The Allen Consulting Group

Phasing Out Light-Weight Plastic Bags

Costs and Benefits of Alternative Approaches

May 2006

Report to the Environment Protection and Heritage Council

The Allen Consulting Group

The Allen Consulting Group Pty Ltd

ACN 007 061 930

Melbourne

4th Floor, 128 Exhibition St

Melbourne VIC 3000

Telephone: (61-3) 9654 3800

Facsimile: (61-3) 9654 6363

Sydney

Level 12, 210 George St

Sydney NSW 2000

Telephone: (61-2) 9247 2466

Facsimile: (61-2) 9247 2455

Canberra

Level 12, 15 London Circuit

Canberra ACT 2600

GPO Box 418, Canberra ACT 2601

Telephone: (61-2) 6230 0185

Facsimile: (61-2) 6230 0149

Perth

Level 21, 44 St George's Tce

Perth WA 6000

Telephone: (61-8) 9221 9911

Facsimile: (61-8) 9221 9922

Brisbane

Level 11, 77 Eagle St

Brisbane QLD 4000

PO Box 7034, Riverside Centre,

Brisbane QLD 4001

Telephone: (61-7) 3221 7266

Facsimile: (61-7) 3221 7255

Online

Email: info@allenconsult.com.au

Website: www.allenconsult.com.au

Disclaimer:

While The Allen Consulting Group endeavours to provide reliable analysis and believes the material it presents is accurate, it will not be liable for any claim by any party acting on such information.

© NEPC Service Corporation 2006

Contents

Executive summary

This report has been commissioned on behalf of the Environment Protection and Heritage Council to provide a cost-benefit analysis of policy options that could be used to phase out light-weight plastic bag (LWPB) use in Australia.

Reducing LWPB use is a significant and iconic policy issue — momentum has been building for some time to see a tangible reduction. In October 2003, the Environment Protection and Heritage Council, comprising Environment Ministers from the Commonwealth, and State and Territory governments, instructed officials to commence negotiations with retailers to phase out LWPBs within five years. Action to reduce plastic bag consumption was driven by the Australian Retailers Association *Code of Practice for the Management of Plastic Bags* (the ARA Code — which was appended to the National Packaging Covenant), which has recently expired.

The National Packaging Covenant (NPC) requires brand owners over a certain size to adopt take-back and reporting provisions or to become a signatory to the NPC and develop an action plan for managing their use of packaging. For LWPBs, the 'brand owner' is considered to be the importer or manufacturer of the plastic bag or the retailer who provides the plastic bag to the customer at point of sale.

Covenant signatories who provided bags to customers were also subject to the ARA Code. This applied target obligations on major retailers that would see LWPB consumption reduced to 50 per cent of 2002 levels by the end of 2005. Other obligations applied to smaller retailers. Following the expiration of the ARA Code, it is not yet certain whether retailers will continue the initiatives that were in place to reduce LWPB consumption.

The broad pattern of LWPB use (classified and traded as high density polyethylene (HDPE) bags) for 2002 is depicted in Figure E.1. This shows LWPB consumption in Australia at that time of around 6 billion bags per year. Low-density polyethylene (LDPE) bags — the heavier carry bags typically provided by major retailers — represented a further 900 million bags consumed by shoppers.

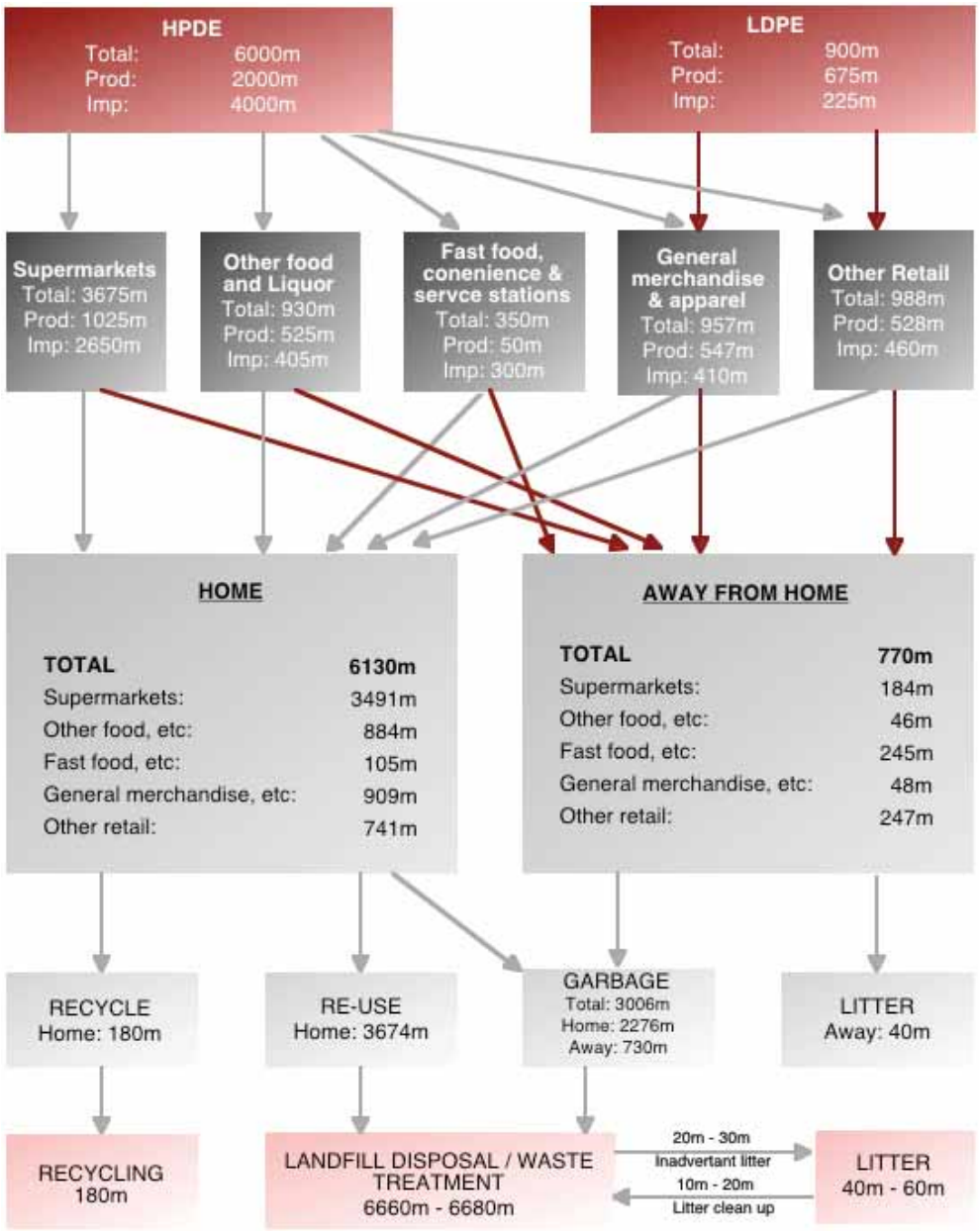
Action under the ARA Code to reduce LWPB consumption saw a range of initiatives introduced such as consumer awareness campaigns, greater availability and promotion of re-usable bags, and staff training, with a focus on point of sale communication with the customer. Obligations under the ARA Code for ongoing actions in this area expired on 31 December 2005. On current estimates, these initiatives are expected to have reduced LWPB consumption to around 4.3 billion bags per year[1] — final estimates of the reduction in LWPB use over the 2002 to 2005 period have yet to be developed.

In parallel with the 'code of practice' approach, the Environment Protection and Heritage Council also asked officials to develop advice on legislative options for achieving a phase-out objective. These options are to represent a mandatory pathway toward achieving LWPB reductions if the approach negotiated with industry did not deliver an adequate outcome.

[1] Nolan-ITU 2005, *Plastic Retail Carry Bag Use: 2002-2005 Consumption,* Melbourne, p. 7.

Figure E.1

PLASTIC BAG PRODUCTION, CONSUMPTION AND DISPOSAL, 2002



Based on: Nolan-ITU 2002, Plastic Shopping Bags — Analysis of Levies and Environmental Impacts, Melbourne, p. 9.[2]

Options for further action to achieve a phase-out of LWPBs are to be examined in the context of a subsequent regulatory impact statement.

[2] Calculating the number of bags that end up in the litter stream is complex and depends on the definitions and methodologies used. The economic modelling used here is based on a derived estimate of 40-60m littered bags. This differs from the Nolan-ITU 2002 estimate of 50-80m bags due to an alternative method used to aggregate Nolan-ITU's original inputs. The difference between these two estimates does not have a significant effect on the outcomes of the modelling.

Examination of policy options

Cost-benefit analysis of a range of LWPB phase-out policy options is presented in this study. Economic implications are examined at a national and industry level using the MMRF-Green computable general equilibrium model of the Australian economy. Economy-wide impacts of phase-out options were supplemented with analysis of flow on environmental effects.

The policy options evaluated are:

- Scenario 1 — elimination of LWPBs on 1 January 2009 (that is, an outright ban);
- Scenario 2 — no further government action;
- Scenario 3 — extension of the Australian Retailers Association *Code of Practice for the Management of Plastic Bags* (the ARA Code — which has been appended to the National Packaging Covenant);
- Scenario 4 — industry agreement to impose a gradually escalated charge, supported by co-regulatory measures;
- Scenario 5 — industry agreement to phase out LWPBs, followed by government regulation to restrict their supply;
- Scenario 6 — an outright ban on LWPBs prior to 2009;
- Scenario 7 — an advance disposal fee for LWPBs;
- Scenario 8 — retailers will be obliged (by regulation) to impose a minimum charge on every LWPB; and
- Scenario 9 — a government imposed levy on LWPBs.

In comparison to the scenario under which no further action is taken (that is, Scenario 2), all change options identified by the Environment Protection and Heritage Council produce outcomes in which the estimated economic and environmental costs exceed the benefits by substantial margins (see Table E.1).

Table E.1

SUMMARY TABLE OF ECONOMIC AND ENVIRONMENTAL COSTS AND BENEFITS IN RELATION TO SCENARIO 2

Scenario	Benefits (NPV*, $m)	Costs (NPV*, $m)	Net impact (NPV*, $m)
1. Eliminate LWPBs by 2009	$217.78	-$1057.08	-$839.30
3. Extend ARA Code	$156.34	-$646.01	-$489.67
4. Escalated charge	$266.28	-$1293.08	-$1026.80
5. Voluntary phase out to 2009, mandatory beyond	$270.61	-$1093.48	-$822.87
7. Disposal fee (cost recovery)	$181.48	-$767.95	-$586.47
8. Regulated price (kept by retailers)	$217.78	-$1035.12	-$817.34
9. Levy on LWPBs	$188.74	-$900.03	-$711.29

*Net Present Value (NPV)
Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum. Further detail about the methodology is provided in Appendix B and Appendix C.

This consistently negative outcome — ranging from $45 million to $85 million a year (consistently less than 0.02 per cent of gross domestic product, and equivalent to a net cost of around $5.80 to $11.00 per household per year) across the different scenarios — is:

- due to the fact that the environmental benefits of the different options are driven by reductions in the less than one per cent of LWPBs that are littered annually, and not by the overall consumption of LWPBs;
- driven by the adjustment costs faced by retailers, including increased transaction times, staff training and expenditure on in-store education and promotion, in relation to the situation in which there is no further action, and the ARA Code is no longer adhered to; and;
- relatively insensitive to alternative implementation dates and alternative discount rates.

The three lowest cost options are:

- Scenario 2 (which is not explicitly shown in Table E.1) — this scenario represents a baseline or 'inaction' scenario in which the ARA Code is no longer followed and no further government action is taken. Modest administrative savings are associated with this outcome, but LWPB usage and associated environmental damage costs grow unabated (that is, in the period from 2005 to 2016 an estimated 59.3 billion LWPBs will enter the waste stream and an additional 515.8 million will persist as litter).
- Scenario 3 — under this scenario LWPBs are not fully eliminated, because retailers are subject to ongoing suasive pressure through continuation of the ARA Code, and it is assumed that LWPB consumption will remain constant as a proportion of retail sales. Commensurate growth in the number of LWPBs in the waste stream, and consequential environmental damage effects, explain the lower net environmental benefits associated with this approach. It is less costly, but it also achieves less.

- Scenario 7 — this is also a lower cost option, and also does not eliminate all plastic bags. However, this option depicts a bag levy designed to recoup the cost of a litter elimination campaign in which LWPBs are successfully removed. A litter campaign funded to a level of over $300 million (and rising through time) focussing exclusively on the collection of LWPB's is assumed to achieve this purpose. This represents an effective 'bounty' of about $0.50 per littered LWPB, and an expenditure level about 50 per cent higher than the total amount currently spent on all public litter collection in Australia.

The other scenarios depicted achieve elimination of LWPBs, but at higher levels of economic cost and with only a moderate additional environmental benefit. This reflects the fact that less than one per cent of LWPBs arise as litter[3], the rest are disposed of in landfill. The calculations represented here reflect the costs of eliminating ninety-nine LWPBs to get at the one that is the principal cause of environmental damage.

The dominance of economic costs over environmental benefits is likely to be insensitive to changes in the estimate of environmental damages arising from discarded LWPB. In this study, an environmental benefit of $1.00 per LWPB removed from the national litter stream was assumed — based on the value of voluntary effort invested in the 'Clean Up Australia' campaign and a significant scaling factor. There is reason to believe that this is a generous treatment.

Setting the social impact aside, the environmental damage attributable to an LWPB would need to be around $2.50 (in net present value (NPV) terms) for each of the LWPB elimination policy options to break even. Inclusion of net greenhouse reduction benefits does not significantly alter this result.

Based on the environmental estimates calculated in this report, the additional 'social' benefit (needed to fill the NPV 'gap') per bag eliminated from the litter stream as a result of these policy options would need to be around $2.00, or be in excess of $0.02 for each of the tens of billions of bags expected to be consumed — but forgone as a result of these measures — over the next decade.

Reflecting the tradeoffs between the economic costs and the environmental benefits, Figure E.2 shows the impacts modelled for the various scenarios, with the clear implication that the efficiency frontier (that is, the options that represent the most efficient tradeoffs) is made up of Scenarios 3, 7 and 5.

The approximately 4182[4] supermarkets in Australia in 2004-05 would need to meet their obligations under the policy options at a cost of less than around $12 000 a year in order to break even with the maximum possible environmental benefit of $50 million a year — to say nothing of the administrative and regulatory costs incurred by jurisdictions, or the costs faced by the plastic products manufacturing industry.

[3] Nolan ITU 2002, *Plastic Shopping Bags — Analysis of Levies and Environmental Impacts*, Melbourne, p. 9.

[4] IBIS World 2005, G5111 — *Supermarkets and other grocery (except convenience) stores in Australia,* http://www.ibisworld.com.au/industry/keystatistics.asp?industry_id=1834, accessed on 15 February 2006.

Despite the estimated net costs associated with the abolition of LWPBs, a change in social behaviour can be achieved by imposing a relatively modest fee on LWPBs, allowing consumers to benefit from investing in a re-usable bag, and reducing the incidence of transactions in which a consumer accepts an LWPB without thought, and subsequently discarded without thought. This report also highlights that in a situation where a consumer can reduce their grocery bill by rejecting a LWPB, re-usable carry bags represent a remarkably cost effective investment.

Clearly, there is merit in pursuing policies that reduce waste and profligate use of scarce resources within our society. There appears to be widespread recognition of an over-consumption problem associated with LWPBs, and support for policies that reduce their use. However, it remains an open question as to whether the non-quantified social benefits associated with the elimination of LWPBs would be sufficient to justify the significant net costs identified in this study.

Given this uncertainty, and the government and industry commitment to phase out single use LWPBs, Table E.2 shows a ranking of the identified *change* scenarios (that is, not including the 'no further action' scenario) against a number of alternative criteria. The scenarios are ranked — with 1 as the strongest ranking and 7 as the weakest — based on the extent to which they minimise costs, the extent to which they maximise benefits, and the extent to which they maximise the benefit per dollar of cost incurred.

Figure E.2

THE RELATIONSHIP BETWEEN ECONOMIC AND ENVIRONMENTAL COSTS UNDER VARIOUS SCENARIOS

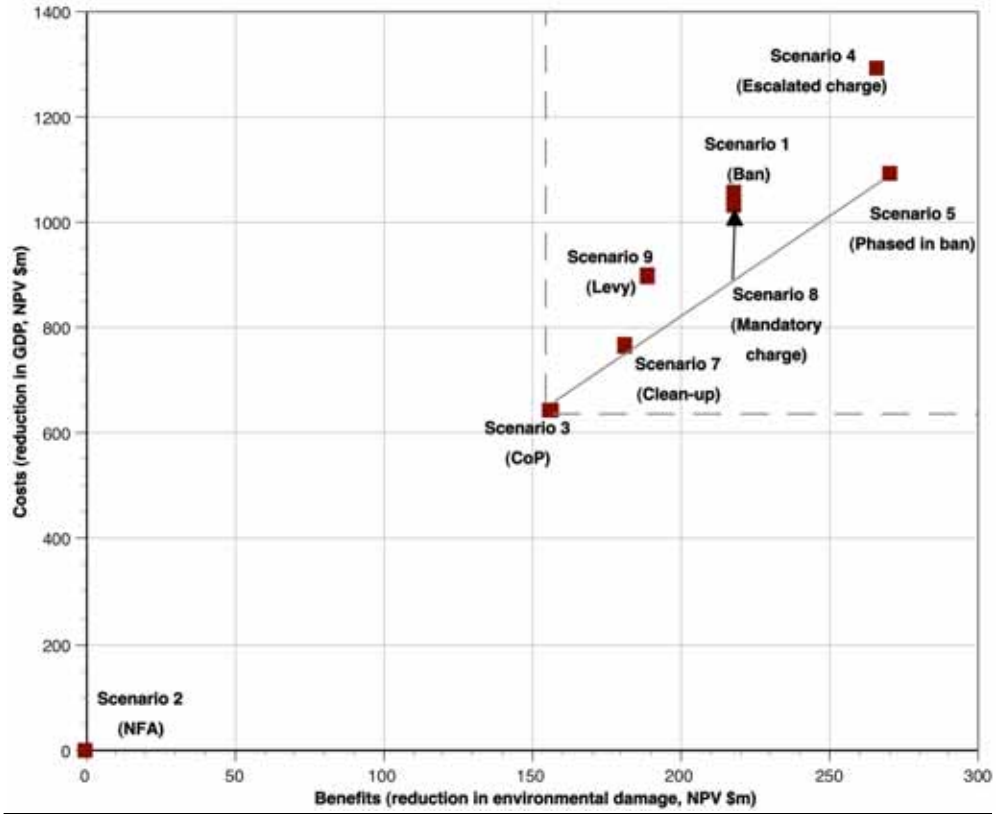


Table E.2

SUMMARY TABLE OF ECONOMIC AND ENVIRONMENTAL COSTS AND BENEFITS

Scenario	Costs (PV, $m)	Benefits (PV, $m)	Litter reduction (millions)	Maximise Benefits	Minimise Costs	Maximise benefit: cost ratio
1. Eliminate LWPBs by 2009	-$1057.1	$217.8	360.6	3	5	6
3. Extend ARA Code	**-$646.0**	$156.3	233.2	**7**	***1***	**2**
4. Voluntary charge	-$1293.1	$266.3	418.4	2	7	7
5. Voluntary phase out to 2009, mandatory beyond	-$1093.5	$270.6	422.4	***1***	6	***1***
7. Disposal fee (cost recovery)	-$767.9	$181.5	300.5	6	2	3
8. Regulated price (kept by retailers)	-$1035.1	$217.8	360.6	3	4	4
9. Levy on LWPBs	-$900.0	$188.7	312.5	5	3	5

As there is no single identified policy scenario that is clearly superior, it is useful to highlight some key characteristics that can act as navigation points for the development of an efficient and effective policy for reducing the environmentally adverse and socially undesirable implications of LWPBs. These are:

- the implied 'free' status of LWPBs generates no incentive for consumers to reduce their use of these items;
- consumption of LWPBs falls off significantly at modest prices;
- re-usable bags are a highly cost effective alternative to LWPBs, but consumers cannot pocket this benefit if the cost of LWPBs continues to be spread across the cost of groceries and other goods;
- consumers will continue to face circumstances where a LWPB is an efficient option for their carrying needs (for example, to carry refrigerated products, for impulse purchases, etc); and
- environmental benefits flow from reductions in littered bags.

These findings, supported by the comparison of the identified scenarios, suggest that a price-based approach is likely to be considerably more cost-effective than a ban in circumstances where it allows for residual bag use. That is, when a price is used to drive a significant reduction in bag consumption but allows those consumers who put a high value on LWPBs to continue to access them.

Chapter 1

Introduction

Light-weight plastic bags (LWPBs) have become ubiquitous in Australian society. They are a convenient means of bundling and carrying a miscellany of food, hardware and grocery items, and are provided at no charge to customers by thousands of supermarkets, smallgoods and fast food outlets. They have been designed as a single use item, and perform that function well. Around 60 per cent of LWPBs are re-used as bin-liners or waste bags, but ultimately, more than 95 per cent of all LWPBs end up in landfill.[5] Another 2 to 3 per cent are recycled, while the others decorate the landscape as litter or find their way into waterways and other ecosystems.

In 2002, Australians are estimated to have consumed around 6 billion LWPBs,[6] however, concerted efforts by governments and retailers to discourage LWPB consumption have seen current demand drop to about 4.3 billion units in 2005[7] — equivalent to about 24 425 tonnes of material and tens of millions of dollars worth of resources and production.

For many, single-use plastic bags have become symbolic of our 'disposable' society, flagrantly chewing through Earth's finite resources. Yet, few would deny the service they perform and the need for this function to be maintained, but in a way that is more sustainable and cost effective.

1.1 The ongoing policy context

The issue of reducing LWPB use is important to policymakers, and momentum has been building for some time to see a tangible reduction. In October 2003, the Environment Protection and Heritage Council, comprising Environment Ministers from the Commonwealth, and State and Territory governments, instructed officials to commence negotiations with retailers to phase out LWPBs within five years. The Council also asked officials to develop advice on legislative options for achieving this objective. These options are to represent a mandatory pathway toward achieving LWPB reductions if the approach negotiated with industry did not deliver an adequate outcome.

Action to reduce plastic bag consumption was driven by the Australian Retailers Association *Code of Practice for the Management of Plastic Bags* (the ARA Code — which was appended to the National Packaging Covenant), and expired at the end of 2005.

The National Packaging Covenant (NPC) requires brand owners over a certain size to adopt take-back and reporting provisions or to become a signatory to the NPC and develop an action plan for managing their use of packaging. For LWPBs, the 'brand owner' is considered to be the importer or manufacturer of the plastic bag or the retailer who provides the plastic bag to the customer at point of sale.

[5] Nolan-ITU 2002, *Plastic Shopping Bags — Analysis of Levies and Environmental Impacts,* Melbourne, p. 6.

[6] Nolan-ITU 2005, op. cit. , p. 7.

[7] Ibid.

Covenant signatories who provided bags to customers were also subject to the ARA Code. This applied target obligations on major retailers that would see LWPB consumption reduced to 50 per cent of 2002 levels by the end of 2005. Other obligations applied to smaller retailers. Following the expiration of the ARA Code, it is not as yet certain whether retailers will continue the initiatives that were in place to reduce LWPB consumption.

To date, action under the ARA Code to reduce LWPB consumption has seen a range of initiatives introduced such as consumer awareness campaigns, greater availability and promotion of re-usable bags and staff training, with a focus on point of sale communication with the customer. Obligations under the ARA Code for ongoing actions in this area expired on 31 December 2005.

Government officials and key industry stakeholders are developing a draft agreement to further phase out LWPBs between 2006 and 2008. Ministers noted the draft agreement and the advice on legislative options at their 1 July 2005 meetings and that the draft agreement would be finalised during August and September 2005. Options for further action to achieve a phase-out of LWPBs are to be examined in the context of a subsequent regulatory impact statement.

1.2 This report

This report has been commissioned by the Environment Protection Heritage Council to provide a cost-benefit analysis of the following nine key policy options for the post-2008 period:

- Scenario 1 — elimination of LWPBs from 2009;
- Scenario 2 — no further government action (used as the 'base case' in this study);
- Scenario 3 — extension of the ARA Code;
- Scenario 4 — industry agreement to impose a gradually escalated charge, supported by co-regulatory measures;
- Scenario 5 — industry agreement to phase out LWPBs, followed by government regulation to restrict their supply;
- Scenario 6 — a stand-alone ban on LWPBs;
- Scenario 7 — an advance disposal fee for LWPBs;
- Scenario 8 — retailers will be obliged (by regulation) to impose a minimum charge on every LWPB; and
- Scenario 9 — a government imposed levy on LWPBs.

Assessment of the costs and benefits associated with these scenarios has been undertaken in a 'triple bottom line' context. That is, giving explicit recognition to economic, environmental and social impacts.

Conceptually, triple bottom line analysis allows direct comparison between scenarios based on their economic, social and environmental implications. This increases transparency, but complexity also increases, there can be disagreement about the relative importance of some indicators (and even whether their contribution to the bottom line is positive or negative). Social effects can be particularly prone to these problems.

To ensure comparability within the triple bottom line framework, outcomes have been quantified and valued where this has been considered feasible:

- for economic and environmental impacts, enough is known about the production, use and disposal of LWPBs in Australia to develop modelling tools for the analysis of economic income, welfare and environmental effects; but
- the social implications of different policy scenarios are more problematic from a valuation perspective and so are considered separately in section 5.3. These represent an 'x-factor' that, while difficult to quantify, should nevertheless enter the decision framework of policy makers. The implicit or judged values attributed to these factors by policy makers, weighed alongside empirical results, can help identify an appropriate ranking for policies — or at least the value that would need to be attributed to 'social' impacts for one policy option to come to dominate another on the basis of relative costs and benefits.

Analysis of the costs and benefits of alternative approaches to phasing LWPBs in Australia is presented in the following chapters:

- Chapter 2 provides an overview of current LWPB usage patterns in Australia and their significance in output and consumption patterns for various stakeholders. Production, use and disposal of plastic bags are significant issues for households and industry, and the implications of an induced bag reduction will depend on the nature and extent of activities stimulated by this change.
- Chapter 3 outlines how various key stakeholder groups — that is, manufacturers, retailers, government, consumers and the environment — are likely to be affected by a reduction in LWPB consumption.
- In Chapter 4 the nine policy scenarios are outlined, along with the assumptions used for broader consideration of the initial impacts on industry, households, government and the environment. Using a general equilibrium model of the economy, the flow-on impacts associated with these first-round impacts are identified, as well as the benefits of the various scenarios on litter reduction (that is, impacting on issues such as aesthetics and wildlife).
- Chapter 5 discusses wider implications and variations on these scenarios in the context of a sensitivity analysis. The likely impacts of changes in policy timing are examined, as are the implications of inducement and behavioural issues that can affect the practicality of policy approaches in an applied environment.
- Conclusions are presented in chapter 6.

This report examines the costs and benefits of alternative approaches to reducing the consumption of LWPBs in Australia. This cost-benefit analysis will form part of a regulatory impact statement for consideration by governments.

Chapter 2

Light-weight plastic bag usage

As background on the scale and nature of the challenge of phasing out LWPBs, this chapter provides an overview of current LWPB usage patterns in Australia and their significance in output and consumption patterns.

The most recent and comprehensive study of plastic bag consumption in Australia was conducted in 2002, finding that Australians consumed approximately 6.9 billion plastic bags, 6.0 billion of which were single use, LWPBs — see Figure 2.1.[8]

The use of single use LWPBs was reduced by nearly one third between 2002 and 2005, falling from 6.0 billion to 4.3 billion bags.[9] This reduction can be attributed in part to the introduction and up-take of the ARA Code. There is little data on the number of plastic bags consumed in Australia prior to the introduction of the ARA Code but it is generally thought that the number of plastic bags was steadily increasing.

Of the different sorts of retailers, supermarkets were by far the greatest users of LWPBs made from high-density polyethylene (HDPE), accounting for 3.5 billion in 2002. Of the other types of retailers that used only the HDPE plastic bags, 'other food and liquor' retailers had the next greatest usage (930 million) followed by fast food outlets, convenience stores and service stations (350 million). The thicker, printed and more easily recycled low-density polyethylene plastic bags were restricted in use among 'general merchandise and apparel' retailers and miscellaneous 'other retailers'. These two sectors used 957 million and 988 million plastic bags respectively — a combination of HDPE and low-density polyethylene (LDPE) plastic bags.

Of the HDPE and LDPE plastic bags consumed in 2002, 6.1 billion were used to carry items home from the shops, while the remaining 770 million were used to carry items to locations away from home. Bags that were carried home were more likely to be re-used or recycled than bags that were used away from home that tended to end up:

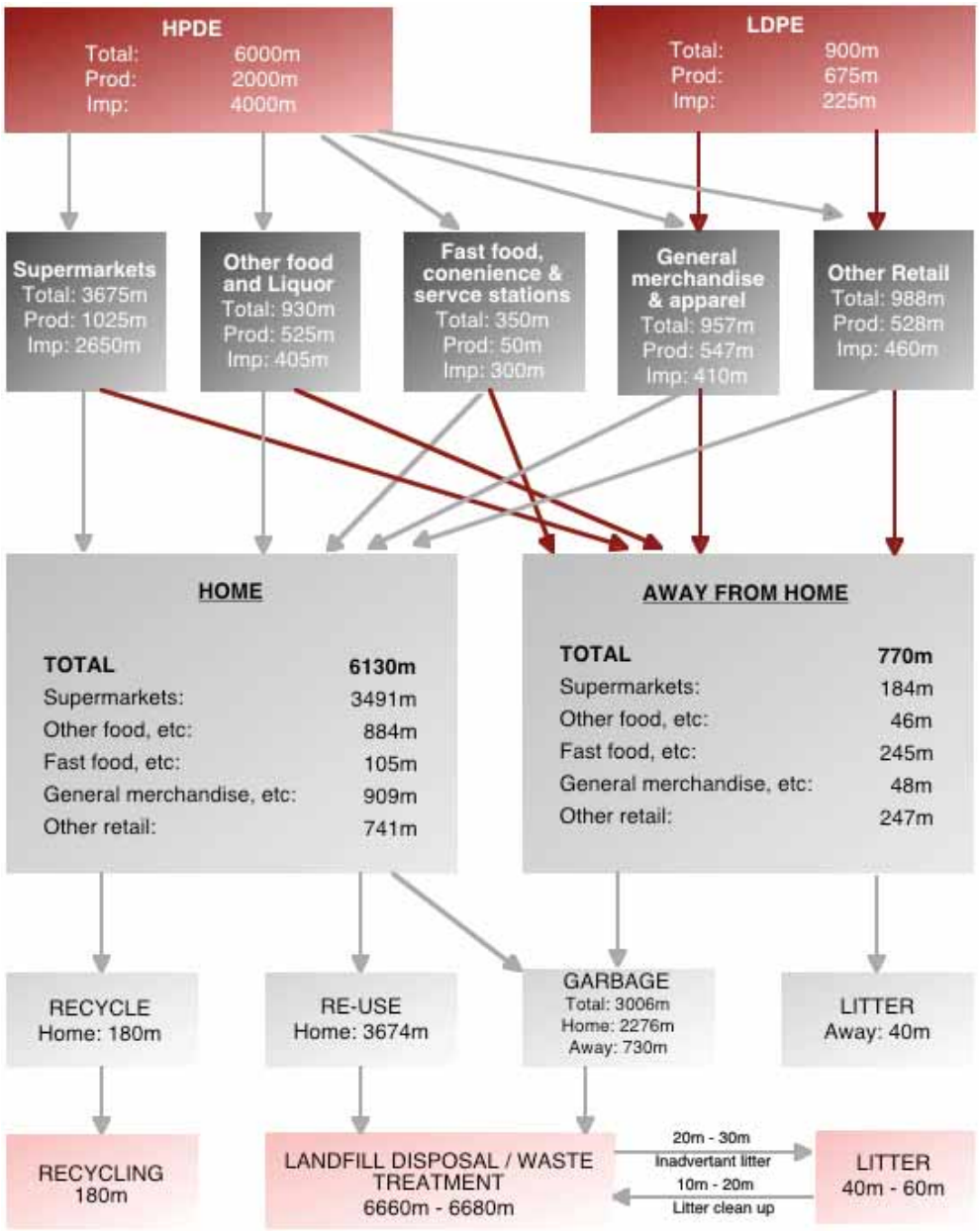
- in the garbage, and subsequently the landfill; or
- in the litter stream.

[8] Nolan-ITU 2002, *Plastic Shopping Bags — Analysis of Levies and Environmental Impacts,* Melbourne, p. 9.

[9] Nolan-ITU 2005, op.cit., p. 7.

Figure 2.1

PLASTIC BAG PRODUCTION, CONSUMPTION AND DISPOSAL, 2002



Based on: Nolan-ITU 2002, *Plastic Shopping Bags — Analysis of Levies and Environmental Impacts*, Melbourne, p. 9.[10]

[10] Calculating the number of bags that end up in the litter stream is complex and depends on the definitions and methodologies used. The economic modelling used here is based on a derived estimate of 40-60m littered bags. This differs from the Nolan-ITU 2002 estimate of 50-80m bags due to an alternative method used to aggregate Nolan-ITU's original inputs. The difference between these two estimates does not have a significant effect on the outcomes of the modelling.

Some of the major supermarket chains have established a plastic bag 'return recycling' scheme, where drop-off bins are provided for shoppers to return used, unwanted bags. The scheme relies on HDPE bags being collected separately to all other recyclables. It is estimated that in 2002, 1000 tonnes (approximately 180 million bags) were recycled through these drop-off bins, achieving a recycling rate of approximately 2.7 per cent. The majority of bags are exported for reprocessing, whilst about 50 tonnes were reprocessed in Australia, with the reprocessed material used in pipe manufacture. LWPB recycling via kerbside collection is limited to only a few council areas in South Australia. In all other areas, any plastic bags placed in the kerbside recycling stream are disposed to landfill.

The overwhelming majority of plastic bags ended in landfill (97.1 per cent) — including those that were re-used. Around 180 million bags were returned for recycling, with the remaining 40 million bags ending in the litter stream. It was estimated that volunteers and other litter collectors were able to retrieve between 10 and 20 million bags that were initially littered and send them to landfill. Conversely, due to the lightness of the plastic bags, between 20 and 30 million of the plastic bags that were destined for landfill are estimated to have blown away — on the way to, or from — the landfill sites. These bags enter the litter stream once more, meaning that the number of bags released into the litter stream — whether it is due to thoughtless disposal, or inadvertent litter — ranges from 40 to 60 million bags.[11]

[11] This estimate based on analysis of plastic bag 'flows' represented in the Nolan ITU (2002) report. That report provides an aggregate litter estimate of 50-80 million bags — apparently based on an assumption of a constant number of bags retained in landfill.

Chapter 3

Stakeholder perspectives on carry bags

This chapter provides an overview of responses likely to be triggered by government action to put further pressure on LWPB use. Identifying the responses and 'fall back' positions of these stakeholders as they respond to policy action on LWPBs is fundamental to estimating the likely costs and benefits associated with particular scenarios.

3.1 Manufacturers

The single-use LWPBs provided by retailers in Australia are predominantly imported. Approximately one third of LWPBs are produced domestically, and around 90 per cent of this production is concentrated in Victoria. In line with the reduction in the consumption of LWPBs, there has also been a reduction in both the production and import of LWPBs in Australia.[12]

There are a number of alternatives to LWPBs, with substitutes made out of paper, cloth and thicker plastic coming onto the market in recent years. In addition to the alternatives available to substitute for the primary purpose of LWPBs (to carry good home from the shops), households also re-use the LWPBs to collect rubbish, or as a liner for their rubbish bins. A reduction in the demand for LWPBs would not only see an increase in the demand for different types of bag, but also for bin-liners. The estimated rate of substitution is equivalent to one bin-liner demanded for every seven plastic bags foregone.[13]

Official data on economic activity in Australia's manufacturing industry do not recognise a 'bag' (or 'bin-liner') industry, and as such the impact of a decrease in the consumption of plastic bags would register in the plastic product manufacturing, paper products manufacturing, and textiles industry. As a result, reduction in demand for LWPBs would lead to a reduction in the output of the 'plastic and rubber products manufacturing' industry, offset to some extent by the increase in demand for plastic bin-liners.

Reduced demand for LWPBs could have a mixed impact on Australia's balance of trade:

- The re-usable bags are currently fully imported from manufacturers in Asia. In spite of demand for re-usable bags increasing, it is anticipated that domestic manufacturers would not be able to meet the prices of overseas suppliers for re-usable bags. While there may be a niche market for a specialty or boutique re-usable bag that could be met by Australian domestic manufacturers, it is anticipated that in the main, domestic producers will not manufacture enough re-usable bags to have a significant impact on the composition of supply.

[12] Nolan ITU 2005, op.cit., p. 3.

[13] J. Cadman, S. Evans, M. Holland, R. Boyd and AEA Technology Environment 2005b, *Proposed Plastic Bag Levy - Extended Impact Assessment Final Report, Volume 2: Appendices*, Environment Group Research Report 2005/06 for the Scottish Executive, Edinburgh, p. 21.

- With respect to paper bags, the simple, low-cost paper alternative to an LWPB is currently produced domestically, and it is anticipated that an increase in the demand for this paper substitute can be fully met by domestic producers.

Aside from manufacturers, there are also importers — organisations that purchase the re-usable bags from off-shore and then sell them to retailers. Following the introduction of the ARA Code, Australian consumers have replaced around 2 billion LWPBs with an estimated 10 million re-usable bags[14], mostly imported from China. Each re-usable bag has an estimated value of $0.65[15], which would have generated around $6.5 million worth of turnover for re-usable bag importers.

3.2 Retailers

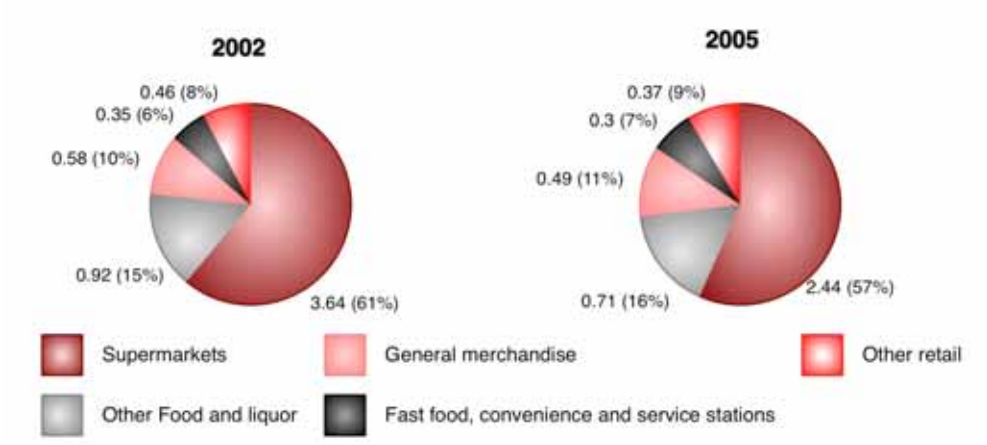
There are a number of plastic bag substitutes readily available to consumers at a range of different types of stores:

- major supermarkets have made available substitutes to LWPBs such as heavier weight plastic bags that are easier to recycle, and the green polypropylene re-usable bags. Some supermarkets have calico and paper substitutes for plastic bags, but these are more rare; and
- department stores, and smaller, specialised retailers tend not to use the LWPBs, preferring instead the thicker, printed plastic bags. Department stores are starting to offer re-usable bags as a plastic bag alternative, and several of the smaller, specialised retailers offer paper or cloth bags — in some cases as an alternative, and in others as their bag of choice.

Figure 3.1 shows the reduction in the use of plastic bags by retailers between 2002 and 2005. The supermarket sector has not only reduced its overall use of LWPBs by 33 per cent, but has also reduced its usage as a proportion of total LWPBs provided by retailers. This supports the assertion that it is the larger supermarket chains that are making the greatest effort to comply with the ARA Code.

Figure 3.1

RETAIL SERVICES INDUSTRY USE OF PLASTIC BAGS, 2002 AND 2005



Source: Nolan ITU 2005, *Plastic Retail Carry Bag Use: 2002-2005 Consumption*, Melbourne, p. 7.

[14] C. Long 2005, 'Who is making money out of Enviro carry bags?', *The Age (Money)*, 4 August, p. 13.

[15] Ibid.

Manufacturers are the first sector when considering the supply chain for LWPBs, but it is the retail sector that is the first to incur costs with respect to implementing the policy options, and — in passing on these costs — the sector that drives the impacts to the other stakeholders. There are a number of costs that are almost always associated with a change in regulatory arrangements. These include:

- initial set-up costs, such as modifying the equipment at the check-out to cater for different types of bags, and providing training for all employees to ensure that they understand and comply with the regulation;
- on-going administrative costs associated with reporting or auditing; and
- expenditure on in-store education and promotion aimed at encouraging consumers to consider alternatives to plastic bags.

In addition to these costs, the retail sector is also likely to incur indirect costs related to:

- an increase in the average time taken to complete a transaction at the check-out, due to the introduction of less efficient alternatives to LWPBs; and
- a one-off increase in the incidence of theft. In Ireland a survey of retailers indicated that the incidence of theft was higher after the introduction of a €0.15 'PlasTax' levy on LWPBs, but eventually returned to pre-PlasTax proportions.[16] As noted by one observer: 'In the first few months after the bag tax was introduced in Ireland, shoppers were seen carrying their groceries out in their jumpers, a lot of wire baskets went missing, and it is safe to assume that the fate of the turtles was a very long way from everyone's minds'.[17]

Retailers spend an estimated $173 million a year on plastic bags that are provided to consumers 'for free'.[18] While customers are not directly charged for plastic bags, the cost of providing the bags is worked into the retail mark-up on goods sold. Subsequently, there is no benefit to the retail services sector from no longer having the option of providing plastic bags, as it is the household sector that ultimately pays for them.

Presently, there is a range of alternatives to plastic bags, and an even greater variety of prices associated with them:

- the price of the re-usable, non-woven polypropylene bags ranges from $1.80 for a bag to nothing — where bags are given away with purchases or as part of promotional activity; and
- there is also little clarity on what the mark-up on re-usable bags might be. Once more, there is a range of estimates; 'green' re-usable bags retail for $0.99 each, and it is estimated that they cost retailers approximately $0.65. However,

[16] J. Cadman, S. Evans, M. Holland, R. Boyd and AEA Technology Environment 2005b, *Proposed Plastic Bag Levy - Extended Impact Assessment Final Report, Volume 2: Appendices*, Environment Group Research Report 2005/06 for the Scottish Executive, Edinburgh, p. 8.

[17] *Guardian* 2002, 'Plastic planet', 17 October, http://www.guardian.co.uk/waste/story/0,12188,813364,00.html.

[18] Planet Ark Environmental Foundation 2005, Plastic check-out bag use in non-supermarket retail outlets, http://www.deh.gov.au/settlements/publications/waste/plastic-bags/planet-ark/key-results3.html, Accessed 25 November 2005.

several stores donate $0.10 from each bag sold to charities or environmental initiatives such as Planet Ark, Clean Up Australia or Landcare.[19]

It is quite likely that retailers could profit from the sale of re-usable bags, particularly if they are one of the only alternatives available to consumers. However, it is equally likely that current retailer policy on bags reflects a set decision designed to service customer needs and maximise retailer profits. The extent to which this is the case depends on the knowledge that retailers have of the costs and benefits of LWPBs and their alternatives. As shown in Box 3.1, individual views vary considerably.

3.3 Government

Designing, introducing and implementing a regulatory intervention introduces costs to governments, as well as to the stakeholders whose behaviour the regulation is intended to affect. All of these costs can be controlled or minimised to some extent, but there is a trade-off against the effectiveness of the regulation. A policy to reduce the demand for LWPBs will be ineffective in achieving its objective if it is not properly enforced, or if no appropriate penalties exist for failure to comply. Much like the retail services industry, the government sector likely faces a one-off, initial set-up cost, followed by a stream of implementation costs.

These costs need to be justified not only within the context of the net benefit they are expected to achieve, but also within the context of whether it is necessary for the government to intervene. So far, government has relied on the retail services industry to self-regulate, with mixed results:

- of signatories to the ARA Code:
  - self-regulation has been relatively successful among the larger retailers. Compliance with the ARA Code required that major retailers that are signatories to the Code halved their supply of LWPBs between 2002 and 2005. Only supermarkets — categorised as 'Group One' retailers under the ARA Code — were committed to this target, and their reporting suggests that they will have achieved a reduction of at least 38 per cent by December 2005;[20]
  - Group Two signatories were from the non-supermarket segment of the retail services sector. Signatories to the ARA Code from Group Two made up a very small percentage of the non-supermarket sector, which in total, is responsible for up to 47 per cent of the LWPBs supplied. Additionally, many of these signatories were not able to report accurately on their use of bags;
- the ARA Code only addressed the conduct of a small percentage of the total number of retailers. Indeed, it is estimated that tens of thousands of the 200 000 non-supermarket retailers in Australia are not members of *any* industry association. For example, a recent survey commissioned by the Commonwealth Department of the Environment and Heritage found that:

[19] C. Long 2005, 'Who is making money out of Enviro carry bags?', *The Age (Money)*, 4 August, p. 13.

[20] Nolan-ITU 2005, op. cit., p. 8.

62 per cent of the retailers who took part in our survey could not confirm whether they were members of an industry association or not. Additionally, some of the industry associations we spoke to don't represent all of the retailers in their category. One industry body confidentially told Planet Ark that they do not even have the resources or the means to contact most of their members. This could explain the lack of retailer awareness about the ARA agreement to reduce HDPE plastic bag use by 50 per cent by the end of 2005. Despite extensive publicity about the agreement, 47 per cent of the retailers we questioned did not know about it.[21]

Box 3.1

COSTS ASSOCIATED WITH ALTERNATIVE BAGS — DIFFERENCES IN PERCEPTION BETWEEN RETAILERS AND SUPPLIERS

In March 2005, Planet Ark conducted a survey of retailers and of distributors of plastic bag alternatives. The survey identified that there are several information asymmetries (that is, differing levels of understanding/information) between retailers and LWPB distributors.

For example, of the retailers surveyed:

- Thirty-five of the 129 retailers questioned (27 per cent) do not currently provide any plastic bag alternatives for customers. 21 of these 35 retailers (60 per cent) are now thinking of offering plastic bag alternatives in their outlets.
- Cost was the major obstruction factor stated by 40 per cent of these 35 retailers, for holding their company back from using re-usable bags.
- Fourteen per cent of the 35 retailers stated that having to order a minimum quantity of re-usable bags was a reason for not stocking re-usable bags. A similar number said their not knowing any re-usable bag suppliers was another reason.
- From the 35 retailers that do not provide any plastic bag alternatives for their customers, 51 per cent of them stated that cost was the main reason for primarily using plastic bags, 46 per cent said it was habit (that is, "it's just the way we have always done things") and 43% said convenience was a reason why they currently primarily use plastic bags.

Of the distributors surveyed, it was found that:

- All distributors surveyed stated that all plastic bag alternatives, such as degradable, paper, calico and non-woven polypropylene bags, have minimum order numbers that are well within the reach of small retail outlets.
- When it came to non-woven polypropylene bags, one distributor had no minimum order, three only required ten bags to be ordered and one required a 50 bag order.
- When it came to calico bags, two distributors had no minimum order and another only required an order of ten bags.
- When it came to paper bags, two distributors stated that 10 was the minimum order and another said it was 500.
- When it came to degradable bags, one distributor didn't have a minimum number of bags that needed to be ordered. Two out of the 7 distributors said that 1000 degradable bags were the minimum order. Only 1 out of the 7 distributors surveyed stated that 2000 degradable bags was the minimum order for their business.

Examples like this, made it all too apparent that the job of buying plastic bag alternatives and implementing a plastic bag policy was often done by executives who had no prior experience of carrying out such a strategy. Indeed, our research showed that 83 per cent of retailers we spoke to did not have an Environment Manager — an ideal person to oversee a plastic bag reduction strategy.

Retailers also need to be educated in the types of plastic bag alternatives that are available to them. The fact that degradable bags are the most popular option that retailers would think about stocking in their outlets (above all other plastic bag alternative options), indicates that retailers want the cheapest and most convenient alternative to single-use plastic bags.

Source: Planet Ark Environmental Foundation 2005, Plastic check-out bag use in non-supermarket retail outlets, http://www.deh.gov.au/settlements/publications/waste/plastic-bags/planet-ark/key-results3.html, Accessed 25 November 2005

[21] Planet Ark Environmental Foundation 2005, op. cit.

Given that take-up of the self-regulatory measures by retailers has not been complete, and that there is considerable incentive for small and medium retailers to free-ride off the efforts of the larger retailers, this could justify a role for government in providing information and mandating a co-ordinated approach to either phasing out or reducing the consumption of LWPBs.

The benefits to the government sector vary depending on the policy option chosen. If a levy or an 'advance clean-up fee' is implemented, the government receives increased revenue from this, net of monitoring and administration expenses, and the revenue can be allocated to litter clean-up, increased education and awareness about the impacts of litter, or improving infrastructure with respect to recycling and collecting LWPBs or their substitutes for recycling.

In cases where no revenue directly accrues to the government, the reduction in litter associated with the reduced use of LWPBs reduces the costs of LWPB litter collection or, to look at it from another angle, increases the relative proportion of already allocated funding for collecting non-LWPB litter.

Of course, 'government' in this section aggregates all 3 levels of government, and costs and effort can be attributed to all. State and local government contributions are particularly important to policy coordination and litter reduction efforts.

3.4 Consumer impacts

Prior to the introduction of the ARA Code in 2002, retailers only provided their consumers one or two types of bag with their purchases. As shown in Figure 2.1, this option was usually a LWPB. Since the ARA Code was introduced, the larger retailers not only started to provide consumers with a number of alternatives to the LWPB at the check-out (as discussed in section 3.2), but they trained check-out staff to ask customers if they require a bag with purchase before packing the goods.

This is not to say that consumers had no choice in the matter prior to 2002. Consumers have always had the option of:

- taking their own bags when shopping and asking that their goods be packed in these bags, rather than avail themselves of the bags provided by retailers; and
- advising check-out staff that they do not require a bag with purchase, without having to be asked directly.

Part of the reason that relatively few consumers exercised these options prior to the introduction of the ARA Code is because they are not directly charged for the cost of plastic bags. While consumers pay for plastic bags, the do so via a mark up in grocery prices rather than through an explicit price. As a result the cost of bags is not 'front-of-mind'. Perhaps more importantly, for those who *are* aware of the cost of plastic bags, there is no opportunity to 'opt out' of paying for plastic bags. Households are estimated to indirectly spend around $10 to $15 on LWPBs in a year,[22] yet customers who refuse plastic bags are not able to recoup this value.

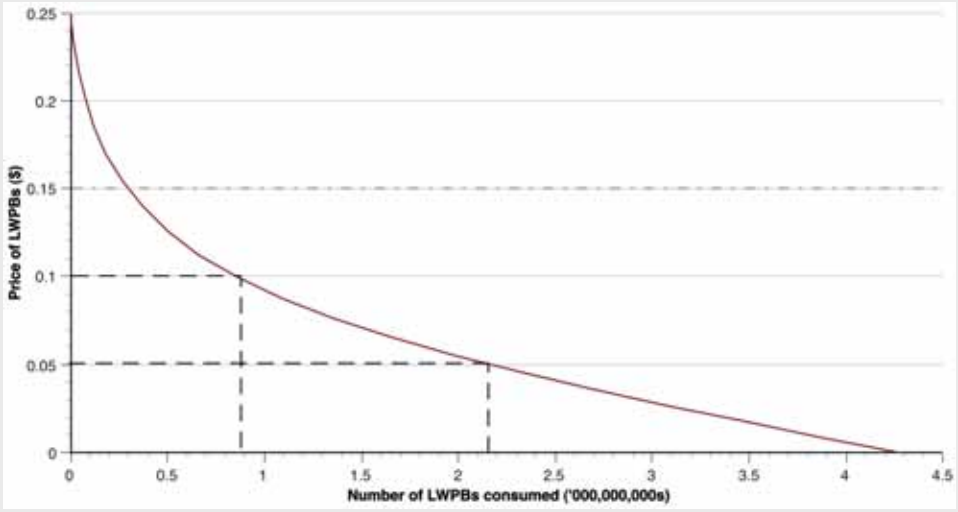
[22] Nolan-ITU 2002, op. cit., p. 4.

However, introducing a direct and transparent charge for LWPBs does not mean that consumption of LWPBs will vanish. Consumers demand the services provided by LWPBs, and these can take on a high value in certain circumstances. It is therefore necessary to determine how many LWPBs are likely to be consumed over a range of different prices — in effect, to derive a demand curve for LWPBs as is done in Box 3.2.

Box 3.2

ESTIMATED CONSUMER DEMAND FOR LIGHT-WEIGHT PLASTIC BAGS, 2002

Establishing a consumer demand curve for plastic bags is a fundamental requirement of the policy assessment exercise. It is a key determinant of the revenues associated with bag sales and the costs that would be imposed on consumers through a ban. The following demand curve has been estimated for modelling purposes.



Its construction relies on the following data estimates:

- 4.3 billion bags at $0.00[23];
- a reduction in consumption of around 80 per cent at $0.10[24]; and
- a reduction of close to 100 per cent at $0.25[25].

These data points are indicative only. The first two are derived from the Nolan ITU report, and changes in LWPB consumption observed in a number of case studies drawn from the Irish experience, and local bag pricing initiatives from a range of retail outlets including Bunnings, Byron Bay supermarket, etc. A near-100 per cent reduction in consumption at a price of $0.25 is assumed, as consumers reduce bag consumption and re-direct their demand for 'bag services' to less costly substitutes.

For the purposes of the modelling, the assumption is that if LWPBs are not available, consumers will choose a least cost and closely substitutable alternative. In this study, a simplifying assumption is that when a bag is in high demand, and an LWPB is no longer available at the checkout, the least cost 'fallback' solution is the purchase of a single-use paper bag. This has the effect of capping the maximum price that consumers must pay for LWPB services at $0.15 per bag.

Source: J. Cadman, S. Evans, M. Holland, R. Boyd and AEA Technology Environment 2005a, *Proposed Plastic Bag Levy - Extended Impact Assessment Final Report, Volume 1: Main Report*, Environment Group Research Report 2005/06 for the Scottish Executive, Edinburgh; Nolan ITU 2002 *Plastic Shopping Bags – Analysis of Levies and Environmental Impacts, Final Report*, Dept of the Environment and Heritage, Canberra.

[23] Nolan-ITU 2005, op. cit., p. 6.

[24] Nolan-ITU 2002, op. cit. p. 50.

[25] Based on the availability of cheaper substitutes. While LWPBs may still be purchased at the $0.25 price, the amount consumed is assumed to be insignificant, and close to zero for modelling purposes.

The curve shown in Box 3.2 illustrates a relationship in which consumption of bags is characteristically sensitive to price (that is, highly elastic). This implies that close substitutes exist for LWPBs, such as re-usables (see Box 3.3) or paper bags.

In spite of the fact that a number of close substitutes exist for LWPBs, there is also a hard core of bag consumption that is relatively insensitive to price. In this region, consumers are willing to pay a high price for the services provided by the LWPBs. The level of demand in this region can be thought of as representing consumers who find currently available alternatives for LWPBs inadequate.

These are consumers who:

- find it inconvenient to carry a re-usable — they might be planning to do some other type of shopping before they go to the supermarket at the mall);
- prefer plastic for carrying certain types of products — for example, meat or other chilled items from the supermarket, or take-away foods; or
- find themselves in need of a bag but do not have a re-useable with them — they forgot, or are buying on impulse.

Planet Ark's survey for the Commonwealth Department of the Environment and Heritage suggested that:

> the non-supermarket retail sector is characterised by 'impulse buying'. Thus the likelihood of shoppers bringing a re-usable bag is not as high as it is for supermarkets. As a result, in some parts of the non-supermarket retail sector (such as the fast-food sector), major reductions in total bag usage may not be achievable. In this instance, a more sustainable single use alternative, such as paper or truly biodegradable/compostable bags, would be more suitable.[26]

There is a range of worst-case (and high cost) scenarios that might be applied to this eventuality and the costs that it can impose if LWPBs are not available. In thinking about the *likely* cost implications it is useful to think about the feasible fallback position for consumers in this situation. Shoppers that plan ahead can easily arrange their affairs and budgets to avoid the LWPB price impost. It is mainly the opportunistic and forgetful shoppers that will be faced with making a bag purchase at the point of sale in a situation where LWPBs are unavailable or have an explicit price attached.

This approach will have a different impact on different types of consumers, and this will have an impact on the proportion of LWPBs littered under the different policy options. As discussed earlier, consumers are not directly charged for the plastic bags they consume. By introducing an explicit charge or levy for a plastic bag, consumers are able to refuse the bag and enjoy the associated monetary saving.

By definition, consumers who continue to purchase LWPBs value the services provided by the bag at an amount greater than or equal to the price they are willing to pay. Those that are most sensitive to a LWPB price include those that put the lowest value on the availability of a bag. It is likely that a disproportionate share of deliberately littered ('throw away') bags emanate from this group.

[26] Planet Ark Environmental Foundation 2005, op. cit.

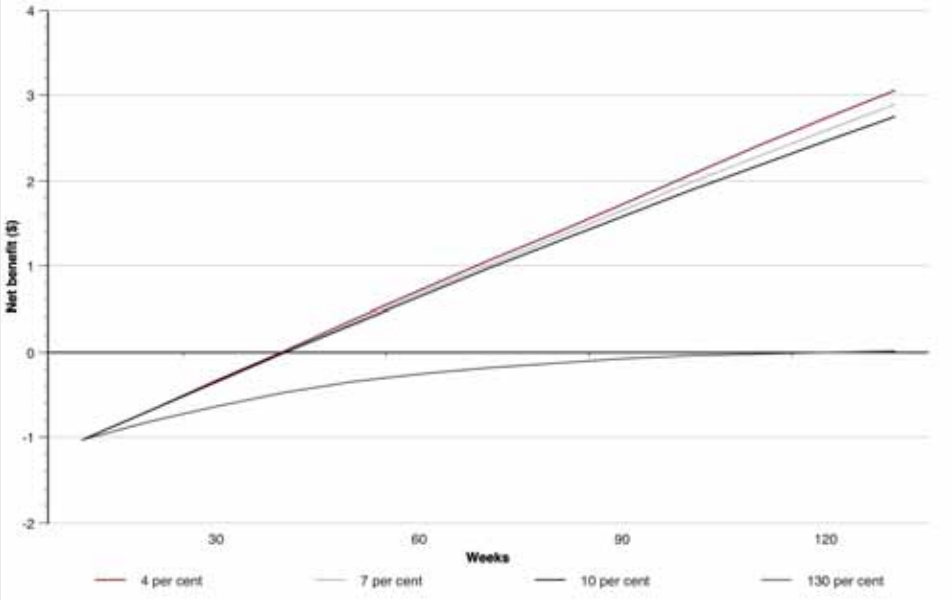
Box 3.3

ECONOMICS OF RE-USABLE BAGS

Re-usable bags are a close substitute for single-use LWPBs. They cost more, but are longer lived and therefore, in a world where consumers pay for the cost of LWPBs, represent a 'technology' with a high initial cost that generates a stream of savings into the future. The economics of this investment will depend on the relative cost of re-usable bags and LWPBs, the number of LWPBs that a re-usable bag replaces over time, and consumer time preferences (that is, the rate at which they discount future consumption relative to current).

The figure below illustrates the net economic cost or benefit of a re-usable bag 'investment' as a function of its economic life and a consumer's discount rate (rates of 4, 7 and 10 per cent per annum are examined). It is based on the following assumptions:

- price of re-usable bag = $1.40;[27]
- price of single use LWPB = $0.03 (explicitly charged to consumer); and
- re-usable bags replace 1.2 LWPBs per week.



The figure highlights that a re-usable bag is an attractive investment, with a positive net present value if it is used at least once a week for a year. If, as expected, it has a two-year life — and is used routinely as a LWPB replacement, a re-usable bag would deliver a rate of return on its upfront cost of close to 130 per cent per annum. The example shown assumed a price for re-usable bags of $1.40, an average of the prices observed in shops during the course of this study. For re-usable bag prices of $1.00 or $1.80, the same calculation shows that an investment in a re-usable is profitable at a maximum discount rate of 192 and 96 per cent respectively. At a 10 per cent discount rate, even spending $4.00 for a re-usable bag is a profitable investment.

Shoppers with this usage pattern would be financially advantaged by replacing LWPBs with a re-usable bag, but only if they can enjoy the cost savings associated with their lower LWPB consumption — something that will only happen if they face an explicit charge for LWPBs.

[27] Coles 2005, *Our Services,* http://www.coles.com.au/frame/build.asp?url=/services/, accessed on 25 November 2005.

This inversely links the proportion of bags littered to the price charged for bags — as the price increases, only those consumers who continue to value the services at or above the amount of the charge will purchase the bags. The number of consumers that fit into this category will decrease as the price increases — as represented by the demand curve. Additionally, of the plastic bags consumed, a lesser proportion are likely to be littered because, on balance, there is likely to be a higher proportion of 'throw away' bag consumption among those that value them least. Grocery shoppers with multiple items can be expected to take their bags home — as can purchasers of hot food for home consumption. But buyers of a small number of items (for which a plastic bag may be unnecessary or provide a short lived service) are most likely to be faced with the temptation to litter.

This is particularly the case with respect to plastic bags that are used to carry goods only a short distance, or are used away from home — for example, take-away food packaging. The services that the bags provide are no longer required after the bag's initial purpose is fulfilled, and the bag is subsequently discarded, either in the garbage or by littering. With a direct charge on plastic bags, these consumers who do not value the services that a bag provides beyond its initial use may choose not to purchase a bag. Reduced LWPB consumption by this group is likely to result in a disproportionate reduction in 'deliberate' littering.

However, of the 40 to 60 million LWPBs that find their way into the landscape annually, about half are estimated to have been littered inadvertently. This means that they were intended for garbage collection and landfill, but have blown off-course at some stage, or are blown off the landfill sites once they are dumped. Changes in household behaviour, with respect to how plastic bags are disposed of, cannot directly address this problem. Instead, the number of plastic bags that are inadvertently littered can only be contained or reduced by reducing the consumption of plastic bags (for example, by placing a charge on the bags so that people who choose to have a bag clearly value it and are less likely to dispose of it – see Table 3.1), and improving garbage collection, litter clean-up and landfill management practices.

Table 3.1

LWPB CONSUMPTION AND DISPOSAL — THE PRICE EFFECT

Price	Consumption (in relation to current consumption)	Proportion (of total bags consumed) littered
$0.00	100%	0.87%
$0.05	50%	0.72%
$0.10	20%	0.58%
$0.15	20%	0.58%
$0.25	≈ 0%	n.a.

Source: The change in the number of LWPBs consumed and littered is based on estimates of bag consumption and litter by Nolan-ITU 2002, op. cit. p. 9, p. 13, and pp. 49-51.

Many consumers re-use LWPBs as 'bin-liners' or receptacles for rubbish around the home. Policy options that affect the consumption of LWPBs will also affect the demand for and consumption of commercially produced plastic bin-liners, made out of a similar light-weight plastic. In Ireland, it was observed that sales of bin-liners increased by 75 per cent following the introduction of the PlasTax.[28] The rate of substitution between LWPBs and bin-liners was recently estimated at approximately one bin-liner consumed for every seven LWPBs foregone.[29] Table 3.2 summarises the assumptions made about the price and degree of substitutability of the LWPB alternatives.

Table 3.2

CHARACTERISTICS OF THE ALTERNATIVES TO LWPBS

Substitute	Price (assumed)	Rate of substitution (number of LWPBs)
Re-usable bags	$1.40	125.3
Paper bags	$0.15	1.0
Bin-liners	$0.05	7.0

Source: J. Cadman, S. Evans, M. Holland, R. Boyd and AEA Technology Environment 2005a, *Proposed Plastic Bag Levy - Extended Impact Assessment Final Report, Volume 1: Main Report*, Environment Group Research Report 2005/06 for the Scottish Executive, Edinburgh; Nolan ITU 2002 *Plastic Shopping Bags – Analysis of Levies and Environmental Impacts, Final Report*, Department of the Environment and Heritage, Canberra.

3.5 Environmental impacts

Assigning a monetary value to the environmental impacts of the policy options under consideration is an inherently difficult proposition. Individual households are often unable to indicate a *reliable* 'willingness to pay' for a better environment, because one person's expenditure on clearing up litter in the neighbourhood benefits the entire neighbourhood. The service provided is a public good.[30] What's more, an expectation that government (not the householder) will pay for the provision of a benefit can lead to an exaggeration of willingness to pay, while an expectation that a payment may be required can result in an under-statement (particularly if there is an expectation by individuals that they may be able to 'free ride' on the contributions of others).

An initial value of $1.00 for each LWPB removed from the environment was used in the modelling. A discussion of how this estimate was derived — as well as some of the limitations of this approach — is provided in Box 3.4.

[28] *Guardian* 2005, 'Excess Baggage', 26 October, http://society.guardian.co.uk/societyguardian/story/0,7843,1600179,00.html.

[29] J. Cadman, S. Evans, M. Holland, R. Boyd and AEA Technology Environment 2005a, *Proposed Plastic Bag Levy - Extended Impact Assessment Final Report, Volume 1: Main Report*, Environment Group Research Report 2005/06 for the Scottish Executive, Edinburgh; Nolan ITU 2002 *Plastic Shopping Bags – Analysis of Levies and Environmental Impacts, Final Report*, Department of the Environment and Heritage, Canberra.

[30] A public good is a good that exhibits two particular features: 'non-excludability', which means that people cannot be excluded from deriving a benefit from the good (or that the costs of doing so are prohibitive); and 'non-rivalry in consumption', which means that the consumption of the good by one individual does not limit consumption by others (that is, there is no scarcity). These properties significantly limit the incentive for private providers to supply a public good, resulting in an undersupply or no supply at all.

Box 3.4

VALUING ENVIRONMENTAL DAMAGE — WILLINGNESS TO PAY

Due to the 'public good' nature of litter clean-up, it is difficult for individuals to meaningfully articulate their willingness to pay for a cleaner environment. Indeed, this is the main reason that litter collection is undertaken either by the government, or by volunteers. To some extent, a value can be imputed from observed behaviour — people freely volunteer their time to improve their environment by removing litter from it. The value they attach to litter reduction can be estimated from these actions, rather than rely on survey responses.

A significant initiative in this regard is 'Clean Up Australia Day'. In 2005, 678 146 volunteers donated approximately 1.5 million hours of their time to Clean Up Australia.[31] At an average remuneration rate of $16.00 an hour (derived from an average weekly earning of $810.60,[32] and adjusted for income tax[33]) this represents a resource input of approximately $24 million (— valuing the input of all contributors including children, who are likely to make up a significant proportion of total hours, at this rate). Of this resource input, $480 000 can be attributed to the collection of LWPBs, as LWPBs account for 2 per cent of the stream of litter. With approximately 20 million LWPBs collected, this gives a value of just over $0.02 per LWPB.

This valuation takes into account the full range of environmental impacts — on the assumption that the volunteers who collect LWPB litter do so because they too are concerned about the full range of aesthetic, biological and economic damage that littered LWPBs can cause.

However, to obtain a community-wide value for LWPB litter reduction it is also necessary to scale this sampling result to account for factors such as:

- people are likely to care more about 'localised' litter occurring in their own vicinity or preferred locations than they do about litter in remote localities (- implying a need to scale down the imputed average value per bag);
- people may contribute un-counted hours to litter reduction (- implying a need to scale up the per bag value)
- Clean Up Australia volunteers make up only a small sample of the total Australian population (about 3.4 per cent), and therefore their values could be extended to a broader base (- implying a need to scale up the per bag value); and
- Clean Up Australia volunteers are not a representative sample, and are likely to place a higher than 'average' value on the environmental damage caused by LWPBs (- implying a need to scale down the per bag value).

It is a matter of judgement how these effects should be weighted. For this exercise, in order to take these effects into account in the valuation of the environmental damage caused by LWPBs, an estimate of $1.00 per LWPB was taken as a starting point. The sensitivity of results to this estimate will be an important factor in considering the policy insights from this exercise.

[31] Clean Up Australia 2005, *Australians Put Rubbish Away for Good,* http://www.cleanup.com.au/main.asp?RequestType=MediaReleaseIn&SubRequestType=Detail&MediaRelID=233, accessed on 9 January 2006.

[32] Australian Bureau of Statistics 2006, *Average Weekly Earnings Australia November 2005,* cat. no. 6302.0 AusInfo, Canberra.

[33] Income tax adjustment was conducted using the Australian Tax Office's 'simple tax calculator' (http://calculators.ato.gov.au/scripts/ASP/SimpleTaxCalc/main.asp, accessed on 24 March 2006), and applying the tax rates for 2004-05.

The value that people place on the clean up of LWPBs is not intended to reflect the cost of clean-up — rather it is intended to reflect what a reduction in environmental damage is worth, in dollar terms. If a person values a reduction in environmental damage at $20, this indicates that that person is indifferent between receiving $20 or observing a reduction in environmental damage — that is, the person in question values both equally. The $1.00 per bag starting value for the clean up of LWPBs currently in the litter stream is derived in Box 3.4 as being based on the amount of money volunteers were willing to forgo in order to remove LWPBs from the litter stream.

This estimation of the value placed on a reduction in the environmental damage attributable to LWPBs accounts for all of the potentially damaging aspects of a littered LWPB. It assumes that the people who voluntarily pick up littered LWPBs do so because of their concerns about an LWPB's potential to impact adversely on:

- marine biodiversity;
- other wildlife or livestock;
- drains and sewers (unsightly – and also delivering an adverse economic impact when blockages lead to flooding);
- the aesthetics of their neighbourhood or other valued locations.

These considerations may not be explicitly stated, and anybody being asked why they volunteer to pick up littered LWPBs may simply respond that it is because LWPBs are bad for the environment. The fact that they recognise this, however, means that they have an implicit concern for some of the impacts stated above. This methodology attempts to place a value on all of the environmental damage that can be attributed to LWPBs, however, it should be noted that this valuation is based on the extent to which people are willing to allocate their time to addressing the problem — that is, the value that *people* place on the damage caused by littered LWPBs.

The analysis does not attempt to estimate an inherent value for individual animals or habitats that might be adversely affected by LWPB litter in the landscape and waterways. It assumes that these valuations are inherent in the effort expended by community volunteers in removing littered LWPBs from our landscapes and waterways (and which were significantly scaled up in this analysis). Of course, it is also possible that attributing an environmental value $1.00 to all non-littered bags may be considered by some to be overly generous. The implications of non-linearity in the environmental damage function are considered in Appendix D.

Litter

LWPBs are perceived to be an environmentally unsustainable product, and seeing them being blown across the streets or the environment more generally detracts from the aesthetic of our surroundings. Indeed, the introduction of the plastic bag reduction policies in several countries was due to a consideration of aesthetics.[34] Littered LWPBs can also have a serious impact on wildlife — particularly marine life — in relation to entanglement, suffocation and ingestion.

[34] See Cadman, Evans, Holland, Boyd and AEA Technology Environment 2005b, op. cit.

As a response to this, in August 2003 the Federal Minister for the Environment and Heritage listed injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris as a key threatening process. Plastic bags are included in the definition of 'harmful marine debris'.

While LWPB litter on land does not appear to be a major problem for wildlife, it is unsightly and can block gutters and drains creating stormwater problems. Litter studies indicate that LWPBs are generally in the top twenty litter items counted, although not the top ten. LWPBs lend themselves to inadvertent litter due to their lightness and easy ability to 'balloon' with the wind. As plastic bags do not readily break down in the environment, the number of plastic bags in the environment is effectively cumulative (with the nation releasing between 40 to 80 million bags into the environment each year).

Degradable plastic bags are available, however, it is unlikely that they will address this particular aspect of the costs associated with LWPB consumption. Degradable plastic bags are predominantly made from starch-based polymers, polyesters manufactured from hydrocarbons, or starch-polyester blends. The different types of bags degrade over different time frames, which are dependent on the environmental conditions they experience (that is, anything from three months to ten years). An Australian performance standard for composting and biodegradability is expected to be finished soon, however, a similar standard for plastics that break down primarily by non-biological means has yet to be developed anywhere. Whether or not degradable bags are an environmentally viable alternative to LWPBs is debatable:

> While the two sides bicker over whether plastic is better or worse than paper for carrying our shopping, they do at least agree on one thing: biodegradable bags are not the answer. 'It may actually encourage wrong attitudes to litter prevention and does not contribute to environmental sustainability,' says a statement by the UK's Packaging and Industrial Films Association, based in Nottingham. 'Biodegradable bags make people feel better for doing something that is still unhelpful, and it's not actually tackling the bigger problem of wasting resources,' Wilton [Claire Wilton, senior waste campaigner for Friends of the Earth in London] says. And to your average turtle, a degradable bag looks just as much like a jellyfish as a non-degradable one.[35]

Greenhouse gas and other emissions

A change in Australia's production mix of different types of bags has an impact on the level of greenhouse gas emissions. Assuming 52 shopping trips a year,, and using the conversion factors discussed earlier for finding how many LWPBs each of the alternatives represent, Table 3.3 presents the emissions of each of the different bag alternatives into the:

- atmosphere as greenhouse gas emissions, measured as carbon dioxide equivalent — the measure of greenhouse gas emissions is primarily related to the carbon dioxide associated with energy consumption (electricity used in production and fuels consumed in transporting the bags), and methane emissions released by the degradation of the bag in landfill; and
- waterways as eutrophication — the release of nitrates and phosphates into the waterways, as well as nitrogen oxides emitted into the air as part of combustion processes. This latter effect makes up by far the greatest share of the eutrophication of each bag alternative.

[35] Williams 2004, op. cit.

Table 3.3

ANNUAL GREENHOUSE GAS EMISSIONS AND PHOSPHATE EUTROPHICATION ASSOCIATED WITH LWPBS AND ALTERNATIVES

Type of bag (annual consumption)	Greenhouse (kg CO_2 equivalent per annum)	Phosphate (grams PO_4 equivalent per annum)
Light-weight plastic bag	6.1	2.5
Paper bag	30.2	26.6
Re-usable bag	2.0	1.2
Calico bag	6.4	8.0
Biodegradable bag	2.5	2.7

Note: The type of degradable bag chosen for this comparison is a bag made of biodegradable polyester, which has the lowest greenhouse and eurotrophication emissions of all the varieties of biodegradable bags considered in the paper referenced below.
Source: K. James and T. Grant 2005, *Life Cycle Assessment of Degradable Plastic Bags,* Royal Melbourne Institute of Technology, Melbourne p. 10.

Of the various bags available to consumers, re-usable bags have by far the lowest emissions in both categories, and this is directly related to the fact that they have the greatest life span. The emissions associated with paper bags are the highest of all of the available options, due to the high usage of electricity and gas in the production of paper bags.[36] It is also true that while a reduction in LWPB use in favour of a re-usable bag will reduce national emission levels, at least part of this reduction will be associated with a shift in emissions to an offshore location. LWPB production (and associated emissions) in Australia declines, while offshore production of re-usable bags increases.

Landfill

Most of the waste in Australia is disposed of in landfills. Surveys indicate that 60 per cent of bags taken home are reused as bin-liners or waste bags, lunch bags and general carry bags.[37] Bags that are reused as bin liners end up in landfill, and it is likely that bags reused for other purposes also end in landfill. That annual plastic bag disposal to landfill was estimated at 6.67 billion bags — or 36 700 tonnes — in Australia in 2002.[38] This equates to roughly 0.2 per cent of total solid waste going to landfill each year in Australia.

LWPBs may take between 20 to 1000 years to break down in the environment. As a result, the environmental impact of plastic bags in landfill is likely to be low due to their inert nature. The major impact of plastic bags in disposal is not their effect on the actual landfill, but in litter emanating from the site. This is associated with unloading operations as well as the compaction and burial of waste.

[36] The impact of the different policy scenarios discussed in chapter 4 on Australia's greenhouse gas emissions is estimated in the modelling, and is linked to the impacts that the various policies have on the level of demand and output, and the composition of domestic production. These estimates are based on the assumptions of resource use and greenhouse gas emissions that are inherent in MMRF-Green (see appendix B), and are not based on the figures in Table 3.3.

[37] Nolan-ITU 2002, op. cit., p. 6.

[38] Nolan-ITU 2002, op. cit., p. 9.

Chapter 4

Assessing the policy options

Determining the relative costs and benefits of alternative policy options calls for an empirical approach. This report builds its cost benefit analysis on impact assessments and scaling factors drawn from relevant literature as well as economic impact analysis derived from a dynamic, computable general equilibrium (CGE) model of the Australian economy. The general equilibrium approach captures the interdependency of income and production relationships within the economy, and is therefore a powerful tool for examining the industry-level impact of policy-induced changes on an inter-temporal basis.

4.1 The policy scenarios and their initial impacts

The Environment Protection and Heritage Council identified nine regulatory approaches to address the problems associated with LWPBs. The key features of each of the regulatory approaches were estimated in terms of their impact on the stakeholders referred to in the previous chapter.

MMRF-Green is built on data supplied by the Australian Bureau of Statistics, and complemented by data from other sources further detailing the inter-industry and production relationships within the Australian economy. This information is supplemented by detailed information on LWPB costs, consumption patterns and likely preferences for LWPB alternatives identified in the context of this study.

Each of the scenarios modelled for this study is described in Table 4.1 which summaries the key features that distinguish it for modelling purposes (see Appendix B for more detail). These features represent the 'shocks' applied to CGE model (see Section 4.2), and drive a realignment of equilibrium production and consumption outcomes. Each scenario has been attributed 'first round impacts' based on data drawn from the available literature and expert advice.

For instance, each scenario has been modelled according to likely impacts on a range of key factors including:

- administration costs – for government and industry, and differentiated according to costs of oversighting a ban, point of sale suasive approach or levy;
- training and staff costs – for retail staff, involved in delivering new point of sale bag handling arrangements;
- theft — from retailers, associated with increased theft of shopping baskets or trolleys (based on the Irish experience with 'PlasTax');
- replacement bag sales — affecting consumers and manufacturers; and
- capital costs — affecting retailers who may need to install new equipment and processes.

As a point of comparison, the input value of these policy shocks is summed over time and discounted to account for the fact that (even after adjusting for inflation) $100 worth of consumption today is more valuable than $100 in 5 years time. The resultant figures are called Net Present Values (NPVs) and are calculated on the basis of the patterns of costs and benefits over the period 2005 to 2016. An estimate of the total decrease in the number of littered LWPBs over the same period (relative to the situation in which current policy action stopped and bag use began to drift upward again in line with retail sales growth) is also shown.

Table 4.1

SUMMARY TABLE OF FORECAST INITIAL ECONOMIC AND ENVIRONMENTAL COSTS AND BENEFITS, IN COMPARISON TO 'NO FURTHER ACTION'

Scenario	Timing	Description	Key sectors affected by scenarios identified by the Environment Protection Heritage Council			
			Retail industry	Households	Government	Environment
1	Eliminate LWPBs by 2009	Comprehensive ban effective from 1 January 2009	• implementation costs (equipment modification, staff training, increased theft) • reduced revenue due to longer transaction times • increased cost due to in-store education and promotion • net cost ($432.9m)	• reduced consumption of LWPBs, increased consumption of alternatives • net benefit ($109.8m)	• increased administrative expenses • reduced litter clean-up expenses • net benefit ($19.0m)	• reduction in litter • 360.6m fewer bags littered
2	**No further action** (ARA Code expires)	Code expired on 31 December 2005, then no further action.	• no impact	• trend toward pre-2002 purchase behaviour	• no impact	• no further policy impact • (expect litter increase)
3	**Extend Code**	**Continuation of 50 per cent reduction on 2002 bag ratio to 2016**	• **50 per cent of 2002 bag/sales ratio maintained over the period 2005-2020 for all large retailers, and half of all medium and small retailers** • **implementation costs and on-going costs (similar to Scenario 1)** • **net cost ($329.6m)**	• **50 per cent reduction of LWPB consumption, increased consumption of alternatives** • **net benefit ($82.9m)**	• **increased administrative expenses** • **reduced litter clean-up expenses** • **net benefit ($12.7m)**	• **reduction in litter** • **245.3m fewer bags littered**
4	Escalating charge (kept by retailers)	LWPB charge from 1 January 2007 at $0.05 per bag, $0.15 from 2008, $0.25 from 2009	• increased implementation costs and on-going costs (similar to Scenario 1) • increased administrative costs • increased revenues (from LWPB sales) • net cost ($663.4m)	• reduced consumption of LWPBs (see demand curve), increased consumption of alternatives • net benefit ($1.6m)	• increased administrative expenses • reduced litter clean-up expenses • net benefit ($23.1m)	• reduction in litter • 418.4m fewer bags littered

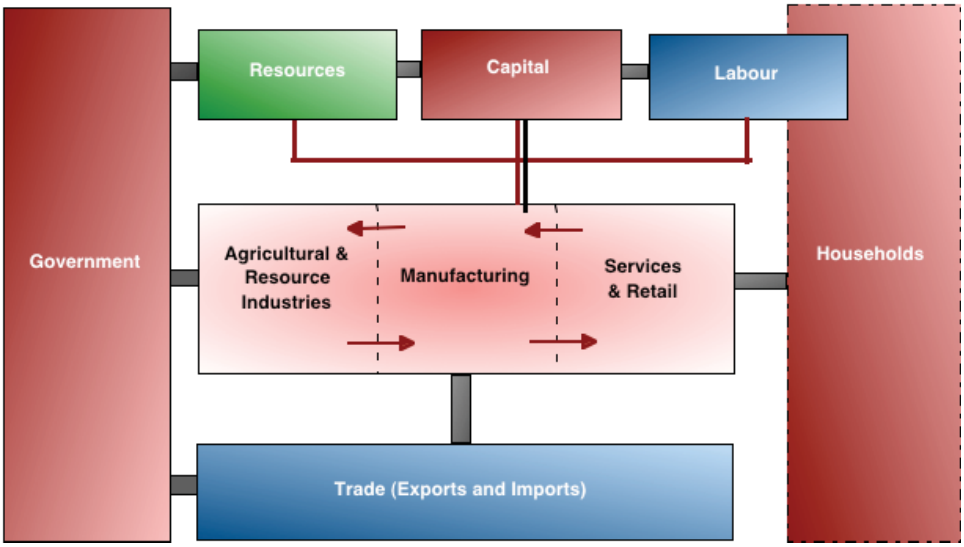
Scenario	Timing	Description	Key sectors affected by scenarios identified by the Environment Protection Heritage Council			
			Retail industry	Households	Government	Environment
5	Voluntary phase out to 2009, mandatory beyond	Linear phase out to zero between 2006 and 2009	• increased implementation costs and on-going costs (similar to Scenario 1) • net cost ($563.9m)	• reduced consumption of LWPBs, increased consumption of alternatives • net benefit ($136.5m)	• increased administrative expenses • reduced litter clean-up expenses • net benefit ($23.9m)	• reduction in litter • 422.4m fewer bags littered
6	Earlier ban on LWPBs	Timing variations on Scenario 1	• see chapter 5	• see chapter 5	• see chapter 5	• see chapter 5
7	Disposal fee (cost recovery)	Fee charged to consumers ($0.05) to recover cost of effective LWPB disposal initiative from 1 January 2009	• increased implementation, on-going and administrative costs (similar to Scenario 4) • net cost ($433.9m)	• reduced consumption of LWPBs (see demand curve), increased consumption of alternatives • net cost ($195.5m)	• increased administrative expenses (general) • increased administrative expenses (levy collection) • reduced litter clean-up expenses • net cost ($10.8m)	• reduction in litter • 300.5m fewer bags littered
8	Regulated price (kept by retailers)	Fee charged to consumers ($0.25), and applied by retailers from 1 January 2009	• increased implementation, on-going and administrative costs (similar to Scenario 4) • net cost ($620.8m) • (bag consumption & revenue approx zero @ price of $0.25 per bag)	• reduced consumption of LWPBs (see demand curve), increased consumption of alternatives • net benefit ($152.1m)	• increased administrative expenses • reduced litter clean-up expenses • net benefit ($19.5m)	• reduction in litter • 360.6m fewer bags littered
9	Levy on LWPBs	LWPB levy ($0.10) applied at point of sale from 1 January 2009	• increased implementation, on-going and administrative costs (similar to Scenario 4) • net cost ($511.2m)	• reduced consumption of LWPBs (see demand curve), increased consumption of alternatives • net cost ($262.8m)	• increased administrative expenses (similar to Scenario 7) • reduced litter clean-up expenses • net cost ($12.9m)	• reduction in litter • 312.5m fewer bags littered

4.2 The modelling approach

Capturing all significant impacts, while ensuring that the overlap of effects does not result in double counting, is a critical requirement of cost benefit analysis. A network of relationships and interactions characterise a market economy, and it is important to distinguish between actual resource and welfare impacts and their reverberation along the value chain. For example, if $100 worth of resources was bought and on-sold five times, while representing $500 worth of economic activity within the economy (and affecting up to five different stakeholders), this activity would nevertheless represent a *net* change in consumption of $100. A stylised depiction if the structure of a general equilibrium model of the economy is provided in Figure 4.1.

Figure 4.1

STYLISED INTERACTIONS IN A GENERAL EQUILIBRIUM ECONOMIC MODEL



Economic models are a tool for keeping track of price, production and tax relationships within an economy and netting out 'transfer' effects. They are well suited to estimating the likely net impacts of policy changes at an economy-wide and industry level. The outcomes of the model should not be taken as exact predictions of future outcomes — rather, they are approximations and are best suited to indicating the signs (positive or negative), magnitude and relativities of changes likely to be induced by a policy or economic 'shock'.

The CGE model used in this analysis is the Monash Multi-Regional Forecasting — Green (known as MMRF-Green)[39] — see Box 4.1. The MMRF-Green model is recognised as one of the leading CGE models in Australia, and is used extensively by government and industry, and enjoys a strong reputation in Australia and overseas.

[39] See P. Adams, M. Horridge and G. Wittwer 2003, *MMRF-GREEN: A Dynamic Multi-Regional Applied General Equilibrium Model of the Australian Economy, Based on the MMR and MONASH Models*, CoPS/IMPACT Working Paper Number G-140, October.

Box 4.1

MMRF-GREEN

MMRF-Green model is a multi-regional, dynamic CGE model. It distinguishes up to eight Australian regions (six States and two Territories) and, depending on the application, up to 144 commodities/industries. The model recognises:

- domestic producers classified by industry and domestic region;
- investors similarly classified;
- up to eight region-specific household sectors;
- an aggregate foreign purchaser of the domestic economy's exports;
- flows of greenhouse gas emissions and energy usage by fuel and user;
- up to eight state and territory governments; and
- the federal government.

The model contains explicit representations of intra-regional, inter-regional and international trade flows based on regional input-output data developed by Monash University's Centre of Policy Studies, and includes detailed data on state and Federal government budgets, with each region modelled as a mini-economy. Second round effects are captured via the model's input-output linkages and account for economy-wide and international constraints.

The MMRF-Green model estimates the implications of policy (and resource) changes on an inter-industry and year-by-year basis. For the purposes of this exercise MMRF-Green can track economic impacts in terms of:

- national output, including breaking down the results to identify activity level changes for retailers, domestic industries associated with the manufacture of lightweight bags, re-usable bags, bin liners and replacement bags, and other upstream and downstream industries;
- employment (that is, changes in full time equivalent jobs);
- net impact on consumers (that is, by measuring the change in real net welfare);
- government budget positions;
- real wage levels; and
- the balance of trade (that is, regional international export earnings, international import expenditures and international balance of payments).

The model also provides a detailed representation of the energy sector and associated resource flows. In particular, it provides insight to the usage patterns of coal, oil and gas across the economy (the latter being important to plastics production) and forestry activity (important for paper production). The model also estimates the greenhouse gas implications of different production outcomes.

4.3 Comparison of identified scenarios

This section presents the estimates of the impacts on the relevant stakeholders in terms of whether they are better or worse off with the regulatory intervention than they would have been if the government had taken no action. The outputs of all of the policy options are therefore considered with respect to how much, and in which direction, they vary from Scenario 2 (that is, the scenario in which the government undertakes no further action). In specifying the impact of 'no further action' on the economy and the environment, it was assumed that the ARA Code and action under it would expire, and that the consumption of LWPBs would increase over time.

National impacts

Under Scenario 2, Group One retailers no longer incur the estimated annual cost of $21 million currently necessary to comply with the ARA Code. That is, 'no further action' results in a direct economic benefit to those involved in administration of the ARA Code (such as costs involved with staff training, awareness campaigns, etc are no longer incurred), but the environment suffers because LWPB consumption is no longer curtailed. Compared to Scenario 2 (the 'base' case), this benefit is removed under other 'action' policy scenarios.

The impact of the policy scenarios in comparison to 'business as usual' falls somewhere between the impact relative to Scenario 2 (that is, no further action), and the impact in comparison to Scenario 3 (that is, extension of the ARA Code to a wider group of retailers).

A summary of the headline results is presented in Table 4.2 for 2010 and 2016.

A key observation is that, as expected:

- the value of environmental damage avoided varies considerably between the different scenarios for 2016, ranging from a decrease of $3.1 million in Scenario 3 to $12.6 million in Scenarios 4 and 5; but
- the economic indicators show little variation between the scenarios, both in 2010 and in 2016.

However, it is important to look behind these headline results to gain a better understanding of the full impacts associated with the various options. This is done in the remainder of this section. Annual economic and environmental outcomes for each of the key scenarios, showing the impact of cost shocks and subsequent adjustment paths, are provided in Appendix C.

Table 4.2

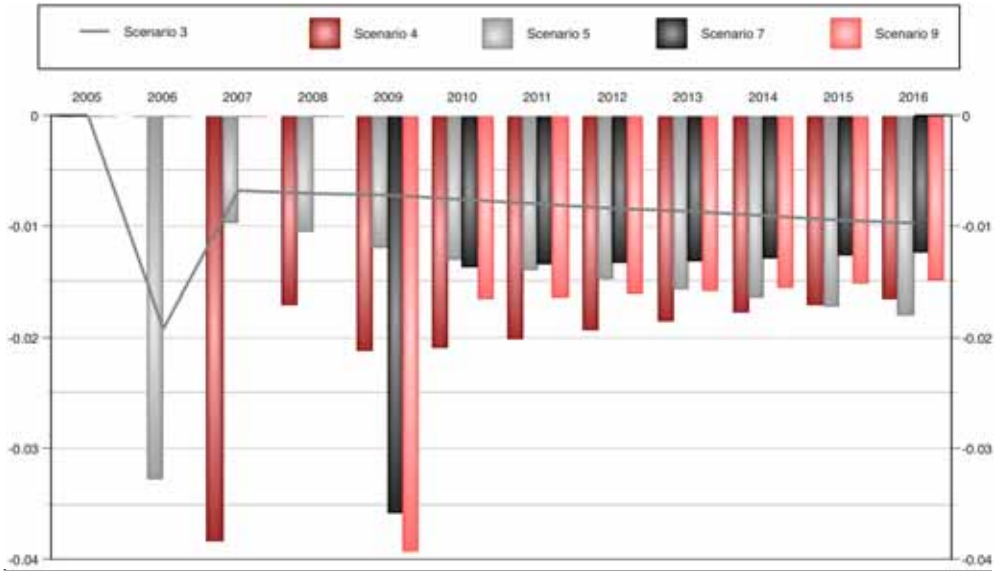
SUMMARY TABLE OF ECONOMIC AND ENVIRONMENTAL IMPACTS (DEVIATIONS FROM PROJECTED 'NO FURTHER ACTION (SCENARIO 2)' OUTCOMES, 2005 PRICES)

	2010					2016				
	Scen.3	Scen.4	Scen.5	Scen.7	Scen.9	Scen.3	Scen.4	Scen.5	Scen.7	Scen.9
Gross domestic product ($m)	-69.6 (-0.01)%	-189.1 (-0.02)%	-117.5 (-0.01)%	-123.6 (-0.01)%	-149.5 (-0.02)%	-105.2 (-0.01)%	-175.8 (-0.02)%	-191.7 (-0.02)%	-132.2 (-0.01)%	-158.8 (-0.01)%
Household income ($m)	-56.2 (-0.01)%	-126.7 (-0.02)%	-95.0 (-0.01)%	-88.3 (-0.01)%	-105.8 (-0.01)%	-91.4 (-0.01)%	-131.8 (-0.01)%	-166.5 (-0.02)%	-97.0 (-0.01)%	-116.1 (-0.01)%
Household expenditure ($m)	-34.6 (-0.01)%	-74.1 (-0.01)%	-58.1 (-0.01)%	-52.8 (-0.01)%	-62.6 (-0.01)%	-59.0 (-0.01)%	-83.4 (-0.01)%	-107.3 (-0.02)%	-60.8 (-0.01)%	-72.6 (-0.01)%
Retail industry value added ($m)	-4.6 (-0.03)%	-2.6 (-0.02)%	-7.9 (-0.05)%	-6.0 (-0.04)%	-7.5 (-0.04)%	-8.1 (-0.04)%	-4.3 (-0.02)%	-7.5 (-0.04)%	-5.4 (-0.03)%	-6.5 (-0.03)%
Plastic products value added ($m)	-17.7 (-0.58)%	-12.4 (-0.4)%	-32.3 (-1.05)%	-6.5 (-0.21)%	-10.1 (-0.33)%	-20.2 (-0.62)%	-16.0 (-0.49)%	-38.1 (-1.16)%	-8.3 (-0.25)%	-12.8 (-0.39)%
Paper products value added ($m)	4.4 (0.07)%	7.7 (0.13)%	8.2 (0.13)%	2.2 (0.04)%	4.1 (0.07)%	5.7 (0.08)%	11.1 (0.16)%	10.8 (0.16)%	4.0 (0.06)%	7.0 (0.1)%
Environmental damage ($m)	-20.6 (-48.74)%	-42.3 (-100)%	-42.3 (-100)%	-35.3 (-83.33)%	-36.7 (-86.67)%	-23.9 (-48.74)%	-49.0 (-100)%	-49.0 (-100)%	-40.9 (-83.33)%	-42.5 (-86.67)%
Greenhouse gas emissions (Kt CO_2e)	-58.0 (-0.01)%	-148.1 (-0.02)%	-99.4 (-0.02)%	-95.8 (-0.02)%	-116.1 (-0.02)%	-77.3 (-0.01)%	-167.1 (-0.02)%	-140.2 (-0.02)%	-117.2 (-0.02)%	-145.2 (-0.02)%

Gross domestic product (GDP) is reduced under each of the policy scenarios. This pattern can be seen in the annual GDP outcomes depicted in Figure 4.2, which shows outcomes relative to a 'no further action' base case and also highlights outcomes relative to Scenario 3 results which represent 'extension of the ARA Code'. Changes in household income (an important welfare measure that abstracts from international trade effects) exhibit a similar pattern.

Figure 4.2

REAL GROSS DOMESTIC PRODUCT, PERCENTAGE DEVIATION FROM 'NO FURTHER ACTION' — 2005 TO 2016



This is due to a number of factors. Key among these are:

- in the scenarios where the consumption of plastic bags is reduced, consumers substitute LWPBs with re-usable bags. One third of the LWPBs consumed in Australia is produced domestically, however all of the re-usable bags consumed in Australia are fully imported. An increase in the value of imports can decrease GDP.
- as value added decreases and imports increase, holding everything else constant, household income also decreases. This could be due to a decline in employment, or a fall in the productivity of labour. Reduced household income is generally followed by reduced demand and lower household expenditure, which in turn can reduce GDP until the economy stabilises.

However, it should be noted that while value added to the retail services industry may decrease — because the retail services industry is paying people to train its staff, refit the check-outs to cater for the alternatives to LWPBs or undertake the auditing necessary for implementing and administering a levy or direct LWPB charge — there is likely to be an increase in the value added of the industries from which the retail services industry sources its inputs, and this is taken into consideration by the CGE model.

As Figure 4.2 shows, the extent to which GDP in each of the policy scenarios varies from GDP in Scenario 2 is less than 0.05 per cent in the years between 2005 and 2016. That is, GDP under each of the 'action' scenarios is generally at least 99.95 per cent of what would be under a no further action scenario. Not surprisingly, plastic bags policy, carried forward in a range of manifestations, does not appear to have a major impact on the Australian economy. However, industry level impacts can be significant, as can the value of impacts when considered in aggregate dollar terms.

The greatest impact to GDP occurs in the year in which the policy is introduced, because this is the year in which the up-front expenditure associated with implementing the policy option is incurred. Subsequently, the deviation of the policy options from Scenario 2 declines in magnitude as the economy stabilises.

The reduction in GDP can be attributed to the reduced value added of the retail services industry and the plastic and rubber products manufacturing industry, although this is off-set to some extent by increases in the value added of the paper products manufacturing industry. Given that the large impacts occur in the initial year of each scenario, it is useful to look at the present value[40] of the impacts over time, particularly since the polices come into effect in different years.[41]

In evaluating the present values of the impact on GDP, the costs associated with policies that come into effect sooner have a higher present value than policies that are implemented later. This is because the costs are discounted over a shorter period. As a result, in present value terms, Scenario 4 has the greatest impact on GDP because it is one of the first to come into effect, and has one of the highest up-front costs (see Table 4.3).

Table 4.3

PRESENT VALUE OF POLICY IMPACTS ON REAL GDP — 2005 TO 2016 ($MILLION)

Scenario 3	Scenario 4	Scenario 5	Scenario 7	Scenario 9
-$646	-$1293	-$1093	-$768	-$900

Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum.

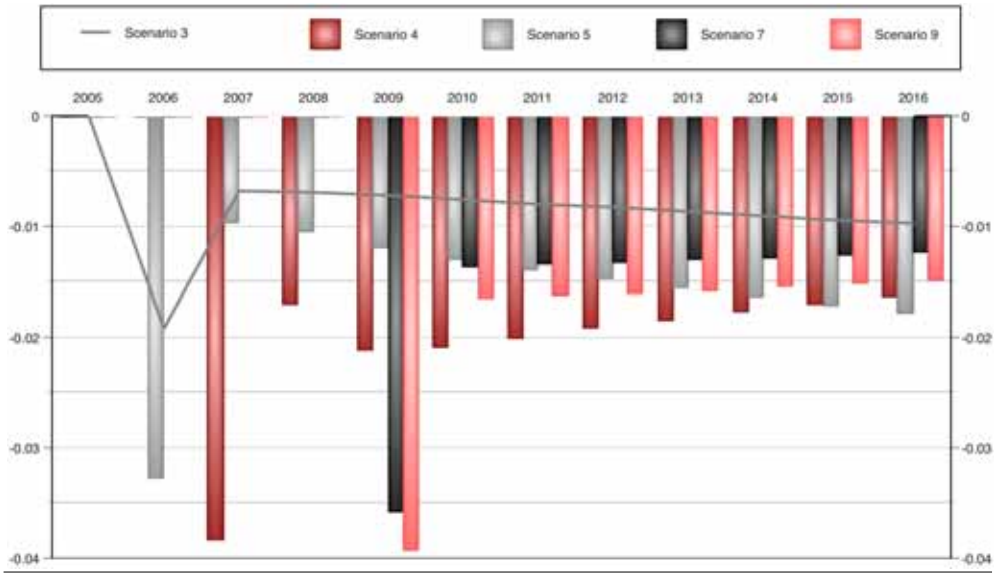
In Scenarios 4, 7 and 9, retailers have higher on-going costs initially, due to the administrative arrangements around levies and charges, and the expenditure on in-store education and promotion (see Figure 4.3). Expenditure on these activities falls over time, due to changes in consumer behaviour, and improvements in administrative efficiency. In Scenarios 3 and 5, on-going costs to the retail services industry start out lower in comparison, but increase in-line with growth in the industry.

[40] NPV analysis is a method used for comparably evaluating investments in very dissimilar projects by discounting the current and projected future cash inflows and outflows back to the present value based on the discount rate, or cost of capital, of the firm.

[41] In this case, the NPV of costs between 2005 and 2016 was calculated using a 7 per cent discount rate, with 2005 as 'year zero'.

Figure 4.3

REAL RETAIL SERVICES INDUSTRY VALUE ADDED, PERCENTAGE DEVIATION FROM 'NO FURTHER ACTION' — 2005 TO 2016



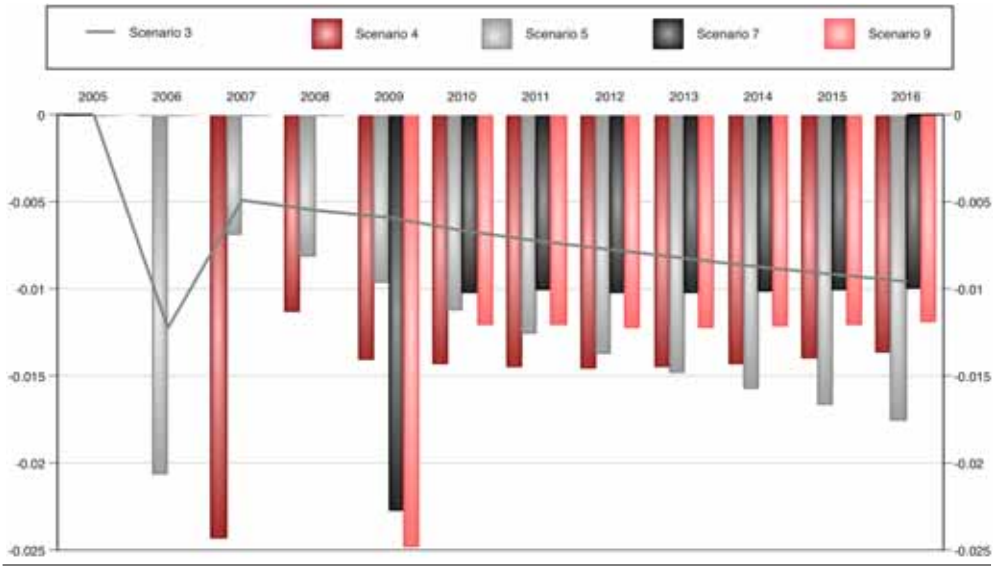
As the estimated rate of growth in the retail services industry is higher than the rate of growth for GDP, the costs to retailers under Scenarios 3 and 5 increase over time. Costs to retailers in Scenarios 4, 7 and 9 would start to grow in-line with retail services industry growth rates once efficiency gains have been fully exploited — assumed to occur ten years after the introduction of the relevant policy.

The up-front costs incurred by the retail services industry should be analysed taking into consideration the fact that these costs are assumed to occur in comparison to a scenario in which there is no further government action, and in which the ARA Code expires. Subsequently, when new policy initiatives are introduced in each of the alternative scenarios, it is necessary to factor these up-front costs back into the model because, based on the stated assumption that the ARA Code behaviours 'atrophy' in Scenario 2, all retailers enjoy the benefit of non-compliance between 1 January 2006 and the implementation or uptake of a subsequent initiative. The reduction in the consumption of LWPBs under each of the policy scenarios has a direct impact on both the plastic and paper products manufacturing industries. The impacts to these sectors are discussed with reference to Table 4.4.

Household income is closely linked with value added and with GDP. When value added falls, payments to capital and labour decrease, either because they have been less effective in production, or because more expenditure is allocated to intermediate inputs. As a result, household expenditure falls (see Figure 4.4). The proportion by which it falls is directly linked to the reduction in GDP and, once income and expenditures from changed export and import volumes are taken into account, reflects aggregate costs (relative to business as usual) about half to two thirds those reported for GDP.

Figure 4.4

REAL HOUSEHOLD EXPENDITURE, PERCENTAGE DEVIATION FROM 'NO FURTHER ACTION' — 2005 TO 2016

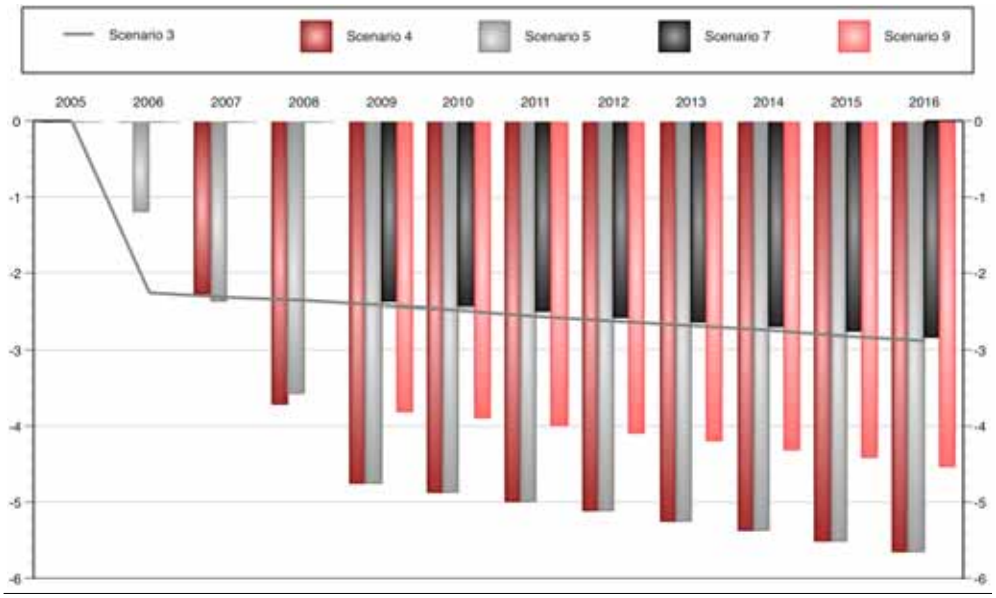


Generally, however, environmental benefits rise in line with economic costs. It is the more expensive policy options (Scenarios 4 and 5) that are the most effective at reducing the number of LWPBs consumed, as shown in Figure 4.5.

Perverse effects also need to be considered — such as the possibility that an advance disposal fee (as in Scenario 7) could lead to a more 'relaxed' attitude to littering and increase its incidence above assumed levels.

Figure 4.5

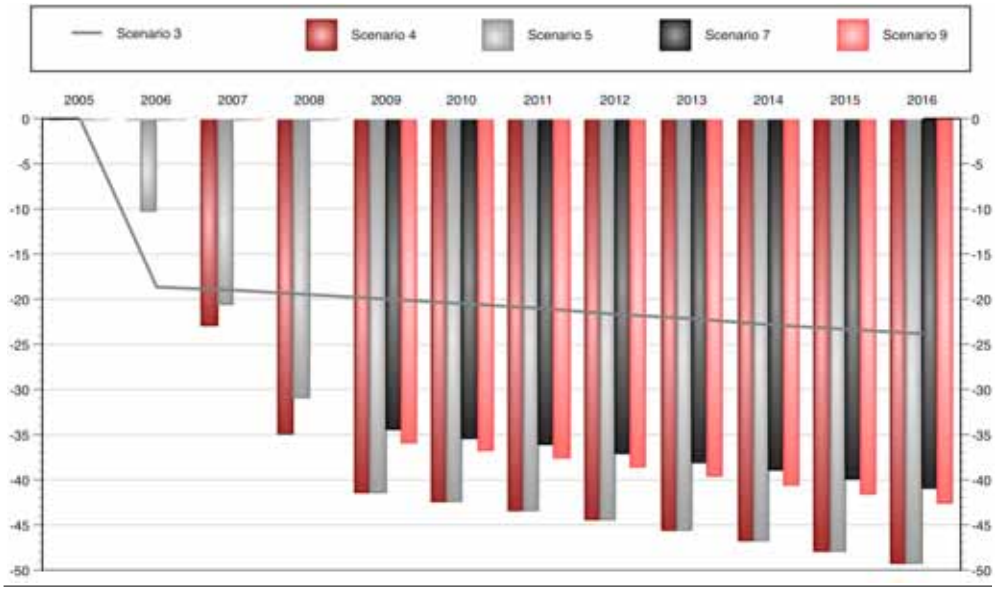
LWPB CONSUMPTION, ABSOLUTE DEVIATION FROM 'NO FURTHER ACTION' — 2005 TO 2016, BILLIONS OF LWPBS



However, it is not the reduction in the consumption of LWPBs that is of most interest, but the reduction in the number of LWPBs littered, and the value placed on this reduction in environmental damage. Figure 4.6 shows the impact on the environmental damage caused by LWPBs, as estimated using the valuation discussed in section 3.5.

Figure 4.6

VALUATION OF ENVIRONMENTAL DAMAGE, ABSOLUTE DEVIATION FROM 'NO FURTHER ACTION' — 2005 TO 2016, $M



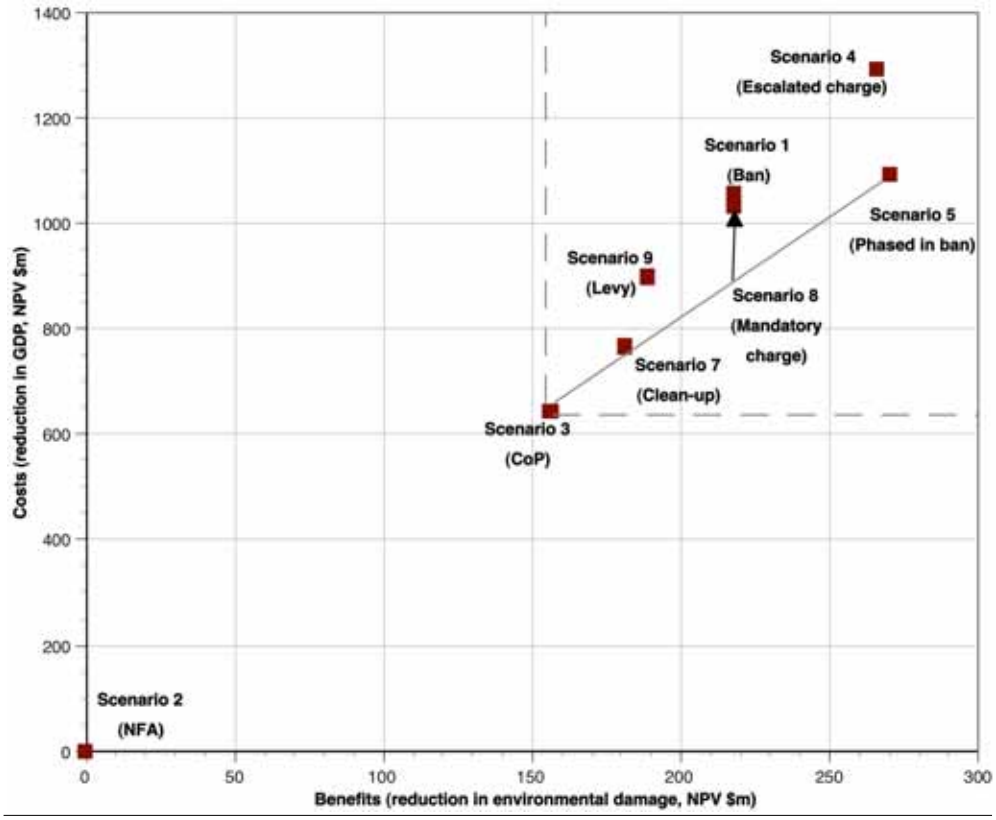
While both Scenario 3 and Scenario 7 reduce consumption of LWPBs by around 50 per cent relative to Scenario 2, the impact on environmental damage is greater in Scenario 7 because a price is charged for LWPBs, meaning that those who litter 'free' LWPBs because they have no further use for them are less likely to purchase one. Secondly, as an advance 'clean-up' fee is collected and allocated to cleaning up littered LWPBs, the proportion of consumed LWPBs that end up in the litter stream under Scenario 7 is far less than in Scenario 3 — 0.29 per cent, as opposed to 0.87 per cent.

Reflecting this focus on the relationship between economic and environmental impacts, Figure 4.7 shows the tradeoffs involved in the change scenarios. The implication to be drawn from Figure 4.7 is that, of the scenarios identified by the Environment Protection and Heritage Council, the efficiency frontier (that is, the options that represent the most efficient tradeoffs) is represented by Scenarios 3, 5 and 7.

These policies also have modest consequential greenhouse impacts, ranging from a maximum scenario impact of 150 000 tonnes per year saved in the initial period to 170 000 tonnes per year later. However, the analysis suggests that these greenhouse savings are achieved at a relatively high cost per tonne, (for example, in Scenario 4, the reduction in greenhouse gas emissions occurs at a cost of approximately $1200 per tonne). Obviously, these GDP impacts need to be spread across the package of environmental benefits. However, it is reasonably clear that greenhouse savings are unlikely to provide a significant additional benefit for this policy analysis.

Figure 4.7

THE RELATIONSHIP BETWEEN ECONOMIC AND ENVIRONMENTAL COSTS UNDER VARIOUS SCENARIOS



Even when comparing the trade-offs 'as if' Scenario 3 were the base case, the ranking of the policy options, and the efficient frontier, remain unchanged.

Sectoral impacts

The retail sector is the lynchpin when thinking about policy regarding LWPBs as increased retail sector costs leads to fall in GDP. A fall in output means that there is a reduction in the labour and capital employed to produce that output, which leads to a fall in household income. Households adjust for this reduced income by spending less — this reduction in demand affects output in other industries, which has a secondary impact on GDP.

While there are obviously employment shocks to a number of industries, the major industries affected, as categorised by MMRF-Green are:

- paper products manufacturing;
- plastic products manufacturing; and
- retail services.

Focusing on these industries, Table 4.4 shows both the NPV for output in these industries, and the average annual change in employment. Key observations include:

- in all the 'change scenarios' average employment increases in the retail services industry (for example, additional training requirements, handling requirements, etc), but as this is not accompanied by any demand growth or offsetting efficiencies industry value add decreases; and
- reductions in employment in the plastic product manufacturing industry exceed gains in the paper products manufacturing industry.

Table 4.4

OUTPUT AND EMPLOYMENT IMPACTS IN SELECTED INDUSTRIES (RELATIVE TO 'NO FURTHER ACTION'), 2005 TO 2016

Scenario	Industry value added NPV ($m)	Employment Average deviation (no.)
Paper products manufacturing		
Scenario 3	**$31.6**	**84.0**
Scenario 4	$48.6	138.0
Scenario 5	$50.4	143.0
Scenario 7	$12.8	39.0
Scenario 9	$23.9	72.0
Plastic products manufacturing		
Scenario 3	**-$129.3**	**-208.0**
Scenario 4	-$68.7	-128.0
Scenario 5	-$206.6	-349.0
Scenario 7	-$36.3	-68.0
Scenario 9	-$55.7	-104.0
Retail services		
Scenario 3	**-$46.0**	**363.0**
Scenario 4	-$26.6	697.0
Scenario 5	-$53.0	633.0
Scenario 7	-$36.4	486.0
Scenario 9	-$43.4	575.0

Regional impacts

The impact of the scenarios on gross state product (GSP) — the sum of value added across each of the industries within each state (Table 4.5) reveals that under no scenario does any state or territory increase total GSP, although there are likely to be redistributions between industries within scenarios. The impact of industry value added in Tasmania is relatively small compared to the other states and territories, in part because the Tasmanian state economy is relatively small, but also because Tasmania's paper products manufacturing industry increases its value added, driven by an increase in the demand for paper substitutes for LWPBs.

Table 4.5

NPV OF CHANGES IN GROSS STATE PRODUCT (2005 TO 2016, $ MILLION)

	Scenarios				
	3	4	5	7	9
NSW	**-$148.1**	-$427.2	-$263.1	-$251.5	-$292.7
Vic	**-$363.6**	-$334.8	-$582.8	-$202.0	-$238.8
Qld	**-$48.3**	-$199.0	-$89.9	-$115.8	-$134.0
SA	**-$17.5**	-$81.1	-$33.1	-$47.7	-$56.8
WA	**-$55.9**	-$196.1	-$101.1	-$116.2	-$137.9
Tas	**-$0.4**	-$10.5	-$1.5	-$7.3	-$7.6
NT	**-$8.4**	-$30.0	-$15.0	-$18.7	-$22.3
ACT	**-$3.9**	-$14.4	-$7.0	-$8.9	-$10.1

Looking at the impact of the proposed scenarios on household income — the best general measure of economic welfare — reveals that there is significant relative variation across jurisdictions in the different scenarios (see Table 4.6).

Table 4.6

NPV OF CHANGES IN HOUSEHOLD INCOME (2005 TO 2016, $ MILLION)

	Scenarios				
	3	4	5	7	9
NSW	**-$92.9**	-$258.3	-$165.3	-$154.0	-$177.6
Vic	**-$316.2**	-$241.3	-$513.8	-$149.1	-$175.8
Qld	**-$24.3**	-$126.6	-$46.2	-$73.6	-$84.0
SA	**-$10.8**	-$52.1	-$20.3	-$30.3	-$36.0
WA	**-$50.3**	-$176.3	-$90.5	-$108.6	-$129.6
Tas	**$0.9**	-$3.5	$1.2	-$3.0	-$2.4
NT	**-$9.1**	-$30.7	-$16.3	-$19.7	-$23.6
ACT	**-$4.5**	-$10.2	-$7.9	-$6.5	-$7.2

Chapter 5

Other issues: sensitivity, practicality and societal values

This chapter discusses important additional factors — that is, beyond those captured in the modelling presented in the previous chapter — that can bear on policy design decisions and pathways for phasing out LWPBs.

Modelling provides a holistic and consistent means of tracking and assessing impacts that work their way through a system. The can provide powerful insights to 'ripple' effects and the magnitude of changes likely to be observed.

However, results can be affected by the nature of the exogenous shocks introduced to the system and the assumptions that underpin the model itself. Models, by their nature, are abstractions and simplifications of reality — they cannot capture all the impacts or behavioural characteristics of markets or individuals. Modelling is a valuable tool for policymakers but does not replace the need to consider wider issues that can affect policy design and outcomes. Significant issues are considered in the following sections.

5.1 Timing

Timing can have an important impact on the costs and effectiveness of policy implementation. An obvious example of this is where discrete events and 'windows of opportunity' exist that can significantly affect costs or potential benefits. However, there are also subtle factors that can affect the calculation of costs and benefits associated with the timing of policy implementation. Key factors in this category (that can be treated as 'variables' in a cost benefit modelling context) are:

- the effect of time preference or 'discount rates' (that is, the rate at which future costs and benefits are discounted relative to those in an earlier period);
- changes in the pattern of costs and benefits that can arise from delayed or advanced action; and
- methodologies for deriving estimates for social and environmental impacts (a discussion of aspects of the environmental valuation model used in this report is provided in Appendix D).

Importantly, the effect of discounting in cost-benefit analysis is to place a higher weighting on near term outcomes and a diminishing weighting on outcomes that occur further into the future. By accentuating early year costs and benefits over delayed costs and benefits, discounting will tend to bias consideration of timing in favour of actions that have the effect of bringing forward a net benefit, or delaying a net cost. The distribution of these costs and benefits over time is also important.

Underlying growth in the economy means that changes that affect, for example, the percentage of bags that are recycled or discarded as litter in a particular year, or changes in industry output shares, can translate into different dollar costs because of base year effects. For example, a policy that reduces GDP by 0.1 per cent represents a dollar cost of $1 billion in an economy of $1000 billion, but only half that in an economy half the size. Differences in policy timing, coupled with discounting effects can fundamentally affect the NPVs of different policy approaches in a modelling context.

Table 5.1 presents the NPVs of the policy options analysed in the previous chapter, revised to reflect differences in implementation date and discount rate. For consistency, values are calculated between 2005 and 2016, with estimates reflected as current year expenditure equivalents (that is, all NPVs are calculated from a 2005 base year).

Table 5.1

NPV IMPLICATIONS OF CHANGES IN SCENARIO TIMING AND DISCOUNT RATE, $M

Scenario	As modelled	Advanced one year	Delayed one year	4% per annum	10% per annum
Scenario 1	-839.3	-944.2	-741.9	-1002.2	-709.8
Scenario 3	**-489.7**	**-549.5**	**-433.8**	**-569.9**	**-426.5**
Scenario 4	-1026.8	-1124.9	-929.4	-1201.6	-887.1
Scenario 5	-822.9	-926.9	-726.3	-957.1	-717.5
Scenario 6	**See Scenario 1 'advanced and delayed implementation results'**				
Scenario 7	-586.5	-651.9	-522.3	-704.7	-492.8
Scenario 8	-817.3	-907.0	-728.0	-985.9	-684.1
Scenario 9	-711.3	-793.2	-630.8	-857.7	-595.6

Notes: The NPVs for the 'as modelled' scenarios were calculated using a 'standard' discount rate of 7 per cent per annum. Net economic impacts for Scenario 2 are not reported because these reflect expiry of the ARA Code on a pre-agreed timetable, and represent a no further action 'baseline' result.

The results of Table 5.1 indicate a general trend toward higher costs if policy action is brought forward. This is because the effect of action is estimated to entail net costs (in both annual and NPV terms) — taking costly action earlier tends to increase estimates of NPV costs. The additional NPV cost of advanced policy implementation is generally in the order of 9 to 13 per cent. For the specific case of bringing forward a ban on bags (specified as Scenario 6, and in line with the project brief), the NPV cost of a bag ban from 2009 is estimated at around $800 million. A ban from 2008 is likely to cost around $950 million in net present value terms.

Using lower discount rates tends to make out-year costs closer to their undiscounted values and also has the effect of making the NPV estimate bigger. For the scenarios presented above, the choice of discount rate (that is, in moving from a rate of 7 per cent per annum to a rate of either 4 per cent or 10 per cent) can raise (or lower) the NPV estimate of a scenario by around 20 per cent. Again, the dominance of out-year net economic costs over estimated environmental benefits is the key driver of these results.

5.2 Practical issues

Cost benefit analysis of policy options provides an insight to the likely impacts of measures — if implementation and coverage proceeds as expected. However, in moving to phase out LWPBs policymakers must also consider the need for supplementary actions designed to reinforce policy objectives, or close 'loop holes' that could see those objectives undermined over time. Practical problems, and implications for policy design, are discussed below.

Avoiding a switch to undesirable substitutes

The policy options reviewed in this study focus on a reduction in LWPBs, and the substitution of a combination of re-usable bags and a point of sale alternative (in this case, a paper carry bag) to perform the function currently carried out by LWPBs. This is a rational 'cost driven' behavioural scenario.

However, there is a range of close substitutes for LWPBs and it is feasible that pressure to eliminate *light-weight* plastic bags could simply serve to stimulate the use of heavier plastic bags, or some other bag variant, in similar numbers. In essence, there is risk that the policy may shift rather than alleviate the problem.

Some supermarkets have already replaced LWPBs in the check-out with thicker plastic bags, and a suggestion that these be reused by customers. Other retailers might find more ingenious and less constructive ways to reduce LWPB use. This is a problem well known to those engaged in drafting legislation — definitions and requirements need to be specified in a way that eliminates 'loop holes' that could be used to undermine the effectiveness of the new law.

Numerous examples of the ingenuity of legislative drafters and those who would avoid requirements laid down by governments can be found in the history of tax law, the commercial tariff concession system and other regulation. If legislation is to be developed to address the problems associated with LWPBs — environmental damage, and a symptom of modern 'throw-away' society — it will be important to identify and eliminate opportunities for regulatory avoidance.

Appropriate legislation would need to consider and respond to the full set of 'problem bags', focusing on those that are currently attracting the attention of policy makers (that is, LWPBs — or more specifically, high density polyethylene singlet-type bags below a certain weight) and also those that might be readily substituted for them.

Nolan-ITU provides examples of a range of bags that might be offered as a replacement for LWPBs.[42] These include the:

- wave-top high density polyethylene (HDPE) bag;
- 'boutique' style low density polyethylene (LDPE) bag (as commonly provided by department stores);
- re-usable LDPE bags; and
- biodegradable bags (for example, starch or polymer-based).

[42] Nolan ITU 2005, op. cit.

Of course, re-usable bags and single use paper bags also figure in the array of 'bag substitute' choices.

The response of retailers to pressure to phase out LWPBs, in terms of the bags they offer customers as replacements, will be a critical factor in the overall success of the policy. It is likely that the aims of Environment Ministers would be thwarted if elimination of 4.3 billion LWPBs simply led to the introduction of an extra 4.3 billion LDPE boutique bags or wave top HDPE bags to the national waste stream.

Promoting re-usables

Even in the case of a substitute paper carry bag (assumed to be the fallback bag 'technology' in this study when a re-usable bag is not convenient) it can be argued that more environmentally benign bag options are available and should be promoted by policymakers. Elimination of LWPBs will not necessarily stimulate retailer actions and consumer responses that align with fully specified environmental goals. This highlights the need to explicitly specify and respond to the LWPB problem.

If the 'problem' with LWPBs is that they are a symbolic example of unnecessary waste within our society, then it is likely that policymakers' deeper purpose in targeting reduction of LWPB consumption is encouraging the uptake of more resource efficient alternatives (that is, to encourage customers to use re-usable bags whenever possible, or no bags at all).

If this is a reasonable synthesis of policymaker objectives, then the issue becomes one of how best to achieve this behavioural change and divert customer choice away from disposable bags toward less resource intensive options.

Solutions to this question are likely to involve either the ongoing cooperation of retailers in limiting the range and availability of bags offered at point of sale so that bag use is constrained to an 'environmentally friendly' set, or ensuring that retailers impose an explicit price on all 'throw away' bags, thereby shifting the economics of bag use in favour of re-usables.

Given the challenges involved in minimising definitional loopholes, and mandating the availability (or non-availability) of particular bags by retailers, the use of a minimum price-based approach applied to the widest range of single use bags promises to be the most practical and effective means of encouraging an overall reduction in throw away bags, and a substitution toward long lived re-usables.

The support and cooperation of retailers would be important to the streamlined implementation of a price-based approach. The scenarios examined explore some useful approaches to introducing a point of sale price on bags — including schemes where retailers are allowed to keep the proceeds of a mandatory bag charge (representing a potentially significant windfall to these businesses). Such mechanisms are likely to be an effective means of winning retailer support — although high price elasticities of demand for bags mean that potential revenues quickly drop off at increasing price levels.

Revenue sharing and pricing arrangements should also be considered in terms of compensation for reduced retailer profits, and the potential efficiencies available to customers from re-usable bags in an environment where the cost of bags is transparent (rather than loaded into grocery prices). As noted in chapter 3, the price of disposable bags does not have to be very high for consumers to recognise and respond to the financial benefits of a re-usable bag.

Potential for inconsistent action under a voluntary approach

Two scenarios put forward for examination in this study relate to voluntary action. These introduce the option of a voluntary charge to be applied by retailers, and the possibility of a voluntary approach to phasing out LWPBs by 2009 (adopted in the first instance by members of the ARA Code).

Voluntary approaches carry the potential benefit for retailers, and the economy, of allowing maximum flexibility in achieving agreed outcomes. The downside of voluntary approaches is that they can suffer from a lack of coordination and lead to disparate action (including the possibility of inaction by some) that can magnify costs and reduce incentives to deliver on commitments. Structure and coverage are important determinants of the effectiveness of a voluntary approach.

A key problem that can undermine voluntary approaches is the risk of 'free riding'. This arises in situations where a firm expects that it will be better off if others take action, and it does not. For LWPBs, this can arise if a party to the ARA Code perceives an advantage in moving more slowly to achieve agreed commitments than its competitors. In extreme cases, the incentive to lag others in implementing policies that can impose costs or reduce profits can paralyse action altogether.

For those looking to fulfil commitments, lack of coordinated action at an industry level can raise the threat of first mover *disadvantage*, and unnecessarily raising their costs or potential loss of market share. Incentives for delayed action or 'shirking' under an extension of the ARA Code can be expected to increase as the phase-out timetable becomes more ambitious and expected costs rise. Free riding can also be an issue for ARA Code members who take action to eliminate LWPBs (or introduce bag charges) in an environment where their smaller competitors do not. This goes to the issue of coverage.

Within this study it has been assumed that all large retailers will comply with the extended ARA Code, and that 50 per cent of small and medium retailers will comply. The remaining 50 per cent of small and medium retailers may not comply, as they are under no obligation to follow the lead of ARA Code members. This represents a risk to the effectiveness of a phase out strategy based on voluntary action. The extent to which this risk is realised depends on competitiveness conditions on the retail market and the response of customers to differences in relative costs and 'branding'.

For the voluntary options analysed in previous chapters, it has been assumed that customers of large supermarkets (and other ARA Code members) are unlikely to switch shopping locations on the basis of a bag charge that might represent (at most) a dollar or two per weekly shopping trip. In fact, some businesses that have introduced bag charges have noted an increase in customer satisfaction and numbers — which they attribute to perceptions of increased social and environmental responsibility[43]. Moreover, even in the face of bag charges, many customers may still perceive that their overall grocery bill is still lower than if they had bought the same basket of goods elsewhere.

The response of small retailers is also difficult to predict. It may be, as assumed, that they will adopt a strategy of continuing to offer LWPBs while their larger competitors phase out bags by introducing explicit prices or availability constraints. However, given the structure of the industry and the leadership role played by the major retailing chains, it is feasible that smaller players might actually follow the lead of ARA Code members — particularly if this represents an opportunity to introduce and profit from a charge on bags.

The likely consequence of these effects is an empirical question requiring deeper analysis of the structure of the retail industry and pricing approaches applied within it. However, it is possible to make the following broad observations about the potential impact of a voluntary policy approach to phasing out LWPBs in Australia:

- a voluntary approach can invite disparate action, unless specific targets are agreed and monitored for individual businesses;
- similarities in business operations and cost structures (as is likely to be exhibited by major supermarkets, and retailers) allow for a more consistent policy treatment and can facilitate negotiation of an effective mandatory approach;
- the dominance of major retail and supermarket chains in Australia is such that volunteerism among non-members of the ARA Code is unlikely to significantly weaken LWPB reduction efforts under the ARA Code;
- greater coverage and constancy of effort are likely to deliver increasing gains in terms of both economic and environmental impacts.

The concentrated nature of retailing means that policymakers have an excellent opportunity to engage major players, and develop a firm plan for further action.

The Organisation for Economic Cooperation and Development (OECD) has recently completed an international study of voluntary environmental measures, and their effectiveness. Detailed observations and advice to policymakers interested in designing such approaches are presented in Box 5.1. This advice aligns with the broad observations outlined above, and also provides some further insight to the challenges and opportunities that can be associated with continued emphasis on voluntary approaches.

[43] Nolan-ITU 2002, op. cit., p. 50.

Box 5.1

KEY OECD PERSPECTIVES ON VOLUNTARY ENVIRONMENTAL POLICY MEASURES

- While the environmental targets of most – but not all – voluntary approaches seem to have been met, there are only a few cases where such approaches have been found to contribute to environmental improvements *significantly different* from what would have happened anyway.
- Hence, the environmental effectiveness of voluntary approaches is still questionable.
- This could indicate that a significant degree of 'regulatory capture' has taken place.
- But it remains unclear what would have been the – realistic – alternative to a given policy or policy combination. Would there in practice have been sufficient political willingness to give priority to reaching ambitious environmental targets – if that, for instance, could jeopardise the (often modest) employment in the most affected (highly polluting) sectors?
- The broadening use of voluntary approaches seems to reflect the fact that policy-makers have tried to find an instrument through which one could avoid having to make such trade-offs. It is, however, unlikely that difficult trade-offs can be avoided if more ambitious environmental target are to be met in the future.
- Voluntary approaches are generally designed to limit the impacts of environmental policies on the production costs of participating firms. However, when firms do not face an appropriate marginal incentive to abate pollution (from a tax, or from the value of a tradable emissions permit), environmental policy largely fails to stimulate a reduction in demand for the products that cause environmental problems in their production.
- The *economic efficiency* of voluntary approaches is *generally low* – as they seldom incorporate mechanisms to equalise marginal abatement costs between all producers, *inter alia* because environmental targets tend to be set for individual firms or sectors, rather than at a national level.
- Voluntary approaches can sometimes be put in place more rapidly than alternative policy instruments, like new regulations or economic instruments. However the likelihood of a voluntary approach providing any environmental improvements beyond 'Business-as-Usual' depends strongly on their quality.
- A 'first best' approach would be to replace the 'command and control' policies by economy-wide economic instruments – taxes or tradable permits – where technically and administratively possible.
- A 'second best' option could be to improve the flexibility of pre-existing 'command-and-control' regulations, instead of a piece-meal approach that lets only a few companies attain environmental improvements in a more flexible manner.
- The performance of many voluntary approaches would be improved if there were a real threat of other instruments being used if (appropriately set) targets are not met. However, if it is likely – or widely believed – that the alternative policy would entail significant negative social impacts, the credibility of such threats may not be great.
- Various types of administrative and transaction costs vary greatly between different voluntary approaches. If too few resources are spent in their preparation, negotiation and enforcement, their environmental impacts are likely to be very modest.

Source: Extracted from OECD 2003, *Voluntary Approaches for Environmental Policy: Effectiveness, Efficiency and Usage in Policy Mixes*, Organisation for Economic Cooperation and Development, Paris, pp. 14-15

5.3 Social impacts

The third dimension of a fully comprehensive cost benefit analysis is consideration of social impacts arising from policy changes. Though there are often overlaps (and therefore a need to avoid double counting), social impacts need to be considered alongside economic and environmental factors in determining whether intended policy reforms and objectives are likely to represent an improvement for society as a whole. As such, assessment of social impact can involve consideration of distributional issues (for example, how will costs and benefits be distributed across income or demographic groups within society) or compatibility with cultural requirements — the current debate on industrial relations reform and its implications for family values is a good example of this; consideration of proposed anti-terrorism laws and implications for personal rights is another.

The net social benefit arising from elimination of LWPBs (and increased uptake of re-usable bags as a consequence) is a subject of debate. Some argue that significant social benefits will accrue to elimination of LWPBs because they are a symbol of waste within society, and such action would represent a first step toward greater environmental consciousness and stewardship. For instance, a:

> factor that needs to be understood in the debate about shopping bags is symbolic value. The plastics and packaging industries came under intense pressure in the 1970s and 1980s because 'they had become a politically incorrect symbol of the threat to the environment' (Bayers, 1995). A cultural analysis of plastics in the United States noted that: By definition the plastics industry was everything ecological activists wanted to expunge from the American experience. Since the early twentieth century, promoters of industrial chemistry and synthetic materials had boasted of transcending age-old limits of transitional materials by extending scientific control over nature. During the 1920s predictions of an expanding stream of inexpensive artificial goods had suggested material abundance as the basis for a utopian democracy. By the final third of the century that transcendence threatened to drain natural resources and pollute the society that supported it by generating a flow of irrecoverable, inassimilable materials — garbage, society's excrement. (Meikle 1995: 264)

> To some extent the concerns about the large number of plastic shopping bags consumed in Australia, and their high level of visibility in domestic waste and litter, are representative of much broader concerns about plastics and packaging. This does not mean that concerns about plastic shopping bags are any less important or urgent from a policy perspective. It does mean however, that the development of policy solutions needs to consider social and cultural issues as well as the scientific facts about environmental impact. Policy measures to reduce consumption (or impacts) of shopping bags are likely to be well received in the community.[44]

Consumer surveys also suggest that action to reduce LWPBs would have popular support. Environmental surveys commonly detect concern over litter and waste issues, and the high volume (and profile) of plastic bags in society make them a target for policy action. For example, a survey conducted for the NSW Department of Environment and Conservation in 2004, found the environment to be a middle ranked (and unprompted) concern among the 805 participants, with waste being raised as an issue in about 10 per cent of responses focused in this area, and ranking fourth in terms of priority categories (see Table 5.2).

[44] Re-usable Bags, Facts About Plastic Bags, http://www.re-usablebags.com.au/plasticbags.htm, Accessed 28 November 2005.

Table 5.2

NSW SURVEY RESPONSES ON PRIORITY ENVIRONMENTAL CONCERNS

issue	First response	Second response	Total responses
Water quality	42	20	62
Pollution (general)	14	10	23
Air quality	14	16	30
Waste	5	9	14
Flora and fauna protection	3	5	8
Urban management	2	5	7
Land degradation	1	1	2
Energy conservation	0	1	1
Chemicals & pesticides	2	2	4
Noise	1	3	4
Other	3	4	7
Don't know/none	13	11	24

Source: Department of Environment and Conservation (NSW) 2004, *The Environment and Ethnic Communities in 2004: A Survey of the Environmental Knowledge, Attitudes and Behaviours of Eight Ethnic Communities in NSW*, DEC Social Research Series, Sydney, p. 23.

Notably, disaggregation of category responses reveals that nearly all the concern over waste was focused on litter issues, with 'litter and dumping of rubbish' accounting for 12 of the 14 recorded responses, and ranking third in the tally of 27 disaggregated responses.

On the other hand, industry groups such as the Plastics and Chemicals Industry Association, while recognising the need for improved resource use and waste reduction in society, point to the benefits that bags provide and their contribution to health, convenience and general amenity (see Box 5.2). These issues must also be weighed in determining appropriate social values.

Box 5.2

PRODUCER PERSPECTIVES ON LIGHT WEIGHT PLASTIC BAGS

- Analysis of litter collections proves less than 1 per cent of litter is plastic supermarket checkout bags (Source: Clean Up Australia)
- Overseas research indicates that people worry less about littering if they think products will degrade
- Banning plastic bags will not solve the litter problem. It is a behavioural issue, not a product issue
- Best solution is education, a strong focus on recycling and enforcement of penalties for littering
- Plastic bags are photo-degradable but need U.V. light
- Could be made bio-degradable with starch and other additives but not a solution:-
  a. Would send wrong message to those who litter
  b. Will destroy the existing and emerging plastics recycling industry
  c. The process of degradation will give off greenhouse gases
  d. Degradation will increase risk of ground water contamination in landfill where most bags finish up
- 75 per cent of plastic shopping bags have a recognised second use as kitchen tidy liners, nappy bags, household storage, etc. This is a very efficient second use product that conserves resources and should be encouraged.
- All plastic waste to landfill represents around 4 per cent of landfill
- Australian public respond positively to recycling and leads the world
- Plastic bags have handles and are waterproof
- Paper cost is 800 per cent higher than plastic, which would be passed onto consumers
- Paper uses four times the energy on a cradle to grave analysis
- Plastic leaves the smallest footprint on earth's environment
- Bring your own bag? — not practical for many people
- Shopping habits have changed - we shop more often and on impulse
- Tests with bag-free lanes show people want speed and convenience
- Population change - older people, weight is an issue if bags over-filled
- Health problems with contaminated bags used previously for fresh meat or cleaning products, then for vegetables. Who will be responsible for food safety?
- Slower checkouts increase costs for consumers
- Bag costs impact heavily on people in society who can least afford it.

Plastic Bags are safe, non-toxic, used in food packaging, efficient and low cost to consumers, recyclable, re-usable and use the least amount of earth's resources. Polling shows people want a solution without radically changing their lifestyle. People want recycling as it offers a solution and they are doing their bit for the environment

Source: Plastics and Chemical Industry Association, 'Plastic bags', http://www.pacia.org.au/index.cfm?menuaction=mem&mmid=009&mid=009.002, Accessed 30 November 2005.

Ultimately, it is up to policymakers to judge the social merits of pursuing symbolic objectives, recognising that such actions will entail economic costs. Issues of public perception and cultural acceptance can also attach to the means and rate at which a LWPB phase out is achieved. This set of issues is also linked to consumer sentiment, and best judged by political decision-makers. The value of social benefits necessary to balance the cost of options and deliver a positive net present value is discussed in the following chapter.

Chapter 6

Conclusions

In comparison to the *status quo*, all change options identified by the Environment Protection and Heritage Council produce outcomes in which the estimated economic and environmental costs exceed the benefits by substantial margins. As shown in earlier chapters, this negative outcome is:

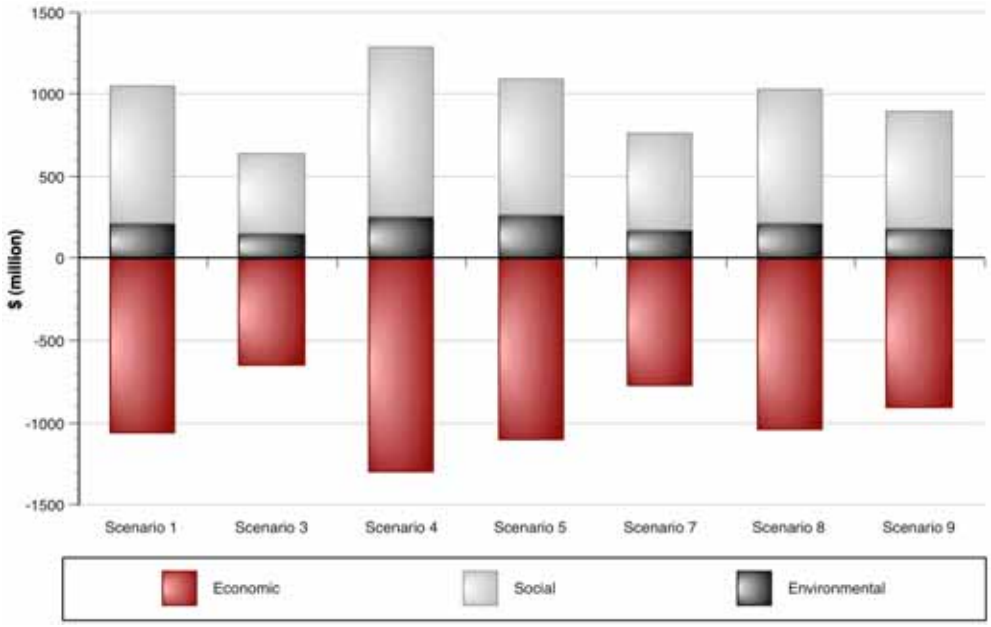
- driven by the interaction of adjustment costs for industry and higher costs for industry and/or consumers associated with the switch to LWPB alternatives; and
- relatively insensitive to alternative implementation dates and alternative discount rates (that is, the scenarios all still have a significantly negative impact on national income).

6.1 Full impact outcomes

Figure 6.1 depicts the net present value of costs and benefits estimated for the economic and environmental impacts of LWPB phase out scenarios covered in this study. Importantly, it shows the significant social benefits that must be attributed to different LWPB phase out options for the net present value of these initiatives to be positive — that is, for net benefits to accrue to these actions. In most cases, a net present value (NPV) of social benefits of around $500 million to $1 billion is required to justify the phase out of LWPBs, relative to a 'no further action' scenario.

Figure 6.1

REQUIRED SOCIAL BENEFIT TO DELIVER A 'BREAK EVEN' NPV RESULT RELATIVE TO SCENARIO 2 — 'NO FURTHER ACTION'



Scenario 2 is not explicitly depicted here. It represents a baseline or 'inaction' scenario in which the current ARA Code on LWPBs expires and no further action is taken. Modest administrative savings are associated with this outcome, but LWPB usage and associated environmental damage costs grow unabated. In the period from 2005 to 2016 in the absence of further action (as reflected in the scenarios) an estimated 83.3 billion LWPBs will enter the waste stream and an additional 724.7 million will wind up as litter.

A smaller social benefit (equivalent to an NPV of around $0.75 billion) is required to balance the economic costs associated with Scenario 3, but this is mainly due to the fact that bags are not fully eliminated under this option — instead they are subject to ongoing suasive pressure through continuation of the ARA Code of practice, assumed to maintain bag usage as a proportion of retail sales at current levels. Commensurate growth in the number of LWPBs in the waste stream, and consequential environmental damage effects, explain the lower net environmental benefits associated with this approach. It is less costly, but it also achieves less.

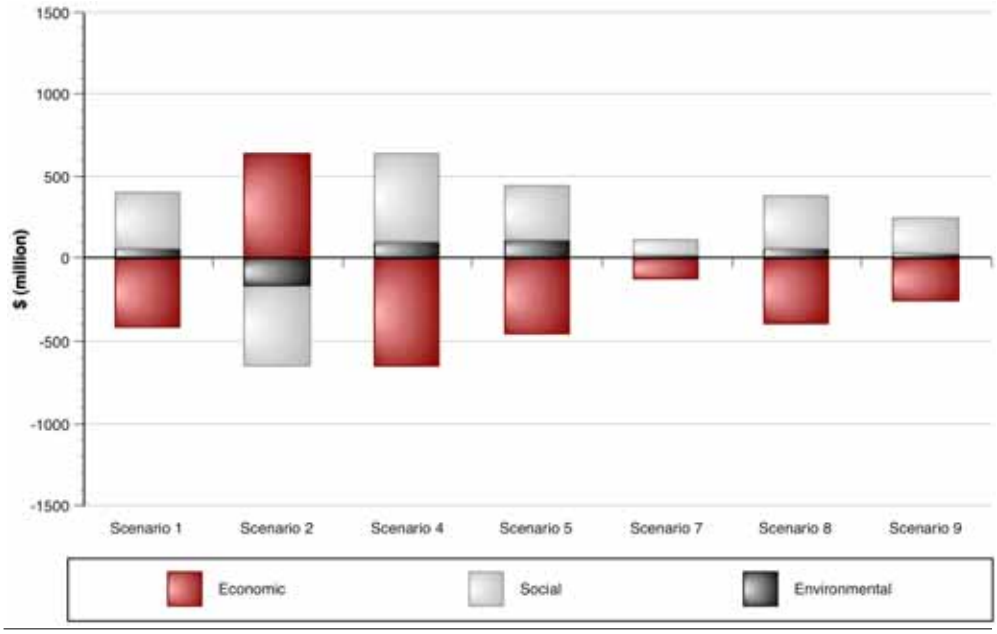
Scenario 7 is also a lower cost option, but it also does not eliminate all plastic bags. Rather, this option depicts a bag levy designed to recoup the cost of a litter elimination campaign in which LWPBs are successfully removed. A litter campaign funded to a level of over $300 million (and rising through time) focussing exclusively on collection of LWPB's is assumed to achieve this purpose. This represents an effective bounty of about 50 cents per littered bag, and an expenditure level about 50 per cent higher than the total amount currently spent on all public litter collection in Australia.

Other scenarios depicted achieve elimination of LWPBs, but at higher levels of economic cost and with only a moderate additional environmental benefit. This reflects the fact that only a small percentage (under 1 per cent) of LWPBs arise as litter — the rest are disposed of in landfill. The calculations represented here reflect the costs of attempting to eliminate 100 per cent of LWPBs in order to get at the less than 1 per cent of LWPBs that are the principal cause of environmental damage.

While none of the modelled scenarios is representative of 'business as usual' the value of the social impact necessary under each of the options is likely to be between the impact necessary under Scenario 2 and Scenario 3 — the extension of the ARA Code. The required social benefit to deliver a 'break even' NPV result relative to Scenario 3 is shown in Figure 6.2. Moving to a ban, if the 'fallback position' for future policy is to continue actions along the lines of those already implemented, would be justified if the perceived social benefit (out to 2016 — measured in net present value terms) is in the order of several hundred million dollars.

Figure 6.2

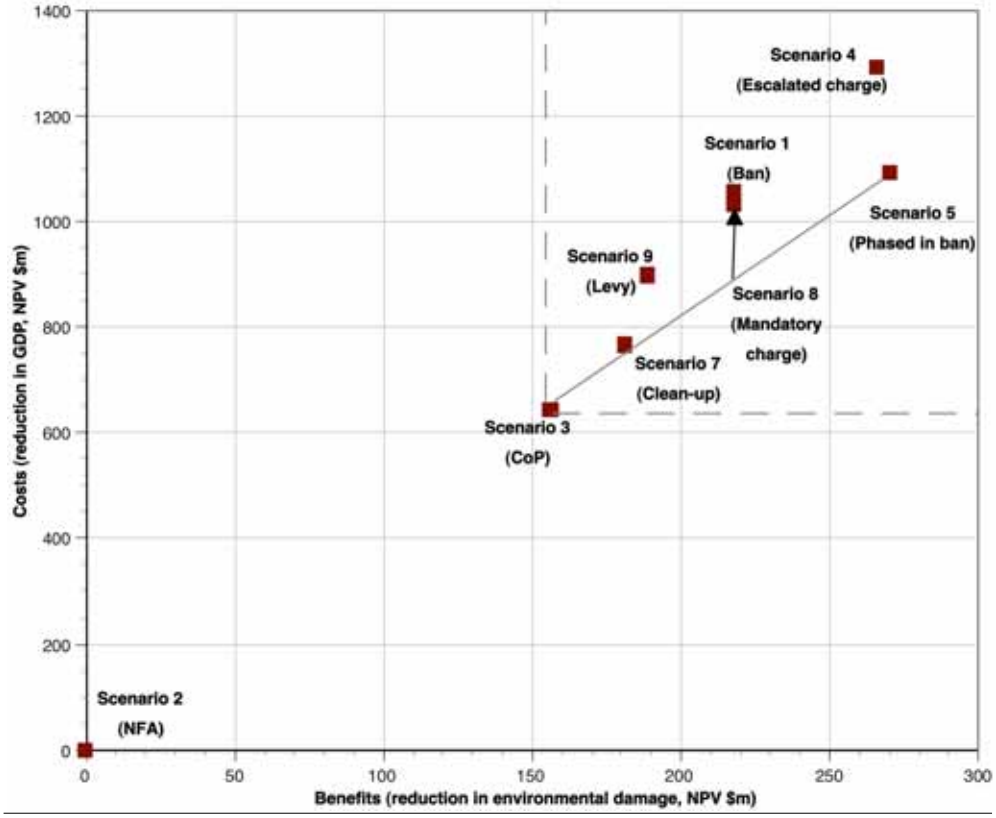
REQUIRED SOCIAL BENEFIT TO DELIVER A 'BREAK EVEN' NPV RESULT RELATIVE TO SCENARIO 3 — 'EXTENDED ARA CODE OF PRACTICE'



Reflecting the relationship between economic and environmental impacts, Figure D.2 shows the tradeoffs involved in the modelled change scenarios, with the clear implication that the efficiency frontier (that is, the options that represent the most efficient tradeoffs) are Scenarios 3, 5, and 7.

Figure 6.3

THE RELATIONSHIP BETWEEN ECONOMIC AND ENVIRONMENTAL COSTS UNDER VARIOUS SCENARIOS



6.2 Key policy observations

As highlighted in Figure 6.1, non-captured benefits of an elimination policy for LWPBs must be substantial to outweigh its cost, and this is not fundamentally altered by the mechanism that is applied, although phasing strategies tend to result in earlier (and therefore, in NPV terms, higher) costs. Essentially, this is because the regulatory mechanisms under consideration aim to remove *all* LWPBs, when the environmental benefits are derived by the elimination of the less than one per cent of LWPBs that are a problem (that is, those that are littered).

The dominance of economic costs over environmental benefits is likely to be insensitive to changes in the estimates of environmental damages arising from discarded LWPBS. Setting the social impact aside, the environmental damage attributable to an LWPB would need to begin at around $2.50 to $3.00 each before the net present value (NPV) of the LWPB elimination policy options broke even. This is equivalent to the economic cost of the measures, divided by the amount of litter reduction achieved by each over the analysis period. Higher values would need to be attributed to these benefits (on a per bag basis) if the incremental value of litter reduction showed diminishing environmental returns (eg. halving the number of bags induced more than half of the pay-off).

The analysis shows that the environmental benefits from eliminating the 1 bag in a 100 that is a problem do not come close to justifying the costs associated with eliminating the other 99, and this is likely to be true over a wide range of environmental values.

Nevertheless, it is clear that policymakers are responding to a strong sentiment within society to take action on bags. A change in social behaviour can be affected by imposing a relatively modest fee on LWPBs, allowing consumers to benefit from investing in a re-usable bag, and reducing the incidence of transactions in which a consumer accepts an LWPB without thought, and subsequently discarded without thought. It remains an open question as to whether such non-quantified benefits would be sufficient to offset the significant net costs identified in this study.

Given this uncertainty, and the government and industry commitment to phase out single use LWPBs, Table 6.2 shows a ranking of the identified change scenarios (that is, not including the 'no further action' scenario) against a number of alternative criteria. This exhibits a mixed pattern of rankings, and policy makers may put different weightings on these criteria.

Table 6.1

SUMMARY TABLE OF ECONOMIC AND ENVIRONMENTAL COSTS AND BENEFITS

Scenario	Costs (PV, $m)	Benefits (PV, $m)	Litter reduction (millions)	Maximise Benefits	Minimise Costs	Maximise benefit: cost ratio
1. Eliminate LWPBs by 2009	-$1057.1	$217.8	360.6	3	5	6
3. Extend ARA Code	**-$646.0**	$156.3	233.2	**7**	***1***	**2**
4. Voluntary charge	-$1293.1	$266.3	418.4	2	7	7
5. Voluntary phase out to 2009, mandatory beyond	-$1093.5	$270.6	422.4	***1***	6	***1***
7. Disposal fee (cost recovery)	-$767.9	$181.5	300.5	6	2	3
8. Regulated price (kept by retailers)	-$1035.1	$217.8	360.6	3	4	4
9. Levy on LWPBs	-$900.0	$188.7	312.5	5	3	5

Magnitudes also need to be put in perspective. The essence of a NPV calculation is to collapse future costs and benefits into a value relevant to the current year through the use of a discount factor. The estimates tabled above reflect the outlook of impacts between 2005 and 2016 at a discount rate of 7 per cent per annum. In broad terms, LWPB phase out scenarios reflect costs to the economy of around $100 million per year — consistently less than 0.02 per cent of gross domestic product, but by no means a trivial amount.

Social benefit requirements can also be considered on a per bag basis. Between 2006 and 2016 approximately 59.3 billion bags are due to be consumed in Australia on a 'business as usual' basis (that is, no further action, and expiry of the ARA Code), with 515.8 million of these ending in the litter stream. A number of the policies analysed above drive this to around zero (recall that consumers are likely to buy plastic bags for garbage disposal in response to a ban). Required social net present values, calculated per eliminated and littered bag, are shown in Table 6.2.

Table 6.2

REQUIRED SOCIAL NPV ON A PER BAG 'CONSUMPTION-REDUCED' AND 'LITTER –REDUCED' BASIS

Scenario	Required 'break even' NPV ($m)	LWPB consumption foregone (billions)	Required NPV per bag – reduced consumption ($)	Required NPV per bag – reduced litter ($)
1. Eliminate LWPBs by 2009	$839.30	41.5	$0.025	$2.33
3. Extend ARA Code	$489.67	26.8	$0.024	$2.10
4. Voluntary charge	$1026.80	47.4	$0.027	$2.45
5. Voluntary phase out to 2009, mandatory beyond	$822.87	48.6	$0.023	$1.95
7. Disposal fee (cost recovery)	$586.47	20.7	$0.037	$1.95
8. Regulated price (kept by retailers)	$817.34	41.5	$0.025	$2.27
9. Levy on LWPBs	$711.29	33.2	$0.027	$2.28

Table 6.2 indicates that the cost of bag reduction policies can be justified on a net present value (NPV) basis if policymakers judge that the social benefit (over and above economic and environmental considerations) from reducing bag consumption exceeds around 2.4 cents per bag (for each of the tens of billions of bags that would otherwise be consumed in future years). If the perceived social benefit is focused on litter reduction, then the NPV of this social benefit must be at least $1.95 per bag to begin to justify the policy options examined — in addition to the environmental benefit that would be generated.

It remains for policymakers to consider these estimates, and review them in the context of further issues associated with practicality, stakeholder acceptability and wider environmental and social opportunities. However, some broad observations on these issues and how they might be reflected in a preferred policy outcome are discussed briefly below.

'Navigation points' for policy development

The foregoing analysis highlights the impact of different policy approaches to reducing the use of LWPBs in our society. Different approaches generate different mixes of costs and benefits, but all phase out options generate high costs relative to the environmental benefit they generate. This is because environmental costs are chiefly associated with littered bags, and these represent less than 1 per cent of bags used. The remaining bags go to landfill, and their environmental impact is relatively benign in this location. Social disdain for LWPBs is a legitimate issue for policymakers to respond to, but there is risk that outlawing bags might see the current plethora of LWPBs replaced by a plethora of some other convenient and low cost disposable bag.

This study has highlighted some key characteristics that can act as navigation points for the development of an efficient and effective policy for reducing the environmentally adverse and socially undesirable implications of LWPBs. These are:

- the 'free' status of LWPBs generates no incentive for consumers to reduce their use of these items;
- experience has shown that consumption of LWPBs falls off significantly at modest prices;
- re-usable bags are a highly cost effective alternative to LWPBs, but consumers cannot pocket this benefit if the cost of LWPBs continues to be spread across the cost of groceries and other goods;
- consumers will continue to face circumstances where a LWPB is an efficient option for their carrying needs (eg. to carry refrigerated products, for impulse purchases, etc); and
- environmental benefits flow from reductions in littered bags.

These findings, supported by the comparison of modelled options, suggest that a price-based approach is likely to be considerably more cost-effective than a ban in circumstances where it allows for residual bag use. That is, when a price is used to drive a significant reduction in bag consumption but allows those consumers who put a high value on LWPBs to continue to access them. Policymakers have the opportunity to weave these characteristics into a 'package' of measures that balances the economic, environmental and social issues involved.

Appendix A

Abbreviations

ARA Code	Australian Retailers Association *Code of Practice for the Management of Plastic Bags*
CGE	Computable general equilibrium
GDP	Gross domestic product
HDPE	High-density polyethylene
LDPE	Low-density polyethylene
LWPB	Light-weight plastic bag
NEPM	National Environment Protection (Used Packaging Materials) Measure
NPC	National Packaging Covenant
NPV	Net present value

Appendix B

Overview of policy shocks input to the MMRF-Green model

The model of consumer demand and alternatives for LWPBs is a key driver of the modelling. It is important that a simple and representative set of assumptions be used to inform subsequent MONASH modelling work. The following specifications describe the policy scenarios for modelling work. Some of these are closely related, and a core set of these will forward for MONASH modelling. Other results and variants can be interpolated from key scenario model outcomes.

B.1 General industry behavioural assumptions

- Retailers pass full cost of bags onto customers.
- The cost to retailers of the current Code of Practice arrangements for LWPBs is around $21 million per annum. This is reflected in staff training costs, in-store promotion and signage and administrative costs associated with ARA Code responsibilities.
- The substitution elasticity of large and small retail/ supermarket service providers is 0.5 (that is, a 1 per cent increase in supermarket prices will see a 0.5 per cent reduction in patronage, and migration to smaller traders).

Scenario specifications

1. Eliminate LWPBs by 2009

Timing: comprehensive ban effective from 1 January 2009

Key assumptions:

Industry — adapted from Nolan-ITU's cost-benefit analysis.[45]

- One-off cost to retailers of $187 million ($65 million for staff training, $120 million for increased theft — based on the Irish experience — and $1.7 million to modify equipment to cater for LWPB substitutes)
- On-going costs to retailers caused by increased transaction times/administration costs of $60 million annually.
- No costs to retailers associated with in-store education and promotion.
- No costs to retailers associated with in administration.
- **All other impacts modelled by MMRF-Green**

Households — Based on demand curve for LWPBs

- 100 per cent reduction in the consumption of LWPBs from 2009 onwards, at $0.03 per LWPB ($142 million in 2009)

[45] DEH internal document.

- Re-usable bags consumed as substitutes for 95 per cent of LWPBs foregone, at a replacement rate of about 125 LWPBs for each re-usable, at $1.40 per re-usable ($50 million in 2009).
- Paper bags consumed as substitutes for 5 per cent of LWPBs foregone, at a replacement rate of one for one, at $0.15 per bag ($36 million in 2009).
- Bin-liners consumed as substitutes for 100 per cent of LWPBs foregone, at a replacement rate of one for seven, at $0.05 per bin-liner ($36 million in 2009).
- **All other impacts modelled by MMRF-Green**

Government — Based on Nolan-ITU studies, and consultation with DEH

- Reduction in expenditure on litter clean-up for stray LWPBs ($4 million).
- On-going costs of 0.1 full-time-equivalent for administration and monitoring for each jurisdiction (nine jurisdictions, at $11 000 each, $99 000).
- **All other impacts modelled by MMRF-Green**

2. No further action (Code of Practice expires – the base case)

Timing: current practice runs to 31 December 2005, then no further action

Key assumptions:

Industry — DEH

- Reduction to retailers in the costs of complying with the CoP (approximately $21 million annually).

Households

- Continuation of 2005 LWPB consumption, increasing gradually over time (2.5 per cent annually).

Government

- No change.

3. Extend Code

Timing: Reduction in the consumption of LWPBs of 50 per cent, among all of the large retailers, and half of the small and medium retailers.

Key assumptions:

Industry — adapted from Nolan-ITU's cost-benefit analysis.[46]

- One-off cost to retailers not currently part of the ARA Code of $100 million .
- On-going costs to retailers not currently part of the Code caused by increased transaction times/administration costs of $9 million annually.
- On-going costs to retailers associated with in-store education and promotion of $22 million annually.

[46] Ibid.

- No costs to retailers associated with in administration.
- **All other impacts modelled by MMRF-Green**

Households — Based on demand curve for LWPBs

- Approximately 50 per cent reduction in the consumption of LWPBs from 2006 onwards, at $0.03 per LWPB ($68 million in 2006)
- Re-usable bags consumed as substitutes for 95 per cent of LWPBs foregone, at a replacement rate of about 125 LWPBs for each re-usable, at $1.40 per re-usable ($24 million in 2006).
- Paper bags consumed as substitutes for 5 per cent of LWPBs foregone, at a replacement rate of one for one, at $0.15 per bag ($17 million in 2006).
- Bin-liners consumed as substitutes for 100 per cent of LWPBs foregone, at a replacement rate of one for seven, at $0.05 per bin-liner ($17 million in 2006).
- **All other impacts modelled by MMRF-Green**

Government

- On-going costs of 0.1 full-time-equivalent for administering the code and monitoring compliance for each jurisdiction (nine jurisdictions, at $11 000 each, $99 000).
- Reduction in expenditure on litter clean-up for stray LWPBs ($2 million in 2006).
- **All other impacts modelled by MMRF-Green**

4. Gradually escalated charge

***Timing:** LWPB charge from 1 January 2007 at $0.05 per bag, $0.15 from 2008, $0.25 from 2009.*

Key assumptions:

Industry — adapted from Nolan-ITU's cost-benefit analysis.[47]

- One-off cost to all retailers in 2007 of $187 million.
- On-going costs to all retailers caused by increased transaction times/administration costs (inversely related to LWPB consumption, $58 million in 2007, increasing to $82 million in 2009 and then linearly declining to $55 million in 2017 due to improved administrative efficiency).
- On-going costs to retailers associated with in-store education and promotion (starting at $10 million in 2007 and linearly declining to nothing by 2017).
- **All other impacts modelled by MMRF-Green**

Households — Based on demand curve for LWPBs

[47] Ibid.

- Approximately 50 per cent reduction in the consumption of LWPBs in 2007, 80 per cent reduction in 2008 and 100 per cent reduction in 2009, at $0.03 per LWPB ($68 million in 2007, $111 million in 2008 and $142 million in 2009)
- Off-set by increase in the amount spent on LWPBs at the charged price, 50 per cent of LWPBs at an additional $0.02 per LWPB ($45 million in 2007), 20 per cent of LWPBs at an additional $0.12 per LWPB ($111 million in 2008). No expenditure on LWPBs from 2009 onwards.
- Re-usable bags consumed as substitutes for 95 per cent of LWPBs foregone, at a replacement rate of about 125 LWPBs for each re-usable, at $1.40 per re-usable ($24 million in 2007, $39 million in 2008 and $50 million in 2009).
- Paper bags consumed as substitutes for 5 per cent of LWPBs foregone, at a replacement rate of one for one, at $0.15 per bag ($17 million in 2007, $28 million in 2008 and $36 million in 2009).
- Bin-liners consumed as substitutes for 100 per cent of LWPBs foregone, at a replacement rate of one for seven, at $0.05 per bin-liner ($17 million in 2007).
- **All other impacts modelled by MMRF-Green**

Government

- On-going costs of 0.1 full-time-equivalent for administration and monitoring for each jurisdiction (nine jurisdictions, at $11 000 each, $99 000).
- Reduction in expenditure on litter clean-up for stray LWPBs ($2 million in 2007, $3 million in 2008 and $4 million from 2009 onwards).
- **All other impacts modelled by MMRF-Green**

5. Voluntary phase out to 2009, mandatory beyond

Timing: 2006-08; Phase from current levels to zero (Code members), mandatory for all retailers beyond 1 Jan 2009.

Key assumptions:

Industry — adapted from Nolan-ITU's cost-benefit analysis.[48]

- One-off cost to all retailers in 2006 of $187 million.
- On-going costs to all retailers caused by increased transaction times/administration costs (inversely related to LWPB consumption, $15 million in 2007, increasing linearly to $60 million in 2009).
- On-going costs to retailers associated with in-store education and promotion (starting at $10 million in 2006 and linearly declining to nothing by 2010).
- No costs to retailers associated with administration.
- **All other impacts modelled by MMRF-Green**

Households — Based on demand curve for LWPBs

[48] Ibid.

- Linear reduction in the consumption of LWPBs to zero between 2006 and 2009, at $0.03 per LWPB ($35 million in 2006, $71 million in 2007, $107 million in 2008, and $142 million in 2009).
- Re-usable bags consumed as substitutes for 95 per cent of LWPBs foregone, at a replacement rate of about 125 LWPBs for each re-usable, at $1.40 per re-usable ($13 million in 2006, $25 million in 2007, $38 million in 2008, and $50 million in 2009).
- Paper bags consumed as substitutes for 5 per cent of LWPBs foregone, at a replacement rate of one for one, at $0.15 per re-bag ($13 million in 2006, $25 million in 2007, $38 million in 2008, and $50 million in 2009).
- Bin-liners consumed as substitutes for 100 per cent of LWPBs foregone, at a replacement rate of one for seven, at $0.05 per bin-liner ($13 million in 2006, $25 million in 2007, $38 million in 2008, and $50 million in 2009).
- **All other impacts modelled by MMRF-Green**

Government

- On-going costs of 0.1 full-time-equivalent for administration and monitoring for each jurisdiction (nine jurisdictions, at $11 000 each, $99 000).
- Reduction in expenditure on litter clean-up for stray LWPBs ($1 million in 2006, $2 million in 2007, $3 million in 2008, and $4 million in 2009).
- **All other impacts modelled by MMRF-Green**

6. Ban on LW plastic bags (early implementation)

Timing: Ban in place from 1 Jan 2007, 1 Jan 2008 (an experiment in timing).

Key assumptions:

- Linearity in model can be used to interpolate results for this scenario.

7. Disposal fee (cost recovery)

Timing: Additional fee of $0.02 applied by retailers to recover cost of effective LWPB disposal initiative from 1 January 2009 (making LWPB price = $0.05).

Currently, $4 million spent on cleaning up LWPBs, only cleaning up 20 million of the 60 million LWPBs littered. To clean-up the remaining 40 million, assuming decreasing marginal return on effort, is estimated at costing an additional $56 million. $60 million required, need roughly $0.02 per LWPB for 4 billion bags currently consumed.

Key assumptions:

Industry — adapted from Nolan-ITU's cost-benefit analysis.[49]

- One-off cost to all retailers in 2009 of $187 million (ie. tooling up costs incurred if preparatory action is not undertaken in advance of official commencement of obligations).

[49] Ibid.

- On-going costs to all retailers caused by increased transaction times/administration costs (starting at $58 million in 2009 and linearly declining to $55 million in 2019 to capture improved administrative efficiency).
- On-going costs to retailers associated with in-store education and promotion (starting at $10 million in 2009 and linearly declining to nothing by 2019).
- **All other impacts modelled by MMRF-Green**

Households — Based on demand curve for LWPBs

- 50 per cent reduction in the consumption of LWPBs from 2009 onwards, at $0.03 per LWPB ($71 million in 2009).
- Off-set by increase in the amount spent on LWPBs at the charged price, 50 per cent of LWPBs at an additional $0.02 per LWPB ($47 million in 2009).
- Re-usable bags consumed as substitutes for 95 per cent of LWPBs foregone, at a replacement rate of about 125 LWPBs for each re-usable, at $1.40 per re-usable ($25 million in 2009).
- Paper bags consumed as substitutes for 5 per cent of LWPBs foregone, at a replacement rate of one for one, at $0.15 per bag ($18 million in 2009).
- Bin-liners consumed as substitutes for 100 per cent of LWPBs foregone, at a replacement rate of one for seven, at $0.05 per bin-liner ($18 million in 2009).
- **All other impacts modelled by MMRF-Green**

Government

- On-going costs of 0.1 full-time-equivalent for administration and monitoring for each jurisdiction (nine jurisdictions, at $11 000 each, $99 000).
- Reduction in expenditure on litter clean-up for stray LWPBs ($2 million in 2009).
- Increased income from levy, less cost (assumed 8 per cent of amount collected) of collecting the levy ($44 million in 2009).
- **All other impacts modelled by MMRF-Green**

8. Regulated price (kept by retailers)

Timing: Fee of $0.25 applied by retailers from 1 January 2009.

Key assumptions:

Linearly interpolated from Scenario 4.

+9. Levy

Timing: LWPB levy of an additional $0.07 applied at point of sale from 1 January 2009.

Key assumptions:

Industry — adapted from Nolan-ITU's cost-benefit analysis.[50]

- One-off cost to all retailers in 2009 of $187 million.
- On-going costs to all retailers caused by increased transaction times/administration costs (starting at $76 million in 2009 and linearly declining to $52 million in 2019 to capture improved administrative efficiency).
- On-going costs to retailers associated with in-store education and promotion (starting at $10 million in 2009 and linearly declining to nothing by 2019).
- **All other impacts modelled by MMRF-Green**

Households — Based on demand curve for LWPBs

- 80per cent reduction in the consumption of LWPBs from 2009 onwards, at $0.03 per LWPB ($114 million in 2009).
- Off-set by increase in the amount spent on LWPBs at the charged price, 20 per cent of LWPBs at an additional $0.07 per LWPB ($66 million in 2009).
- Re-usable bags consumed as substitutes for 95 per cent of LWPBs foregone, at a replacement rate of about 125 LWPBs for each re-usable, at $1.40 per re-usable ($40 million in 2009).
- Paper bags consumed as substitutes for 5 per cent of LWPBs foregone, at a replacement rate of one for one, at $0.15 per bag ($28 million in 2009).
- Bin-liners consumed as substitutes for 100 per cent of LWPBs foregone, at a replacement rate of one for seven, at $0.05 per bin-liner ($28 million in 2009).
- **All other impacts modelled by MMRF-Green**

Government

- On-going costs of 0.1 full-time-equivalent for administration and monitoring for each jurisdiction (nine jurisdictions, at $11 000 each, $99 000).
- Reduction in expenditure on litter clean-up for stray LWPBs ($3 million from 2009).
- Increased income from levy, less cost (assumed 8 per cent of amount collected) of collecting the levy ($61 million in 2009).
- **All other impacts modelled by MMRF-Green**

[50] Ibid.

Appendix C

Scenario summary outcomes

The following tables show annual impacts of policy scenarios from 2005 to 2016. Economic costs are calculated relative to gross domestic outcomes under a 'no further action' scenario, while environmental benefits reflect the estimated reduction in environmental damage associated with reduced LWPB consumption.

C.1 Modelled scenarios

Table C.1

SCENARIO THREE — EXTENSION OF THE CODE OF PRACTICE

	NPV*	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Model inputs – economic													
Retail industry ($m)	-$329.6	$0.0	-$131.3	-$31.5	-$31.5	-$31.5	-$31.5	-$31.5	-$31.5	-$31.5	-$31.5	-$31.5	-$31.5
Households ($m)	$82.9	$0.0	$9.9	$10.2	$10.4	$10.7	$10.9	$11.2	$11.5	$11.8	$12.1	$12.4	$12.7
Government ($m)	$12.7	$0.0	$1.8	$1.9	$1.8	$1.8	$1.7	$1.7	$1.6	$1.6	$1.5	$1.5	$1.5
Model inputs - environmental													
LWPBs consumed (millions)	-26 815.2	0.0	-2148.1	-2201.8	-2256.8	-2313.2	-2371.0	-2430.3	-2491.1	-2553.4	-2617.2	-2682.6	-2749.7
LWPBs littered (millions)	-233.2	0.0	-18.6	-19.1	-19.6	-20.1	-20.6	-21.1	-21.7	-22.2	-22.8	-23.3	-23.9
Model outputs - economic													
GDP ($m)	-$646.0	$0.0	-$156.9	-$57.6	-$60.5	-$64.4	-$69.6	-$75.0	-$80.5	-$86.4	-$92.5	-$98.7	-$105.2
Household income ($m)	-$507.3	$0.0	-$107.2	-$40.3	-$45.0	-$49.8	-$56.2	-$62.3	-$68.1	-$73.8	-$79.6	-$85.5	-$91.4
Household expenditure ($m)	-$307.1	$0.0	-$57.2	-$23.8	-$27.0	-$30.2	-$34.6	-$38.7	-$42.7	-$46.7	-$50.7	-$54.8	-$59.0
Retail industry value added ($m)	-$26.6	$0.0	-$7.9	-$2.1	-$2.2	-$2.3	-$2.6	-$2.9	-$3.1	-$3.4	-$3.7	-$4.0	-$4.3
Plastic products industry value added ($m)	-$129.3	$0.0	-$13.7	-$14.6	-$15.9	-$17.1	-$17.7	-$18.2	-$18.6	-$19.1	-$19.4	-$19.8	-$20.2
Paper products industry value added ($m)	$31.6	$0.0	$1.8	$3.4	$3.9	$4.2	$4.4	$4.7	$4.9	$5.1	$5.3	$5.5	$5.7
Model outputs - environment													
Environmental damage ($m)	-$156.3	$0.0	-$18.7	-$19.1	-$19.6	-$20.1	-$20.6	-$21.1	-$21.7	-$22.2	-$22.8	-$23.3	-$23.9

*Net Present Value (NPV)
Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum.

Table C.2

SCENARIO FOUR — GRADUALLY ESCALATED CHARGE

	NPV*	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Model inputs – economic													
Retail industry ($m)	-$663.4	$0.0	$0.0	-$255.7	-$82.9	-$90.2	-$85.8	-$81.4	-$77.0	-$72.7	-$68.3	-$63.9	-$59.5
Households ($m)	$1.6	$0.0	$0.0	-$35.3	-$94.9	$20.8	$21.3	$21.9	$22.4	$23.0	$23.6	$24.1	$24.7
Government ($m)	$23.1	$0.0	-$0.1	$1.9	$3.1	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9
Model inputs - environmental													
LWPBs consumed (millions)	-47 428.4	0.0	0.0	-2258.8	-3704.5	-4746.4	-4865.1	-4986.7	-5111.3	-5239.1	-5370.1	-5504.4	-5642.0
LWPBs littered (millions)	-418.4	0.0	0.0	-22.9	-34.9	-41.3	-42.3	-43.4	-44.4	-45.6	-46.7	-47.9	-49.1
Model outputs - economic													
GDP ($m)	-$1293.1	$0.0	$0.0	-$320.5	-$145.7	-$186.9	-$189.1	-$187.0	-$184.3	-$181.8	-$179.7	-$177.7	-$175.8
Household income ($m)	-$529.0	$0.0	$0.0	-$116.0	-$55.6	-$71.0	-$74.1	-$77.2	-$79.7	-$81.5	-$82.6	-$83.2	-$83.4
Household expenditure ($m)	-$899.0	$0.0	$0.0	-$216.6	-$95.2	-$123.4	-$126.7	-$129.4	-$131.5	-$132.6	-$132.9	-$132.6	-$131.8
Retail industry value added ($m)	-$53.0	$0.0	$0.0	-$15.5	-$1.9	-$7.6	-$7.9	-$8.0	-$8.0	-$7.9	-$7.8	-$7.6	-$7.5
Plastic products industry value added ($m)	-$68.7	$0.0	$0.0	-$3.2	$1.5	-$10.9	-$12.4	-$13.4	-$14.1	-$14.7	-$15.2	-$15.6	-$16.0
Paper products industry value added ($m)	$48.6	$0.0	$0.0	$0.7	$5.1	$6.8	$7.7	$8.5	$9.1	$9.6	$10.2	$10.6	$11.1
Model outputs - environment													
Environmental damage ($m)	-$266.3	$0.0	$0.0	-$22.9	-$34.9	-$41.3	-$42.3	-$43.4	-$44.4	-$45.6	-$46.7	-$47.9	-$49.1

*Net Present Value (NPV)
Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum.

Table C.3

SCENARIO FIVE — PHASED BAN

	NPV*	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Model inputs – economic													
Retail industry ($m)	-$563.9	$0.0	-$212.5	-$37.5	-$49.8	-$62.1	-$59.5	-$59.5	-$59.5	-$59.5	-$59.5	-$59.5	-$59.5
Households ($m)	$136.5	$0.0	$5.2	$10.4	$15.6	$20.8	$21.3	$21.9	$22.4	$23.0	$23.6	$24.1	$24.7
Government ($m)	$23.9	$0.0	$0.9	$1.9	$2.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9	$3.9
Model inputs - environmental													
LWPBs consumed (millions)	-48 570.9	0.0	-1182.5	-2367.7	-3555.6	-4746.4	-4865.1	-4986.7	-5111.3	-5239.1	-5370.1	-5504.4	-5642.0
LWPBs littered (millions)	-422.4	0.0	-10.3	-20.6	-30.9	-41.3	-42.3	-43.4	-44.4	-45.6	-46.7	-47.9	-49.1
Model outputs - economic													
GDP ($m)	-$1,093.5	$0.0	-$266.5	-$80.4	-$90.1	-$105.5	-$117.5	-$129.5	-$141.6	-$153.8	-$166.2	-$178.8	-$191.7
Household income ($m)	-$859.1	$0.0	-$180.1	-$55.0	-$66.4	-$80.7	-$95.0	-$108.0	-$120.1	-$131.8	-$143.3	-$154.9	-$166.5
Household expenditure ($m)	-$520.1	$0.0	-$95.9	-$32.9	-$39.7	-$48.4	-$58.1	-$66.9	-$75.2	-$83.2	-$91.2	-$99.2	-$107.3
Retail industry value added ($m)	-$46.0	$0.0	-$13.3	-$2.8	-$3.3	-$4.0	-$4.6	-$5.2	-$5.8	-$6.3	-$6.9	-$7.5	-$8.1
Plastic products industry value added ($m)	-$206.6	$0.0	-$8.7	-$14.3	-$22.1	-$30.3	-$32.3	-$33.7	-$34.8	-$35.7	-$36.5	-$37.3	-$38.1
Paper products industry value added ($m)	$50.4	$0.0	-$1.0	$2.9	$5.1	$7.3	$8.2	$8.8	$9.2	$9.7	$10.1	$10.4	$10.8
Model outputs - environment													
Environmental damage ($m)	-$270.6	-$10.3	-$20.6	-$30.9	-$41.3	-$42.3	-$43.4	-$44.4	-$45.6	-$46.7	-$47.9	-$49.1	-$50.3

*Net Present Value (NPV)
Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum.

Table C.4

SCENARIO SEVEN — ADVANCE CLEAN UP FEE

	NPV*	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Model inputs – economic													
Retail industry ($m)	-$433.9	$0.0	$0.0	$0.0	$0.0	-$250.6	-$65.9	-$63.4	-$60.9	-$58.4	-$55.8	-$53.3	-$50.8
Households ($m)	-$195.5	$0.0	$0.0	$0.0	$0.0	-$37.1	-$38.0	-$38.9	-$39.9	-$40.9	-$41.9	-$43.0	-$44.0
Government ($m)	-$10.8	$0.0	$0.0	$0.0	$0.0	-$1.9	-$2.0	-$2.1	-$2.2	-$2.3	-$2.4	-$2.5	-$2.6
Model inputs - environmental													
LWPBs consumed (millions)	-20 732.5	0.0	0.0	0.0	0.0	-2373.2	-2432.5	-2493.3	-2555.7	-2619.6	-2685.1	-2752.2	-2821.0
LWPBs littered (millions)	-300.5	0.0	0.0	0.0	0.0	-34.4	-35.3	-36.1	-37.0	-38.0	-38.9	-39.9	-40.9
Model outputs - economic													
GDP ($m)	-$767.9	$0.0	$0.0	$0.0	$0.0	-$316.9	-$123.6	-$125.4	-$127.3	-$128.8	-$130.1	-$131.2	-$132.2
Household income ($m)	-$544.8	$0.0	$0.0	$0.0	$0.0	-$214.0	-$88.3	-$89.5	-$92.3	-$93.9	-$95.3	-$96.2	-$97.0
Household expenditure ($m)	-$320.3	$0.0	$0.0	$0.0	$0.0	-$114.4	-$52.8	-$53.7	-$55.9	-$57.5	-$58.8	-$59.9	-$60.8
Retail industry value added ($m)	-$36.4	$0.0	$0.0	$0.0	$0.0	-$17.4	-$6.0	-$5.7	-$5.6	-$5.5	-$5.5	-$5.4	-$5.4
Plastic products industry value added ($m)	-$36.3	$0.0	$0.0	$0.0	$0.0	-$7.6	-$6.5	-$7.0	-$7.3	-$7.6	-$7.8	-$8.1	-$8.3
Paper products industry value added ($m)	$12.8	$0.0	$0.0	$0.0	$0.0	-$0.4	$2.2	$2.7	$3.1	$3.4	$3.6	$3.8	$4.0
Model outputs - environment													
Environmental damage ($m)	-$181.5	$0.0	$0.0	$0.0	-$34.4	-$35.3	-$36.1	-$37.0	-$38.0	-$38.9	-$39.9	-$40.9	-$41.9

*Net Present Value (NPV)
Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum.

Table C.5

SCENARIO NINE — LEVY

	NPV*	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Model inputs – economic													
Retail industry ($m)	-$511.2	$0.0	$0.0	$0.0	$0.0	-$273.6	-$82.9	-$79.5	-$76.1	-$72.6	-$69.2	-$65.8	-$62.4
Households ($m)	-$262.8	$0.0	$0.0	$0.0	$0.0	-$49.8	-$51.0	-$52.3	-$53.6	-$55.0	-$56.3	-$57.7	-$59.2
Government ($m)	-$12.9	$0.0	$0.0	$0.0	$0.0	-$2.2	-$2.3	-$2.5	-$2.6	-$2.8	-$2.9	-$3.1	-$3.2
Model inputs - environmental													
LWPBs consumed (millions)	-33 172.0	0.0	0.0	0.0	0.0	-3797.1	-3892.0	-3989.3	-4089.1	-4191.3	-4296.1	-4403.5	-4513.6
LWPBs littered (millions)	-312.5	0.0	0.0	0.0	0.0	-35.8	-36.7	-37.6	-38.5	-39.5	-40.5	-41.5	-42.5
Model outputs - economic													
GDP ($m)	-$900.0	$0.0	$0.0	$0.0	$0.0	-$347.1	-$149.5	-$151.7	-$154.0	-$155.6	-$157.0	-$158.0	-$158.8
Household income ($m)	-$636.4	$0.0	$0.0	$0.0	$0.0	-$233.9	-$105.8	-$107.6	-$110.9	-$112.9	-$114.4	-$115.4	-$116.1
Household expenditure ($m)	-$373.7	$0.0	$0.0	$0.0	$0.0	-$125.0	-$62.6	-$64.1	-$66.9	-$68.8	-$70.4	-$71.6	-$72.6
Retail industry value added ($m)	-$43.4	$0.0	$0.0	$0.0	$0.0	-$19.1	-$7.5	-$7.2	-$7.1	-$6.9	-$6.8	-$6.7	-$6.5
Plastic products industry value added ($m)	-$55.7	$0.0	$0.0	$0.0	$0.0	-$10.7	-$10.1	-$10.9	-$11.4	-$11.8	-$12.2	-$12.5	-$12.8
Paper products industry value added ($m)	$23.9	$0.0	$0.0	$0.0	$0.0	$1.1	$4.1	$4.9	$5.4	$5.9	$6.3	$6.6	$7.0
Model outputs - environment													
Environmental damage ($m)	-$188.7	$0.0	$0.0	$0.0	$0.0	-$35.8	-$36.7	-$37.6	-$38.5	-$39.5	-$40.5	-$41.5	-$42.5

*Net Present Value (NPV)
Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum.

C.2 Imputed scenarios

Scenarios 1 and 8 were not modelled using the MMRF-Green CGE model. The impacts of these policy scenarios were imputed using the results of the MMRF-Green CGE modelling for Scenarios 5 and 4, respectively. The impacts on GDP and on environmental damage imputed for Scenarios 1 and 8 are shown below.

Table C.6

SCENARIO ONE — BAN

	NPV*	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GDP ($m)	-$1,057.1	$0.0	$0.0	$0.0	$0.0	-$572.7	-$117.5	-$129.5	-$141.6	-$153.8	-$166.2	-$178.8	-$191.7
Environmental damage ($m)	-$217.8	$0.0	$0.0	$0.0	$0.0	-$41.3	-$42.3	-$43.4	-$44.4	-$45.6	-$46.7	-$47.9	-$49.1

*Net Present Value (NPV)
Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum.

Table C.7

SCENARIO EIGHT — MANDATORY CHARGE

	NPV*	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GDP ($m)	-$1,035.1	$0.0	$0.0	$0.0	$0.0	-$371.6	-$189.1	-$187.0	-$184.3	-$181.8	-$179.7	-$177.7	-$175.8
Environmental damage ($m)	-$217.8	$0.0	$0.0	$0.0	$0.0	-$41.3	-$42.3	-$43.4	-$44.4	-$45.6	-$46.7	-$47.9	-$49.1

*Net Present Value (NPV)
Note: The net present values are calculated as the sum of costs and benefits that arise in the years 2005 to 2016 (inclusive), discounted at 7 per cent per annum.

Appendix D

Possible non-linearity in environmental damage

In developing estimates in this report, care has been taken to be as methodical as possible in valuing environmental damages and associated benefits from reducing LWPB usage. An environmental damage valuation model was developed for this purpose. Given the absence of markets for wildlife, aesthetic values and pollutants (including the damage attributable to greenhouse gas emissions) there is room for speculation around the values arrived at, and the focus on littered bags as the chief environmental culprit. This reflects the need to draw on value indicators rather than raw speculation.

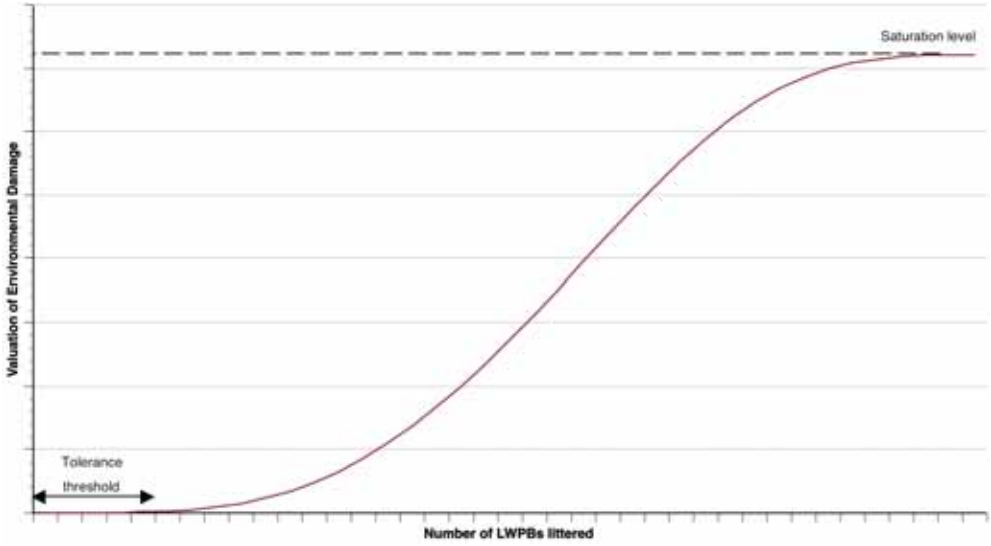
The starting value of $1 for every LWPB that was kept out of or retrieved from the litter stream was one of the critical factors in determining the environmental benefits. For the benefits of the policy options to outweigh the estimated costs, Australians would need to value the reduction in environmental damage at around $5 per LWPB. Changing the value to $5 per LWPB would linearly increase the benefits five-fold, while reducing the value to $0.50 per LWPB would halve the estimated benefits.

Another factor is that the value placed on a reduction in environmental damage may not necessarily be linear. This takes into account considerations of absorptive capacity (or tolerance of low level irritants), increasing marginal damage and saturation — beyond which point the marginal (negative) contribution of additional pollutant falls because the core value of the environment, landscape or ecosystem in question has effectively been destroyed. For example, people may be willing to tolerate a certain number of LWPBs in the environment initially, because they are few and far between. As the number of LWPBs in the litter stream increases, people become less tolerant, and are willing to pay more for each additional bag littered.

Once a certain threshold is reached, however, the amount that people are willing to pay starts to decrease — people are willing to pay more to reduce the number of LWPBs in the litter stream from 50 million bags to 40 million bags than they are to reduce the number of LWPBs in the litter stream from 200 million bags to 190 million bags, even though in each case, the number of LWPBs in question is the same. Eventually, a 'saturation point' is reached, where the damage has already been done, and people perceive that the marginal damage done by additional LWPBs is very small. A stylised damage function with these characteristics is depicted in Figure D.1.

Figure D.1

A STYLISED 'ENVIRONMENTAL DAMAGE CURVE'



In considering environmental damage due to LWPBs it is possible that marginal costs may follow this pattern. For reduction in aesthetic landscape values, it could be that deterioration will not only increase as more bags pollute the local environment, but that the rate of the increase in damage might begin to rise as the number of bags exceeds some minimum threshold. Damage to ecosystems and habitat also tend to exhibit an ability to tolerate low levels of irritation — although thresholds differ according to the host and irritant in question.[51]

The corollary of this functional approach to environmental damage is that reductions in levels of pollution (in this case LWPBs) will carry relatively higher pay-offs early, but have reduced pay-offs as pollution levels drop back toward tolerance thresholds levels. Subsequently, the first 10 per cent of effort expended would have a greater return than the second 10 per cent, which would in turn have a greater return than the third 10 per cent, and so on — the approach is summarised in Box D.1.

[51] See for example, the discussion of biological adaptive capability in Allen Consulting Group 2005, *Climate Change Risk and Vulnerability: Promoting an Efficient Adaptation Response in Australia*, Australian Greenhouse Office, Canberra.

Box D.1

THE 'NON-LINEAR' ENVIRONMENTAL VALUATION

Reflecting this declining return on effort in the valuation of environmental damage could be done by assuming that the total number of bags that could be released into the environment in one year is 60 million bags. Dividing this amount into deciles, the first 6 million LWPBs removed from the environment would be valued at $1 per LWPB. The second 6 million LWPBs to be removed would be valued at $0.82 per LWPB, and then so on down to $0.66, $0.52, $0.40, $0.30, $0.22, $0.16, $0.12 and then $0.10 — so that the last decile valued at 10 per cent of the first. Under this valuation, the maximum environmental benefit that can be obtained is $25.8 million — compared to the $50 million that can be achieved if the removal of *each* LWPB is valued at $1.00. If the starting value were changed from $1.00 to $0.50, then the total benefit attainable is halved — to around $13 million.

As shown in Table D.1, introducing non-linearity to the valuation of the environmental damage attributable to LWPBs has a significant impact on the net cost of each of the policy scenarios, however, it does not have much of an effect on the rankings of each of the scenarios.

Table D.1

NPV IMPLICATIONS OF CHANGES IN ENVIRONMENTAL DAMAGE MODELLING, $M

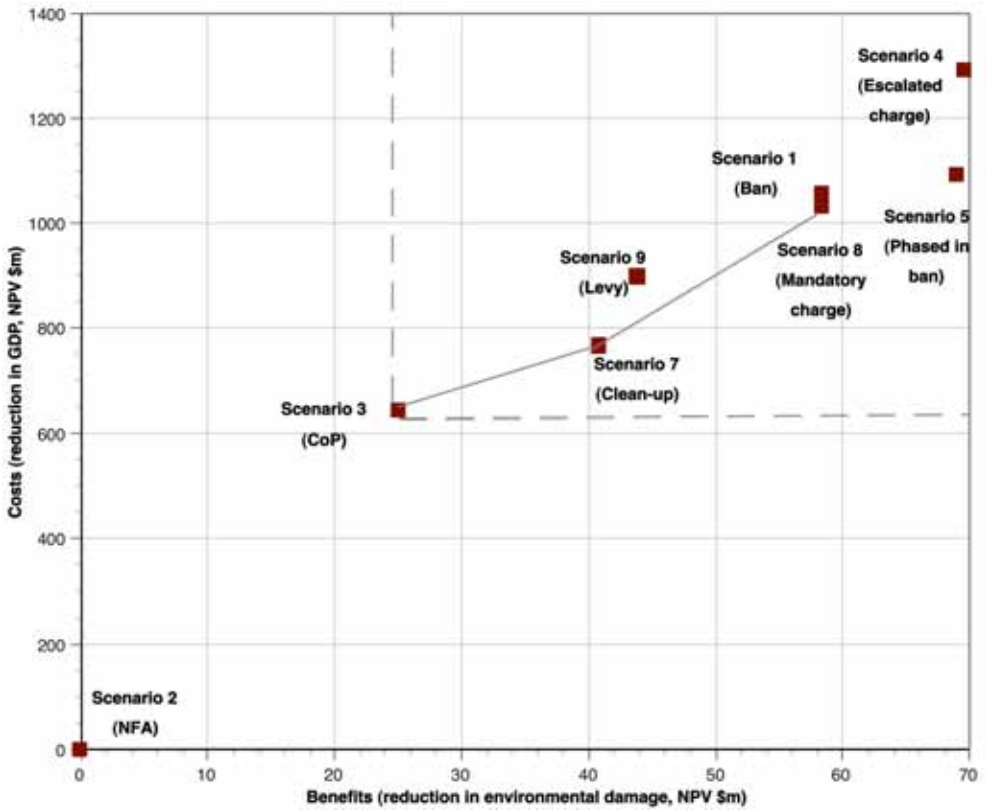
Scenario	$0.50 — linear	$1.00 — linear	$5.00 — linear	$0.50 — non-linear	$1.00 — non-linear	$5.00 — non-linear
Scenario 1	-$948	-$839	$33	-$999	-$940	-$474
Scenario 3	-$568	-$490	$136	-$621	-$596	-$396
Scenario 4	-$1160	-$1027	$38	-$1224	-$1154	-$597
Scenario 5	-$958	-$823	$260	-$1024	-$955	-$403
Scenario 7	-$677	-$586	$139	-$727	-$686	-$360
Scenario 8	-$926	-$817	$54	-$977	-$918	-$452
Scenario 9	-$806	-$711	$44	-$856	-$812	-$461

Notes: The NPVs for the 'as modelled' scenarios were calculated using a 'standard' discount rate of 7 per cent per annum. Net economic impacts for Scenario 2 are not reported because these reflect expiry of the ARA Code on a pre-agreed timetable, and represent a no further action 'baseline' result.

Figure D.2 shows the tradeoffs between economic costs and environmental benefits in the situation in which a non-linear environmental damage model is used, with a starting value of $0.50 for the first 6 million LWPBs removed. Under this alternative, the net costs are significantly higher, because the environmental benefits are around a quarter of what they were previously. The efficient frontier of policy options using a non-linear approach is made up Scenarios 3, 7 and 8.

Figure D.2

ALTERNATIVE ENVIRONMENTAL DAMAGE VALUATION — THE RELATIONSHIP BETWEEN ECONOMIC AND ENVIRONMENTAL COSTS UNDER VARIOUS SCENARIOS



Importantly, while the non-linearity model has intuitive appeal it also has some problems. At present, there is not enough information to estimate the shape of this damage function, or our location on it — though it is probably safe to assume that there are very few locations in Australia where the litter has reached saturation point and marginal impacts will be effectively zero. Additionally, although we are in a position to make reasonable (ballpark) estimates of the number of plastic bags entering the litter stream each year, we have less reliable information on the stock of bags already resident in the landscape.

Given these complexities, and the desirability of avoiding assumption laden analysis, the non-linear model can be useful in providing an alternative perspective on the challenge of estimating marginal environmental damage and benefits. But the demands of this approach can be unsuited to a data poor environment, such as litter.

Appendix E

Sources

P. Adams, M. Horridge and G. Wittwer 2003, *MMRF-GREEN: A Dynamic Multi-Regional Applied General Equilibrium Model of the Australian Economy, Based on the MMR and MONASH Models*, CoPS/IMPACT Working Paper Number G-140, October.

Allen Consulting Group 2005, *Climate Change Risk and Vulnerability: Promoting an Efficient Adaptation Response in Australia*, Australian Greenhouse Office, Canberra.

J. Andriof and M. McIntosh 2001, *Perspectives on Corporate Citizenship*, Greenleaf Publications.

J. Cadman, S. Evans, M. Holland, R. Boyd and AEA Technology Environment 2005a, *Proposed Plastic Bag Levy - Extended Impact Assessment Final Report, Volume 1: Main Report*, Environment Group Research Report 2005/06 for the Scottish Executive, Edinburgh.

J. Cadman, S. Evans, M. Holland, R. Boyd and AEA Technology Environment 2005b, *Proposed Plastic Bag Levy - Extended Impact Assessment Final Report, Volume 2: Appendices*, Environment Group Research Report 2005/06 for the Scottish Executive, Edinburgh.

Department of Environment and Conservation (NSW) 2004, *The Environment and Ethnic Communities in 2004: A Survey of the Environmental Knowledge, Attitudes and Behaviours of Eight Ethnic Communities in NSW*, DEC Social Research Series, Sydney.

Guardian 2005, 'Excess Baggage', 26 October, http://society.guardian.co.uk/societyguardian/story/0,7843,1600179,00.html.

Guardian 2002, 'Plastic planet', 17 October, http://www.guardian.co.uk/waste/story/0,12188,813364,00.html

K. James and T. Grant 2005, *Life Cycle Assessment of Degradable Plastic Bags,* Royal Melbourne Institute of Technology, Melbourne.

Nolan-ITU 2005, *Plastic Retail Carry Bag Use: 2002-2005 Consumption,* Melbourne.

Nolan-ITU 2002, *Plastic Shopping Bags — Analysis of Levies and Environmental Impacts*, Melbourne.

OECD (Organisation for Economic Co-operation and Development) 2003, *Voluntary Approaches for Environmental Policy: Effectiveness, Efficiency and Usage in Policy Mixes*, Organisation for Economic Cooperation and Development, Paris.

Planet Ark 2005, Why are plastic bags a problem? http://www.planetark.org/campaignspage.cfm/newsid/52/newsDate/7/story.htm, Accessed on 28 November 2005.

Planet Ark Environmental Foundation 2005, Plastic check-out bag use in non-supermarket retail outlets, http://www.deh.gov.au/settlements/publications/waste/plastic-bags/planet-ark/key-results3.html, Accessed 25 November 2005.

Plastics and Chemical Industry Association, 'Plastic bags', http://www.pacia.org.au/index.cfm?menuaction=mem&mmid=009&mid=009.002, Accessed 30 November 2005.

Re-usable Bags, Facts about plastic bags, http://www.re-usablebags.com.au/plasticbags.htm, Accessed 28 November 2005.

C. Williams 2004, 'Battle of the Bag', *New Scientist*, vol. 183, no. 2464, p. 30.