and other non-ferrous)	29,000	38,000	67,000
Ferrous	195,000	239,000	434,000
Plastic	332,000	7,000	339,000
Food and Garden Organics, and Wood/Timber	1,497,000	148,000	1,645,000
Concrete, sand, bricks and rubble	977,000	334,000	1,311,000
Rubber, Textiles and Other Recyclables	62,000	3,000	65,000
Totals	3,797,000	973,000	4,770,000

7.2 Appendix 2 – Comparison of Western Australia waste generation against other Australian jurisdictions

Table 9 – Tonnage comparison of Western Australia Resource Recovery Performance (2002/03) (derived from Hyder Consulting 2006b[11])

Category	WA	NSW	Vic	Qld	SA	TAS	ACT	NT	AU Totals
Disposed	3,706,000	6,341,000	4,180,000	2,722,000	1,277,000	497,000	207,000	83,000	19,013,000
Recycled	826,000	5,830,000	4,429,000	1,251,000	2,156,000	38,000	467,000	10,000	15,007,000
Generated	4,532,000	12,171,000	8,609,000	3,973,000	3,433,000	535,000	674,000	93,000	34,020,000

[11] *Estimates for Perth per capita disposal were multiplied by WA population to get a state waste disposal figure. Recycling figures for Tasmania are preliminary numbers comprising Plastic 2,000 tonnes, Newsprint, 8,070 tonnes, Cardboard 20,000 tonnes and Glass 8,000 tonnes (Source: Personal Communication Marree Bakker, Tasmania Department of Tourism, Arts and Environment) – Population of Tasmania for 02/03 was 477,100 (Source ABS Australian Demographic Statistics – June Quarter 2003), this gives a per capita recycling rate for Tasmania of at least 0.1 tonnes per capita (rounded to nearest 100 kilogrammes).*