

The Allen Consulting Group

## **Benefit–Cost Analysis of Victoria's Towards Zero Waste Strategy**

**14 November 2003**

Report to EcoRecycle Victoria

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## Acronyms

BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
C&D	Construction & Demolition
C&I	Commercial & Industrial
ET	Enclosed Treatment
GSP	Gross State Product
MBT	Mechanical Biological Treatment
MSW	Municipal Solid Waste
NPV	Net Present Value
OWC	Open Windrow Composting
SIW	Solid Industrial Waste
SKM	Sinclair Knight Merz (Pty Ltd)

## Executive summary

### **Introduction and Background**

This Report presents an economic benefit-cost analysis (BCA) of Victoria's *Towards Zero Waste Strategy*. The economic (net) benefits represent the welfare gains and losses to the Victorian community from undertaking the Strategy.

### **Project Objectives**

This Report analysed:

- a conventional benefit–cost analysis (Chapters 2, 3);
  - three separate scenarios were modelled: High, Moderate and Low by varying landfill prices and environmental benefit valuation parameters.
- a macroeconomic general equilibrium (GE) model of the Victorian and Australian economies (Chapter 4) by using the results of the Moderate scenario; and
- an augmented benefit–cost analysis, which has used as input, the results of the GE modelling.

Sensitivity analysis was undertaken on these results by varying the discount rate and by varying the values of the benefits and costs.

### **Main summary points**

The results of the analysis show the Strategy has positive net economic benefits for Victoria. The only instance in which the net economic benefits are (slightly) negative is when the future costs of landfill are assumed to be low and when the environmental benefits from reprocessing are also assumed to be low.

When the landfill costs and economic value of the environmental benefits are moderate or high, then the net economic benefits are positive, sometimes strongly positive. Even when the macroeconomic costs of the Strategy are incorporated in the benefit–cost analysis, the net benefits are still positive.

The macroeconomic effects of the costs to Victoria's businesses of the Strategy are that there is a small drop in Gross State Product. However, the effects are very mild.

### **Conclusion**

The overriding conclusion is that the economic benefits of the *Towards Zero Waste Strategy* will exceed their costs.

## Chapter 1

# Introduction and Background

### 1.1 This Report

This Report presents an economic benefit–cost analysis (BCA) of Victoria’s *Towards Zero Waste Strategy*. This Strategy involves reducing the quantity of solid waste generated by Victoria’s households and businesses, and increasing the recovery (i.e. recycled) rate of the waste that is generated.

The economic benefits to Victoria of this Strategy, as modelled in this Report, are dollar values of reduced greenhouse gases, air pollution, water pollution and natural resource depletion savings, over the period 2003/4 to 2012/13. The economic costs of the Strategy are the costs of implementing the technologies associated with reprocessing different types of waste streams, as well as the collection, administrative and transport costs that would not otherwise be incurred, over the same time period.

The analysis of these benefits and costs is in Chapter 2 and Chapter 3. The BCA methodology is discussed in Chapter 2, while numerical results are presented in Chapter 3. The analysis shows that the benefits of the Strategy exceed its costs under the moderate and high value scenario. The Strategy is marginally negative under the low value scenario.

Chapter 4 reports the results of General Equilibrium (GE) modelling of the costs of the Strategy, using the MMRF–Green model of the Victorian and Australian economies. This modelling shows what the economy-wide effects of the Strategy’s costs. It does this by taking the direct costs of the Strategy to Victorian businesses (as derived in BCA analysis of Chapters 2 and 3) and allows them to be multiplied throughout the economy. (For example, in the GE modelling, an increase in the costs to business arising from the Strategy reduces their profits, causing them to invest less and employ fewer people. This negative effect ripples through all sectors of the economy.) This modelling is *very* conservative, because it assumes that there are no offsetting multiplied benefits. However, even so, the negative macroeconomic effects of the Strategy are found to be very small. Moreover, factoring in these negative effects into the benefit–cost analysis still results in the benefits of the Strategy exceeding its costs, except in the most pessimistic of cases.

Thus, even under very conservative assumptions, the *Towards Zero Waste Strategy* is found to have positive net economic benefit for Victoria.

Conclusions are presented in Chapter 5.

### 1.2 The Towards Zero Waste Strategy

The *Towards Zero Waste Strategy* aims to:

- reduce the quantity of annual waste generated by 1.5 million tonnes from 2003 levels by 2013, representing a 13 per cent reduction in waste levels by July 2013 (assuming the economy grows by 3.5 per cent per year over the next 10 years);

- increase the recovery rate of all solid waste generated from the current rate of 48 per cent to 75 per cent by 2013. Targets for materials recovery are shown in Table 1.1; and
- reduce the environmentally damaging impacts of waste.

Table 1.1

**TARGETS FOR MATERIALS RECOVERY (PER CENT)**

Recovery Rate	2001/02	2008 target	2013 target
Household waste	27	45	65
Commercial & Industrial waste	60	65	80
Construction & demolition waste	49	65	80
<b>All solid waste streams</b>	48	60	75

Source: EcoRecycle Victoria

There are two broad categories of waste that are targeted by the Strategy.

- Municipal Solid Waste (MSW), with the aim of bringing all metropolitan councils and large provincial city councils to a comprehensive collection, recycling and residual waste treatment system. Currently 15 of 31 metropolitan councils, and 27 out of 48 non-metropolitan councils, provide a mobile bin service for recyclables, while 18 of 31 metropolitan councils and 2 of the 3 major provincial councils provide a regular green waste collection. In 2000/01, 1.5 million tonnes of Municipal Waste was disposed in landfills.
- Solid Industrial Waste (SIW), comprising Commercial and Industrial (C&I) Waste and Construction and Demolition (C&D) Waste. The largest categories of SIW disposed in landfills are fill material, concrete/bricks/asphalt and timber. The current recovery rate is 55 per cent with the aim of recovering 65 per cent of SIW by July 2008 and 80 per cent by July 2013. In 2000/01, 2.6 million tonnes of Solid Industrial Waste was disposed in landfills.

The approach to systems, technologies and infrastructure will be<sup>1</sup>:

- MSW waste – source separation of recyclables, (containers, paper and cardboard); a preference for source separation of garden and food waste; and processing of residuals.
- C&D waste – sorting facilities capable of handling mixed loads, with residuals to further processing or landfill.
- C&I waste – an appropriate mix of the above approaches, depending on the size and location of the facility, the types of waste produced, and the local infrastructure available.

<sup>1</sup> EcoRecycle *Towards Zero Waste: Sustainable production and consumption for Victoria (Ministerial Draft 1 October 2003)*.

### 1.3 Relationship to Triple Bottom Line Report

This report is complementary to the Report by Sinclair Knight Merz (SKM) of June 2003, *Triple Bottom Line Assessment: An Examination of the Economic, Environmental and Social Costs and Benefits of Strategic Waste Management Options*. That report examined the economic, environmental and social benefits (and costs) of 16 Options for recycling solid waste generated by households and businesses. These options each involved the use of different technologies (e.g. composting, anaerobic digestion, pyrolysis/gasification). For each option, SKM calculated an environmental benefit (in dollar terms), a net benefit and a social ranking.

In conducting the BCA for this Report, each stream of waste was assigned one of the technologies analysed by SKM. That is, it assumed that, over the life of the Strategy a certain type of waste will be recovered using a particular technology.<sup>2</sup> The benefits and costs (per kilo tonnes recovered) for each waste stream drew on estimates from the SKM report, as well as figures supplied to The Allen Consulting Group by EcoRecycle Victoria. Finally, as discussed above, economy-wide costs of the Strategy were estimated using the MMRF–Green model.

The analysis in this Report thus differs from the SKM Report in three respects:

- the economic benefit–cost analysis is more comprehensive than that found in the SKM Report; and
- the benefits and costs of the *Towards Zero Waste Strategy* itself are explicitly modelled; however
- this Report is not as wide ranging, in that it contains no independent environmental analysis, and no social analysis.

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<sup>2</sup> The assignment of technologies to waste streams was made as a result of discussions with EcoRecycle Victoria.

## Chapter 2

# Methodology

This chapter details the benefit and cost impacts identified for evaluating the *Towards Zero Waste Strategy*. The benefits and costs are compared to those that would prevail under the Base Case. The Base Case is that which, based on analysis of past trends, would prevail if the waste generated in Victoria were to grow in line with economic activity (Gross State Product) and population parameters. The benefits of the Strategy (improved environmental impacts) are quantified in monetary terms, as are the costs of the Strategy.

### 2.1 Tonnages Model

The first step is to forecast the physical amount of waste that will be generated, recovered and disposed, under the Base Case and the Strategy. This is accomplished with a *tonnages model*. By definition, waste generation is the sum of recovery and landfill.

#### *Base Case*

The two key parameters that drive waste generation are population growth and GSP growth. In the tonnages model, population is assumed to grow by 0.45 per cent each year until 2006/07 and 0.06 per cent per year thereafter. GSP is assumed to grow by 3.5 per cent each year.<sup>3</sup>

The weight that each of these parameters has in forecasting total waste generated depends on the sector. For example, around 50 per cent of growth in MSW waste generation is driven by population growth, with the remaining 50 per cent is driven by GSP growth.<sup>4</sup> GSP growth holds a greater weighting in the growth of solid industrial waste (SIW) generated. An estimated 90 per cent of the growth in waste generation for SIW's is driven by GSP growth and the remaining 10 per cent is driven by the population growth.

The tonnes recovered are forecast by growing the actual amounts in 2001/02 actuals according to population and GSP parameters.<sup>5</sup> Landfill is the difference between waste generated and recovered amounts.

#### *Strategy*

As noted in Chapter 1, the Strategy's objective is to reduce waste generation by 1.5 million tonnes by 2013. To derive the waste generated under the Strategy, the 1.5 million tonnes were apportioned across each year that the Strategy is to be in place. That is, in the analysis, 0.15 million tonnes less waste is generated each year compared with the Base Case.

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<sup>3</sup> Based on assumptions provided by EcoRecycle Victoria.

<sup>4</sup> Based on assumptions provided by EcoRecycle Victoria.

To calculate the recovered amounts, it was assumed that both the SIW and MSW sectors meet their recovery targets anticipated under the Strategy. As noted in Chapter 1, the target is for a 75 per cent recovery of waste for MSWs and SIWs by 2012/13. Tonnes diverted to landfill is then the difference between waste generated and recovered amounts.

## **2.2 Regional Coverage**

All of Victoria has been incorporated into the benefit–cost analysis with total waste generated according to the following proportions:

- 74 per cent for Melbourne;
- 14 per cent for provincial cities; and
- 12 per cent for rural areas.

## **2.3 Benefit–Cost Model**

As noted in Section 2.1, the tonnage model calculates the tonnages for the Strategy relative to the Base Case. The benefit–cost model specifies benefit and cost parameters and applies the tonnages to estimate total benefits and costs of the Strategy. Incremental benefits and costs are defined as the total benefits and costs of the Strategy less the total benefits and costs of the Base Case.

**Benefits** are avoided Environmental costs, in terms of reduced:

- greenhouse gas emissions
- water pollution
- air pollution
- resource depletion

**Costs** are:

- technology costs;
- additional organic waste collection costs; and
- administration costs.

Other transport and collection costs are excluded from the analysis on the grounds that these would not significantly differ under the Base Case and Strategy Case. Any increase in these costs per tonne due to the Strategy (for example, due to the typically lower density of kerbside recyclables) would be offset by the low quantity of tonnes collected due to waste reduction.

Each of these benefits and costs is considered in detail in Section 2.9 and 2.10.

### ***Input parameters***

The input parameters and assumptions have mostly been obtained from the SKM report and EcoRecycle Victoria. The benefit-cost analysis is conducted in real terms i.e. dollar amounts refer to values in 2003 prices.

### **High and Low Value Scenarios**

Some of the benefit–cost parameters have a range of estimates – a high estimate and a low estimate. Due to this variability, three benefit–cost scenarios have been assessed:

- Scenario 1: Moderate Value where price parameters are measured as an average of the high and low estimates.
- Scenario 2: High Value where all price parameters are high estimates.
- Scenario 3: Low Value all price parameters are low estimates.

Scenarios 2 and 3 provide a lower and upper bound of the total costs and total benefits of the Strategy.

The price parameters, which are varied under the scenarios, are:

- landfill prices; and
- environmental valuation parameters.

In the language of benefit-cost analysis, these price parameters are *shadow prices*. They measure the opportunity cost to society of elements of the benefits and costs. Unlike the SKM report, the Report does not consider any variability in saleable product prices. The Allen Consulting Group understands that these benefits have been incorporated into the Technology costs.

## **2.4 Costs**

### **Technologies and their associated costs**

To date, residual waste streams in Victoria have almost entirely been deposited in landfill. The Strategy requires the adoption of alternative technological systems capable of processing large quantities of waste recovered. The Strategy envisages a combination of technologies for use in MSW and C&I waste streams. These include:

- Open Windrow Composting (OWC);
- Enclosed Treatments (ET); and
- Mechanical Biological Treatments (MBT).

For C&D waste, it is likely that current technologies will be used.

For each of the technologies, a trade off exists between operating costs and the generated environmental benefits. For example, OWC is a relatively inexpensive approach to converting organic waste into compost but has a number of environmental disadvantages, such as odour problems.

### **Technologies used for MSW**

The Strategy proposes using different reprocessing technologies according to the type of waste being recovered. Food wastes are currently not being treated for reprocessing. Under the Strategy, it is envisaged that these wastes will undergo ET. Green waste is currently being processed by OWC but this process will be phased out over the Strategy period and replaced with ET.

Recovered waste that is not processed by OWC and ET will be processed by MBT, phasing in over the Strategy period. By 2008/09, it is envisaged that 15 per cent of residuals will be processed by MBT, increasing to 88 per cent by 2012/13.

Table 2.1 summarises the anticipated recovery tonnages according to the technology that will be used for reprocessing this waste.

Table 2.1

**RECOVERED WASTE FOR MSW (MILLIONS OF TONNES)**

	Year	Kerbside Recycle	Food	Green Waste		Total
			ET	OWC	ET	
<b>Base data</b>	2000/01	0.37	0	0.19	0	0.61
	2001/02	0.43	0	0.23	0	0.72
	2002/03	0.44	0	0.23	0	0.73
<b>Base case</b>	2003/04	0.45	0	0.24	0	0.74
	2004/05	0.46	0	0.24	0	0.76
	2005/06	0.47	0	0.25	0	0.78
	2006/07	0.48	0	0.25	0	0.79
	2007/08	0.49	0	0.26	0	0.81
	2008/09	0.50	0	0.26	0	0.83
	2009/10	0.51	0	0.27	0	0.85
	2010/11	0.52	0	0.28	0	0.87
	2011/12	0.53	0	0.28	0	0.89
	2012/13	0.55	0	0.29	0	0.91
	<i>TOTAL</i>	<i>5.00</i>	<i>0</i>	<i>2.6</i>	<i>0</i>	<i>8.20</i>
<b>Strategy targets</b>	2003/04	0.46	0.04	0.22	0.03	0.81
	2004/05	0.48	0.06	0.22	0.06	0.89
	2005/06	0.49	0.10	0.21	0.09	0.98
	2006/07	0.51	0.13	0.20	0.12	1.06
	2007/08	0.53	0.16	0.21	0.14	<b>1.14*</b>
	2008/09	0.55	0.21	0.18	0.19	1.25
	2009/10	0.57	0.28	0.14	0.24	1.36
	2010/11	0.60	0.34	0.09	0.30	1.47
	2011/12	0.62	0.40	0.05	0.35	1.58
	2012/13	0.64	0.47	0.00	0.41	<b>1.68*</b>
<i>TOTAL</i>	<i>5.50</i>	<i>2.20</i>	<i>1.5</i>	<i>1.9</i>	<i>12.2</i>	
<b>Tonnage changes due to Strategy</b>	2003/04	0.01	0.04	-0.02	0.03	0.07
	2004/05	0.02	0.06	-0.02	0.06	0.13
	2005/06	0.03	0.10	-0.03	0.09	0.20
	2006/07	0.03	0.13	-0.05	0.12	0.27
	2007/08	0.04	0.16	-0.05	0.14	<b>0.33*</b>
	2008/09	0.05	0.21	-0.08	0.19	0.42
	2009/10	0.06	0.28	-0.13	0.24	0.51
	2010/11	0.08	0.34	-0.18	0.30	0.60
	2011/12	0.09	0.40	-0.23	0.35	0.69
	2012/13	0.10	0.47	-0.29	0.41	<b>0.78*</b>

Source: EcoRecycle Victoria. Numbers for 2000/01 and 2001/02 are actual outcomes. Under the Base Case, the relevant population and GSP projections forecast tonnage recovered. Under the Strategy, tonnage recovered is estimated by meeting the Strategy's targets (marked with an asterisk for the relevant target years of the Strategy).

The costs associated with reprocessing additional recovered material vary by technology and it is assumed that these will be reflected in fees. These are shown in Table 2.2. The Allen Consulting Group's understanding is that each of these costs has been measured using a lifecycle approach by combining the capital and operating costs and expressed as costs per tonne of processed waste. These technology costs are net of the product revenues generated from saleable materials (i.e. reprocessing waste generates saleable materials that can be sold at market, such as recycled paper, glass, metal etc. The revenue benefits from this process have been internalised into the technology costs.)

Table 2.2

**TECHNOLOGY COSTS FOR MUNICIPAL SOLID WASTE (MSW)**

Recovered material	Technology use	Cost per tonne
Kerbside recycling	MRF – currently in use and will continue to be under Strategy	\$35
Green waste	OWC – currently in use but assumed to be phased out over Strategy period	\$30
Green waste	ET – to be introduced with Strategy	\$55
Food waste	ET – to be introduced with Strategy	\$55
Residual processing	MBT – to be phased in over Strategy period with 15 per cent of landfill residuals to go through by 2008/09, increasing to 88 per cent by 2012/13.	\$80

Source: EcoRecycle Victoria

***Technologies used for SIW***

Currently, residual waste from the C&I and C&D industries do not readily lend themselves to source separation of materials for recycling. This is partially due to the complexity of the waste stream.

Under the Strategy, all recovered waste from the C&I sector will be processed. Part of the recovered waste will undergo ET processing and part will be processed with MBT technology. After reprocessing, any residual left over will be disposed in landfill, incurring landfill costs.

For the C&D sector, recovered waste is mostly delivered to sorting facilities and is anticipated to continue to do so under the Strategy. The difference between the Base Case and the Strategy is that there will be more tonnes to be processed as a result of a higher recovery rate.

Table 2.3 summarises the anticipated recovery tonnages according to the technology that will be used for reprocessing this waste.

Table 2.3

**RECOVERED WASTE FOR SIW (MILLIONS OF TONNES)**

	Year	Commercial & Industrial			Construction & Demolition	Total
		ET	MBT	Total		
<b>Base data</b>	2000/01	-	-	-	-	3.37
	2001/02	0.00	0.00	1.63	1.71	3.34
	2002/03	0.00	0.00	1.67	1.76	3.43
<b>Base case</b>	2003/04	0.00	0.00	1.73	1.82	3.55
	2004/05	0.00	0.00	1.78	1.88	3.66
	2005/06	0.00	0.00	1.84	1.94	3.78
	2006/07	0.00	0.00	1.90	2.00	3.90
	2007/08	0.00	0.00	1.96	2.06	4.02
	2008/09	0.00	0.00	2.02	2.13	4.15
	2009/10	0.00	0.00	2.09	2.20	4.29
	2010/11	0.00	0.00	2.16	2.27	4.43
	2011/12	0.00	0.00	2.23	2.34	4.57
	2012/13	0.00	0.00	2.30	2.42	4.72
<b>Strategy targets</b>	2003/04	0.00	0.00	1.74	1.92	3.66
	2004/05	0.00	0.00	1.81	2.09	3.90
	2005/06	0.00	0.00	1.87	2.25	4.13
	2006/07	0.00	0.00	1.94	2.42	4.36
	2007/08	0.03	0.05	<b>2.01*</b>	<b>2.58*</b>	<b>4.67*</b>
	2008/09	0.06	0.15	2.14	2.77	5.12
	2009/10	0.09	0.25	2.27	2.96	5.57
	2010/11	0.09	0.25	2.40	3.16	5.89
	2011/12	0.11	0.30	2.53	3.35	6.29
	2012/13	0.11	0.30	<b>2.66*</b>	<b>3.54*</b>	<b>6.60*</b>
<b>Tonnage changes due to Strategy</b>	2003/04	0.00	0.00	0.01	0.11	0.12
	2004/05	0.00	0.00	0.02	0.21	0.24
	2005/06	0.00	0.00	0.03	0.32	0.35
	2006/07	0.00	0.00	0.04	0.42	0.46
	2007/08	0.03	0.05	<b>0.05</b>	<b>0.52</b>	<b>0.64</b>
	2008/09	0.06	0.15	0.11	0.64	0.96
	2009/10	0.09	0.25	0.18	0.77	1.28
	2010/11	0.09	0.25	0.24	0.89	1.47
	2011/12	0.11	0.30	0.30	1.01	1.72
	2012/13	0.11	0.30	<b>0.36</b>	<b>1.12</b>	<b>1.89</b>

Source: EcoRecycle Victoria. Numbers for 2000-01 and 2001/02 are actual outcomes. Under the Base Case, the relevant population and GSP projections forecast tonnage recovered. Under the Strategy, tonnage recovered is estimated by meeting the Strategy's targets (marked with an asterisk for the relevant target years of the Strategy).

The costs associated with reprocessing recovered material vary by technology and are shown in Table 2.4.

Table 2.4

**PROCESSING COSTS FOR BUSINESS**

Technology use	Cost per tonne
C&I processing	\$50
Enclosed treatment (ET)	\$55
Mechanical Biological Treatment (MBT)	\$80
C&D processing	\$50

Source: EcoRecycle Victoria

The Allen Consulting Group's understanding is that an increase in processing streams will not impact on additional transport costs on the basis that recovered waste will be taken from one reprocessing site to an alternative site.

***Avoided Landfill Disposal Costs***

Under the Strategy, it is anticipated that there will be a reduction in the amount of waste that would normally go to landfill. Table 2.5 shows the yearly amounts of waste directed to landfill under the Base Case as well as the amount that is avoided.

Table 2.5

**TONNES DIRECTED TOWARDS LANDFILL**

Million tonnes	Year	MSW	C&I	C&D	Total
<b>Base data</b>	2000/01	<b>1.59*</b>	<b>1.04*</b>	<b>1.70*</b>	4.33
	2001/02	1.68	1.10	1.80	4.58
	2002/03	1.71	1.13	1.85	4.69
<b>Base case</b>	2003/04	1.74	1.17	1.91	4.82
	2004/05	1.78	1.21	1.97	4.95
	2005/06	1.81	1.25	2.03	5.09
	2006/07	1.85	1.29	2.10	5.23
	2007/08	1.89	1.33	2.16	5.39
	2008/09	1.94	1.37	2.23	5.54
	2009/10	1.98	1.41	2.31	5.70
	2010/11	2.03	1.46	2.38	5.87
	2011/12	2.07	1.51	2.46	6.04
	2012/13	2.12	1.56	2.54	6.21
	<b>TOTAL</b>	<b>19.0</b>	<b>14.0</b>	<b>22.0</b>	<b>55.00</b>
<b>Strategy targets</b>	2003/04	1.64	1.12	1.76	4.52
	2004/05	1.58	1.11	1.66	4.36
	2005/06	1.52	1.10	1.57	4.19
	2006/07	1.46	1.09	1.48	4.03
	2007/08	1.40	1.08	1.39	3.79
	2008/09	1.31	1.01	1.27	3.37
	2009/10	1.22	0.93	1.15	2.96
	2010/11	1.13	0.86	1.03	2.68
	2011/12	1.05	0.78	0.91	2.33
	2012/13	0.91	0.66	0.89	2.05
	<b>TOTAL</b>	<b>13.0</b>	<b>10.0</b>	<b>13.0</b>	<b>34.0</b>
<b>Avoided landfill due to Strategy</b>	2003/04	-0.10	-0.05	-0.15	-0.29
	2004/05	-0.19	-0.09	-0.30	-0.59
	2005/06	-0.29	-0.14	-0.46	-0.90
	2006/07	-0.40	-0.19	-0.62	-1.21
	2007/08	-0.50	-0.25	-0.78	-1.60
	2008/09	-0.63	-0.36	-0.97	-2.17
	2009/10	-0.76	-0.48	-1.16	-2.74
	2010/11	-0.89	-0.60	-1.35	-3.19
	2011/12	-1.03	-0.72	-1.55	-3.71
	2012/13	-1.21	-0.89	-1.65	-4.16

Source: EcoRecycle Victoria. Numbers for 2000-01 and 2001/02 are actual outcomes.

Table 2.6 shows low and high price estimates for landfill.

Table 2.6

**REAL LANDFILL PRICES PER TONNE (2003 PRICES)**

Year	Low estimate	High estimate
2003/04	\$22	\$34
2004/05	\$24	\$38
2005/06	\$25	\$41
2006/07	\$27	\$45
2007/08	\$29	\$49
2008/09	\$31	\$53
2009/10	\$33	\$57
2010/11	\$34	\$60
2011/12	\$36	\$64
2012/13	\$38	\$68

Source: EcoRecycle Victoria.

Landfill prices are expected to increase over time mainly through the implementation of best practice in landfill (such as better drainage systems) and the scheduled increases in the landfill levy.<sup>6</sup>

In the benefit–cost analysis, the additional waste that is diverted from landfill multiplied by the landfill price represents avoided landfill costs. It is assumed that this is passed onto households and businesses in the form of lower rate collection fees. For this reason, avoided landfill costs are deducted to derive total costs.

### **Organic Waste Collection Costs**

At present, local councils in the metropolitan Melbourne and the provincial cities provide differing waste management systems for organics waste. Of the 38 councils in these regions, 20 councils currently offer green organics collection.<sup>7</sup> As noted earlier, the Strategy proposes that the remaining councils will move towards a comprehensive organics collection, recycling and residual waste treatment system.

The cost involved is essentially the additional costs to local councils for administering the Strategy. It is assumed, however, that the cost impacts will be passed onto households in the form of higher rate charges.

For councils that are currently collecting organics, a small incremental charge will be collected for upgrading their green waste collection systems (in line with the Strategy’s objectives).

<sup>6</sup> Landfill levies will increase from the current \$5 (MSW) and \$7 (SIW) to \$9 and \$15 respectively by 2007–08 in metropolitan Melbourne and provincial cities. Source: EcoRecycle Victoria.

<sup>7</sup> *Local Government Data Collection 2001-02: Kerbside Waste Management Services (May 2003)* EcoRecycle Victoria

For households that live in these council areas, the incremental cost is due to the introduction of new technologies, such as ET, for processing organic residuals. The Allen Consulting Group's understanding is that these costs are included in the Technology costs.

For households that reside in councils that are currently not collecting green waste, the additional costs borne are from moving from a 2-bin to a 3-bin system. These costs are assumed to be \$77 per tonne of recovered waste. This estimate is calculated on the following basis:

- Additional costs for councils currently collecting green organics are around \$13.6 million with 127,000 tonnes being collected.<sup>8</sup> This is equivalent to \$107 per tonne.
- There is a small offset to these costs in that the processing of organic wastes under the Strategy has already been incurred under technology costs. These are estimated as \$30 per tonne.

### **Administration**

For the additional recycling activity (over and above standard recycling), it is assumed that there is an additional administration, facilitation and promotion cost of \$4 per tonne of recovered organic waste.<sup>9</sup>

### **Costs not included in the Benefit–Cost model**

The costs of waste reduction (reducing waste by 1.5 Mt) are assumed to have no net financial impact for businesses. This is consistent with the analysis undertaken in the SKM report and is based on the assumption that waste reduction programs implemented by industry are cost neutral. That is, the investments made by industry for introducing new waste reduction practices (i.e. minimising the usage of virgin materials) are recoverable through cost savings or additional revenues. Case studies have shown that there are financial benefits from undertaking large waste reduction strategies. Small waste reduction initiatives are, on the other hand, may often not be financially viable. On average, therefore, a cost neutral assumption is maintained.

## **2.5 Benefits**

The key benefit from implementing the Strategy is the environmental benefits. The benefits are a function of both the reduction in waste generated and the increase in the amount of waste that is recovered. As with the SKM report, four key environmental impacts have been assessed:

- Greenhouse Emissions;
- Air Emissions;
- Water Emissions; and
- Resource Impacts.

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<sup>8</sup> *Local Government Data Collection 2001-02: Kerbside Waste Management Services (May 2003)*  
EcoRecycle Victoria

<sup>9</sup> Based on assumptions provided by EcoRecycle Victoria.

The value of environmental benefits has been sourced from the SKM report. It is assumed that recyclables in the C&I waste stream have equivalent environmental impacts and valuations (per tonne of recovered waste) as materials recovered in the municipal waste stream. In practice, the composition of materials for C&I recovered waste is different from that of MSW recovered waste (e.g. a higher share of concrete and brick compared with paper). Given the lack of specific material based data, there is no distinction in the environmental benefits sourced from MSW recovered waste and C&I recovered waste.

The following valuations have been sourced from the SKM report.

Table 2.7

**ENVIRONMENTAL BENEFIT VALUATION PARAMETERS  
LOW PRICES (\$ PER TONNE OF RECOVERED WASTE)**

	ET	MBT	OWC
Greenhouse	32	36	16
Air Pollution	56	63	45
Water Pollution	0.5	12	4
Resources	19	31	20

Source: SKM report p.25

Table 2.8

**ENVIRONMENTAL BENEFIT VALUATION PARAMETERS  
HIGH PRICES (\$ PER TONNE OF RECOVERED WASTE)**

	ET	MBT	OWC
Greenhouse	63	71	32
Air Pollution	90	101	72
Water Pollution	1.0	25	8
Resources	32	51	33

Source: SKM report p.25

## Chapter 3

# Benefit–Cost Analysis of the Strategy

### 3.1 Assessing the Strategy

This chapter reports on the results of the benefit–cost analysis of the *Towards Zero Waste* Strategy. The benefits and costs are those that directly flow from the Strategy. (Indirect (economy–wide) effects are considered in the following chapter, which reports the result of general equilibrium macroeconomic modelling of the Strategy.)

Economic (net) benefits represent the welfare gains and losses to the Victorian community from undertaking the Strategy. The results should not be interpreted as whether particular sections of the industry or households in certain local councils will be impacted positively or negatively in a financial sense.

The benefits under the Strategy are ‘social’ rather than identified for private businesses or households, in the sense that they are measured irrespective of the people to whom they accrue: they are not confined to specific locations or local council communities. Costs, on the other hand, are distinguished between households (MSW) and industry (SIW).

There are two ways to assess whether economic benefits of the Strategy exceed its costs:

- the difference between the net present value (NPV) of the benefits and the NPV of the costs i.e. NPV of the net economic benefits. This figure represents the dollar value of the contribution that the Strategy will make to economic welfare, or well-being, with future values being converted to present values by the use of a discount rate; and
- the ratio of the NPV of the benefits and costs.

The NPVs of the benefits and costs were calculated using two discount rates: 7.5 per cent and 3.5 per cent. A detailed discussion of the appropriate rate for discounting is in Attachment A.

### 3.2 Results

The results of the benefit–cost analysis, under each scenario, are presented in Tables 3.1 to 3.15.

Benefits and costs are associated with both the Base Case and the Strategy, for example, as a result of the technologies used for reprocessing waste. That is, currently (under the Base Case) technologies are in place that lead to environmental outcomes but under the Strategy, there will be more environmental benefits and more costs. To assess the effectiveness of the Strategy, however, the *incremental* benefits and costs are considered.

Under each of the scenarios below, total benefits and costs are presented, as are the incremental benefits and costs.

Table 3.1

**TOTAL TECHNOLOGY AND ADDITIONAL ORGANIC COLLECTION COSTS – MODERATE VALUE SCENARIO (\$M, 2003 PRICES)**

		MSW	C&I	C&D
Base Case	2003/04	89	119	144
	2004/05	96	126	154
	2005/06	103	134	165
	2006/07	111	142	176
	2007/08	119	150	188
	2008/09	127	159	200
	2009/10	135	168	213
	2010/11	144	177	226
	2011/12	153	187	241
	2012/13	163	198	256
Strategy Case	2003/04	100	118	145
	2004/05	111	124	155
	2005/06	122	131	204
	2006/07	133	137	240
	2007/08	143	148	244
	2008/09	172	167	247
	2009/10	202	183	250
	2010/11	225	187	252
	2011/12	250	196	253
	2012/13	263	196	263

Source: Allen Consulting Group analysis

Table 3.2

**INCREMENTAL COSTS DUE TO STRATEGY – MODERATE VALUE SCENARIO (\$M, 2003 PRICES)**

	Admin.	MSW	C&I	C&D	Total Costs
2003/04	1	10	-1	1	11
2004/05	1	15	-2	1	16
2005/06	2	19	-3	40	58
2006/07	3	22	-5	64	84
2007/08	4	25	-2	57	84
2008/09	6	45	9	47	106
2009/10	7	67	16	37	127
2010/11	8	81	10	25	125
2011/12	10	97	8	12	127
2012/13	11	101	-1	7	117

Source: Allen Consulting Group analysis

Table 3.3

**TOTAL TECHNOLOGY AND ADDITIONAL ORGANIC COLLECTION COSTS – HIGH VALUE SCENARIO (\$M, 2003 PRICES)**

		MSW	C&I	C&D
Base Case	2003/04	139	126	155
	2004/05	149	135	168
	2005/06	159	144	181
	2006/07	169	153	195
	2007/08	180	163	209
	2008/09	192	174	225
	2009/10	204	185	241
	2010/11	216	196	257
	2011/12	229	208	275
	2012/13	242	221	294
Strategy	2003/04	150	125	156
	2004/05	164	132	167
	2005/06	179	139	217
	2006/07	193	146	253
	2007/08	206	159	258
	2008/09	237	174	261
	2009/10	271	187	264
	2010/11	297	190	265
	2011/12	324	197	266
	2012/13	339	197	276

Source: Allen Consulting Group analysis

Table 3.4

**INCREMENTAL COSTS DUE TO STRATEGY – HIGH VALUE SCENARIO (\$M, 2003 PRICES)**

	Admin. Costs	MSW	C&I	C&D	Total Costs
2003/04	1	11	-1	0	11
2004/05	1	16	-2	-1	14
2005/06	2	20	-4	36	54
2006/07	3	24	-7	58	78
2007/08	4	26	-4	49	75
2008/09	6	46	1	37	89
2009/10	7	68	2	23	100
2010/11	8	81	-7	8	91
2011/12	10	96	-11	-9	84
2012/13	11	97	-24	-17	67

Source: Allen Consulting Group analysis.

Table 3.5

**TOTAL TECHNOLOGY AND ADDITIONAL ORGANIC COLLECTION COSTS – LOW VALUE SCENARIO (\$M, 2003 PRICES)**

		<b>MSW</b>	<b>C&amp;I</b>	<b>C&amp;D</b>
Base Case	2003/04	79	112	132
	2004/05	84	118	140
	2005/06	89	124	148
	2006/07	94	130	157
	2007/08	100	137	166
	2008/09	105	144	175
	2009/10	111	151	185
	2010/11	118	158	196
	2011/12	124	166	206
	2012/13	131	174	218
Strategy Case	2003/04	90	112	134
	2004/05	100	117	144
	2005/06	110	122	192
	2006/07	120	127	226
	2007/08	129	137	230
	2008/09	157	160	234
	2009/10	188	180	236
	2010/11	211	185	238
	2011/12	235	194	240
	2012/13	250	195	250

Source: Allen Consulting Group analysis

Table 3.6

**INCREMENTAL COSTS DUE TO STRATEGY – LOW VALUE SCENARIO (\$M, 2003 PRICES)**

	<b>Admin.</b>	<b>MSW</b>	<b>C&amp;I</b>	<b>C&amp;D</b>	<b>Total Costs</b>
2003/04	1	11	0	2	<b>13</b>
2004/05	1	16	-1	3	<b>20</b>
2005/06	2	21	-2	43	<b>65</b>
2006/07	3	26	-3	69	<b>95</b>
2007/08	4	30	1	64	<b>99</b>
2008/09	6	52	16	58	<b>132</b>
2009/10	7	76	29	51	<b>164</b>
2010/11	8	93	27	43	<b>171</b>
2011/12	10	111	28	34	<b>183</b>
2012/13	11	119	21	32	<b>182</b>

Source: Allen Consulting Group analysis

Table 3.7

**BENEFITS – MODERATE VALUE SCENARIO (\$M, 2003 PRICES)**

		Greenhouse	Air Pollution	Water Pollution	Resources	Total Benefits
Base Case	2003/04	6	14	1	6	27
	2004/05	6	14	1	6	28
	2005/06	6	14	1	7	28
	2006/07	6	15	2	7	29
	2007/08	6	15	2	7	30
	2008/09	6	15	2	7	30
	2009/10	6	16	2	7	31
	2010/11	7	16	2	7	32
	2011/12	7	16	2	7	32
	2012/13	7	17	2	8	33
Strategy Case	2003/04	12	23	3	10	48
	2004/05	15	28	3	12	58
	2005/06	18	33	3	14	68
	2006/07	22	38	3	16	79
	2007/08	29	49	4	20	102
	2008/09	51	82	10	36	178
	2009/10	75	118	16	52	262
	2010/11	88	137	19	60	304
	2011/12	105	163	23	72	363
2012/13	114	175	24	77	390	

Source: Allen Consulting Group analysis

Table 3.8

**INCREMENTAL BENEFITS DUE TO STRATEGY — MODERATE VALUE SCENARIO (\$M, 2003 PRICES)**

Year	Greenhouse	Air Pollution	Water Pollution	Resources	Total
2003/04	6	9	1	4	21
2004/05	9	14	1	6	30
2005/06	13	19	2	7	40
2006/07	16	23	2	9	50
2007/08	23	34	3	13	73
2008/09	45	67	8	29	148
2009/10	69	103	15	45	231
2010/11	81	121	17	53	272
2011/12	99	146	21	64	331
2012/13	107	158	22	69	356

Source: Allen Consulting Group analysis

Table 3.9

**BENEFITS — HIGH VALUE SCENARIO (\$M, 2003 PRICES)**

	Year	Greenhouse	Air Pollution	Water Pollution	Resources	Total
Base Case	2003/04	8	17	2	8	<b>34</b>
	2004/05	8	17	2	8	<b>35</b>
	2005/06	8	18	2	8	<b>36</b>
	2006/07	8	18	2	8	<b>37</b>
	2007/08	8	19	2	8	<b>37</b>
	2008/09	8	19	2	9	<b>38</b>
	2009/10	9	19	2	9	<b>39</b>
	2010/11	9	20	2	9	<b>40</b>
	2011/12	9	20	2	9	<b>41</b>
	2012/13	9	21	2	10	<b>42</b>
Strategy Case	2003/04	16	29	3	13	<b>61</b>
	2004/05	20	35	4	15	<b>74</b>
	2005/06	25	41	4	17	<b>87</b>
	2006/07	29	47	4	20	<b>100</b>
	2007/08	38	60	6	25	<b>130</b>
	2008/09	68	101	13	44	<b>227</b>
	2009/10	100	146	22	65	<b>333</b>
	2010/11	117	168	25	75	<b>386</b>
	2011/12	140	201	31	90	<b>461</b>
	2012/13	151	215	32	96	<b>495</b>

Source: Allen Consulting Group analysis

Table 3.10

**INCREMENTAL BENEFIT DUE TO STRATEGY – HIGH VALUE SCENARIO (\$M, 2003 PRICES)**

Year	Greenhouse	Air Pollution	Water Pollution	Resources	Total Benefit
2003/04	9	12	2	5	<b>27</b>
2004/05	12	17	2	7	<b>38</b>
2005/06	17	23	2	9	<b>51</b>
2006/07	21	29	2	11	<b>63</b>
2007/08	30	42	4	17	<b>93</b>
2008/09	59	82	11	36	<b>188</b>
2009/10	91	126	20	56	<b>294</b>
2010/11	108	149	23	66	<b>346</b>
2011/12	131	180	29	80	<b>420</b>
2012/13	142	195	30	86	<b>453</b>

Source: Allen Consulting Group analysis

Table 3.11

**BENEFITS – LOW VALUE SCENARIO (\$M, 2003 PRICES)**

		Greenhouse	Air Pollution	Water Pollution	Resources	Total Benefits
Base Case	2003/04	4	11	1	5	20
	2004/05	4	11	1	5	21
	2005/06	4	11	1	5	21
	2006/07	4	11	1	5	21
	2007/08	4	12	1	5	22
	2008/09	4	12	1	5	22
	2009/10	4	12	1	5	23
	2010/11	4	12	1	6	23
	2011/12	5	13	1	6	24
	2012/13	5	13	1	6	25
Strategy Case	2003/04	8	18	2	8	36
	2004/05	10	22	2	9	43
	2005/06	12	25	2	10	50
	2006/07	15	29	2	12	58
	2007/08	19	38	3	15	75
	2008/09	34	63	7	27	130
	2009/10	50	91	11	39	191
	2010/11	59	105	12	45	222
	2011/12	71	125	15	54	265
2012/13	76	134	16	58	284	

Source: Allen Consulting Group analysis

Table 3.12

**INCREMENTAL BENEFITS DUE TO STRATEGY– LOW VALUE SCENARIO (\$M, 2003 PRICES)**

Year	Greenhouse	Air Pollution	Water Pollution	Resources	Total Benefit
2003/04	4	7	1	3	15
2004/05	6	11	1	4	22
2005/06	8	14	1	6	29
2006/07	11	18	1	7	36
2007/08	15	26	2	10	53
2008/09	30	51	5	21	108
2009/10	46	79	9	34	168
2010/11	54	93	11	40	198
2011/12	66	113	14	48	241
2012/13	72	121	14	52	260

Source: Allen Consulting Group analysis

Table 3.13

**NPV OF BENEFITS AND COSTS—MODERATE VALUE SCENARIO (\$M, 2003 PRICES)**

	7.5% discount rate	3.5% discount rate
NPV Benefits	899	1193
NPC Costs	531	679
NPV Net Benefits	368	514
Benefit-Cost Ratio	1.7	1.8

Source: Allen Consulting Group analysis

Table 3.14

**NPV OF BENEFITS AND COSTS—HIGH VALUE SCENARIO (\$M, 2003 PRICES)**

	7.5% discount rate	3.5% discount rate
NPV Benefits	1143	1517
NPC Costs	422	533
NPV Net Benefits	721	984
Benefit-Cost Ratio	2.7	2.8

Source: Allen Consulting Group analysis

Table 3.15

**NPV OF BENEFITS AND COSTS—LOW VALUE SCENARIO (\$M, 2003 PRICES)**

	7.5% discount rate	3.5% discount rate
NPV Benefits	655	870
NPC Costs	686	885
NPV Net Benefits	-30	-16
Benefit-Cost Ratio	0.96	0.98

Source: Allen Consulting Group analysis

**Key aspects of the results**

- The Benefits and Costs grow over time. This is due to increased tonnages recovered, increasing landfill prices and increasing environmental valuation parameters.

- Under the Strategy, the bulk of the incremental costs come from processing MSW, especially in the later years.
- Under the Strategy, the greatest incremental benefits come from reducing air pollution followed by greenhouse reductions.
- The NPV of the net economic benefits the Strategy is strongly positive for the moderate value scenario (\$368m to \$514m) and the high value scenario (\$721m to \$984m). It is slightly negative for the low value scenario (-\$16m to -\$30m). Thus, when the value of the benefits of recycling waste are moderate or high, and the costs of depositing waste in landfill are moderate or high, the Strategy has a strongly positive net economic benefit. When the values of the benefits are low, and when the costs of depositing waste in landfill are low, the Strategy has a marginal net economic loss.
- The choice of the discount rate significantly affects the size of the net economic benefits under each of the scenarios. However, the discount rate does not affect the benefit cost ratio (BCR), in any scenario. Under the moderate value scenario, the BCR is around 1.7, under the high value scenario it is about 2.7 and under the low value scenario it is 0.96. This suggests that under the low scenario, the Strategy is close to breaking even.

### 3.3 Sensitivity analysis

The above results depend on the estimated values of the stream, over time, of benefit and costs of the Strategy. Inevitably, there is some uncertainty about the value of these benefits and costs. A sensible check on the results of the benefit cost analysis is to check their sensitivity to variations in the values of the benefits and costs.

Table 3.16 shows the amount (in percentage terms) by which the benefits need to change in order the Strategy benefits to just equal the costs, under the moderate and high scenario.

Table 3.16

**SENSITIVITY ANALYSIS: PERCENTAGE CHANGE IN BENEFITS THAT YIELD BCR=1**

Scenario	7.5% discount rate	3.5% discount rate
Moderate Value	-34	-35
High Value	-52	-53

Source: Allen Consulting Group analysis

Table 3.16 shows that:

- In the moderate value scenario, even if the benefits were around 35 per cent lower than posited in the benefit–cost analysis, then the economic benefits of the Strategy would still about equal the costs.
- In the high value scenario, this conclusion would hold if the benefits were cut by around 53 per cent.

### *Attachment to Chapter 3*

## Choice of discount rate

In any benefit-cost analysis of a project, an important decision is the choice of discount rate, which is used to evaluate the net present value of the benefits and costs of the project. The prevailing view in economic analysis is that the discount rate is the social rate of return that should be earned by the capital employed in the project under analysis — that is, the opportunity cost of capital employed in the project.<sup>10</sup> This rate of return should reflect the risks of the project i.e. the variability of the net returns of the project, other than the risks that could be eliminated by investments in other projects. These risks are known as ‘non-diversifiable’ risks.

While there is more than one method of allowing for these risks in the calculation of the discount rate, the most widely accepted is through Capital Asset Pricing Model (CAPM).<sup>11</sup> Briefly, the CAPM posits that the return to a risky project can be written as the sum of two parts

$$R = R(f) + \text{beta} * (R(m) - R(f))$$

where  $R(f)$  is the return on a riskless project (the ‘risk free rate’),  $R(m)$  is the return to a portfolio comprising all projects, and beta is a parameter reflecting the covariance between the project under consideration and the portfolio of all projects.

The risk free rate is usually proxied by the rate of return on government bonds. In this instance, since the benefit–cost analysis is conducted in terms of real (inflation adjusted) variables, the risk free rate is taken as the return on Commonwealth capital indexed bonds, which is currently about 3.5 per cent.<sup>12</sup> As discussed above, the rate of waste generation in Victoria varies closely with total economic activity in the State. This suggests that the risks in the Zero Waste Strategy i.e. the variations in the benefits and costs, will most likely be closely associated with the risks to variations in the State’s Gross State Product. This in turn suggests that a reasonable value for beta for the Strategy is the beta for a portfolio of all assets. While this is not known, the value of beta for all assets traded on the Australian Stock Exchange is known, and is about 0.7 Also reasonably well known is the long run estimate of the quantity  $[R(m) - R(f)]$ . It is about 6 per cent, or a bit lower.<sup>13</sup>

Putting these estimates together suggests a discount rate (in real terms) to be used in the benefit–cost analysis of the *Towards Zero Waste Strategy*

$$R = 3.5\% + 0.7 * 6\%$$

which, rounding to the nearest half per cent, is 7.5 per cent.

<sup>10</sup> Richard W. Tresch, *Public Finance: a Normative Theory*. Irwin, Georgetown Ontario, 1981, p 479.

<sup>11</sup> Richard Brealey et al *Principles of Corporate Finance*, McGraw Hill, Sydney, 2000, p 210-218.

<sup>12</sup> The yields for Treasury Indexed Bonds maturing in August 2010 and August 2015 are 3.420 per cent and 3.555 per cent, respectively. Source: Australian Financial Review, 7<sup>th</sup> November 2003, p 53.

<sup>13</sup> Essential Services Commission, *Review of Gas Access Arrangements*, October 2002, p 326-342.

An alternative view is that the discount rate in benefit–cost analysis should reflect the social rate of time preference i.e. the discount rate the government deems appropriate for discounting consumption, over time. Ignoring (as is usually done) the problem of uncertainty in consumption, this would mean using the government bond rate (3.5 per cent, in this case) as the discount rate.

There is no straightforward way of resolving this problem, in theory. However, as the benefit–cost analysis of the *Towards Zero Waste Strategy* showed, the ratio of benefits to costs was virtually unaffected by the discount rate, in any case.

## Chapter 4

# Macroeconomic Impact of the *Towards Zero Waste Strategy*

This chapter details the modelling undertaken to determine the likely economic impact the *Towards Zero Waste Strategy*. It describes the model used (including key assumptions), it details the scope of the modelling exercise and presents the resulting findings.

### 4.1 The Study

As noted in Chapter 3, this economic impact assessment considers both the direct and indirect impacts of the Strategy.

Using MMRF-Green (see section 4.2), the total economic effects of the Strategy are modelled for Victoria and the rest of Australia. (The rest of Australia is affected because of links between the Victorian economy and the other state economies). From an economic point of view (in the model), the Strategy requires Victorian industries to purchase additional waste services. The cost of these additional services must be borne by the using industries.

### 4.2 The MMRF-Green Model

MMRF-Green is a multi-sector dynamic model of the Australian economy covering the six states and two territories. It models each region as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries, and so on. Since MMRF-Green is dynamic, it is able to produce sequences of annual solutions connected by dynamic relationships. The model also includes enhanced capabilities for environmental analysis.

As each state and territory is modelled as a mini-economy, MMRF-Green is ideally suited to determining the impact of region-specific economic shocks. It has already been used to address a wide range of issues, including the economic impacts of large export-oriented projects, the effects of global trading in greenhouse emission permits, and the effects of changes in state and federal tax rates.

### 4.3 Simulation Design

In generating the results, the following two scenarios are modelled over the ten year period 2003/04 to 2012/13.

- Base case: The Base Case is a projection for the Australian and state economies compiled on the assumption that the Strategy in Victoria does not go ahead.
- Strategy scenario: In this scenario, it is assumed that the *Towards Zero Waste Strategy* is implemented. This scenario shows the effects of the Strategy, with the national and regional economies adjusting away from Base case trends to accommodate the proposed changes.

The effects of the new waste proposal are reported as deviations between the values of variables under the Strategy and their values in the Base Case.

### **Exogenous shocks**

In modelling the impacts of the *Towards Zero Waste Strategy* the following annual changes in total costs (\$ million, 2003 prices) to Victorian businesses are imposed in the model. These costs are taken from the data used in the benefit–cost analysis of Chapter 3.

Table 4.1

#### **AVERAGE INCREMENTAL BUSINESS COSTS FROM IMPLEMENTING THE STRATEGY (\$M, 2003 PRICES)**

Year	\$M
2003/04	0.5
2004/05	-0.4
2005/06	36.6
2005/07	58.7
2007/08	54.9
2008/09	56.0
2009/10	52.8
2010/11	35.4
2011/12	20.7
2012/13	5.9

Source: Allen Consulting Group analysis

These costs are assumed to be distributed across Victorian industries in proportion to industry output. They are assumed to represent additional sales for Victoria’s waste management industry.

No attempt has been made to add any exogenous benefits to Victoria’s industries that might arise from the Strategy. While it is possible to conceive of such benefits (for example, productivity benefits) these are contentious and very difficult to quantify and so have not been included in the analysis.

The costs to households from the Strategy are assumed to take the form of demand shifts towards waste services, and away from the purchases of other goods and services.

***Other assumptions******Labour markets***

At the national level, the deviation in the national real wage rate from its Base Case level increases in proportion to the deviation in economy-wide employment from its Base Case level. Eventually, the real wage adjustment would eliminate any deviation in national employment caused by the waste management plan. At the regional level, it is assumed that labour is mobile between state economies. Labour is assumed to move between regions so as to maintain inter-state wage and unemployment rate differentials at their Base Case levels.

***Public expenditure, taxes and government budget balances***

It is assumed that the shocks associated with the waste management plan make no difference to the paths of federal and state real public consumption expenditures. We also assume no deviation in the paths of tax rates applying to commodity sales and applying to labour and capital income. Government budget balances are therefore allowed to vary.

***Consumption, investment, ownership of capital and measurement of welfare***

In each year of Strategy, aggregate real consumption in each state diverges from its Base Case level by an amount reflecting the divergence in real income available to the residents of Victoria.

***Rates of return on capital***

Under the Strategy simulations, MMRF-Green allows for short-run divergences in rates of return on industry capital stocks from their levels in the Base Case forecasts. Such divergences cause divergences in investment and capital stocks. The divergences in capital stocks gradually erode the divergences in rates of return.

***Production technologies***

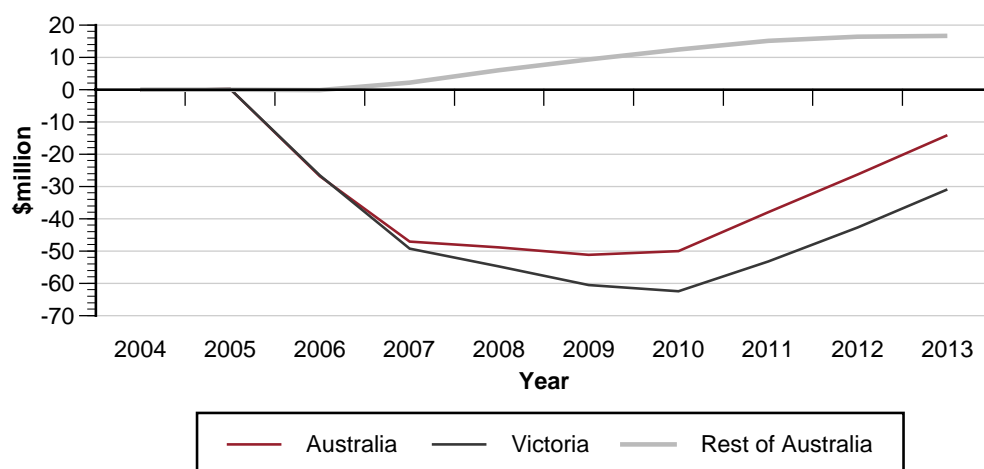
MMRF-Green contains many types of technical change variables. Under the Strategy simulation, we assume that all technology variables have the same values as in the Base Case simulation, except for those variables used to implement the exogenous cost increases.

**4.4 Modelling Results: Economic Impacts**

Table 4.2 shows the extent to which a range of macroeconomic variables in the Strategy scenario differ from their values under the Base Case. For example, it shows that the Strategy will reduce real GSP in Victoria in 2013 by \$50.9 million relative to its level in the Base Case. Tables 4.3 and 4.4 show percentage deviations in real value added and employment by industry in Victoria. Tables 4.5 and 4.6 show absolute deviations in real value added and employment for Victorian industries.

The Strategy has a small negative impact on the Victorian economy. Real GSP falls by \$142 million relative to the Base Case peak-cost year (2008/09). The loss in real GSP diminishes over time in line with the falling costs of the Strategy. Less real GSP means less real income available for consumption in Victoria. Thus, in line with the deviations in real GSP, real consumption in Victoria falls relative to its Base Case level throughout the simulation period (see Figure 4.1).

Figure 4.1

**REAL CONSUMPTION**

Source: MMRF-Green

The reduction is largest in 2009/10, by \$62.5 million. The deviations in investment, international exports and employment in Victoria follow a similar pattern to those for real GDP and consumption. Real import volumes, though, are less affected: the negative effects on imports of reduced activity are almost fully offset by the positive effects arising from reduced competitiveness of Victorian import-competing industries.

At the industry level, the only industry to benefit from the new Strategy is the waste services industry (embedded in the larger 'Other services' industry). In the peak-cost year, real value added in 'Other services' is 0.11 per cent above its Base Case level, or around \$5 million. In the same year, employment in 'Other services' is 0.33 per cent above the Base Case, which is equivalent to around 500 full and part-time jobs. The Strategy reduces output and employment in all other industries. The reductions are fairly uniform, reflecting the equi-proportionate allocation of the additional waste cost. The industries projected to experience the largest percentage fall in output are Chemicals and Dwelling services. Chemicals are highly trade exposed and so cannot easily pass on the cost increase. The Dwelling services industry sells only to household consumption and so moves with aggregate real consumption in the Victorian economy.

Box 4.1

**NOTE ON EMPLOYMENT**

In the model, employment is measured in terms of hours worked, not persons employed. Accordingly, percentage changes in employment, as simulated by the model, represent percentage changes in hours worked. To derive estimates of changes in the number of persons employed, a calculation is made outside of the model in which it is assumed that the exogenous shocks do not affect the ratio of hours employed to persons employed in each industry. Under this assumption, in each industry the percentage increase in persons employed equals the percentage increase in hours worked. Our simulations suggest that the proposed scheme will reduce aggregate employment in Victoria in 2013 by 0.01 per cent. In our Base Case, employment in Victoria in 2013 is around 4.0 million persons. Applying the percentage increase to the baseline number yields a decrease of around 400 in the number of full and part-time jobs.

This estimate is qualified, however, by noting that the translation from hours to persons probably overestimates the likely change in persons employed. This is because a reduction in employment (persons) is likely to arise from a mix of reduced hours worked per person and reduced employment (persons). This needs to be kept in mind when interpreting the results.

Source: MMRF–Green

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Table 4.2

**MACROECONOMIC VARIABLES (ABSOLUTE DEVIATIONS FROM BASE CASE VALUES)**

		2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
<b>Real gross value added (GDP/GSP)</b> <i>(\$million, 2003 prices)</i>	Australia	-0.9	0.7	-67.7	-110.5	-104.2	-105.5	-99.0	-66.2	-38.6	-11.6
	Victoria	-1.1	0.7	-77.2	-130.8	-132.1	-141.7	-141.5	-110.0	-81.4	-50.9
	Rest of Aust.	0.1	0.0	9.4	20.3	27.9	36.1	42.5	43.8	42.9	39.2
<b>Real consumption</b> <i>(\$million, 2003 prices)</i>	Australia	-0.3	0.2	-26.8	-47.1	-48.9	-51.2	-50.0	-38.0	-26.3	-14.1
	Victoria	-0.3	0.2	-26.5	-49.3	-54.8	-60.6	-62.5	-53.2	-42.7	-30.9
	Rest of Aust.	0.0	0.0	-0.2	2.2	6.0	9.3	12.4	15.1	16.4	16.7
<b>Real investment</b> <i>(\$million, 2003 prices)</i>	Australia	-0.3	0.3	-21.4	-30.2	-23.9	-22.2	-18.8	-8.7	-2.1	3.7
	Victoria	-0.3	0.3	-24.1	-36.6	-32.3	-32.7	-30.4	-19.9	-12.2	-4.6
	Rest of Aust.	0.0	0.0	2.7	6.3	8.5	10.4	11.7	11.2	10.1	8.4
<b>Real international exports</b> <i>(\$million, 2003 prices)</i>	Australia	0.0	0.0	1.7	2.9	4.2	6.0	7.4	8.2	8.5	8.0
	Victoria	0.0	0.0	-3.3	-5.6	-5.7	-6.2	-6.3	-5.1	-4.0	-2.9
	Rest of Aust.	0.1	0.0	5.0	8.5	9.9	12.2	13.7	13.3	12.5	10.8
<b>Real international imports</b> <i>(\$million, 2003 prices)</i>	Australia	0.0	0.0	3.6	6.5	7.5	8.6	9.3	8.1	6.7	5.1
	Victoria	0.0	0.0	1.9	2.6	2.0	1.7	1.3	0.0	-0.9	-1.8
	Rest of Aust.	0.0	0.0	1.7	3.9	5.4	7.0	8.0	8.1	7.7	6.8
<b>Taxation revenue</b> <i>(\$million, 2003 prices)</i>	Federal	0.0	0.0	-2.5	-5.2	-6.1	-7.0	-7.3	-6.4	-5.3	-3.9
	Victoria	-0.1	0.0	-5.1	-8.3	-8.3	-8.7	-8.6	-6.6	-4.7	-2.8
	Rest of Aust.	0.0	0.0	0.7	1.2	1.2	1.5	1.7	1.6	1.6	1.4

Source: MMRF-Green

Table 4.3

**REAL VALUE ADDED FOR VICTORIAN INDUSTRIES (PERCENTAGE DEVIATIONS FROM BASECASE VALUES)**

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Agriculture	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Mining	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Food and beverages	0.00	0.00	-0.03	-0.05	-0.06	-0.06	-0.07	-0.06	-0.05	-0.03
Textiles, clothing and footwear	0.00	0.00	-0.02	-0.03	-0.04	-0.04	-0.05	-0.04	-0.04	-0.03
Paper and wood products	0.00	0.00	-0.02	-0.04	-0.05	-0.06	-0.06	-0.06	-0.05	-0.04
Chemicals	0.00	0.00	-0.03	-0.05	-0.06	-0.08	-0.08	-0.08	-0.07	-0.06
Non-metal building products	0.00	0.00	-0.03	-0.05	-0.05	-0.05	-0.05	-0.04	-0.03	-0.02
Metal products	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01
Transport equipment	0.00	0.00	-0.04	-0.07	-0.06	-0.07	-0.07	-0.06	-0.05	-0.04
Machinery and equipment	0.00	0.00	-0.02	-0.04	-0.04	-0.05	-0.05	-0.04	-0.03	-0.02
Other manufacturing	0.00	0.00	-0.04	-0.07	-0.06	-0.07	-0.07	-0.06	-0.05	-0.04
Utilities	0.00	0.00	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.01
Construction	0.00	0.00	-0.04	-0.07	-0.07	-0.07	-0.07	-0.05	-0.04	-0.02
Trade and accommodation services	0.00	0.00	-0.02	-0.04	-0.04	-0.05	-0.05	-0.04	-0.03	-0.02
Transport services	0.00	0.00	-0.01	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.02
Communication services	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01
Financial and business services	0.00	0.00	-0.02	-0.03	-0.04	-0.04	-0.04	-0.04	-0.03	-0.02
Dwelling services	0.00	0.00	0.00	-0.01	-0.02	-0.03	-0.03	-0.04	-0.05	-0.05
Public services	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01
Other Services (includes waste services)	0.00	0.00	0.08	0.13	0.11	0.11	0.10	0.07	0.04	0.02

Source: MMRF-Green

Table 4.4

**EMPLOYMENT FOR VICTORIAN INDUSTRIES (PERCENTAGE DEVIATIONS FROM BASECASE VALUES)**

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Agriculture	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01
Mining	0.00	0.00	-0.03	-0.05	-0.04	-0.05	-0.04	-0.03	-0.02	-0.01
Food and beverages	0.00	0.00	-0.04	-0.07	-0.07	-0.07	-0.07	-0.05	-0.03	-0.02
Textiles, clothing and footwear	0.00	0.00	-0.02	-0.04	-0.04	-0.04	-0.05	-0.04	-0.03	-0.02
Paper and wood products	0.00	0.00	-0.03	-0.05	-0.06	-0.06	-0.06	-0.05	-0.04	-0.03
Chemicals	0.00	0.00	-0.04	-0.07	-0.07	-0.08	-0.08	-0.06	-0.05	-0.03
Non-metal building products	0.00	0.00	-0.04	-0.07	-0.06	-0.06	-0.06	-0.04	-0.02	-0.01
Metal products	0.00	0.00	-0.02	-0.03	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01
Transport equipment	0.00	0.00	-0.05	-0.07	-0.06	-0.07	-0.07	-0.05	-0.04	-0.02
Machinery and equipment	0.00	0.00	-0.03	-0.04	-0.04	-0.05	-0.05	-0.04	-0.03	-0.02
Other manufacturing	0.00	0.00	-0.05	-0.07	-0.06	-0.07	-0.07	-0.05	-0.04	-0.02
Utilities	0.00	0.00	-0.02	-0.03	-0.03	-0.03	-0.03	-0.02	-0.01	0.00
Construction	0.00	0.00	-0.05	-0.08	-0.08	-0.08	-0.07	-0.05	-0.03	-0.02
Trade and accommodation services	0.00	0.00	-0.03	-0.05	-0.05	-0.05	-0.05	-0.04	-0.03	-0.02
Transport services	0.00	0.00	-0.02	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.01
Communication services	0.00	0.00	-0.02	-0.03	-0.03	-0.03	-0.02	-0.02	-0.01	0.00
Financial and business services	0.00	0.00	-0.03	-0.05	-0.05	-0.05	-0.05	-0.03	-0.02	-0.01
Dwelling services	0.00	0.00	-0.03	-0.05	-0.05	-0.06	-0.06	-0.05	-0.03	-0.02
Public services	0.00	0.00	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01
Other Services (includes waste services)	0.00	0.00	0.24	0.37	0.33	0.33	0.30	0.19	0.10	0.02

Source: MMRF-Green

Table 4.5

**REAL VALUE ADDED FOR VICTORIAN INDUSTRIES (ABSOLUTE DEVIATIONS (\$MILLION) FROM BASECASE VALUES)**

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Agriculture	0.0	0.0	-0.2	-0.4	-0.5	-0.6	-0.7	-0.7	-0.7	-0.6
Mining	0.0	0.0	-0.2	-0.4	-0.6	-0.7	-0.9	-0.9	-1.0	-0.9
Food and beverages	0.0	0.0	-0.8	-1.4	-1.5	-1.7	-1.8	-1.5	-1.3	-0.9
Textiles, clothing and footwear	0.0	0.0	-0.5	-0.9	-1.1	-1.2	-1.4	-1.2	-1.1	-0.9
Paper and wood products	0.0	0.0	-0.9	-1.7	-2.0	-2.4	-2.6	-2.4	-2.2	-1.9
Chemicals	0.0	0.0	-1.4	-2.7	-3.2	-3.7	-4.1	-3.8	-3.4	-2.8
Non-metal building products	0.0	0.0	-0.2	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.2
Metal products	0.0	0.0	-0.3	-0.6	-0.5	-0.5	-0.5	-0.4	-0.3	-0.2
Transport equipment	0.0	0.0	-1.2	-1.8	-1.7	-1.9	-1.9	-1.5	-1.3	-1.0
Machinery and equipment	0.0	0.0	-0.8	-1.4	-1.5	-1.6	-1.6	-1.3	-1.1	-0.8
Other manufacturing	0.0	0.0	-1.2	-1.8	-1.7	-1.9	-1.9	-1.5	-1.3	-1.0
Utilities	0.0	0.0	-0.2	-0.4	-0.5	-0.6	-0.7	-0.7	-0.6	-0.5
Construction	-0.1	0.0	-3.6	-5.9	-5.8	-5.9	-5.7	-4.2	-2.9	-1.6
Trade and accommodation services	-0.1	0.0	-4.3	-7.6	-8.0	-8.8	-9.0	-7.5	-6.0	-4.4
Transport services	0.0	0.0	-1.0	-1.8	-2.0	-2.3	-2.5	-2.2	-2.0	-1.6
Communication services	0.0	0.0	-0.3	-0.5	-0.6	-0.6	-0.7	-0.6	-0.5	-0.4
Financial and business services	0.0	0.0	-3.3	-6.0	-6.6	-7.4	-7.8	-6.8	-5.7	-4.5
Dwelling services	0.0	0.0	-0.1	-0.8	-1.9	-2.8	-3.8	-4.6	-5.1	-5.4
Public services	0.0	0.0	-2.8	-5.0	-5.2	-5.6	-5.7	-4.6	-3.6	-2.5
Other Services (includes waste services)	0.1	0.0	4.1	6.2	5.3	5.4	5.1	3.3	2.1	0.8

Source: MMRF-Green

Table 4.6

**EMPLOYMENT FOR VICTORIAN INDUSTRIES (ABSOLUTE DEVIATIONS (THOUSAND PERSONS) FROM BASECASE VALUES)**

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food and beverages	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0
Textiles, clothing and footwear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paper and wood products	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0
Chemicals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-metal building products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Metal products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport equipment	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
Machinery and equipment	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0
Other manufacturing	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
Utilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
Trade and accommodation services	0.0	0.0	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.1
Transport services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Communication services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Financial and business services	0.0	0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1
Dwelling services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public services	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0
Other Services (includes waste services)	0.0	0.0	0.3	0.5	0.5	0.5	0.4	0.3	0.1	0.0

Source: MMRF-Green

#### 4.5 Supplementary Benefit–Cost Analysis

The macroeconomic modelling showed that the costs of the Strategy are likely to be multiplied throughout the Victorian economy, resulting in a small reduction in GSP and associated variables, such as aggregate consumption.

This section redoes the benefit–cost analysis by adding to the costs of the Strategy the loss of consumption that has been modelled in the GE analysis. The decrement to consumption rather than GSP is appropriate for this purpose because the objective of the benefit–cost analysis is to quantify the change in economic welfare of the Strategy. While consumption is not a perfect measure of economic welfare, it is better than Gross State Product.<sup>14</sup>

Tables 4.7, 4.8 and 4.9 show the NPV of benefits and costs of the Strategy, when the costs are augmented by the decrement to consumption. It can be seen that the benefit–cost ratio still exceeds one in the moderate value and high value cases. However, the BCR under the low value scenario, is now less than one. This analysis is very conservative, because the GE modelling did not attempt to capture any multiplied benefits of the Strategy (such as any productivity improvements for Victorian businesses). Had it done so, then the estimated decrement to Victorian consumption would have been smaller, and the decrease in benefit–cost ratio correspondingly smaller. Indeed, if these hypothetical productivity improvements were sufficiently large, then the macroeconomic effects of the Strategy would have been positive, the estimated benefit–cost ratio would have increased.

Table 4.7

#### NPV OF BENEFITS AND AUGMENTED COSTS—MODERATE VALUE SCENARIO (\$M, 2003 PRICES)

	7.5% discount rate	3.5% discount rate
NPV Benefits	899	1193
NPV Costs	771	984
NPV Net Benefits	128	209
Benefit-Cost Ratio	1.2	1.2

Source: Allen Consulting Group analysis

<sup>14</sup> There are several reasons for this. First, purpose of economic activity is to generate consumption (broadly defined to include leisure, environmental amenity, and so on). Gross State Product is the sum of consumption of goods and services, and investment in goods and services. Investment, however, is not welfare enhancing in itself, unless it generates consumption at a later date. Second, to the extent that the funds used for the Strategy are borrowed from overseas (directly or indirectly), they will have to be paid back, with interest. The repayments will be paid out of Victoria's GSP. What is left over, will be available for consumption.

Table 4.8

**NPV OF BENEFITS AND AUGMENTED COSTS—HIGH VALUE SCENARIO (\$M, 2003 PRICES)**

	7.5% discount rate	3.5% discount rate
NPV Benefits	1143	1517
NPC Costs	662	838
NPV Net Benefits	481	679
Benefit-Cost Ratio	1.7	1.8

Source: Allen Consulting Group analysis.

Table 4.9

**NPV OF BENEFITS AND AUGMENTED COSTS – LOW SCENARIO (\$M, 2003 PRICES)**

	7.5% discount rate	3.5% discount rate
NPV Benefits	655	870
NPC Costs	926	1190
NPV Net Benefits	-271	-321
Benefit-Cost Ratio	0.71	0.73

Source: Allen Consulting Group analysis.

As discussed above, these productivity benefits are very hard to quantify, and so they haven't been modelled. What the analysis of this section does show, however, is that the overall conclusion of benefit–cost analysis, which is that the Strategy under the moderate and high value scenarios has net positive economic benefits.

## Chapter 5

# Conclusions

This Report has analysed the economic benefits and costs of the *Towards Zero Waste Strategy*, using

- a conventional benefit–cost analysis (Chapters 2, 3);
- a macroeconomic general equilibrium model of the Victorian and Australian economies (Chapter 4); and
- an augmented benefit–cost analysis, which has used as input, the results of the GE modelling.

The results of the analysis are that, in most of the scenarios examined, the Strategy has positive net economic benefits for Victoria. Under both the moderate and high value scenarios, the net economic benefits are strongly positive while under the low value scenario, the Strategy breaks even. Even when the macroeconomic costs of the Strategy are incorporated in the benefit–cost analysis, the net benefits under the moderate and high value scenarios are still positive. This is without incorporating any additional macroeconomic benefits in the analysis.

The macroeconomic effects of the costs to Victoria’s businesses of the Strategy are that there is a small drop in GSP. However, the effects are very mild. The largest effect occurs in 2008/9, when GSP is predicted to be lower by 0.07 of one per cent than it would be without the Strategy. To put some perspective on this figure, it means that the effect of the Strategy is that level of GSP that would be reached at the end of June 2009 without the Strategy, will instead be reached one week later.

The overriding conclusion is that the economic benefits of the *Towards Zero Waste Strategy* will exceed their costs.