



***Environment  
Australia***

***Department of the Environment and Heritage***

# **Plastic Shopping Bags – Analysis of Levies and Environmental Impacts Final Report**

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## EXECUTIVE SUMMARY

The plastic bag is an established part of Australian shopping – with approximately 6.9 billion plastic bags used by Australian consumers every year. The current plastic shopping bag is well suited to its task – it is cheap, lightweight, resource efficient, functional, moisture resistant, allows for quick packing at the supermarket and is remarkably strong for its weight. However, the perceived environmental impacts of plastic shopping bags have raised community concern.

The Commonwealth Government resolved to evaluate the likely impacts of taxes and levies on plastic bags and the potential impacts of alternatives to provide a solid base for informed debate and national policy development regarding plastic shopping bags in Australia. Nolan-ITU, in association with the RMIT Centre for Design and Eunomia Research and Consulting, has been commissioned by Environment Australia to conduct the evaluation.

The purpose of this report is to explore the options and their associated potential environmental and economic impacts to inform policy and decision making. Therefore, no specific policy recommendations are made.

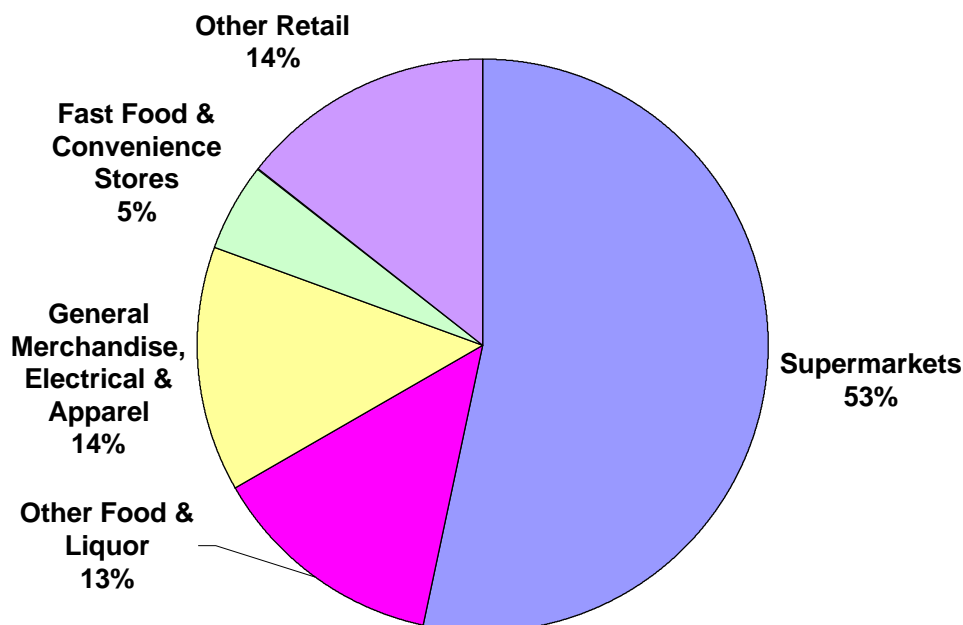
### ***Plastic Bag Flows in Australia***

Approximately 6.9 billion plastic bags are consumed annually in Australia, with 6 billion of these being high density polyethylene (HDPE) such as supermarket singlet bags, and 0.9 billion being low density polyethylene (LDPE) such as boutique bags. 67% of HDPE and 25% LDPE bags are imported, with the remainder locally produced.

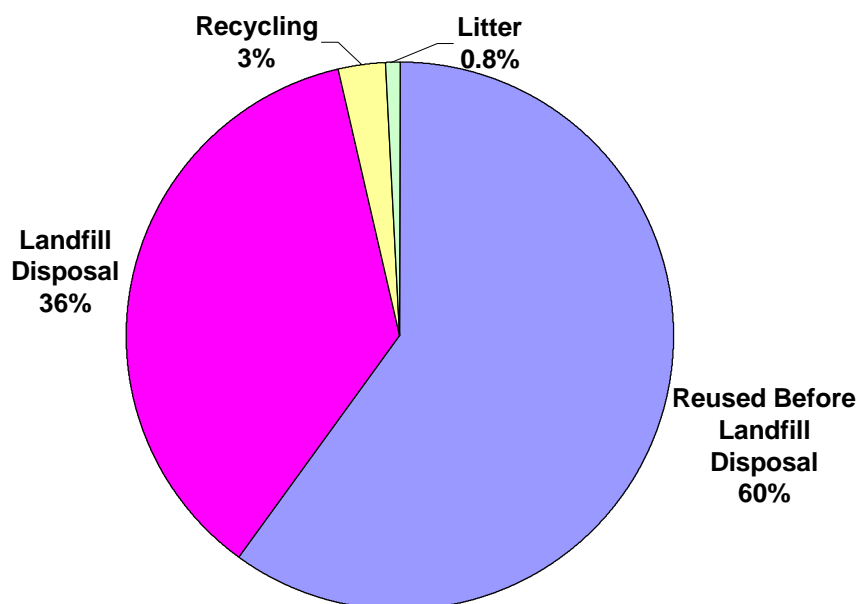
In this study, plastic shopping bag flows through retail outlets have been estimated as shown in Figure E1. As can be seen, supermarkets supply consumers with 53% of the total number of plastic shopping bags used annually.

The estimated end of life disposal routes for plastic shopping bags are shown in Figure E2. There is a high level of reuse of plastic shopping bags, with an estimated 60% of bags with an 'at home' destination cascading to a second use before disposal. Recycling levels are currently low (3%) due to this reuse, inadequacy or inconvenience of current recycling systems and general consumer apathy.

Plastic shopping bags appear to be approximately 2% of the Australian litter stream, although reliable data on the total litter stream is unavailable. The impact of this litter is increased due to the material's persistence in the environment and capacity to injure wildlife, particularly in marine environments. Inadvertent littering of plastic shopping bags is believed to be a major contributor to the plastic shopping bag litter stream and is caused largely by their light weight.



**Figure E1 - Purchase/Use of Plastic Shopping Bags**



**Figure E2 - Disposal Destination of Plastic Shopping Bags**

### ***Approaches in Other Countries***

Internationally, countries and jurisdictions have taken different approaches to plastic bags. Ireland is the only country with a plastic shopping bag levy paid directly by consumers. However, South Africa currently has a proposal to introduce a similar levy. Denmark and Italy have indirect taxes which apply to plastic shopping bags, which are absorbed into the overall

costs of products to consumers. Bangladesh, Taiwan and parts of India are currently introducing bans on plastic bag manufacture and distribution.

In Ireland in 2001, the *Waste Management (Environmental Levy)(Plastic Bag) Regulations* were brought into effect. The PlasTax levy of 0.15 euro (AUS\$0.27) applies to all single use plastic carry bags, including biodegradable polymer bags. The levy does not apply to those used to contain fresh produce, and those designed for reuse and sold for more than 0.70 euro (AUS\$1.27). The levy is aimed at the consumer, rather than the retailer, as the aim was to change consumer behaviour.

This levy has resulted in a dramatic decrease of 90-95% in 'single-use' plastic bag consumption over the past year and a substantial increase in reusable bags. Although the levy does not apply to paper bags, these have not replaced plastic shopping bags in the supermarket sector.

The implementation and administration costs of the Irish PlasTax has been minimal, and the levy is widely supported by both consumers and the retail industry. In the first four months since its introduction, the levy has raised 3.5 million euro which has been specifically allocated to waste management and environmental projects. Projections for the first full year are approximately 10-12 million euro.

### ***Life Cycle Analysis of Plastic Bags and Alternatives***

There is significant potential to reduce life cycle environmental impacts of plastic bag usage in the form of resource consumption, energy, greenhouse gas emissions and litter.

A substantial shift to more durable reusable bags would deliver environmental gains over the full life cycle of the bags. Heavy duty reusable plastic bags with a long usable life were found to achieve the greatest environmental benefits.

Little or negative gain was found to be derived from the shift from single use bags to other single use bags such as biodegradable bags and paper bags, with potential litter gains offset by negative resource use, energy and greenhouse outcomes.

### ***Potential Options for Australia***

Alternative options to influence the use of plastic shopping bags include:

- ❑ Status Quo ( with current Shopping Bag Code of Practice);
- ❑ Expansion of the Shopping Bag Code of Practice;
- ❑ Kerbside Recycling of Plastic Shopping bags;
- ❑ Litter Education;
- ❑ Biodegradable Bags;
- ❑ Reusable Bags and 'Bags for Life';
- ❑ Ban on plastic bags;
- ❑ Voluntary Levy; or

- Legislated Levy.

A review of these options identified voluntary and legislated levy options and an expanded Code of Practice as being viable options. All other options were considered less viable as stand alone options due to lower impacts or other barriers.

## Scenarios

Five scenarios were chosen as representing the implications of a range of potential measures based on the potential options for Australia discussed in Section 5 and currently being considered by government and other stakeholders. Different configurations and combinations of the options are possible, and the policy options are not intended to be limited to the scenarios modelled in this section. The scenarios, as outlined below, were subjected to environmental and preliminary economic analysis:

Scenario 1A	15c Legislated Levy with Expanded Code of Practice
Scenario 1B	25c Legislated Levy with Expanded Code of Practice
Scenario 2	Voluntary Levy as part of Expanded Code of Practice
Scenario 3	Expanded Code of Practice
Scenario 4	Current Code of Practice (Draft III)

The introduction of a levy on single-use shopping bags paid directly by the consumer would result in a change in behaviour, leading to a significant reduction in single use bags and an increase in reusable bags and consumers choosing the ‘no bag’ option.

Reusable bags would then become the prevalent method of carrying groceries from supermarkets. For general merchandise, fast food and convenience store purchases the prevalent method would likely be to have no bag.

Any levy introduced would most practically and effectively occur at a national level, providing consistency of approach and compliance across the states.

A voluntary approach to try and reduce plastic shopping bag use and impacts is through a comprehensive revamping of the National Code of Practice for the Management of Retail Carry Bags. However, it is expected that a reliance on the Code, if not combined with a levy, would produce only minor change to plastic shopping bag consumption and associated impacts.

## Preliminary Economic Analysis

Based on the experience in Ireland, and in other areas where voluntary levies have been implemented, it is believed that a levy set at 15-30 cents per bag would be sufficient to result in a significant behavioural change, and therefore minimal levy imposition. The outcomes of the preliminary economic analysis for each scenario is outlined in Table E1.



**Table E1 - Economic Outcomes of Scenarios**

<b>Costs</b>	<b>1A</b>	<b>1B</b>	<b>2</b>	<b>3</b>	<b>4</b>
% Reduction in Single Use Plastic Shopping Bags	75%	85%	54%	25%	10%
Revenue Raised by a Levy	332.9 M	358.2 M	191.7 M	0	0
Consumer Costs per person per year (including extra costs of reusable bags and replacement bin liners)	\$14.89	\$15.34	\$3.45	-\$0.78	-\$1.27
Purchase cost of plastic bags to retailers	- 142 M	- 161 M	- 103 M	- 48 M	- 49 M

The supermarket sector has estimated that the use of reusable bags will increase transaction time by 5 seconds per transaction, which could result in additional costs of \$82 million annually to consumers. Other potential costs incurred in the implementation of a levy include:

- ❑ Administration;
- ❑ Stolen goods;
- ❑ Stolen equipment;
- ❑ Auditing ;
- ❑ Monitoring; and
- ❑ Education.

These costs are predicted to be minor in comparison to those quantified in Table E1, however, a full regulatory impact assessment would be required before implementation of any of the above options.

### ***Environmental Analysis***

The five scenarios were also subjected to an environmental analysis based on the estimated reduction in bag uses as outlined in Table E1, with following outcomes:

- ❑ Scenario 4 (Current Code of Practice) represents the base case, producing 8.62m m<sup>3</sup>/y litter, 73.8m CO<sub>2</sub>/kg equivalents and utilising 2 540 GJ of energy.
- ❑ Scenario 1B (a 25 cent legislated levy) achieves the most significant reductions in environmental impact when compared to Scenario 4:
  - ❑ 63% reduction in primary energy use
  - ❑ 65% reduction in global warming impacts
  - ❑ 82% reduction in contribution to litter (using persistence as the measure).
- ❑ Scenario 1A (a 15 cent levy) also achieves significant benefits:

- 54% reduction in primary energy use
- 56% reduction in global warming impacts
- 71% reduction in contribution to litter (using persistence as the measure).
- Scenario 2 (a voluntary levy) achieves the following:
  - 36% reduction in primary energy use
  - 37% reduction in global warming impacts
  - 48% reduction in contribution to litter (using persistence as the measure).
- Scenario 3 (Expanded Code of Practice) achieves the following:
  - 6% reduction in primary energy use
  - 9% reduction in global warming impacts
  - 16% reduction in contribution to litter (using persistence as the measure).

## 1 INTRODUCTION

The plastic bag is an established part of Australian shopping – with goods from groceries and take away food to clothing and hardware being carried from retail outlets in plastic bags. Approximately 6.9 billion plastic bags are used by Australian consumers every year.

Recent public concern and debate has developed over plastic bag usage and disposal. This debate has been largely triggered by the highly publicised outcomes of a plastic bag levy which has been recently introduced in Ireland, with dramatic reductions in plastic bag use reported. These results are tempered, however, by differing results from other countries with similar schemes.

The issue of plastic bags in Australia and how their impacts are to be addressed, including the potential application of levy schemes, requires an appropriate investigation of the available evidence to inform policy decision-making. To fully understand both the current situation and the relative effectiveness of various future interventions for plastic bags, a holistic perspective including an understanding of both environmental and economic impacts, as well as their inter-relationship, is required.

The Commonwealth Government resolved to scope the impacts of taxes or levies on plastic bags and the potential impacts of alternatives. Nolan-ITU, in association with the RMIT Centre for Design and Eunomia Research and Consulting Ltd, have been commissioned by Environment Australia to undertake this study in order to provide a solid base for informed debate and national policy development regarding plastic shopping bags in Australia.

The purpose of this report is to explore the options and their associated potential environmental and economic impacts to inform policy and decision making. Therefore, no specific policy recommendations are made.

### 1.1 Definition – Plastic Shopping Bags

In this report, a ‘plastic shopping bag’ refers to a polymer carry bag provided or utilised at the retail point of sale for carrying and transporting retail goods. This includes all plastic retail carry bags, but excludes produce bags used in-store, dry cleaning bags, garbage bags and other primary product packaging.

In relation to levies and potential future options, all retail shopping carry bags are considered, including those made of paper or other materials. This however, excludes small paper bags used for the containment of goods without other primary packaging, such as sandwiches or greeting cards.

### 1.2 Defining The ‘Problem’

Australians use approximately 6.9 billion new plastic shopping bags every year, or just under one bag per person per day.

The perceived problems with plastic shopping bags are based on two factors that are probably equally important. Firstly, there are concerns about their environmental impact, particularly impacts on resource consumption and litter. These impacts, discussed in more detail in Section 3, are important and need to be addressed.

The production of 6.9 billion plastic shopping bags consumes approximately 36 850 tonnes of plastic, or 2% of total plastics produced in Australia each year. This is a small percentage of the total amount of packaging consumed in Australia each year, which is estimated to be around 3 million tonnes<sup>1</sup>. It has been estimated that plastic shopping bags make up 2.02% of all items in the litter stream; however, they pose real ecological impacts and hazards and as such need to be effectively addressed along with other components of the litter stream.

The second 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.

Several measures to deal with the plastic bag 'problem' have been raised in recent times. These measures are varied and include components such as:

- Legislated measures such as levies and bans;
- Voluntary measures such as retailer initiated actions and expanded Code of Practice;
- Increased consumer education; and
- Increased recovery and recycling.

In this study, a range of measures which achieve the highest environmental benefit, whilst considering the economic and social impacts, are investigated and identified.

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<sup>1</sup> Based on an estimated value of \$7.3 billion per annum, and an average value of \$2,500 per tonne (Lewis et al 2002).

### 1.3 Why Target Only Plastic Shopping Bags?

The current focus and debate on plastic shopping bags, and the range of measures being suggested to reduce their impacts, has also led to questioning of “why just plastic bags? Why not other packaging materials?”. This is an important issue to be considered in the development of any policy initiatives regarding plastic shopping bags, particularly in the introduction of a levy.

While they do not consume large amounts of resources and are a comparatively minor part of the overall Australian litter stream, several reasons can be used to justify the targeting of plastic bags:

- ❑ Australia’s highest volume ‘add-on’ packaging;
- ❑ Given away for free in large numbers;
- ❑ Designed as a single use or disposable product;
- ❑ Often not essential to product integrity;
- ❑ Visual litter impacts;
- ❑ Ecological litter impacts;
- ❑ Persistence of the material in the environment;
- ❑ Potential for replacement by other materials and methods;
- ❑ Not currently widely accepted into the kerbside recycling system; and
- ❑ High level of community concern.

### 1.4 Aims and Goals

The primary aim of addressing the issue of plastic shopping bags can be defined as follows:

*To reduce the overall environmental impacts of retail carry bags in Australia.*

Specific goals underlying this aim are:

- ❑ to reduce the number of plastic shopping bags used in Australia;
- ❑ to reduce the number of bags released in to the litter stream;
- ❑ to promote the sustainable use of resources; and
- ❑ to introduce changes that will achieve environmental goals in a manner that is supported by the community and is economically efficient and practical.

## 2 PLASTIC SHOPPING BAGS IN AUSTRALIA – CONSUMPTION AND USE

To understand the real impacts of plastic bags and the effect of their potential alternatives and the introduction of levy schemes, a comprehensive picture of plastic bags material flows is required. Outlined below are the major bag types, their sources, uses and destinations. This provides data to inform the analysis of their impacts, the scope of those impacts, where they occur and the potential areas of focus.

### 2.1 Functionality and Cost

The current plastic shopping bag is well suited to its task – it is cheap, lightweight, resource efficient, functional, moisture resistant, allows for quick packing at the supermarket and is remarkably strong for its weight.

Quick retail service is a key issue for consumers. This is particularly the case at supermarkets, where over 40% of customer complaints are related to check-out times. There are a range of check-out designs and methods in use – with some less suited to ‘pack your own’ or non-conventional bag use. Plastic bags also currently perform an important task in product and food safety, keeping uncooked meat or cleaning products separate from other foods.

The ‘free of charge’ nature of shopping bags is longstanding and consistent with all other forms of packaging in Australia. Most plastic shopping bags cost around one or two cents each, which is generally built into the product cost and represents much less than 1% of the total transaction cost. It is estimated that the annual average cost per household for plastic shopping bags is likely to be \$10-15 per year. Some European owned stores (such as Aldi and IKEA) are now introducing charges for bags.

### 2.2 Plastic Bag Types

The major plastic bag types used in Australia are the ‘singlet’ bag, made of high density polyethylene (HDPE) and the ‘boutique’ style bag, made of low density polyethylene. Some HDPE bags are also used in a ‘wave top’ shape, with a reinforced handle.



The HDPE singlet bag is generally used in supermarkets, fresh produce, take-away food and other non-branded applications. The LDPE boutique and HDPE wave top bags are generally branded and used to carry higher value goods such as clothing.

Industry data indicates that 6.9 billion, or over 36 850 tonnes, of plastic shopping bags were used in Australia in 2001, with 6 billion of these being HDPE bags and 900 million LDPE bags.

## 2.3 Production and Imports

Many of the plastic bags utilised by Australian retailers are imported. It is estimated that 67% of HDPE singlet bags are imported, with approximately 4 billion units of HDPE bags imported in 2001/2002 with the remaining 33%, or 2 billion units, produced in Australia. It is believed that 84% of the HDPE bags utilised in Australia (both imported and locally produced) have a recycled content of between 30 and 50%. This recycled content is mostly from industrial waste sources.

225 million LDPE bags were imported in 2001-2002, with 675 million produced in Australia.

## 2.4 Use

The use of plastic bags may be split into two distinct phases – the purchase location and the destination.

### 2.4.1 Purchase

Bags are currently given by the retail sector to carry a variety of goods. From industry knowledge and data, the total consumption of bags has been split to the following retail areas:

□ Supermarkets	3.68 B units/year
□ Other Food & Liquor	0.93 B units/year
□ General Merchandise & Apparel	0.96 B units/year
□ Fast Food, Convenience Stores & Service Stations	0.35 B units/year
□ Other Retail	0.99 B units/year

### 2.4.2 Destination

The nature of many goods purchased and carried in plastic bags effects the end destination of both the product and the bag. Three major destinations have been identified:

- Home;
- Away from home – outdoor; and
- Away from home – commercial and industrial.

Outdoor use locations would include take-away food, picnics and camping, building sites etc. Indoor locations include businesses, offices, shows and exhibitions and other commercial areas.

Supermarket shopping bags are likely to go to a home, and many take-away food bags may go to an outdoor or street location. The destination of bags strongly effects the disposal destination, including the recycling and reuse of the bags and littering potential.

Purchase points such as fast food outlets which have a high percentage of 'away from home – outdoor' destinations are considered to have higher likely impacts in litter, and these sectors may therefore be the focus of different policy and actions than other sectors.

## **2.5 Reuse, Recycling and Disposal**

The major impacts for plastic shopping bags result from their disposal destination. The major potential disposal routes and destinations are outlined below.

### **2.5.1 Reuse**

Due to their inherent usefulness in carrying and containing objects, many plastic shopping bags are used beyond their 'single use' life. Reuse applications include:

- Waste bags or bin liners;
- Lunch bags;
- General carry bags (i.e. gym or pool gear, picnic supplies)

Surveys carried out by the Plastics Industries Association (1992) indicated that 85% of people reused plastic shopping bags for some application, and in a more recent survey carried out by Quantum for the CEPA Trust (2002) found that 75% of people reused shopping bags as bin liners or waste bags, with other reuses on top of this again. As it is unlikely that all the bags that this percentage of people take home are reused, it is estimated that approximately 60% of the bags taken home are reused. This is a significant consideration in the environmental assessment of the impact of plastic shopping bags and their alternatives.

### **2.5.2 Recycling**

Major supermarket chains in Australia have established a plastic shopping bag 'take-back' recycling system at stores. Drop-off bins are provided at many major supermarkets for used bags, which are collected for recycling.





It is estimated that in 2001-2002, 1 000 tonne of bags, or approximately 180 million units, was recycled in this manner, with the majority exported for reprocessing. This represents a recycling rate of approximately 2.7%. About 50 tonne was reprocessed in Australia, with the reprocessed material utilised in pipe manufacture.

To this point, recycling of plastic shopping bags via the kerbside recycling system 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 unsorted and disposed to landfill.

The current in-store drop-off recycling system relies on separation, with only HDPE shopping bags in the stream as much as possible.

### 2.5.3 Litter

Of the 6 billion HDPE bags and 0.9 billion LDPE bags distributed annually in Australia, a certain percentage are littered, either directly by consumers or from being blown out of the garbage stream and landfills, however the actual number of bags currently in the environment and the number littered annually is not known.

Many litter surveys and counts have been undertaken at sites around Australia, some of which have collected data on plastics litter and specifically plastic shopping bags. This data cannot be applied to the plastic bag consumption to determine the numbers of plastic bags littered annually, as the total size of the litter stream is not known and the items counted at specific sites may not have necessarily been littered that year due to the physical persistence of plastic bags.

Litter collection data from Clean Up Australia (2002) indicates that plastic bags make up 2.02% of the litter stream. Keep Australia Beautiful (Victoria) data (1999) indicates that all plastic items make up an average of 26.7% of the litter stream by item, which includes items at landfill sites where plastic items consist of 47%. It is further estimated by Keep Australia Beautiful that 'bags, sacks and sheeting' makes up an average of 6.2% of the litter stream by item in Victoria; however the shopping bag breakdown of this is not known, and as surveys were carried out in rural sites along with metropolitan sites, this is believed to consist of significant numbers of items such as silage wrap and sacks etc. However, assuming approximately 1/3 of this percentage is plastic

shopping bags, the data would appear to correlate with the Clean Up Australia data of approximately 2% of the litter stream.

As there is no data available on the total size of the litter stream in Australia, this data cannot be applied to determine the total number of bags entering the litter stream. In this report, it has been estimated that a total of between 50 and 80 million bags enter the environment as litter annually. This equates to approximately 20% or less of the bags utilised in outdoor away-from home locations being littered, with a further 1/3 of the total litter stream coming from inadvertent litter sources through waste management activities, as data on the litter occurrence around landfills would infer. It is assumed that the vast majority of these bags would be HDPE bags. The existing data on litter would need to be improved in order for performance related targets to be reliably measured.

Approximately 200 million dollars are spent annually by local and state governments on total litter clean ups. In addition private sector companies such as landfill operators and community organisations, such as Clean Up Australia, also devote considerable resources to litter recovery. As plastic shopping bags are a highly visible litter object, it is probably fair to allocate more than 2% of litter clean-up costs to bag clean-up costs. Therefore a figure of over \$4mill is deemed attributable to shopping bags.

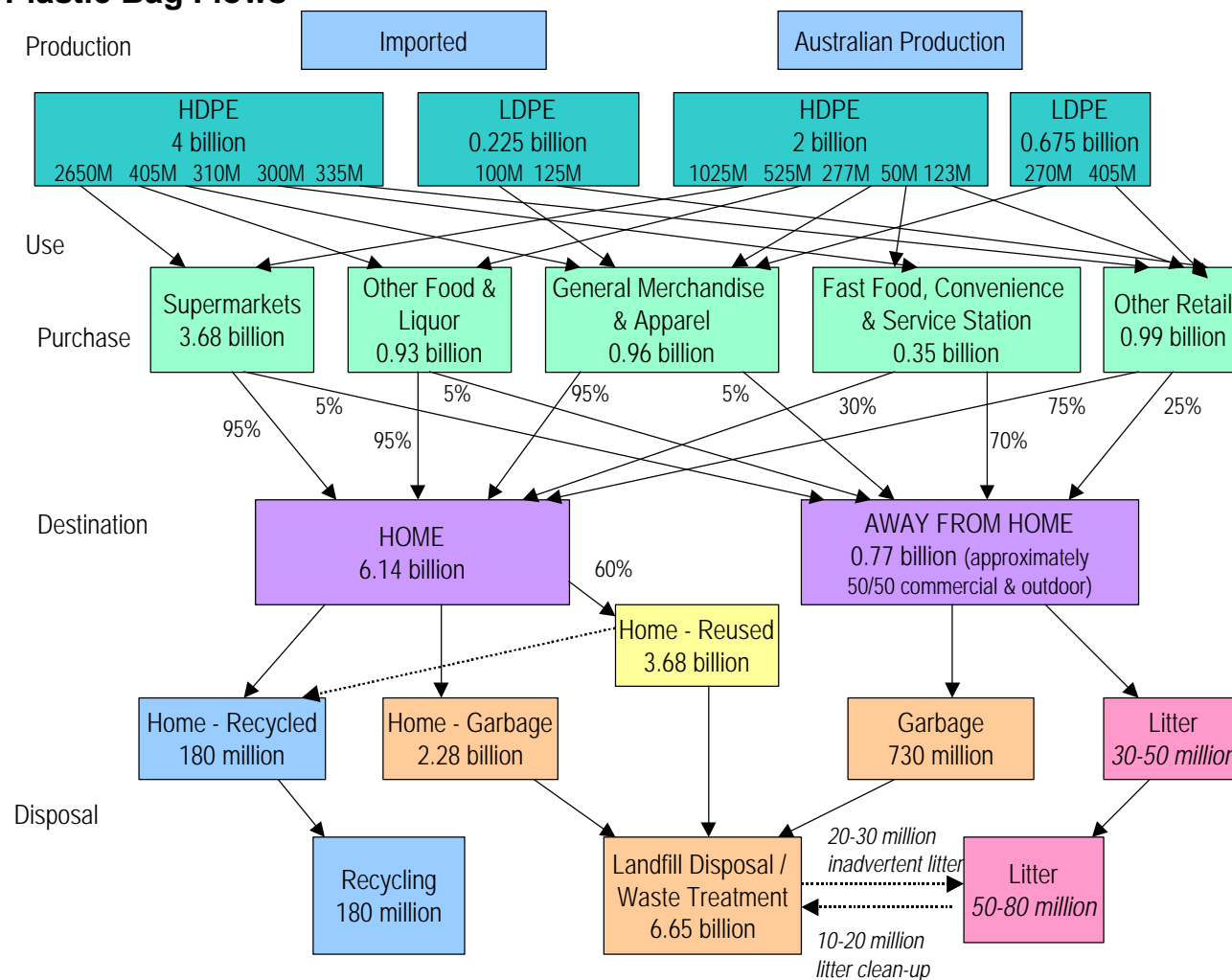
The environmental impacts of litter are addressed in Section 4.2.

#### **2.5.4 Disposal**

Currently, the vast majority of waste produced in Australia is disposed of to landfill. Some plastic shopping bags are disposed directly into the waste stream, while many are reused as garbage bags, and then are subsequently disposed to landfill. Bags that are reused for other purposes are assumed to eventually be disposed of, if they are not recycled.

Very little waste currently disposed of in Australia undergoes alternative waste treatment such as waste to energy. It is therefore assumed that all plastic shopping bags are eventually disposed to landfill aside from those recycled and those not recovered from the litter stream. Annual plastic bag disposal to landfill is therefore estimated at 6.67 billion units or approximately 36 700 tonnes per year.

## 2.6 Summary of Plastic Bag Flows





### **3 OVERSEAS LEVY AND TAX SCHEMES**

Over the last decade on an international basis, the use of economic instruments – including but not limited to taxes and levies – that seek to address environmental challenges has become markedly more prominent. More than 60 environmental levies and taxes on products now exist internationally, including some applied to shopping bags.

The theoretical advantages of economic instruments (over traditional command and control regulatory systems) are:

- Economic agents have the flexibility to choose how to respond to the price signal (with the assumption being that they do so at the lowest costs and therefore efficiently); and
- Creation of an on-going incentive to environmentally innovate in order to minimise tax requirements.

At the same time, there is clear concern in many jurisdictions about impacts on industry competitiveness and the equity of the distribution of costs arising from levies or taxes.

#### **3.1 Summary of Approaches In Other Countries**

Different countries and jurisdictions around the world have taken a range of approaches to plastic bags and other packaging materials. Ireland is the only country with a plastic shopping bag levy paid directly by consumers. South Africa currently has a proposal to introduce a similar levy. Denmark and Italy have indirect taxes which apply to plastic shopping bags, which are absorbed into the overall costs of products to consumers. Bangladesh, Taiwan and parts of India are currently introducing bans on plastic bag manufacture and distribution. Under the European Union, a number of countries have packaging material levies and packaging recovery targets which apply to industry. In many European countries, retailers charge for plastic bags outside any government levy. The approaches taken in a number of countries are outlined below.

##### ***Bangladesh***

Bangladesh suffers extensive problems with littering of plastic bags and film. Serious flooding resulting in major loss of life has been linked to plastic bags blocking drains. These problems were a combined result of lack of public infrastructure and a reliance on scavenging of valuable materials, lack of consumer responsibility and profound environmental and social consequences. In March 2002, a ban on the manufacture and use of plastic bags was introduced. This was the government's third attempt to introduce a ban. Prior to the bans, Bangladesh consumed 9 million plastic bags a day, of which only 10-15% were placed in bins, with 85% littered into the environment. The first stage of the ban applied to the capital only, and this is to be extended nationally. There is currently strong pressure from industry to extend the ban to other large cities in Bangladesh.

##### ***Canada***

Plastic bags are included in kerbside collection services in many areas of Canada. Wide education campaigns for recycling programs has included plastic shopping bags, and the system has proved to

be very successful. The kerbside collection of plastic bags and film includes the following product types:

- Retail plastic shopping bags;
- Rinsed milk pouches and outer bags;
- Bread bags, sandwich bags and bulk food bags;
- Dry cleaning bags;
- Disposable nappy outer packaging;
- Frozen food bags; and
- Over-wrap for toilet tissue and paper towels.

### **Denmark**

In 1993, the Danish government announced the introduction of a range of 'green taxes'. Taking effect from January 1994, these included taxes on electricity, fuel, water and waste disposal. The Danish packaging tax has evolved considerably over time. As part of this tax, in 1994, a tax on plastic carrier bags was introduced. The aim was to promote the use of re-usable bags (i.e. textile bags). The tax is weight based and is levied on bags > 5 litres capacity. The tax applies at a rate of 10 DKK per kilo for paper, and 22 DKK per kilo for plastic. The relative tax levels are intended to account for the fact that plastic bags are lighter than paper ones. The tax yield has been reported to be around 170 million DKK (Danish EPA, 1999), though a European report estimates this to be around 50 million DKK. European estimates that the tax approximately doubles the cost of the bags.

The tax on shopping bags introduced in 1994 reduced consumption of plastic and paper by 66%. The tax is included in the price of bags to the retailer and it is therefore not obvious to consumers or aimed at changing consumer behaviour and therefore not likely to produce or maintain dramatic reductions in bag usage. Accordingly, the impact on consumer behaviour has been less dramatic than in Ireland where the consumer is directly charged the levy.

### **Hong Kong**

In 2001, it was estimated that 27 million plastic shopping bags were disposed of each day in Hong Kong. This is a figure of nearly 4 bags per person per day, well in excess of the consumption level in Australia of just under 1 bag per person per day.

Hong Kong has therefore implemented a campaign of 'No plastic bag, please', and prohibits retailers over a specified size from providing bags to customers free of charge. The program has been designed to educate the public on alternatives to plastic bags and to encourage customers to make environmentally friendly decisions and purchases. Along with the public campaigns there is an environmental tax on products for which an environmentally friendly alternative is available. Recovery facilities for plastic bags are provided within supermarkets.

## **India**

Like Bangladesh, littering of a broad range of products is a major problem in India. There is very little waste and recycling infrastructure in many areas, and a heavy reliance on low-technology recovery and sorting. The low value of lightweight plastic shopping bags means that many bags are not recovered through scavenging activity, and therefore remain in the environment and find their way into rivers and drains in large numbers.

In August 2000, the manufacture and use of plastic shopping bags was banned in Bombay, in an effort to reduce the number of plastic bags clogging stormwater drains and causing flooding. Large fines and the suspension of trading for one month apply if retailers are caught using plastic bags.

## **Ireland**

In Ireland, plastic shopping bags were a cause for widespread public concern as they were a very visible litter problem in rural environments. This issue was impacting on tourism, Ireland's second largest industry. An estimated 1.28 billion plastic shopping bags, or 325 bags per person, were consumed annually, at a cost to retailers of \$50 million. The recycling rate was below 0.5%.

In 2001 the *Waste Management (Environmental Levy)(Plastic Bag) Regulations* were brought into effect levying all plastic bags with 0.15 euros (AUS\$0.27). The levy applies to all plastic bags (including biodegradable polymer bags) with the exception of those used to contain fresh produce, and those designed for reuse and sold for more than 0.70 euro (AUS\$1.27). The levy is aimed at the consumer, rather than the retailer, as the aim was for a change in behaviour in consumers.

This levy has resulted in a dramatic decrease in 'single-use' plastic bag consumption over the past year and a substantial increase in reusable bags. The levy does not apply to paper bags, and many retailers have switched to paper, but these have not replaced plastic shopping bags in supermarkets. Since its introduction, the levy has raised 3.5 million euros for waste management and environmental projects. It has been reported that the use of plastic bags has fallen by 90-95%. The impact on the litter stream is being monitored by the Coast Watch.

The Irish PlasTax is covered in more detail in Section 3.3.

## **Italy**

In 1988, the Italian government introduced a tax on plastic bags. This is levied at 100 Italian lira per bag, or 0.0051 Euro per bag. This is a very minimal and hidden charge, and is therefore not seen as having a significant impact on consumer behaviour or plastic bag consumption.

## **Northern Ireland**

230 million plastic shopping bags are used each year in Northern Ireland. The Irish levy situation is being watched closely by the Northern Irish Environment Ministry, particularly for its impact on litter. Currently, a voluntary 'Wake up to Waste Retail Partnership' has been established, with retailers signing up to commit to promoting re-usable and biodegradable bags.

## **South Africa**

Due to visual plastic bag litter issues in South Africa, where the plastic bag was becoming dubbed the 'national flower', a plastic ban levy has been proposed. On 26 September 2002, a Memorandum of Agreement (MoA) was signed between the Minister of the Department for Environmental Affairs and Tourism (DEAT), labour and business organisations. The level of the levy has not yet been set, and due to be introduced on May 8 2003. The levy will apply to manufacturers, with the stipulation that the levy is passed on to consumers and denoted separately on sales receipts.

The proposed South African levy is covered in more detail in Section 3.4.

## **Taiwan**

Taiwan utilised 16 million plastic shopping bags per day prior to the phased implementation of a ban in October 2001. The ban applies to the distribution of free plastic shopping bags in an effort to cut environmental impacts. The first stage of the ban was to stop government agencies, schools and the military from distributing free plastic bags or ones thinner than 0.1mm. Fines of up to NT\$300 000 apply. The second stage of the ban covers supermarkets, fast food outlets and department stores; and the third stage applies to peddlers and food dealers. There has been some criticism of this approach as being too focussed on changing to other disposable alternatives rather than durables.

## **United Kingdom**

The United Kingdom utilises an estimated 8 billion plastic shopping bags per annum. Less than 1% of these are returned and recycled. The existence of reusable 'bags for life' is, however common in retail outlets, with some retailers offering a free hand-back replacement service for damaged reusable bags, which are then recycled.

The United Kingdom has observed the Irish experience closely. The apparent success of the PlasTax has led to positive statements from the Minister of the Environment, Michael Meacher who has been relatively critical of other Government policy towards the environment in the UK and his view might not be representative of the UK Government. However, there is an ongoing review of UK waste policy being carried out by the Cabinet Office, and it seems that a shopping bag levy may be one instrument which could be introduced.

The fact that this instrument is being considered (and a 10p tax, or approximately 0.16 euro has been mooted) has led to considerable debate. Bodies such as the British Plastics Federation and the 'The Carrier Bag Consortium' are lobbying against a possible plastic bag tax by seeking to highlight what it perceives as flaws in the argument for a tax.

## **USA**

A primary focus on the United States has been in providing paper bags as an alternative to plastic bags at retail outlets. The federal system in the US means that many state or local jurisdictions have



initiated actions aimed at retail packaging. One example of this is in New Jersey, where a tax is applied to the manufacture, wholesale, distribution and retail of ‘litter generating’ products.

Stores are encouraged to follow the packaging guidelines set by the Integrated Waste Management Board. These guidelines include consumers being given the choice to take a bag, and whether to take plastic or paper. The Environment and Plastics Industry Council are encouraging consumers to choose plastic bags due to lower greenhouse impacts, recyclability and reuse potential. In some areas small discounts are also offered to customers who bring their own bags. Stores are also encouraged to use bags with a recycled content and provide packaging that can be refillable or reusable. Plastic bag collection facilities are available in some stores for customers to return their used plastic bags.

### **3.2 Summary of European Packaging Levies**

In Europe, the principal measures implemented to deal with plastics are the Producer Responsibility mechanisms used by Member States to implement the Packaging Directive. These do not target plastic bags specifically but aim to encourage the recycling and recovery of plastics. Essentially, Member States choose to set a target for recycling and recovery of packaging materials. This is to be chosen from a range set by the European Commission in the Packaging Directive.

Different Member States use different approaches. In most countries, sections of the packaging industry make payments to designated bodies who are responsible for arranging for the collection, separation, recycling and recovery of the required amount of packaging. These ‘Green Dot’ bodies are not necessarily directly responsible for the activities, and may contract out work to specific sub-contractors or make payments to those who carry out such activities. In all but three Member States, the separate collection of household packaging for recycling and recovery is either undertaken by separate bodies funded by the Green Dot system (e.g. Germany), or undertaken by local authorities, with payments made from the Green Dot body. The latter payments are intended to cover the costs of the activity or cover some ‘incremental cost’ above and beyond the cost of normal activities. The three exceptions to this rule are UK, where a tradable credits system is used, the Netherlands, where long-standing covenants between local authorities and Government exist, and Denmark, where there also exists a tax on packaging.

Table 3.1 shows some of the fees implemented by Member States in the context of Green Dot Systems.

It is very important to recognise that these are fees which are not necessarily passed through to consumers in a transparent manner. The intention of these systems, as well as the manner in which revenue is collected, and the fact that achievements in respect of plastics recycling are typically lower than that for other materials, tend to imply that any ‘full pass through’ of costs to the consumers of plastic bags would, in any case, be low, since the fees tend to be weight-related, bags are not the cheapest waste streams to collect, and only a fraction of all plastics is collected under these schemes. The rationale is very different to that of the Irish levy. The latter clearly aims to influence consumer behaviour at the consumption end, whilst Green Dot systems are premised on the need to organise national collection systems to meet specific targets for recycling, implying a need to organise collection and influence *post-consumption* activity.



**Table 3.1 – Summary of Overseas % Recovery Targets**

Country	Global targets			Recycling targets for packaging materials						Reuse/ prevention target %
	Recovery %	Recycling %	Recycling of each material %	Glass %	Paper / cardboard %	Plastics %	Steel %	Aluminium %	Beverage/ composites %	
Austria <sup>1</sup>	50	25	15	93	90	40	95		40	
Belgium	80 <sup>2</sup>	50	15							x
Denmark <sup>3</sup>				65	55	15	15			
Finland	61	42	15	48	53	45 <sup>4</sup>	25	25		x
France	50- 65 75 5	25- 45	15							
Germany	65	45	15	75 <sup>6</sup>	70 <sup>6</sup>	60 <sup>6</sup>	70 <sup>6</sup>	60 <sup>6</sup>	60 5	x
Greece										
Ireland	50- 65	25- 45	15	45	31	10	5	25		
Italy	50- 65	25- 45	15							
Luxembourg	55	45	15							
Portugal	25 <sup>7</sup> 50 <sup>8</sup>	25 <sup>8</sup>	15 <sup>8</sup>							x
Spain	50- 65	25- 45	15							x
Sweden				70	40/ 65 <sup>9</sup>	30 <sup>9</sup>	70	70 <sup>9</sup>		
The Netherlands	65	45 <sup>10</sup> 65 <sup>11</sup>	15	90 <sup>11</sup>	85 <sup>11</sup>	35 <sup>11</sup>	80 <sup>11</sup>			x
UK	58		18							



## **Notes:**

*1 Austria material- specific targets for individual company compliance, expressed as percentages of packaging taken back and own packaging waste arising which must be recycled*

*2 Belgium: targets have to be achieved by 1999*

*3 Denmark: targets of waste management plan, other targets are included in voluntary agreements (see country report)*

*4 Finland: target for plastics applies to recovery*

*5 France: target for household packaging waste to be achieved by the end of 2002*

*6 Germany: material specific recycling targets apply to sales packaging*

*7 Portugal: target to be reached by 2002*

*8 Target to be reached by 2006*

*9 Sweden: recycling target for: corrugated cardboard 65%; paper/ cardboard 40 %; aluminium drinks containers 90%; PET drink bottles 90%*

*10 Netherlands: mandatory target to be achieved in 1998 defined in the Packaging and Packaging waste decree*

*11 Voluntary target defined in the Covenant II to be achieved by 2001*

*Source: ARGUS et al (2001) European Packaging Waste Management Systems, Report to European Commission DGXLE.3*

## **3.3 Irish Plastic Bag Levy ('PlasTax')**

### **3.3.1 Background**

The Irish PlasTax was introduced following a Consultancy study on Plastic Bags. On the date of the study's publication, Mr. Noel Dempsey T.D., Minister for the Environment and Local Government was moved to state:

*"The day of the plastic bag is coming towards an end. [...] It is the policy of this Government to tax plastic bags as a means of discouraging their use. Over 1.2 billion plastic bags are handed out, free of charge, every year to customers in about 19,000 shops and other retail outlets throughout this country. Most end up in landfill. Too many end up in the environment as litter. They are an eyesore on our streets and roadsides, and in hedges and trees throughout the countryside. In addition, plastic bag pollution is a threat to our ecosystems, natural habitats and wildlife. We simply cannot allow this to continue. People need to think twice about taking plastic bags in the first instance and make sure they dispose of them properly when there is no further use for them."*

The purpose of the study was to examine the use of plastic bags in Ireland and their effects on the environment. In doing so the consultants gave detailed consideration to issues relating to compliance with EU legislation, administrative costs, secondary environmental impacts and effects on employment. The study's conclusions and recommendations are set out in Box 1.

**Box 1: Conclusions and Recommendations of Consultancy Study on Plastic Bags**

This report has sought to address the objective set out in the Brief to Consultants, i.e. to examine the use of plastic shopping bags in Ireland and their effects on the environment.

Free plastic shopping bags are a ubiquitous feature of the Irish retailing environment. Of the estimated 14,000 tonnes placed on the Irish market annually some 21% would appear to be sourced from home manufacturers while the remainder is imported - mainly from the rest of the EU and certain South-east Asian countries. The trend in recent years has been strongly in the direction of increased imports at the expense of the home product. However there are still four companies, employing 177 persons, engaged in the manufacture of plastic bags in Ireland.

Most of the product consumed annually is landfilled as part of the domestic waste stream. An unknown proportion appears as litter. The environmental impact of the landfilled quantity is likely to be low due to the essentially inert or unreactive nature of the material. Bags that appear as litter are clearly a source of considerable, if unquantifiable, nuisance and environmental disamenity.

While efforts have been made over recent years by many retailers to encourage the use of alternatives to the free plastic shopping bag these have not been particularly successful to date - mainly due, it would seem, to consumer apathy.

Opportunities for recycling recovered quantities of plastic shopping bags are currently limited in Ireland due to a lack of infrastructure both in terms of collection and processing.

Having assessed a range of policy instruments it is considered that a levy of some form offers the most appropriate means of reducing consumption of plastic shopping bags and thereby reduce consequent environmental problems. This conclusion has been reached following a detailed consideration of issues relating to compliance and administrative costs, secondary environmental impacts and effects on employment.

Other policy instruments, e.g. enhanced litter control measures by local authorities, may be more effective in addressing the specific aspect of litter as a levy can only impact on this indirectly by reducing bag consumption. However, these approaches are either end-of-pipe in nature or they are likely to be more costly or both.

Of the several types of levy systems available either a point of sale or a supply based approach is possible. Both have merits and disadvantages. The former (point of sale) approach has the benefit of adhering more tightly to the polluter pays principle in targeting end consumption, but may be compromised by administrative complexity.

By targeting manufacturers and wholesalers the supply based levy is administratively simpler. It is likely to be less effective however in reducing plastic bag consumption per unit of levy than a point of sale system (without any exemptions) as it offers the possibility of suppliers absorbing some of the levy to maintain bag sales.

On balance it is suggested that the supply based approach is preferable.

It is accordingly recommended that a charge in excess of 3p per unit be levied on plastic shopping bags destined for use in the Irish market from whatever source (home produced or imports).

Although it may invite scrutiny with regard to compliance with EU law the proposed levy is unlikely to run counter to the principles of the EC Treaty. Indeed a levy on plastic bags would be compatible with the general policy direction of the European Commission which, in principle, supports the use of market based instruments as a means of achieving higher standards of environmental protection. This view is however contingent on there being more quantitative evidence on the contribution of plastic bags to the environmental problems of litter.

With the latter point in mind it is further recommended that data on the content and origin of litter be extended and improved through the medium of the National Litter Survey or some other suitable means.

Tracking of the cost-effectiveness of local authority litter management activities is another essential requirement in the process and could be achieved by (i) ensuring all expenditures in this area are separately identified in the annual Local Authority Estimates and (ii) allocating a Cleanliness Rating to all major towns and cities on an annual basis.

Source: <http://www.environ.ie/search/searchindex.html>

### 3.3.2 The Levy

The Irish plastics bag levy was introduced on March 4 2002. It seems clear from the Minister's statements that the imposition of the levy resulted from:

- Concerns about litter;<sup>2</sup> and
- A desire to eliminate, not contain, the problem by making people think twice about using disposable bags in the first place. That is, it was a waste minimisation measure, not a levy intended to support recovery of the material for recycling.

The levy was introduced at 0.15 euro per bag. This is a significant tax in terms of the price of the product (and four times higher - than the lower limit suggested by the consultancy study – see Box 1 - 0.15 euro = IR£0.12). The levy was specifically levelled at consumers to send a very clear message that the scale of plastic bag use was seen as undesirable. It is important to recognise the significance of such a 'punitive' level of tax, as it was believed that a lower levy may have made little difference. The intent appears to have been to 'more or less' ban plastic bags, without eliminating them as an option altogether (which might have made spontaneous shopping more difficult if no containment method had been available at all.)

### 3.3.3 Exclusions from the Levy

Certain types of plastic carry bags are excluded from the levy. The exclusions cover re-usable shopping bags which are sold for 70 euro cents or more, bags used to contain fresh meat, fish or poultry (whether packaged or otherwise), bags used to contain loose fruit and vegetables, bags used to contain ice and other foods that are not otherwise packaged. Plastic bags used to contain goods or products sold on board an aircraft or ship, and in an area of a port or airport to which intending passengers are denied access unless in possession of a valid ticket or boarding card, are also excluded from the levy.

### 3.3.4 Administrative Issues

The levy was imposed at the point of sale and retailers were legally obliged to pass on the levy directly to the customer, with the levy itemised on any invoice, receipt or docket issued. Retailers are required to keep records of bags levied and make payments to the Revenue Commissioners quarterly. The record keeping requirement was framed so as to minimise the compliance burden on the legitimate trader while at the same time ensuring that levy evasion could be combated. The basic requirements are an opening stock take of plastic bags when the levy is introduced, a record of plastic bag purchases and a record of plastic bags supplied to customers where the levy applies. The records must differentiate between (a) those plastic bags used to contain fresh meat, fish, poultry, fruit, vegetables and other foods that are not otherwise packed, ice, and (b) other plastic shopping bags. Records are not required to be kept, however, of re-usable shopping bags

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<sup>2</sup> In the words of Declan Kelly, Irish Ambassador to Australia, *'The levy was introduced primarily as an anti-litter measure. While not the largest component of litter in Ireland, disposable plastic bags were perceived to be the most visible and unsightly. Dropped by careless consumers and whipped up by the Irish winds, plastic bags were a common and unwelcome decoration on Irish trees and hedgerows'* (speech given in Canberra, Sept. 2002).

which are sold for 70 euro cents or more. Information provided by retail associations is shown in Box 2.

Tesco Ireland, one of the country's main supermarket chains, said it welcomed the government initiative. Just prior to the tax's introduction, a spokesman for the company said it was handing out 220 million bags to customers in Ireland each year. The company estimated that the number would be reduced by at least 40% in the first year. Tesco Ireland's environmental manager, Jim Dwyer was reported as saying: *"Customers are telling us they broadly welcome the introduction of the levy. We have seen a marked change in customers' behaviour in anticipation of the new levy, reflected in the significant increase in sales of our re-usable bags."*

**Box 2: Waste Management (Environmental) Levy (Plastic Bag) Regulations 2001. Tax on Plastic Bags**

From the 5th of March 2002 a plastic bag levy of 15 cents (12p) has applied.

The following classes of plastic bags are exempted from the definition of a plastic bag:

a. Plastic bags solely used to contain -

(i) fresh fish and fresh fish products, (ii) fresh meat and fresh meat products, (iii) fresh poultry and fresh poultry products.

and where plastic bags solely used to contain the products referred to where such products are contained in a plastic bag or other packaging provided that such bags are not greater in dimension than 215 mm by 345 mm by 450 mm;

b. Plastic bags solely used to contain -

(i) fruit, nuts or vegetables, (ii) confectionery, (iii) dairy products, (iv) cooked food, whether hot or cold, provided that such products are not otherwise contained in packaging and where such bags are not greater in dimension than 215 mm by 345 mm by 450 mm;

c. Plastic bags designed for re-use, which are used to contain goods or products and which are sold to customers for a sum of not less than 70 cents each.

The Levy will be collected by the Revenue Commissioners by **DIRECT DEBIT PAYMENT**.

The following records will be required to be kept:

**LEVY BAGS**

A. Opening stock at beginning of period. B. Purchases. C. Bag supplies to customers.

**NON LEVY BAGS**

A. Opening stock B. Purchases. C. Closing stock.

Where a plastic bag is liable to levy such levy must be charged to the customer and must be itemised on any invoice or receipt issued to the customer.

The levy is not liable for VAT. However, where a retailer makes a charge for the bag as well as the levy, then the **total amount, including the levy, is liable to VAT at 20%.**

### 3.3.5 Informing the Public

It is important to note, given the high rate of the levy, that a significant effort was made to inform consumers about the tax in advance of its introduction, to both provide consumers with information on how the levy would operate and explain its environmental rationale. A television advertising and a billboard campaign were launched before the levy came in to force. The television advertisement, which was shown on all Irish channels and Sky, informed the public of the introduction of the 15 euro cent levy on plastic shopping bags from Monday 4<sup>th</sup> of March 2002. The advertisement, which featured a dog surrounded by a storm of plastic bag litter, aimed



to highlight the environmental problems caused by the use of free plastic bags. The advertisement ran for a month. It was complemented by an outdoor poster campaign, also featuring the dog, at bus shelters and shopping centres. Retailers were also given leaflets to publicise the measure.

According to both the Department of the Environment and retailers, there has been a high level of understanding and acceptance of the PlasTax; both attribute this in part to the education campaign that occurred prior to its introduction. Retailers commented that they encountered little difficulty with customer resistance or lack of understanding. In the context of a country with poor recycling and recovery infrastructure in comparison to Europe and Australia, the PlasTax has demonstrated the Irish public's willingness to 'do something for the environment' which could lead to further advances in waste management in Ireland.

### **3.3.6 Results**

#### ***Bag Reduction***

Environmental Daily reported on 22nd August 2002 that Irish consumers' demand for disposable plastic shopping bags had plummeted by over 90% since the introduction of the PlasTax. Irish Minister for the Environment, Martin Cullen, said:

*"The reduction has been immediate and the positive visual impact on the environment is plain to see [...]. We are realising that by implementing practical measures such as this, the environment wins."*<sup>3</sup>

In recent consultation with major Irish retailers, the sustained reduction of plastic shopping bags has been confirmed. The overall reduction is estimated at over 90%, with major supermarkets Tesco and SuperQuinn experiencing 92% and 94% reductions respectively. These retailers predict, that rather than an increase in plastic shopping bag consumption over time, that the reduction rate will stabilise at 95-96% of pre-levy consumption.

#### ***Litter Reduction***

There is no data yet available to determine the effect of the PlasTax and resultant bag reduction on the litter stream in Ireland, however, the Irish Coast Patrol are currently undertaking observations on the number of bags in the coastal marine environment. Whilst no data is available, it can be assumed that the dramatic decrease in bag consumption has led to a related decrease in bag litter.

#### ***Reusable Bags and 'Bags for Life'***

As would be expected, in the initial year of the levy introduction, the sale of reusable bags and 'bags for life' (which are replaced free of charge by the retailer on return of damaged bags for recycling) have increased significantly.

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<sup>3</sup> Julian Glover (2002) Irish Success Paves Way for UK Plastic Bag Levy, *The Guardian*, Tuesday 20 August, 2002.

SuperQuinn supermarkets have sold 1.4 million units of their signature ‘green bag’, and Tesco estimates that over the first year reusable bags sales have been approximately 1/3 of their previous number of free plastic bags. In Ireland these bags are now the dominant form of carrying groceries. It is expected that the number of reusable bags sold will decrease and stabilise over the coming year.

In hindsight, SuperQuinn have intimated that they would have made the ‘green bag’ slightly bigger than the current design, but overall these bags have proved very popular with customers.

### ***Sale of Garbage Bags***

As significant numbers of plastic shopping bags are reused as kitchen tidies and garbage bags, a concern with the reduction of these bags resulting from the PlasTax was that the consumption of conventional garbage bags would increase significantly, and thereby counteracting some of the resource use savings in reducing the bags.

Retailers, though reporting as high as 77% increase in kitchen tidy bag sales, maintain that this increase is not significant in comparison to the reduction in plastic shopping bags. The base level for the sale of these bags was minor compared to plastic shopping bags, and in addition, larger garbage and garden bag sales have not shown any increase.

### ***Security and Safety***

Concerns were expressed prior to the introduction of the PlasTax regarding potential for increased theft from stores with the reduction of plastic shopping bags.

According to retailers, theft of product has not been an issue, although Tesco stores, which had carry baskets which were able to be used outside of the store, experienced a high level of basket theft in the first three months. This was not experienced in other stores where baskets could not be used outside the store or where a deposit is required to use a basket. Trolley theft has also not been an issue.

Potential problems with food safety in supermarket shopping have been combated by the sale in some stores of bags marked out for specific product types (i.e. meat or detergents).

### ***Implementation and Administration***

Retailers have expressed that the consultative approach to the scoping and implementation of the levy in Ireland has significantly reduced the potential administration issues and costs. The levy is handled through the online sales tax system in most large stores, and the system is working well.

Consumer acceptance and feedback has also been very positive in Ireland, with consumers willing to take positive action to ‘help the environment’ whilst avoiding the levy.

In an interview with ABC in Australia, Declan Kelly, Irish Ambassador to Australia, summarised the results as follows:

*‘Consumers went to extraordinary lengths to avoid paying the 15 cent levy, and reports of people carrying bundles of groceries in their arms were common place. Retailers, who were sceptical of the levy, and the additional work involved in administering it, were soon won over when they saw the money they saved on disposable bags - and the margin they made on selling bags for life!’*

*Consumption of disposable plastic bags is estimated to have fallen by around 90%. Most people don’t forget to bring their re-usable bags with them when they shop and are not afraid to bring bags from one store into a rival one. The retail sector also responded very positively to the disciplines involved in operating the levy. Over i3.5 million has also been raised for the Environment Fund. Most importantly of all it has been very popular with the public.*

*It has not all been smooth going of course and there is a small amount of avoidance by some shopkeepers, failing to declare the monies collected, which is being tackled by Irish local authorities and the tax authorities.’*

### 3.3.7 Revenues

Revenue generated from the PlasTax is earmarked into an Environmental Fund. This fund will be used to support waste management, litter and other environmental initiatives. Ironically, the success of the levy in achieving bag reduction has resulted in lower than expected revenues going into the fund.

Prior to the tax’s introduction, expectations had been of revenue of around 130M euro. Yet, because the tax has been so successful in changing behaviour, only 10-12M euro of revenue is expected to be raised in the first full year of operation. This figure is based on the first official receipts from the Revenue Commissioners which show that in the first four months of its operation, the tax raised 3.5M euro. As indicated above, that came from a tax base of 23 million bags compared with the 300 million that it was estimated would have been used by shoppers prior to the tax’s introduction.

### 3.4 Proposed South African Levy

It was the South African Minister for the Environment’s travels in pristine open spaces (beaches, parks etc.) and the observation of plastic bags being blown across these otherwise pristine landscapes, that led him to call not for a levy, but a ban on plastic bags. Plastic bags were so prevalent in the litter stream, that the bags has been described as ‘South Africa’s National Flower’. Currently South Africans use 8 billion bags per year.

The threat of a ban has resulted in industry representatives becoming the proponents of a levy as a means to supplant the proposed ban. Hence, following the proposal of the ban, work has been underway to produce the framework for a levy.

On 26 September 2002, a Memorandum of Agreement (MoA) was signed between the Minister of the Department for Environmental Affairs and Tourism (DEAT), labour and business organisations. As stated in the MoA, the aim of the agreement is:

*‘to adopt an approach for addressing the negative impacts associated with the generation, use, collection, transportation and disposal of plastic bags which will optimise the impacts of the DEAT’s regulatory efforts whilst minimising any negative social or economic impacts’*

The MoA established what is known in South Africa as a ‘Section 21 organisation’, which is a non-Government body with revenue collection responsibilities. A compulsory levy will be placed on plastic bags which will be used to generate revenue for the Section 21 company. The objectives for the Section 21 company suggest a shift in emphasis away from elimination of plastic bags, and towards their management for recycling. These objectives are:

- To promote efficiency in the use, re-use, collection, recycling and disposal of plastic bags;
- To receive a levy from all registered plastic bag manufacturers, and to administer the levy in pursuance of the objects of the company;
- To develop and implement company specific performance indicators to monitor the achievement of objectives;
- To investigate and make recommendations to government in respect of the development of new markets for recycled material;
- To establish that collection points are established within easy walking distance of all major settlements, and to this end exploring the possibility of co-operation with retailers and local governments; and
- To support government (i.e. not to do so itself) in the removal of plastic-bag litter from environmentally sensitive areas and hot spots; etc.

Each of these hints at the dilution of emphasis from consumer behaviour to post-consumer behaviour. Part of the agreement is to apply a minimum thickness of 30 microns and to reduce the use of printing on bags.

The level of the levy has not yet been set, however a lower tax than the Irish levy is expected, and a level of 2 cents has been suggested. Many households in South Africa are not served by any formal recycling collection system. For example, Johannesburg reports weekly waste collections of more than 11 thousand tonnes of waste through formal systems, but over 7 thousand tonnes collected from dumps. If litter and plastic bags are a legitimate problem in South Africa, it is far from clear that this ‘European’ style approach will achieve much by way of minimising the problem. In order to achieve high employment objectives, it would probably need to be levied at a rate which would impact upon minimisation (since Section 2.5 of the MoA suggests that the costs of bags would be made transparent to consumers, and specifically, ‘The cost of plastic bags will not be paid by or recovered from consumers without their knowledge’. The mechanism for ensuring this has not yet been agreed).

The levy is due to be introduced on May 8 2003, and is to be phased in over 5 years and levied on manufacturers. Section 2.10.1 of the MoA notes that ‘the amount of the levy will be shown separately on any invoice and recovered from their customers’. The levy will be adjusted on the basis of recommendations to the Minister of Finance (as required under the SA constitution).




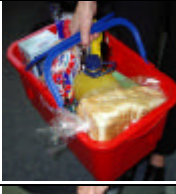




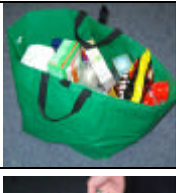

## 4 LIFE CYCLE IMPACTS - PLASTIC BAGS AND ALTERNATIVES

In this section, the impacts of current plastic bags and their potential alternatives are detailed. These impacts are then applied to potential scenarios in Australia in Section 8.

### 4.1 Summary of Shopping Bag Types for Assessment

The alternatives considered in the environmental assessment are outlined in Table 4.1.

**Table 3.1 – Shopping Bag Types for Assessment**

Option		Example	Weight of Bag	Relative Capacity	Option		Example	Weight of Bag	Relative Capacity
1	Singlet HDPE		6g <sup>1</sup>	1 (6-8 items)	7	Kraft Paper – Coles handled		42.6g	1
2	50% recycled Singlet HDPE		6g <sup>1</sup>	1	8	Solid PP Smart Box		250g	2
3	Boutique LDPE		18.1g	0.8	9	Reusable LDPE		35.8g	1.5
4	Coles' Calico		125.4g	1.1	10	Biodegradable – Starch based		12.5g	1
5	Woven HDPE Swag Bag (L)		130.7g	3	11	Biodegradable – PE with prodegradant additives	(Photo Unavailable)	12.5g	1
6	PP Fibre 'Green Bag'		115.9g	1.2					

1 – Although the average bag weight is 5.5g, the weight of the bags assessed in the LCA were weighed at 6g.

## 4.2 Environmental Impacts of Alternatives

The assessment of environmental impacts of plastic shopping bags and alternative packaging systems needs to consider impacts at each stage of the product life cycle i.e. including:

- Extraction/processing or growing/harvesting of resources;
- The manufacturing process;
- Transport from the manufacturer to the wholesaler/retailer;
- Patterns of use by consumers; and
- Disposal routes, either landfill, recycling or litter.

The impacts of the conventional HDPE singlet bag and alternative packaging systems are discussed below. For the purpose of this analysis, 11 products are being assessed. The products are:

- Two HDPE singlet bags, one manufactured from virgin polymer and one manufactured from 50% recycled (post-consumer) material;
- Two LDPE bags, one conventional boutique retail bag and one more durable bag designed for reuse;
- A calico reusable bag;
- A woven HDPE reusable bag ('Swag Bag');
- A polypropylene (PP) reusable bag (the Irish model);
- A kraft paper bag;
- The solid polypropylene 'Smart Box'; and
- Two biodegradable bags, one made from starch and one made from synthetic polymer with a biodegradable additive.

### 4.2.1 HDPE Singlet Bags

#### **Resource Consumption**

Approximately 6.9 billion bags are currently consumed in Australia per year (HDPE and LDPE). This is equivalent to over 36 850 tonnes of polymer. To put this in perspective, 36 850 tonnes of polymer is equivalent to:

- 2.5% of total plastics consumed in Australia per year by weight (approximately 1.5 million tonnes<sup>4</sup>); or
- 1% of total packaging consumed in Australia per year by weight (approximately 3 million tonnes<sup>5</sup>).

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<sup>4</sup> Nolan ITU (2001), *Plastics Recycling Survey 2001*, PACIA, July 2001.



HDPE is manufactured from ethylene, a by-product of gas or oil refining which is extracted from natural gas or naphtha (from oil) by high temperature cracking<sup>6</sup>. Cracking is the process by which larger molecules are broken down into smaller ones. Around two thirds of the HDPE bags consumed in Australia are imported from south-east Asia, where the primary source of HDPE is oil; the primary source for the locally produced bags is natural gas.

## **Energy Consumption**

The embodied energy<sup>7</sup> in one average HDPE singlet bag, weighing 6 grams, is approximately 0.48 MJ<sup>8</sup>, including the production of the polymer, bag manufacturing and transport. This can be compared to energy impacts of the following:

- Fuel consumed by driving a car 1 km is 4.18 MJ, equivalent to 8.7 bags; and
- Fuel consumed by driving a 28 tonne articulated truck 1 km is 31 MJ, equivalent to 64.6 bags (i.e. travelling from Melbourne to Sydney would be roughly equivalent to 57,300 bags).

The embodied energy of HDPE bags compared to other alternatives is presented in Table 4.3.

## **Litter**

Plastic shopping bags are a highly visible component of the litter stream, because they are lightweight (and therefore easily become airborne), moisture resistant (float on waterways) and only degrade over a long period of time.

Data from Clean Up Australia indicates that plastic bags are a high ranking product found in litter collected, but still only make up 2.02% of the total<sup>9</sup>. Consistent national data is not available, but there are other surveys that provide an indicator of the role plastic bags play in litter. For example, Keep Australia Beautiful Council surveys in Victoria collected data on the basis of number of product items per site (48m<sup>2</sup>) – an average of 1.25 items of plastic ‘bags, sacks and sheeting’ were found per site<sup>10</sup>. Plastic bags are also a commonly found item in shoreline litter surveys. Research by the Victorian Institute of Marine Sciences (1993) found 10 plastic bags in one survey of a 2m<sup>2</sup> area of beach in Melbourne, and plastic bags made up 29% of bags trapped in a rock wall in Sydney and made up 3.8% of items recorded in Sydney Harbour litter traps<sup>11</sup>.

Unlike some other visible litter items such as paper, the annual impact of plastic bags on the litter stream is increased, however, due to the physical persistence of the material. Therefore, even

<sup>5</sup> Based on an estimated value of \$7.3 billion per annum, and an average value of \$2,500 per tonne.

<sup>6</sup> 75% of polyethylene manufactured in Victoria is from gas; in Asia it is mostly based on oil

<sup>7</sup> Energy consumed in the manufacturing process plus energy content of the HDPE

<sup>8</sup> A megajoule (MJ) is approximately equal to the energy required to heat three litres of water from 20°C to boiling point – around 12 cups of tea (PIA1992: 11)

<sup>9</sup> Clean up Australia (2002) *Rubbish Report – A Snapshot*, 2002.

<sup>10</sup> Clements, R. (1999), *Yearly Report on Statewide Litter Surveys, December 1998 to October 1999*, report to EcoRecycle Victoria

<sup>11</sup> Victorian Institute for Marine Sciences (1993), *Sources of Coastal Shoreline Litter Near Three Australian Cities*, Report to the Plastics Industry Association, PIA, Melbourne

with litter clean-ups, the actual number of bags in the environment increases annually, and impacts may continue to occur from bags that were littered many years before.

The Environment Australia *State of the Marine Environment* (1995) reports that 80% of the litter in the marine environment comes from the land, carried by waterways and from airborne litter.

### ***Animal Impacts of Litter***

Much of the concern regarding plastic bag litter revolves around the impacts on marine life. Much anecdotal evidence has been gathered around the world on the incidence of at least 143 species being affected, injured and killed by plastic bags – either by ingestion or entanglement.

It is believed that turtles, and other species such as whales, mistake plastic bags in the water for jelly fish or other food. The bags can choke the animal or restrict food absorption in the body leading to injury or death. Mammals and other species also become entangled in bags leading to injury, loss of limbs, infection and possible death.

A figure of 100 000 marine animals killed annually has been widely quoted by environmental groups; this figure was from a study in Newfoundland which estimated the number of animals entrapped by plastic bags in that area over a four-year period from 1981-1984<sup>12</sup>. Actual numbers of animals injured or killed annually by plastic bag litter is obviously nearly impossible to determine.

Despite this lack of reliable data, the potential for plastic shopping bags to injure marine wildlife is real and of a high concern to Australians. Measures to reduce the littering of bags, other plastic film and other packaging should be a high priority. Co-ordinated efforts to reduce litter should involve the following:

- ❑ Focus on applications where littering is more likely (i.e. fast food and convenience stores);
- ❑ Consumer education;
- ❑ Litter cleanups; and
- ❑ Containment of litter through litter traps and other infrastructure.

### ***Waste Management and Disposal***

Single-use plastic shopping bags generate around 35 850<sup>13</sup> tonnes of waste per year. This is equivalent to 0.2% of total solid waste going to landfill each year in Australia (an estimated 16 million tonnes). Average bag use per person in Australia is around 360 bags (1.9 kg), which is equivalent to 0.7% of average household waste going to landfill each year (an estimated 260kg

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<sup>12</sup> Environment Canada, [www.ec.gc.ca/marine/debris/ENG/facts.htm](http://www.ec.gc.ca/marine/debris/ENG/facts.htm)

<sup>13</sup> Consumption of 36 850 tonnes less recycling of 1 000 tonnes



kg<sup>14</sup>). This impact is reduced, however, when you consider the high percentage of bags reused in the home.

Current practice in Australia is to dispose of waste into ‘dry tomb’ landfills which are designed to be as stable as possible. Information from landfill operators (pers. comm. C.S.Bateman, Landfill Victoria, 2002) suggests that once buried, plastic shopping bags do not pose a problem as they are basically inert, and do not break down in landfill.

However, the bags do cause problems in the form of windblown litter, and although most landfills have ‘litter fences’, some of this litter can escape into the environment. It was found by Keep Australia Beautiful (Victoria) that 47% of the litter at and around landfills is plastic litter, with a proportion of this material being plastic bags.

Currently, very little of the total disposal stream in Australia is treated via ‘alternative waste treatment’ technologies which include waste to energy facilities and residual waste composting facilities. Where these technologies are utilised, the impact of plastic shopping bags are disparate – with the embodied energy resulting in positive impacts in regard to energy recovery in waste to energy facilities and their non-degradability resulting in them becoming part of the residual stream from composting facilities.

#### 4.2.2 LDPE Bags

Approximately 900 million LDPE shopping bags are consumed in Australia each year. These are primarily used for ‘boutique’ shopping, e.g. in apparel and general retail stores (not supermarkets or take-away).

Like HDPE, LDPE is manufactured from ethylene from gas or oil. Embodied energy is similar to HDPE. LDPE bags are however, less likely to enter the litter stream because their destination is normally the home, and no recycling program currently exists for LDPE bags.

#### 4.2.3 Calico Bags

Calico bags are made from woven cotton, and are mostly imported into Australia from Asia.

Reusable bags have a couple of major benefits, including:

- A reduction in materials consumed for single use bags, with the extent of resource savings dependent on the expected life of the reusable bag; and
- A reduction in litter, as the chance of these bags entering the litter stream is extremely low.

In the case of calico, an important issue is the fact that the cotton growing industry is a major consumer of synthetic fertilisers and pesticides. Around 10% of the world’s pesticides, and 25% of the world’s insecticides, are used to grow cotton<sup>15</sup>. The labour conditions for bag manufacture

<sup>14</sup> Based on EcoRecycle Victoria data

<sup>15</sup> Marquardt, S. (undated), ‘Pick Your Cotton’, *EcoMall*, [www.ecomall.com/greenshopping/mpick.htm](http://www.ecomall.com/greenshopping/mpick.htm)

in the developing world would be an issue that would warrant careful examination if these bags were to be utilised on a broad scale in Australia.

Environmental impacts during the use stage of the life cycle include impacts of washing, such as water and detergent consumption, energy consumption and waterborne wastes. Some people may choose to iron the bags after washing, which also consumes energy.

It would be difficult (but not impossible) to establish recycling programs for damaged calico bags at the end of their useful life. Some textiles are recycled in Australia, and some are exported for reuse or reprocessing.

#### 4.2.4 Woven HDPE Bag

Woven textile plastic bags are less common in Australia but do exist. Coles sell their 'Swag Bag', which is imported from Taiwan. Ikea also sells a woven bag to encourage reuse rather than purchase of single use bags.

Reusable HDPE bags have some of the same impacts as the calico bag such as:

- Reduced consumption of single use bags; and
- Reduced litter.

These bags are potentially recyclable, but systems would need to be established to collect damaged bags from consumers for recycling.

#### 4.2.5 Irish Polypropylene Fibre 'Green Bag'

The reusable bag sold through supermarkets in Ireland is manufactured from non-woven polypropylene (PP). It also has a solid removable base, which is probably manufactured from either nylon or PET<sup>16</sup>.

PP is manufactured from propylene gas, a by-product of oil refining. Reusable PP bags have some of the same impacts as the calico and HDPE bags, such as:

- Reduced consumption of single use bags; and
- Reduced litter.

The PP bags are potentially recyclable, but systems would need to be established to collect damaged bags from consumers for recycling, and to separate the bases from the bags. No consumer packaging recycling of this PP material currently occurs in Australia.

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<sup>16</sup> The consultants have been unable to locate a manufacturer to advise of the material used, but physical tests on the material indicate that it is made from one of these two materials. For the purposes of the life cycle review, nylon has been assumed.

#### **4.2.6 Kraft Paper Bag**

Kraft paper bags are manufactured in Australia generally include virgin fibre. Environmental impacts include:

- Impacts of timber growing and harvesting on land degradation and biodiversity; and
- Air emissions and waterborne wastes from the pulping and paper making process.

A review of LCA studies comparing plastic and paper shopping bags concluded, “plastic one trip bags have a lower environmental impact than paper one trip bags”<sup>17</sup>. This is because the pulping and bleaching processes involved in paper manufacture produce higher air emissions and waterborne wastes than plastics manufacture. Some Australian kraft paper bags can contain up to 50% recycled content.

One of the major benefits of paper bags compared to plastics is that they are highly degradable, and therefore have less impact in the litter stream. They are also highly recyclable, as collection and recycling systems for paper are now widespread in Australia.

If paper bags are disposed to landfill they are more degradable than plastics and therefore have a higher global warming potential.

#### **4.2.7 Solid Polypropylene ‘Smart Box’**

One of the reference products used for the life cycle review is the Coles ‘Smart Box’, which is imported from Scotland. These boxes use much more material than the reusable bags, and therefore their impact is highly dependent on their expected life (and therefore the number of single use bags they replace).

The boxes would have a similar benefit in terms of litter to the reusable bags. The PP is potentially recyclable, but like the other reusable options, a collection and recycling system would need to be established.

#### **4.2.8 Biodegradable Bags**

Like the current ethylene shopping bags, biodegradable bags are designed for a single use. Both of the reference products used for the review consume similar quantities of raw material but from very different sources.

The starch-based bag is manufactured from a renewable resource such as corn, wheat or potato starch, such as the resin manufactured by Novamont in Italy (Mater-Bi™), made from polycaprolactone (PCL) blended with corn-starch.

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<sup>17</sup> BPF (British Plastics Federation) (2002), The Winnipeg Packaging project: Comparison of Grocery Sacks, BPF

The synthetic bag is conventional polyethylene blended with a prodegradant additive to increase the speed of degradation. The additive is typically used at levels of 1-3%. The BioBag™ marketed in Australia by Valpak is based on this technology.

The life cycle impacts of biodegradable bags are therefore very different for the two options. The starch-based bag will have considerable impacts in the raw material stage, i.e. the growing of crops to make starch. Intensive agriculture can consume large amounts of water, chemicals and energy, and there is potential run-off of chemicals into waterways contributing to eutrophication. An LCA of starch-based plastics compared to polyethylene and polystyrene found that the starch-based plastics had greater negative impacts on eutrophication, soil and biodiversity<sup>18</sup>.

Both bags have the advantage of reduced impact in the litter stream due to faster degradation than conventional plastic bags. Bags in windblown litter and snagged on branches or bushes may still take some time to degrade as they will not necessarily be exposed to sufficient level of microbes for proper degradation to take place. There may be a greater advantage in marine environments. One study of PCL found that after 8 weeks, PCL in seawater was completely decomposed. Enzymes in seawater appear to accelerate biodegradation<sup>19</sup>.

Biodegradable bags have the disadvantage that they could potentially contaminate plastic recycling programs, particularly those already established for shopping bags and reduce the quality of the recycled resin. If biodegradable bags end up in landfill, they will degrade faster than conventional polyethylene bags and could potentially increase the degradation of food waste if used as bin liners. A consequence of this is that they will also contribute to greenhouse gas generation when they degrade.

### 4.3 Life Cycle Review –Shopping Bag Alternatives

A streamlined LCA was undertaken to compare the environmental impacts of each alternative packaging system. This was done using SimaPro software with a combination of Australian data (where available) and international data. This data is the result of a streamlined study using existing data, rather than data from the actual processes used for each specific bag. The results should therefore be used with caution, as indicative data rather than a full scientific study of relative impacts.

Any comparison of life cycle environmental impacts must be based on a comparable function. For the purpose of this study, the ‘functional unit’ for this review has been defined as **a household carrying approximately 70 grocery items home from a supermarket each week for 52 weeks**. The ‘Bio-bag’ polyethylene biodegradable bag with prodegradant additives is not included in the assessment due to lack of sufficient information and data.

The assessment takes into account relative carrying capacity and expected life (defined in Table 4.2). It also takes into account any avoided impacts such as:

- Avoided use of virgin polymer or paper fibre due to bag recycling programs; and

<sup>18</sup> BUWAL (Bundesamt für Umwelt, Wald und Landschaft) (1996), *Ecobalance of Starch-containing Plastics* (Okobilanz stärkehaltiger Kunststoffe), 271/1, Bern

<sup>19</sup> Janik, H., Justrebska, M. Rutkawska, M. (1988), ‘Biodegradation of Polycaprolactone in Sea Water’, in *Reactive Functional Polymers*, 38, 27

- Avoided consumption of kitchen tidy bags as a result of bag reuse in the home.

It should be noted that the analysis is highly dependent on assumptions made about reuse of HDPE singlet bags and LDPE boutique bags; use patterns for reusable bags (e.g. how many are used, particularly in the case of larger bags such as the Swag Bag); purchase of alternative products (e.g. kitchen tidy bags); and the percentage of bags entering the litter stream. Assumptions used are provided in Table 4.2 below, and in more detail in Appendix A. Material consumption is simply measured by the mass of the bag multiplied by the number consumed.

**Table 4.2 – Assumptions for Use of Shopping Bag Alternatives**

Alternative	Weight	Relative Capacity	Bags per Week	Expected Life	Bags per Year
Singlet HDPE	6g <sup>1</sup>	1 (6-8 items)	10	Single trip	520
50% recycled singlet HDPE	6g <sup>1</sup>	1	10	Single trip	520
Boutique LDPE (single use)	18.1 <sup>2</sup>	0.8	12.5	Single trip	650
Reusable LDPE	35.8 <sup>2</sup>	1.5	6.7	12 trips (3 months)	26.8
Calico	125.4g <sup>2</sup>	1.1	9.1	52 trips (1 year)	9.1
Woven HDPE swag	130.7g <sup>2</sup>	3	3.3	104 trips (2 years)	1.65
PP fibre 'Green Bag'	PP 65.6g; Nylon base 50.3g <sup>2</sup>	1.2	8.3	104 trips (2 years)	4.15
Kraft paper – handled	42.6g <sup>2</sup>	1	10	Single trip	520
Solid PP 'Smart Box'	250g <sup>2</sup>	2	5	156 trips (3 years)	1.66
Biodegradable - starch based	12.5 <sup>2</sup>	1	10	Single trip	520

1. Assumption made on average bag weight
2. Actual weight of sample

It is difficult to develop quantitative indicators on litter potential for different options. We have chosen to represent litter by three indicators. These are:

- Mass of material finding its way into the litter stream – representing mass of resources lost from recovery options;
- The area of ground covered by litter – measure in metres squared (m<sup>2</sup>) and based on the maximum area which a bag could cover if lost to the litter stream; and
- The persistence of litter measured in metres squared per annum (m<sup>2</sup>a) to represent the area covered by litter over time.

To model this last indicator an estimate of an average time a piece of litter may remain in the litter stream was needed. The data used for different materials was as follows:

- Plastics (both single use and multiple use but not biodegradable polymers) -5 years.
- Paper and biodegradable polymers – 6 months.
- Calico bags – 2 years.

Alternatives have been modelled assuming 52 shopping trips per year with 10 average plastic shopping bag loads each trip.

**Table 4.3 – Assessment of Alternatives – 52 Shopping Trips per Year**

Alternative	Material Consumption (kg)	Litter (g)	Litter (m <sup>2</sup> )	Litter (m <sup>2</sup> /y)	Greenhouse (CO <sup>2</sup> equiv)	Primary Energy Use (MJ)
Singlet HDPE	3.12	15.6	0.144	0.72	6.08	210
50% recycled singlet HDPE	3.12	15.6	0.144	0.72	4.79	117
Boutique LDPE (single use)	11.77	58.8	0.195	0.975	29.8	957
Reusable LDPE	0.96	4.8	0.0121	0.0603	2.43	78
Calico	1.14	5.7	0.0041	0.0819	2.52	160
Woven HDPE swag	0.22	1.1	0.00148	0.00743	0.628	18.6
PP fibre ‘Green Bag’	0.48	2.4	0.00187	0.00934	1.96	46.3
Kraft paper – handled	22.15	111	0.156	0.078	11.8	721
Solid PP ‘Smart Box’	0.42	NA	NA	NA	1.1	38.8
Biodegradable - starch based (Mater-Bi)	6.5	32.5	0.156	0.078	6.61 <sup>1</sup>	61.3

1 – Assumed to break down into carbon dioxide

The biodegradable polyethylene bag with the prodegradant additive was not included in the analysis due to a lack of data on weight or manufacturing processes from the additive. However we could make an assumption that the material consumption, energy and greenhouse results would be similar to the HDPE singlet bag, but with litter persistence impacts similar to the starch-based biodegradable bag. This would mean:

- ❑ contribution to litter by mass: 15.6 grams
- ❑ contribution to litter by area: 0.144 m<sup>2</sup>
- ❑ contribution to litter by persistence: 0.078 m<sup>2</sup>/y
- ❑ contribution to global warming 6.08 kg/CO<sup>2</sup> equiv.
- ❑ embodied energy 210 MJ

This means that it is not as energy efficient as the starch-based bag but uses less material. Litter impacts per year (in persistence terms) are assumed to be the same.

Based on the streamlined LCA results in Table 4.3, the woven HDPE bag is the preferred option in all the following areas:

- Resource-efficiency in terms of material consumed in manufacturing, followed by the PP Smart Box and then non-woven PP bag.
- In terms of embodied energy and global warming potential, followed by the PP Smart Box and then reusable PP bag.
- In terms of primary energy used, followed by PP Smart Box and the non-woven PP bag.
- Lowest contribution to litter (using persistence as a measure), followed by the reusable PP bag and the calico bag.
- Among the single use bags, biodegradable and paper bags perform better than conventional HDPE and LDPE bags on litter persistence. They both achieved the same outcome against this indicator as they were both assumed to have the same size and to degrade over a 6-month period.

### ***Sensitivity Analysis***

The results for the woven HDPE bag are at least partly due to the larger capacity (3 times that of the HDPE singlet bag). The size of the bag may be a disincentive to use by consumers, and there may be concerns among some customers about mixing different types of groceries, e.g. meat, vegetables and household chemicals in one bag. A sensitivity analysis was undertaken to test the impact of a smaller capacity on the results. If we assume that a woven HDPE reusable bag is developed with the same capacity as the reusable PP bag (i.e. 1.2), the results show an increase in material usage from 220g to 420g in order to meet the functional unit. Consequently, the environmental impact indicators increase also. This is particularly evident when referring to primary energy use (from 18.6MJ to 35.5MJ) and global warming (from 0.628 to 1.12 kg/CO<sup>2</sup> eqv.) In comparison to the PP bag, which has the same relative capacity, the HDPE swag bag still performs better across all the environmental impact indicators. However, it should be noted that the nylon insert within the PP bag has been omitted from the HDPE bag assembly. Such an omission has an influence on the results (Table 4.4 overleaf).

**Table 4.4 – Assessment of Alternatives – Sensitivity Analysis**

<b>Alternative</b>	<b>Material Consumption (kg)</b>	<b>Litter (g)</b>	<b>Litter (m<sup>2</sup>)</b>	<b>Litter (m<sup>2</sup> /y)</b>	<b>Greenhouse (CO<sup>2</sup> equiv)</b>	<b>Primary Energy Use (MJ)</b>
Singlet HDPE	3.12	15.6	0.144	0.72	6.08	210
50% recycled singlet HDPE	3.12	15.6	0.144	0.72	4.75	117
Boutique LDPE (single use)	11.77	58.8	0.195	0.975	29.8	957
Reusable LDPE	0.96	4.8	0.0121	0.0603	2.43	78
<b>Reusable LDPE (50% recycling)</b>	<b>0.96</b>	<b>2.4</b>	<b>0.00605</b>	<b>0.0302</b>	<b>2.14</b>	<b>54.7</b>
Calico	1.14	5.7	0.0041	0.00819	2.52	160
Woven HDPE swag	0.22	1.1	0.00148	0.00743	0.628	18.6
<b>Woven HDPE (smaller capacity)</b>	<b>0.421</b>	<b>2.0</b>	<b>0.00187</b>	<b>0.00934</b>	<b>1.21</b>	<b>35.7</b>
PP fibre ‘Green Bag’	0.48	2.4	0.00187	0.00934	1.96	46.3
Kraft paper – handled	22.15	111	0.156	0.078	11.8	721
Solid PP ‘Smart Box’	0.42	NA	NA	NA	1.1	38.8
Biodegradable - starch based	6.5	32.5	0.156	0.078	6.61	61.3

Another variable is the extent to which the reusable bags can be recycled at the end of the life (i.e. when damaged). Under the ‘bag for life’ scenario, customers could be provided with a free bag if they return their old bag. Under such a scheme, the collected bags could potentially be easily recycled. The results for the reusable LDPE bag were tested against an assumed recycling rate of 50%. The results show that primary energy use (from 78MJ to 54.7MJ) and global warming (from 2.43 to 2.14 CO<sub>2</sub> equivalent units.) would decrease. Moreover, as the recycling rate of the reusable LDPE bag is 50% the percentage of bags entering the litter stream was assumed to decrease by 50% also, consequently halving the litter impact figures compared the reusable LDPE bag that has a 0% recycling rate.

This changes the relative impacts of the alternative options:

- The smaller reusable HDPE bag uses more material to achieve the functional unit, and as a result the reusable HDPE bag becomes equal to that of the PP Box. The next best alternative is the reusable PP bag.
- In terms of primary energy used, the preferred option is still the reusable woven HDPE bag, followed by the PP box and the reusable PP bag.
- In terms of global warming potential, the preferred option changes from the reusable HDPE bag to the PP Smart Box, followed by the reusable HDPE bag and the reusable PP bag.



- The smaller reusable woven HDPE bag no longer achieves the lowest contribution to litter (using persistence as a measure). The calico bag has the lowest impact against this indicator, followed by the reusable PP and HDPE bags which have the same impact.

Data on biodegradable plastic bags is the least reliable of all inventory data used in the analysis, as very little LCA work has been done on starch based plastics to date. It should therefore be treated with particular caution. According to the analysis, the biodegradable bag consumes less energy than the conventional HDPE bag, and is roughly equivalent in global warming potential. It uses more material because the reference bag used for the review is double the weight of the HDPE singlet bag (12.5g compared to 6g). It has a lower impact on litter due to the faster rate of degradation. The biodegradable plastic bag has a lower contribution to global warming and lower embodied energy than the paper bag.

## 4.4 Triple Bottom Line Assessment

Alternatives to the conventional singlet bag need to be assessed against economic, social and environmental criteria, the so-called 'triple bottom line'. An initial assessment of the issues involved for each alternative, including both positive and negative impacts, is shown in Table 4.5.

**Table 4.5 – Triple Bottom Line Assessment**

Option	Economic Issues	Social Issues	Environmental Issues
<b>Singlet HDPE</b>	Well established market for supply of bags  Current retail system and checkout design based on these bags  Low cost to retailers and free to consumers  ~67% of bags imported	Convenient for consumers  A proportion of consumers are concerned about environmental impacts	Manufactured from non-renewable resources (oil or gas)  Prominent in litter stream (aesthetic impact)  Potential hazard to wildlife  Reused in the home for other applications (e.g. bin liners) – avoided impacts of other products
<b>50% Recycled singlet HDPE</b>	~67% of recycled bags imported  No change required to retail systems or consumer behaviour	Just as convenient as virgin bags  Partly addresses consumer concerns about environmental impacts  No impact on overall consumption of bags	Life cycle environmental impacts reduced due to recycled content  Provides a market for post industrial recycled HDPE  Impacts on litter and wildlife the same as for virgin bags
<b>Boutique LDPE</b>	Well established market for supply of bags  High percentage of bags manufactured locally  Current retail system based on these bags  Low cost to retailers	Convenient for consumers  Marketing and branding for products  A proportion of consumers are concerned about environmental impacts, but probably less than for singlet bags	Manufactured from non-renewable resources  Less impact on litter and wildlife than singlet bags (heavier, generally disposed of in the home)  Reused in the home for other applications (e.g. as a general bag)

**Table 4.5 – Cont.**

<b>Option</b>	<b>Economic Issues</b>	<b>Social Issues</b>	<b>Environmental Issues</b>
<b>Calico</b>	<p>Bags are 100% imported</p> <p>Designed to be integrated with current retail system (to fit on bag hooks)</p> <p>Cost to consumers of purchasing bags - \$2 per bag, expected life of 1 year</p> <p>May slow down speed at checkout<sup>20</sup></p>	<p>Less convenient for consumers – need to bring own bags back to supermarket</p> <p>Reusable bags may have indirect impacts on behaviour (i.e. encourage consumers to be more waste wise in other aspects of daily life)</p> <p>Working conditions in overseas manufacturing a potential concern.</p>	<p>Cotton industry is a large user of water and chemicals (pesticides)</p> <p>Washing the bags consumes water, energy and detergents</p> <p>Reduces consumption (and therefore environmental impacts) of single use bags</p>
<b>Woven HDPE Swag Bag</b>	<p>Bags are imported</p> <p>May slow down speed at checkout<sup>2</sup></p> <p>Cost to consumers of purchasing bags - \$4 per bag, expected life of 2 years</p>	<p>Less convenient for consumers – need to bring own bags back to supermarket</p> <p>Reusable bags may have indirect impacts on behaviour (i.e. encourage consumers to be more waste wise in other aspects of daily life)</p>	<p>Manufactured from non-renewable resources (oil or gas)</p> <p>Reduces consumption (and therefore environmental impacts) of single use bags</p>
<b>PP Fibre ‘Green Bag’</b>	<p>Bags are imported</p> <p>May slow down speed at checkout<sup>2</sup></p> <p>Cost to consumers of purchasing bags - \$3 per bag, expected life of 3 years</p>	<p>Less convenient for consumers – need to bring own bags back to supermarket</p> <p>Reusable bags may have indirect impacts on behaviour (i.e. encourage consumers to be more waste wise in other aspects of daily life)</p>	<p>Manufactured from non-renewable resources (oil or gas)</p> <p>Reduces consumption (and therefore environmental impacts) of single use bags</p>
<b>Kraft paper – handled</b>	<p>Bags are manufactured locally</p> <p>May slow down speed at checkout unless system is redesigned to accommodate them<sup>2</sup></p>	<p>Primarily single use therefore requires minimal adjustment by consumers</p>	<p>Manufacture of paper consumes more water and generates more waterborne wastes</p> <p>Paper bags are 100% recyclable where paper collection is available</p>
<b>Solid PP Smart Box</b>	<p>Imported</p> <p>Cost to consumers of purchasing boxes - \$7 per box, expected life of 3 years</p> <p>Cost to retailers of buying trolleys to accommodate boxes, redesigning checkouts to accommodate boxes</p>	<p>Less convenient for consumers – need to bring boxes back to supermarket</p> <p>Awkward to carry long distances</p>	<p>Manufactured from non-renewable resources (oil or gas)</p> <p>Reduces consumption (and therefore environmental impacts) of single use bags</p> <p>Potentially recyclable at end of life but collection and disassembly system would need to be established</p>

<sup>20</sup> Estimated to cause a delay of 5 seconds per transaction, causing an increased cost to retailers of \$x (Clark 2002)

**Table 4.5 – Cont.**

Option	Economic Issues	Social Issues	Environmental Issues
<b>Biodegradable starch based</b>	<p>Bags are imported</p> <p>Bags are more expensive for retailers – estimated at 6 cents per bag</p>	<p>Primarily single use therefore requires no adjustment by consumers</p>	<p>Manufactured from renewable resources (e.g. corn, potato starch)</p> <p>Impacts of agriculture include water consumption, chemical use (fertilisers and pesticides), land degradation</p> <p>Bags will degrade in landfill but over a long period of time (due to lack of moisture &amp; air)</p> <p>Reduced impact in litter due to rapid degradation in the open</p>
<b>Photo-degradable (PE with UV sensitive additives)</b>	<p>Bags are imported?</p> <p>Bags are more expensive for retailers – estimated at 6 cents per bag</p>	<p>Primarily single use therefore requires no adjustment by consumers</p>	<p>Manufactured from non-renewable resources (oil or gas)</p> <p>Same impact on solid waste in landfill as conventional bag</p> <p>Reduced impact in litter due to rapid degradation when exposed to sunlight</p>
<b>Biodegradable (PE with prodegradant additives)</b>	<p>Bags are imported?</p> <p>Bags are more expensive for retailers – estimated at 6 cents per bag</p>	<p>Primarily single use therefore requires no adjustment by consumers</p>	<p>Manufactured from non-renewable resources (oil or gas)</p> <p>Bags will degrade in landfill but over a long period of time (due to lack of moisture &amp; air)</p> <p>Reduced impact in litter due to rapid degradation in the open</p>

## 5 POTENTIAL OPTIONS & ISSUES FOR AUSTRALIA

Currently in Australian retailing, there exists a proportion of shopping bags made up of a variety of materials, including plastic, paper, calico, reusable plastic and baskets. With the introduction of different policy directions, these current proportions are likely to change.

To reduce the impacts of litter and resource use associated with plastic shopping bags, a range of future options exist for Australia. The option implemented should be suited to our local conditions and needs and address real issues, rather than appearing ‘green’ without any real environmental benefit.

A range of options for future direction to reduce plastic bag litter and use exist, both as stand alone measures and as part of wider option introduction. Some of these include:

- Maintenance of the status quo;
- Review and expansion of the Shopping Bag Code of Practice;
- Kerbside recycling of plastic shopping bags;
- Expanded and on-going litter education;
- Introduction of biodegradable bags;
- Use of reusable bags and ‘Bags for Life’;
- Bans on plastic shopping bags;
- Voluntary levy on shopping bags; and
- Legislated levy on shopping bags.

The general outcomes of these options are outlined below.

### 5.1 Status Quo

If it was considered that the plastic shopping bag is a resource efficient, economical and most suitable option for carrying retail goods, the current situation could continue. This would result in approximately 6.9 billion bags being consumed annually, with the capacity for consumption to increase with increasing population and prosperity. Associated environmental and economic impacts would also therefore continue.

*Due public concern and the focus on plastic shopping bags by a range of stakeholders, this option is not likely to be continued.*

### 5.2 Review and Expansion of the Code of Practice

In 1997 the Australian Supermarket Institute (ASI) in consultation with EcoRecycle Victoria, developed a Code of Practice for plastic shopping bags. The Code was adopted by Coles Myer Ltd, Woolworths and Franklins in Victoria. The ASI ceased to exist in 1998, and the Code was amended and adopted by the Australian Retailers Association (ARA).

The Code covers measures to reduce customer bag use, to provide both in-store recycling and reusable bags as an alternative to plastic bags. The ARA has reported annually on Code Implementation to EcoRecycle Victoria.

Whilst the Code was a valuable step in managing plastic bag use, it is widely seen as deficient in many aspects. The coverage of the Code accounted for only 10% of Australia's bag consumption, as it does not extend to all supermarkets, other retailers or states other than Victoria. In addition, the coverage of recycling services and provision of reusable bags does not extend to all member stores. The level of staff training and compliance with Code provisions has varied significantly from store to store, there are still many single-item transactions at supermarkets where a bag is provided, and there has been no apparent reduction in the number of bags used.

At the time of this study, the retail industry is giving active consideration to the review and expansion of the Code, making it a National Code of Practice for the Management of Retail Carry Bags and addressing concerns raised in relation to measurement and reporting. The current proposal is for the Code to be implemented voluntarily at a National level by supermarkets and other retailers who are signatories to the National Packaging Covenant.

While benefits will be derived from the broader adoption of the Code, the current draft of the National Code (draft III) does not depart significantly from the present Victorian Code. The current draft lacks strong targets, and more importantly, tangible actions to achieve these targets, and is therefore unlikely to produce significant change if adopted.

The potential exists however to make the Code more comprehensive by addressing a range of tangible actions such as:

- ❑ Adoption of Code across all retail sectors;
- ❑ Potential voluntary levy;
- ❑ Provision of reusable bags at cost price at all stores;
- ❑ Free replacement of reusable bags;
- ❑ Drop-off recycling facilities provided at all stores;
- ❑ Commitment to Australian recycled content in bags purchased;
- ❑ Comprehensive staff training;
- ❑ Independent auditing of implementation;
- ❑ Media and in-store education; and
- ❑ Litter education.

Recycling rates for single use bags could be expanded significantly under an revamped Code of Practice through a combination of improved infrastructure, better promotion and expansion of focus to all retail bags throughout the country.

***While the Code should not be seen as mutually exclusive from any form of levy, in the absence of other measures it is unlikely to result in a significant reduction in plastic shopping bag usage, litter and other impacts.***

### ***Closed Loop Recycling***

Negotiations are currently taking place between bag manufacturers and supermarket retailers in an effort to establish closed loop recycling of plastic shopping bags; where recovered bags are re-extruded into new bags by Australian reprocessors. The issues that need to be resolved include bag prices, collection, sorting and reprocessing costs and contamination issues.

While there is no environmental preference for bags to be recycled back into bags, there is a product stewardship imperative for ensuring the market outlets for collected materials are adequate. The environmental benefit is enhanced when reprocessing is carried out locally, avoiding transport impacts. In addition, consumers are encouraged to increase recycling when tangible results are promoted; and in conjunction with fixing the market price and outlet, this initiative would therefore provide a good base for an increase in plastic shopping bag recycling in Australia.

### **5.3 Kerbside Recycling**

The plastic shopping bag is one of the most high profile retail packaging exclusions from the kerbside recycling system, with only a very limited number of councils designating them for recovery. Currently, as bags tend to accumulate in households and subsequently be disposed to the waste stream, an opportunity exists to divert these bags into the recycling stream.

Recycling drop-off for HDPE singlet bags is currently available at many supermarkets, and these bags are reprocessed into pipes and other moulded products in Australia and Asia. The convenience of kerbside recycling to householders has proved one of the most important factors influencing the recovery of materials; for example, phone books moved from a recovery rate of 15% to around 35% after their inclusion into the kerbside system. However, several barriers exist for the inclusion of plastic shopping bags into the kerbside recycling system. These include:

1. **The bags are extremely lightweight.** This positive resource efficiency characteristic of plastic shopping bags unfortunately acts as a barrier to recycling. Recycling collection and sorting systems are geared to the most efficient handling of the highest possible volume of material. Recyclables are sold by weight, and the revenue for the tonnes recycled forms a significant part of the overall funds to support recycling. Plastic shopping bags have an average weight of 5.5 grams, and therefore over 180 000 bags are required to make up a tonne of material. In addition, their light weight make plastic shopping bags very difficult to sort using mechanical separation.
2. **The bags are low in value.** All recyclables are sold on the basis of weight, not units. The economic value of each material to kerbside recycling overall is a combination of the price received per tonne of sorted material and the number of tonnes received. Some materials such as aluminium have a relatively low volume but high price per tonne (over \$1 000/t) and others such as newspaper have a lower value but high yields which support their recovery. Plastic bags recovered through the kerbside recycling system would have both low value (<\$120/t) and low weights which decrease the viability of their recovery through the kerbside system. Further, if a levy were introduced which reduced the numbers of bags consumed, this viability would be reduced further due to the low volumes of bags available for recycling.

3. **Contamination.** Plastic bags are designed to contain a wide range of other packaging and products. This poses a problem in recycling as the bags are difficult to wash and residuals often remain in the bags as contamination. In the United States, this issue is resolved at drop-off facilities by consumers being asked to turn bags inside out for recycling. In addition, consumers find it difficult to distinguish between polymer types, and it is therefore likely that kerbside collection would result in a range of plastic films being presented including multi-layers and polymers other than ethylene. An education program would be required to tackle both these contamination issues.

If plastic bags were recovered for recycling through kerbside collections across the country, their recovery would likely be significantly higher than the current 3%. To achieve this the issues of low weight, low value and contamination would need to be addressed. One positive contribution to the potential kerbside collection of plastic shopping bags has been the development of a prototype bag to contain a large number of bags to achieve lower sorting costs and higher densities. If this system was combined with efforts to reduce contamination, the recovery via kerbside would be more viable. As the value of the material remains an issue, one method of overcoming this could be to apply a surcharge within the cost of the bag at manufacture/import to supplement the buy back price of the material. This has been done in the past with PET, PVC bottles and liquid paperboard cartons.

Many bags are collected from current recycling facilities with other recyclables from back of store, such as cardboard and tertiary film packaging. As this constitutes a large volume, this supplements plastic bag collection and an argument may exist to continue this practice.

*As a stand-alone option, increased recycling of plastic shopping bags in this manner will not effect consumption and would be expected to have a negligible effect on the litter stream.*

## 5.4 Litter Education

Australia has a strong history over the last three decades of public education to prevent littering. By international comparison, the 0.8% level of littering plastic bags is very low compared to in Bangladesh, for example, where 85% of plastic shopping bags were entering the litter stream. Table 5.1 summarises the major anti-litter campaigns carried out in Australia and their scope.

**Table 5.1 – Litter Campaigns**

Campaign	Objective	Scope	Target Audience	Timeframe	Comment
<i>Clean Up Australia Day</i>	Community Participation & Awareness, Litter Recovery	National	General Public, Schools, Businesses	Annual	High profile, high participation
<i>Tidy Towns – KAB</i>	Beautification and Community Awareness	State/Local council	Local Councils, General Public	Annual	Long term program, high profile, competition based
<i>Leave Only Footprints – CUA</i>	Litter prevention - beaches	Regional Vic	Beach goers, youth	Summer 2000/01	Increased awareness
<i>Adopt A Road</i>	Roadsides litter recovery and awareness	ACT, Vic, Tas, Local Councils	General Public, Clubs & Groups	Ongoing	Increased awareness and litter reduced/recovered



**Table 5.1 – Continued**

<b>Campaign</b>	<b>Objective</b>	<b>Scope</b>	<b>Target Audience</b>	<b>Timeframe</b>	<b>Comment</b>
<b><i>Bag Yourself a Better Environment</i></b>	Reduce, reuse, recycle plastic bags	National	Retailers, Consumers	2001 (week), 2003 (month)	Increased recycling, and alternatives
<b><i>Do the Right Thing</i></b>	Litter prevention	National	General Public	70's and 80's	High profile, well known
<b><i>Don't Waste Australia</i></b>	Litter prevention	National	General Public	Ongoing	Just commencing
<b><i>Clean Up Your ACT</i></b>	Litter education and prevention	ACT	General Public, Schools	6 months	Just commencing
<b><i>Litter in your Hands – Don't be a Tosser</i></b>	Litter Prevention	NSW State	General Public	3-4 years	Slogan very effective
<b><i>Beach Challenge – KAB</i></b>	Litter recovery and prevention	Local Council	Coastal communities	Ongoing, annual event	Competition based
<b><i>Drain is Just for Rain</i></b>	Stormwater litter and pollution prevention	NSW	Communities	Ongoing	
<b><i>Stow It Don't Throw It</i></b>	Litter preventions	National	Boat users	Ongoing	

This study has not included a review of litter behaviour in relation to plastic shopping bags. The Beverage Industry Environment Council (BIEC) is a leader in the field of understanding litter behaviour and analysis of studies conducted for BIEC is vital in structuring well targeted litter education. BIEC studies have shown, for example, that littering behaviour varies greatly in different settings and an appreciation of this is important in establishing appropriate litter infrastructure.

In the future, further well funded, multi faceted education programs may result in a further reduction of plastic bag littering; however, an element of the population will likely continue to litter, and this will also not prevent 'inadvertent' littering of plastic bags such as those blown from garbage receptacles and landfills. Education of consumers on plastic bag issues needs to address the following key issues:

- ❑ levy (if applied);
- ❑ reuse (bags for life);
- ❑ for recycling (contamination); and
- ❑ litter reduction

***Litter education is an important supporting element of other initiatives that may be undertaken to reduce plastic bags and their impacts.***



## 5.5 Biodegradable Bags

Biodegradable polymers are often mentioned as an alternative to plastic shopping bags – particularly to address litter problems. However, several issues require consideration with this option:

- **Degradation Period and Environments**

A wide range of different ‘biodegradable’ polymers have been developed, from starch based plastics through to conventional polymers with additives which make the polymer chain susceptible to micro-biological attack. Other photo-degradable and water soluble plastics have also been developed.

All of these polymers have different applications based on their physical properties, but they also have widely differing degradation behaviours. Some polymers degrade at appreciable rates only when subjected to composting conditions and micro-organisms (50-60C and 55% moisture), and would therefore not degrade before having negative impacts in litter situations.

- **Degradation Products**

The degradation of the range of potential biodegradable polymers can result in a wide range of degradation products and residues which can be toxic, contribute to the BOD and COD of water bodies and whose impacts are largely unknown in the Australian context. No standards exist in Australia for the use and application of biodegradable polymers, and sufficient testing of the impact of degradation products has not been carried out.

- **Use of Resources**

As biodegradable bags are made from either petroleum products or crop starches, their single use could be seen as wasting more resources than conventional plastic bags. This would include the sustainability of farming and processing methods utilised in the manufacture of starch-based polymers may be in question.

- **Landfill Impacts**

Many people believe that biodegradable bags will benefit landfill disposal. However, the aim of landfill operation is to reach a stable state within the landfill within a short time period. The slower degradation of biodegradable bags would not make any real positive contribution to landfills and may in fact cause leachate problems. The main impact of plastic bags at landfills is as wind-blown litter. Biodegradable bags would therefore have similar impacts as conventional plastic bags in this situation, as they are unlikely to degrade before causing these litter impacts.

- **Consumer Behaviour**

A worrying message that may be sent out with the promotion of biodegradable plastic bags and other packaging products is that, because it is biodegradable, it is ‘OK to litter, as it will just break down’. This could therefore lead to an increase in littering behaviour and levels. Biodegradable bags, as being perceived as

environmentally friendly, may also undermine efforts to reduce overall shopping bag consumption and associated resource use.

#### □ **Impact on Recycling**

The impact of the introduction of biodegradable plastic shopping bags in the current plastic film recycling industry is of concern. The current drop-off recycling system for shopping bags relies on source separation, with only plastic shopping bags in the stream as much as possible. The impact on this system with the introduction of biodegradable alternatives which could compromise the quality of the final product, is of great import, with one plastic bag reprocessor quoted as saying

*“If biodegradables even get a look in, I’m out. I want to sell pipes, not sprinklers”.*

This concern arises from the likelihood of consumer confusion as to the bags type, and what can be recycled and what should not, the difficulty and expense in sorting the plastics out and the compromise in recycled material quality that would occur.

In producing film for building and agricultural industry applications from recycled content, an Australian plastics reprocessor recently experienced serious problems extruding the polymer material in their New Zealand reprocessing facility. They eventually isolated the issue to a single supplier of waste material, and further analysis of this material identified the problem as a batch of starch-based biodegradable material included in the recycling stream. The removal of this material immediately resolved the problem.

The reprocessor claimed that the issue was not confined to the technical problems caused by biodegradables, but also to the industries utilising the recyclate in various applications, which include irrigation piping that contains over 90% recycled content. Biodegradable material in these products would cause them to degrade and fail in these applications.

#### □ **Cost**

Biodegradable polymers are currently more expensive than conventional thermoplastics. To replace plastic shopping bags with biodegradables would therefore cost retailers more, and therefore impact on the consumer.

#### □ **Australian Standards on Biodegradable Plastics**

Currently, no standards exist for the development, production, marketing and labelling of biodegradable plastic products in Australia. For the widespread introduction of biodegradable alternatives, full life cycle impact studies are required to determine the real impacts, both positive and negative, of these materials. Degradation standards, regarding time, conditions and degradation residues are required to ensure that claims made about specific products can be verified and that the appropriate products are selected for particular applications.

Biodegradable polymers may be suitable to many applications— particularly small items of high litter potential or where they are destined for an organics treatment facility. ***However, widespread use as an alternative to plastic shopping bags may not deliver overall environmental gains.***

## **5.6 Reusable Bags and ‘Bags for Life’**

A small but increasing number of Australian consumers use heavy duty reusable shopping bags, particularly for grocery shopping. These bags are made of a broad range of materials, primarily cotton (calico) and woven plastics. In Europe these bags are used on a more widespread basis, and retailers in these countries have actively promoted their use; conversely, in Australia consumers have often been discouraged from using these bags. A contentious issue in regard to reusable bags in Australia is their potential to increase checkout times at supermarkets.

The environmental benefit of reusable bags lies primarily in the resource saving that comes from a large number of uses for each bag.

Many retailers in Europe operate a system called ‘Bag for Life’ where an initially purchased reusable bag is replaced by the retailer free of charge when it wears out. The quality and hence the longevity of these bags vary.

## **5.7 Voluntary Levy**

Levies on plastic shopping bags have achieved significant reductions in plastic bags consumption in other jurisdictions around the world. A uniform national shopping bag levy in Australia, applying to all single-use point of sale carry bags, has the potential to reduce our plastic bag consumption and litter. There are two possible approaches – voluntary and legislated.

Through the National Packaging Covenant, Australian Government and industry have moved strongly in voluntary and co-operative action to achieve environmental goals. A voluntary levy on shopping bags has therefore been suggested as an appropriate tool for reducing plastic bag consumption and litter.

Voluntary levies have been implemented in some isolated Australian contexts, with the following outcomes. These are cited as indicative, but are not considered as representative of the retail industry as a whole.

### **□ Lord Howe Island**

In 2000 retailers on Lord Howe Island were asked to apply a 55 cent charge for plastic bags to their customers. This was introduced as part of a waste management strategy aimed at addressing the island’s waste problems. Previously the island’s waste had been burnt. Now, food waste is composted, paper and cardboard is currently burned but is going to be shredded and also composted, aluminium tins, PET, HDPE and PP plastics are recycled and the residual waste (much of which is packaging) is baled and sent on skips to landfill at Grafton.

Other measures to reduce waste on the island were also taken, these included forming a food co-op which now buys products in bulk and customers take their own reusable containers, avoiding packaging waste.

Of the island’s three grocery shops, one introduced the 55 cent charge straight away. The local Arts Council began distributing reusable calico shopping bags that are sold by the retailers and also as a souvenir for tourists. Hotels and resorts often give

guests one of the printed calico bags upon arrival, as a gift and to use when they shop on the island.

Currently, of the three grocery retailers, one doesn't apply the levy, one sometimes charges does and the other charges it to all shoppers. It seems that an element of the success of the initiative in reducing plastic bag use on the island may have been due to the change in consumer habits and thinking rather than strict implementation by the retailers.

□ **Byron Bay**

The Five Star supermarket in Byron Bay introduced a 10 cent charge for plastic and biodegradable bags on the 12th of October 2002. Before this they averaged 1 200 plastic bags per day. They now sell an average 200 plastic bags per day, representing a decrease in bag use of 83%, and have had a positive response from customers

Three plastic bag alternatives are provided: a biodegradable bag for which they also charge 10 cents, a paper bag provided free of charge and a reusable cotton/string bag sold for \$1.50.

There has been no decrease in sales since the 10 cent charge for plastic bags was introduced. Sales have actually increased slightly in that time, the owner believes that this is through the environmental and community activities that the business has put the 10 cent per bag revenue toward. The supermarket has not experienced any increase in pilfering of shopping baskets or trolleys or any grocery items. The store owner believes that as customers become used to this system there will be no additional checkout time added per transaction.

The supermarket has experienced an increase in costs due to the provision of free paper bags, which cost the supermarket 15 cents as compared to the 4 cents that they pay for plastic bags.

□ **IKEA**

Swedish-owned homewares retailer IKEA introduced its own 10c plastic bag levy in their Moorabin, Victoria store in October 2002. Since its introduction, IKEA have reduced their plastic bag consumption from 8 000 per week to just 250 per week (a 97% reduction).

The store offers for sale large reusable 'blue bags' for \$1.50 per bag, however most customers choose to use no bag. Monitoring has found that one plastic bag is sold per 12 customers, and one blue bag per 24 customers.

Initially, check-out staff were concerned that customer reactions would be negative, however, customer response has been overwhelmingly positive to the initiative.

□ **Aldi Supermarkets**

German-owned discount supermarket chain Aldi, which has recently entered the Australian market in NSW, also charge for plastic shopping bags. The stores have four options for customers to carry their goods:

- 15c plastic bag;
- 69c cotton bag;
- \$1.49 cooler bag;
- reused boxes; or
- no bag or own bag.

Staff indicate that the most common option chosen are the reused boxes, or for small purchases to use no bag.

*It is unlikely that a voluntary levy would get near full compliance across the whole retail sector due to competition for customers, and it may be more difficult to implement and sustain. Lower reductions would therefore be expected from a voluntary levy as opposed to a legislated levy.*

## **5.8 Legislated Levy**

A levy on all single use shopping bags is a potential option for Australia. To be effective in reducing bags and litter, the levy would need to be implemented on a nationally consistent level across all retail. To enhance the message to consumers and prevent retailers from absorbing the levy, the funds would need to be charged separately and collected through a central administration. For consumer support of the levy, it has been suggested that funds would need to be earmarked for use in environmental or similar programs.

In order for reusable carry bags to escape the levy on single use retail carry bags there must be a easily identified defining characteristic that enables retailers to distinguish between single use and reusable bags. In Ireland, the levy applies to all retail carry bags that are priced at less than 0.70 euro. This has the advantages of being easily identified and adhered to. If this cut-off is not changed over time this system has the disadvantage of discouraging the invention and production of real reusable bags at a cost less than the cut-off. However, a definition of reusable bags is more likely to be open to misinterpretation, deliberate or otherwise, and could lead to bags being sold as very cheap reusable bags that are not reusable, or because of their cheap price, that consumers have less incentive to reuse.

Issues to be considered and resolved in the implementation of a legislated levy include:

- National uniformity;
- Compliance and enforcement;
- Earmarking of funds for specific use;
- OH&S impacts;
- Food safety of alternatives;

- Environmental integrity of alternatives; and
- Effect on current Australian bag industry.

*It is likely that such a levy would result in a reduction of single bag usage and thereby an associated litter reduction and an increase in the use of reusable bags and 'no bags' by consumers. This would then have associated impacts on the retailers, the current plastic bag market and the reusable bags market.*

### **Plastic Shopping Bag Price Elasticity & Demand**

Economically, the appropriate level at which a levy should be set is the price at which the marginal social benefit is equal to the marginal social cost. As there is limited knowledge on the cost of the litter and other environmental and social costs that are not included in the price that the retailers currently pay for plastic bags, it is not possible to set the level of the levy using this theoretical approach.

It is more useful to consider what the main objective of a levy on retail carry bags is, and to set the levy at a level at which it is believed these objectives will be met most efficiently. To do this it is necessary to have some understanding of the elasticity in demand for plastic bags. That is, an idea of how the use of plastic bags changes as people react to a change in the price of plastic bags. As retailers, for the most part, supply retail carry bags to consumers free of charge, there is little reliable empirical Australian data concerning how consumers demand for retail carry bags varies with the price of these bags. The elasticity of retail carry bags can be estimated using data from the limited retailers that currently charge for them in Australia, such as IKEA, Aldi and some supermarkets in Lord Howe Island, in addition to data obtained from other countries that have introduced a charge for carry bags.

It is important to note that there are many other variables that influence the demand for carry bags that are not constant between these Australian retailers and between Australia and the different countries. For example, items purchased at Ikea are likely to be large, relatively costly, infrequently purchased items that are transported straight to the home. The way that customers react to a change in the price of carry bags at IKEA may be different to the way that customers react to a charge on carry bags at their local supermarket. Also, community attitudes and lifestyles may differ between countries and even between towns. For example, the small community on Lord Howe Island may feel differently about plastic bag use that the larger community residing in a capital city.

It is believed that to achieve significant reduction in plastic shopping bag consumption that the levy should be set between 10 cents and 30 cents. This is supported by the Irish experience, where an AUS\$0.27 levy resulted in an over 90% reduction, and where retailers believe that a similar shift would have still occurred at a level of AUS\$0.15.

### **Levy on Suppliers**

A levy on the supply of plastic bags, regardless of the source of the product, applies a tax or charge to those selling plastic bags to retailers. Suppliers include domestic producers, importers or wholesalers. Where retailers directly import bags, the retailer would have to be considered the importer and therefore levied, to prevent levy avoidance.

A levy on the supply of single use retail carry bags would raise the cost of these bags to retailers. As this may cause a reduction in demand in bags (as described in the following paragraph) suppliers may absorb some of the cost of the levy up to the point at which it is no longer profitable for them to manufacture and sell bags.

This would increase the incentive for retailers to encourage a change in consumer behaviour. Experience show this has some, limited, effect on bag consumption (Fehily Timoney and Company 1999). The higher the levy, the more incentive the retailer would have to reduce their customers use of bags until it is no longer viable for them to provide the bags free of charge. If the levy is high enough, retailers would then be forced to pass at least some of the cost of the bags directly on to customers.

According to the objectives, the levy is designed to reduce the use of single use retail carry bags by consumers and to reduce the number of bags released into the litter stream. A levy will achieve the latter through not only reducing the total number of bags used but also by providing consumers with the message that the excessive consumption and careless disposal of such bags is considered a problem by the Australian community.

In order that the levy achieve maximum effectiveness it should be passed on in full from suppliers to retailers to consumers. This could be enforced by the legislation implemented.

By targeting suppliers, the implementation and administration required should be relatively small, compared to a levy on retailers. It could also reduce levy evasion as it is estimated that there are less than 1 000 suppliers of single use retail carry bags in Australia.

### ***Levy on Retailers***

A levy on retailers would be a levy on single use retail carry bags at the point of sale. It would not apply to importers or manufacturers of single use retail carry bags, but would apply to all bags purchased – either locally produced or imported.

As with the levy on suppliers, for maximum effectiveness the levy should be introduced in such a way that the retailers were required to pass on the full cost of the levy to consumers. Faced with paying the levy on bags that they use consumers will reduce their use of bags as described above, switching either to alternative bags or where they are able, no bag at all.

A levy on retailers is likely to be more complex administratively than a levy on suppliers, and harder to monitor as there are over 200 000 retailers required to collect and return the levy. The levy administration should be designed to avoid a disproportionate burden on small businesses who are required to spend time learning about and returning the levy despite the fact that they use a very small percent of the total retail carry bags used.

A levy on retailers would have the same impact on consumer behavior as a supply levy that was fully passed on through retailers to consumers.



## 5.9 Plastic Bag Bans

### **Total Bans**

Plastic bag bans have been undertaken in some Asian countries where the litter problem was extreme and causing potentially hazardous outcomes such as flooding. There is the potential in Australia to apply a single use plastic bag ban to all or part of the retail sector. A ban on all plastic bags could lead to the use of less-sustainable alternatives and could be impractical for some retail transactions. This would also take the onus off consumers to make environmentally responsible choices.

### **Limited Ban**

A limited ban on high litter potential bags could, however, be implemented in conjunction with Code of Practice and levy options. In this case, fast food outlets and other sectors with high away from home destination could move to materials with lower litter impact potential either on a legislated or co-operative basis, or through a pilot program.

*For many retail transactions, plastic bags will remain the most convenient and appropriate – and therefore a total ban in Australia would be seen as excessive and inappropriate. A limited ban on plastic bags in some applications within other policy directions may however be considered.*



## 6 DEVELOPMENT OF SCENARIOS

In order to undertake relevant environmental and preliminary economic assessments, a range of scenarios have been developed to indicate the potential impacts arising from different policy measures.

These following scenarios were chosen as representing the implications of a range of potential measures based on the potential options for Australia discussed in Section 5 and currently being considered by government and other stakeholders. Different configurations and combinations of the options are possible, and the policy options are not intended to be limited to the scenarios modelled in this section.

### 6.1 Description of the Chosen Scenarios

For the purpose of modelling the potential impacts arising from different policy directions and options regarding the future of plastic bags in Australia, the following scenarios have been developed:

<i>Scenario 1A</i>	<i>15c Legislated Levy with Expanded Code of Practice</i>
<i>Scenario 1B</i>	<i>25c Legislated Levy with Expanded Code of Practice</i>
<i>Scenario 2</i>	<i>Voluntary Levy as part of Expanded Code of Practice</i>
<i>Scenario 3</i>	<i>Expanded Code of Practice</i>
<i>Scenario 4</i>	<i>Current Code of Practice (Draft III)</i>

Scenarios 1A and 1B revolve around a mandatory levy, legislated by government, on all single use retail carry bags of 15 cents and 25 cents per bag respectively. The revenue resulting from the levy would be ear marked for a waste management fund. Legislation would include specific mechanisms to ban the use of plastic bags in fast food, so that single use bags used in this retail sector would switch to paper.

In these scenarios there would also be an expanded Code of Practice of retailers which would specify that reusable bags were made available as an alternative (to use and to purchase) in every retail store. There would be a standard grocery reusable bag and once purchased the expanded Code of Practice would ensure that this bag be replaced free of charge when the customer returns the old reusable bag to the store. Once returned to the retailer in exchange for a free replacement the old reusable bag would be recovered for recycling. In addition all large stores would have drop-off facilities for the recycling of single use plastic bags. Industry would make a commitment towards the use of recycled and Australian content in both single use plastic bags and in reusable bags. This would help ensure that the reduction in the use of plastic bags does not excessively harm the Australian industry.

In Scenarios 1A and 2A, staff training at retail outlets would be provided in order to ensure that staff make a smooth transition to the increased use of reusable bags and promote options to the consumer. Levy introduction would be accompanied by media and in-store education including:

- ❑ the environmental rationale for the levy;

- ❑ what the funds would be used for;
- ❑ what the options are in terms of reusable bags or no bag; and
- ❑ informing them of the consequences of littering.

Finally, for both of these scenarios, there would be independent auditing of both the levy implementation and the implementation of the Code of Practice to ensure that both are being complied with.

Scenario 2 is similar to 1A but the 15 cent levy is a voluntary initiative written into the expanded Code of Practice and the removal of plastic bag use for fast food is a voluntary initiative written into the Code of Practice. Everything else described for Scenarios 1A and B above applies to Scenario 2.

Scenario 3 involves an expanded Code of Practice that does not involve a levy of any sort or a specific reference to the removal of plastic bags from fast food retail use. Without a levy, it would involve retailers promoting heavily the use of reusable bags, or no bag at all where one is not necessary. As in the previously described scenarios reusable bags would be provided at all retail outlets, there would be free replacement of these reusable bags and recycling facilities for both single use bags and reusable bags at large stores. As part of the code there would be a commitment to using recycled and Australian content. Staff training and consumer education campaigns would be carried out, but they would not be able to be funded through levy revenue as in the previous scenarios.

Scenario 4 is the scenario under which no action is taken other than the adoption and implementation of the current Code of Practice. This would involve some retailers providing reusable bags for sale as an option to free single use bags and some large stores having drop-off recycling facilities for single use HDPE plastic bags. Staff would be trained to avoid excessive use of single use bags, and there would be in-store education and litter education of consumers. The implementation of the Code of Practice (Draft III) would be independently audited.

In all the scenarios where reusable bags are involved, it is assumed that the bags with the least environmental impact is utilised.

## 6.2 Elements of Scenarios

Table 6.1 highlights the differences in the major elements of the developed Scenarios.

**Table 6.1 – Elements of Scenarios**

Elements	1A	1B	2	3	4
Legislated Levy	Y	Y	N	N	N
Voluntary Levy	N	N	Y	N	N
Earmarked Fund	Y	Y	Y	N	N
Elimination of Plastic Bags from Fast Food outlets	Y	Y	Y	N	N
Reusable Bags Provided	Y	Y	Y	Y	Y (some)
Free Replacement of Reusable Bags ('Bag for Life')	Y	Y	Y	Y	N
Drop-off Recycling Facilities Provided at Large Stores	Y	Y	Y	Y	Y (some)
Commitment to Australian Recycled Content	Y	Y	Y	Y	N
Staff Training	Y	Y	Y	Y	Y
Independent Auditing of Levy Implementation	Y	Y	Y	N	N
Independent Auditing of Code Implementation	Y	Y	Y	Y	Y
Media Education	Y	Y	Y	Y	N
In-Store Education	Y	Y	Y	Y	Y
Litter Education	Y	Y	Y	Y	Y

## 6.3 Assumed Consumption Outcomes of Scenarios

Table 6.2 provides the estimates of the percentage reductions and the total numbers of the change in use of single use plastic bags (HDPE and LDPE), reusable bags and paper bags. The woven HDPE reusable bag has been used for the purpose of this analysis to represent the average reusable bag. This bag was chosen as it performed well in the environmental analysis and is currently available at retailers in Australia. The outcomes of each scenario have been utilised in the economic and environmental assessment.

A number of assumptions have been adopted in order to provide the numbers estimated in Table 6.2. The percentage reductions in plastic bags were estimated based on the discussion of the price elasticity of demand for carry bags in Section 5. A levy set at 15-30 cents per bag is likely to be sufficient to result in comprehensive behaviour change and therefore minimal levy imposition. The percentage of shopping currently in single use bags estimated to be transferred

to reusable bags were approximated using a breakdown of the number of bags used in different retail categories. In the different retail categories the likely split between customers opting to use no bag and customers switching to reusable bags was estimated. The numbers of paper bags were estimated based on considerations about the extent of the switch from plastic bag use in the fast food sector to paper bags. Total tonnes of bags were estimated based on average weights of plastic bags, paper bags, and reusable bags.

For Scenario 2, a voluntary levy, a reduction of 54% was estimated assuming that 72% of bags are used by retailers that administer the voluntary levy, and that those that did administer the levy would achieve a reduction in the use of single use retail carry bags of 75%, as in Scenario 1.

**Table 6.2 – Consumption Outcomes of Scenarios**

Scenario	1A	1B	2	3	4
% reduction in plastic bag use	75%	85%	54%	25%	10%
Number of plastic bags used p.a.	1 727.5 M	1 036.5 M	3 178.6 M	5 182.5 M	6 219.0 M
% transferred to Reusable bags	43%	49%	31%	12%	5%
Number of Reusable bags p.a.	23.7 M	26.8 M	17.1 M	6.9 M	2.8 M
% transferred to paper bags	2%	2%	1%	2%	0%
Number of paper bags p.a.	140 M	158.5 M	100.8 M	157.5 M	0
% transferred to 'no bag'	30%	34%	22%	11%	5%
Total number of bags used p.a.	1 891.2 M	1 221.9 M	3 296.5 M	5 366 M	6 221.8 M
Total tonnes of bags p.a.	24 052	19 065	34 504	53 676	55 553

Table 6.2 shows that a mandatory levy would result in by far the biggest reduction in use of single use bags. The switch to reusable bags, and paper bags for fast food, would reduce the total tonnes of bags used in the levy scenarios by similar a proportion. From increasing the reduction in plastic bags from 75% to 85% the result is a 35% reduction in the use of all types of bags and a 21% reduction in the total tonnes of bags used.

## 7 PRELIMINARY ECONOMIC ASSESSMENT

Due to the lack of available data it is difficult to quantify the majority of the costs involved in implementing potential scenarios. It is useful to acknowledge the costs that will be involved and where possible to make assumptions as to their relative size and on which sector they would fall under the different scenarios. This preliminary assessment is presented in this section, however, it is expected that further detailed economic analysis of the preferred systems will be required.

### 7.1 Economic Impacts of a Levy

The way in which a levy is implemented will have important implications regarding the administration and the distribution of costs between different sized retailer, suppliers and government. As discussed in Section 5 a levy applied to the sale of plastic bags by suppliers may require less overall administration by businesses than a levy imposed on the use of plastic bags by retailers. A tiered levy, with different types of bags attracting different levies, is likely to have a higher administration cost as the level of complexity is increased and retailers or suppliers would need more detailed, therefore time consuming, accounting processes.

### 7.2 Potential Revenue Raised by a Levy

A levy would result in a certain amount of revenue, either for government or for retailers, depending on whether the levy is a mandatory requirement or has been voluntarily implemented by retailers. This may be used as additional government revenue to allocate according to government priority, or it may be earmarked as money that must go towards a particular environmental or social cause. The amount of revenue raised will depend largely on which types of shopping bags carry the levy, the size of the levy and the extent to which the use of new shopping bags is reduced by the levy.

A levy on plastic bags could also mean that the sale of plastics bags will be subject to GST, therefore the revenue raised would be the direct amount from the levy plus 10% of that amount which will go directly to the government, whether the levy is voluntary or mandatory. Table 7.1 and 7.2 contain revenue (both direct levy revenue and GST amounts) estimates for a levy of 25 cents and 15 cents on all single use retail bags (7.1) and on supermarket plastic bags only (7.2). The resulting percentage reduction in plastic non-reusable bags is assumed at 50%, 60%, 70%, 80%, 90% and 95%.

**Table 7.1 Revenue from a Levy on All Retail Bags (Excluding Reusable Bags)**

Reduction in Plastic Bags (%)	15 cent Levy			25 cent Levy		
	Direct Levy Revenue (\$M)	GST (\$M)	Total Revenue (\$M)	Direct Levy Revenue (\$M)	GST (\$M)	Total Revenue (\$M)
50%	570.8	57.1	627.8	951.3	95.1	1,046.4
60%	463.5	46.4	509.9	772.5	77.3	849.8
70%	356.3	35.6	391.9	593.8	59.4	653.1
80%	249.0	24.9	273.9	415.0	41.5	456.5
90%	141.8	14.2	155.9	236.3	23.6	259.9
95%	88.1	8.8	96.9	146.9	14.7	161.6

**Table 7.2 Revenue from a Levy on Supermarket Plastic Bags**

Reduction in Plastic Bags (%)	15 cent Levy			25 cent Levy		
	Direct Levy Revenue (\$M)	GST (\$M)	Total Revenue (\$M)	Direct Levy Revenue (\$M)	GST (\$M)	Total Revenue (\$M)
50%	270.0	27.0	297.0	450.0	45.0	495.0
60%	216.0	21.6	237.6	360.0	36.0	396.0
70%	162.0	16.2	178.2	270.0	27.0	297.0
80%	108.0	10.8	118.8	180.0	18.0	198.0
90%	54.0	5.4	59.4	90.0	9.0	99.0
95%	27	2.7	29.7	45.0	4.5	49.5

### 7.3 Initial System Set Up Costs

A levy, whether voluntary or mandatory, will incur costs in order to set it up. For a mandatory levy there will be legislative set-up costs to government in order to research and implement the levy. A voluntary levy could be designed and set-up by an industry body which would will incur the initial set-up costs.

Suppliers and retailers will also face costs associated with time spent learning about the levy and may also have initial costs associated with the stock take of single use retail carry bags just prior to the introduction of a levy.

If the use of plastic bags is reduced by a levy some retailers may also require small structural adjustment at their counters to facilitate the use of alternative or reusable bags. This is likely to be done in cases where transaction time is costly to the retailer and would be increased by the introduction of reusable bags, for example in high through-fare retailers, such as supermarkets. This once off cost may be, for example, to increase the bench space at the end of the counter to facilitate the customer packing their own reusable bags, or to change the current plastic bag holders so that they also hold a chosen standard reusable bag.

### 7.4 Ongoing Costs

#### **Retailers**

Coles Myer has undertaken preliminary estimates that indicate that each transaction would take 5 seconds longer with the use of reusable bags, resulting in a cost of \$82 million to the industry. Nolan-ITU estimates an increase of 5 seconds per transaction would result in a cost of \$52 million to all retailers and \$28 million to supermarkets alone. The assumptions upon which these estimates are based are discussed in Appendix C.

It may be the case that in the long term, transaction times do not increase at all. The likelihood of this is increased if structural changes are made to checkouts making them more reusable bag friendly and a large number of customers become proficient at packing their own reusable bags which reduces the actions required by sales people. A standard reusable bag, agreed to and sold by all major retailers, would significantly affect the change in checkout time caused by a swing

away from plastic bags. A significant proportion of 'no bag' purchases will also reduce transaction time.

Stealing and shoplifting is another cost that may be associated with the increased use of reusable bags. Supermarkets in Ireland reported an initial increase in the pilfering of shopping baskets, which has since eased, and have experienced no increase in shoplifting. See Section 9.4 for further discussion of stolen stock and equipment.

Retailers are most likely already accounting for the number of plastic bags bought and sold, therefore the administrative cost to retailers, particularly of a levy on the suppliers of bags, would be small. Retailers would have to be able to prove that they paid the levy on their plastic bags and that they passed this on to their customers in full if audited. The major change would most likely be that retailers would be required to pay considerably more for their plastic bags and this may, in some cases, be before the sale of the plastic bags to their customers. This could lead to a cash flow problem for some businesses. However, most businesses would receive their plastic bags and have up to 90 days to pay for them. It is also likely that with a levy in place retailers will have to purchase far fewer plastic bags.

In setting prices for reusable bags, retailers will presumably be governed by market forces, so that reusable bags are provided at the price at which retailers cover their costs. In addition to the normal forces of competition, retailers have the added incentive of ensuring that they do not unnecessarily limit their customers purchases by over pricing bags. The cost of free replacement of bags for life will need to be included in the initial purchase price.

Overall, the net cost impact of each of the scenarios to retailers is impossible to quantify. There will be minor administrative costs, perhaps some security costs or temporary increase in the theft of store baskets and trolleys and some store reconfiguration to adjust to increased use in reusable bags. Offsetting this will be the decrease in the current loss of \$190 million across the industry of providing single use bags to customers free of charge and any profits made from in store sales of reusable bags.

## **Consumers**

Initially the purchase of reusable bags may be high, as consumers build up stocks of reusable bags. This will eventually subside as consumers simply replace reusable bags. Consumers who continue to use single use retail carry bags after a levy is used will incur the additional cost of the levy. For the average consumer, if shopping habits were not influenced in any way the cost would be around \$70 per year assuming a 15 cent levy.

The current cost of retail carry bags to consumers is hidden in the price of the goods that they sell. This current hidden cost is on average \$10 per person per year. This figure assumes that the average price of retail carry bags is 2.5 cents, as singlet bags make up approximately 70% of the estimated 6.9 billion plastic bags currently used at an average price of 1 cent per bag. It is assumed that wavetop bags cost an average 3 cents per bag and are approximately 17% of the market and the remainder, boutique bags cost an average of 10 cents per bag. Including GST the average cost of a single use bag to consumers is estimated to be 3 cents per bag.

The introduction of a levy has the potential to change costs to consumers via four avenues. Consumers that continue to use, some or all of the time, single use bags will face the cost of the



levy on these bags. Consumers will also face, hidden or otherwise, the cost of single use bags to retailers not including the levy. This cost will depend on the reduction in bag use brought about by the scenario. Consumers that use reusable bags will face the initial cost of purchasing and later replacing these bags. It is also possible that consumers will face increased costs through having to buy kitchen tidy bags as they no longer have the same numbers of single use bags to reuse for this purpose. In Ireland it is estimated that sales of kitchen tidy bags have increased by up to 77%.

For the purpose of this study it is assumed here that a reusable bag would cost around \$1.50. In Scenario 1A it is assumed that the total sales of kitchen tidy bags increases by 70%, for Scenario 2A kitchen tidy bag sales increase by 80% and in Scenario 3 they increase by 50%.

In Scenario 1A the cost to the average consumer per year is estimated to be \$24, \$3 of this is in purchasing kitchen tidy bags that would otherwise not have been purchased. Compared to the current average hidden cost of single use bags of \$10 per person per year, this represents an average increased cost of \$14 per person per year. For a four person family this amounts to an increase in household costs of \$56 per year.

The average consumer cost for Scenario 1B is estimated to increase on average to \$15 per year, and for Scenario 2 to \$3 per year. Under Scenario 3 the average consumer will experience a decrease in costs of \$1 per year (this includes a decrease in hidden costs) and under Scenario 4 they will also be experience on average a decrease in costs of \$1. A discussion of the assumptions behind these estimates is provided in Appendix B.

### ***Low Income Consumers***

The current hidden cost of plastic bags is \$10 per person year, or for a household of four, \$40 per year. Low income earners have a lower consumer purchase pattern, particularly in retail areas where higher cost bags are more commonly used, such as boutique clothing. Therefore, the hidden cost per household per year may be below \$40 for low income earners.

Assuming that low income earners will want to avoid the levy as much as other consumers, the net cost per person of the levy would be \$14/year. Low income consumers wishing to avoid paying the levy will have a high incentive to use reusable bags when they shop. For this reason, it is expected that the impact on low income families will be lower, much less than \$1 per week. If low income earners reduce their levied bags purchased by 95% rather than the projected 75% for a 15c levy, the cost per year would be \$0/yr.

To alleviate concern about the impact on low income groups of having to purchase reusable bags some of the levy revenue could be used to provide this group, identifiable by health care cards or some other means, with free reusable bags.

### ***Suppliers***

For a levy on suppliers, suppliers will face some administration costs associated with the collection and payment of the levy to government.



Suppliers may face the issue of having to pay the government a levy on plastic bags that they provided to retailers before they have received the levy amount from retailers. These issues could be considered and avoided when designing the levy system.

### The Federal Government

In addition to the initial costs that will be incurred in developing and initiating a levy there will be ongoing administration costs to government (or to an industry body). These will include costs involved in the collection of levy revenue, costs associated with monitoring and auditing suppliers or retailers to ensure compliance, and costs associated with educating the general community and retailers and suppliers about the levy. Levy revenue could be used to fund some of these costs.

Levy administration costs are sometimes estimated as a percentage of the revenue generated by the levy. The administration costs associated with different levies controlled by the Levies and Revenue Service of the Department of Agriculture, Fisheries and Forestry Australia are generally between 0.5% and 2.5%, but can be up to 8%, of the revenue generated by the levy. This includes audits on businesses to check compliance with the levy.

A levy may reduce government costs through reduced litter collection costs. If the levy reduces the use of plastic bags and removes the use of plastic bags in the fast food sector then it is reasonable to assume that the amount of plastic bag litter will be reduced. As plastic bags are a small percentage of the total litter stream, any reduction in government litter collection costs would be marginal.

If the amount of plastic bags in landfill sites is reduced, this would reduce the cost that landfill operators currently spend on cleaning up escaped litter from their sites, much of which is plastic bags as they are easily blown over fences.

## 7.5 Economic Outcomes of Scenarios

Table 7.3 provides an indication of the major parties incurring the set-up costs and Table 7.4 provides an indication of the major parties incurring the ongoing costs under each Scenario.

**Table 7.3 - Economic Outcomes of Scenarios – Set-up Costs**

Scenario	1A	1B	2	3	4
Government (legislative)	Y	Y	N	N	N
Industry Body					
-Levy set-up	N	N	Y	N	N
- Drafting and implementing Code	Y	Y	Y	Y	Some
Retailers (structural changes, time)	Y	Y	Y	Some	Negligible
Suppliers (structural changes, time)	Y	Y	N	N	N

**Table 7.4 - Economic Outcomes of Scenarios – Ongoing Costs**

Scenario	1A	1B	2	3	4
Revenue Raised by a Levy	332.9 M	358.2 M	191.7 M	0	0
Consumer Costs per person per year	\$14	\$15	\$3	-\$1	-\$1
Retailers					
- Reduced purchase cost of plastic bags	- 142 M	- 161.3 M	- 102.5 M	- 47.5 M	- 49.0 M
- Checkout time cost	Potential, especially initially <sup>1</sup>	Potential, especially initially <sup>1</sup>	Potential, especially initially <sup>1</sup>	Negligible	N
- Administration costs	Minor	Minor	Minor	Negligible	N
- Stolen Items	Minor <sup>2</sup>	Minor <sup>2</sup>	Minor <sup>2</sup>	Negligible	N
Government					
- Administration (including auditing, monitoring etc)	Y	Y	Minor	Minor	Minor
- Education	Y	Y	Minor	N	N
- Reduction in litter cleanup costs	Minor-Negligible	Minor-Negligible	Negligible	Negligible	Negligible
Industry Body					
- Administration of levy	Minor	Minor	Y	N	N
- Auditing of Code of Practice	Y	Y	Y	Y	Y
- Education	Some	Some	Y	Some	Minor
Suppliers (administration)	Y	Y	N	N	N
Landfill Operators clean-up costs	Y	Y	Some	Negligible	N

<sup>1</sup>Retailers have estimated that this could be 5 seconds per transaction and result in an estimated cost of up to \$82 M for the industry, however Nolan-ITU estimates indicate that if this time increase did occur the cost would be less than \$50 M for Scenario 1B and less for the other scenarios. This figure is based on an average wage cost of \$18 per hour and an average of 2.5 bags per transaction.

<sup>2</sup>Based on current reports from Irish retailers, the cost of stolen goods and stolen equipment to retailers is estimated to be minor, however there is some conjecture on this issue and the exact cost is unknown. For further discussion on this matter see Section 9.4.

The costs of levy implementation and administration is predicted to be minor in comparison to those quantified; however, a full regulatory impact assessment would be required before implementation of any of the above options.

## 8 ENVIRONMENTAL ASSESSMENT OF SCENARIOS

Based on the consumption assumptions outlined in Section 6 and the life cycle assumptions of shopping bags alternatives outlined in Section 4, the future scenarios have been subjected to an environmental assessment.

The five policy scenarios were also tested using the LCA data (Table 3.2). The reusable bag selected for the analysis was the woven HDPE ‘Swag Bag’ because it achieved the best environmental outcomes in the initial analysis of the functional unit.

Scenario 4 (Current Code of Practice) represents the base case.

Scenario 1B (a 25 cent legislated levy) achieves the most significant reductions in environmental impact when compared to Scenario 4 (the current Code of Practice), ie.:

- 63% reduction in primary energy use
- 65% reduction in global warming impacts
- 82% reduction in contribution to litter (using persistence as the measure).

Scenario 1A (a 15 cent levy) also achieves significant benefits, ie.:

- 54% reduction in primary energy use
- 56% reduction in global warming impacts
- 71% reduction in contribution to litter (using persistence as the measure).

Scenario 2 (a voluntary levy) achieves the following:

- 36% reduction in primary energy use
- 37% reduction in global warming impacts
- 48% reduction in contribution to litter (using persistence as the measure).

Scenario 3 (Expanded Code of Practice) achieves the following:

- 6% reduction in primary energy use
- 9% reduction in global warming impacts
- 16% reduction in contribution to litter (using persistence as the measure).

Table 8.1 (overleaf) details the outcomes of the environmental assessment of the scenarios.

**Table 8.1 – Environmental Outcomes of Scenarios**

Scenario	Product quantities (millions)	Litter (kg)	Litter (m <sup>2</sup> )	Litter (m <sup>2</sup> /y)	Greenhouse (tonneCO <sub>2</sub> /kg equiv.)	Primary energy use (GJ)
1A - 15c Legislated Levy with Expanded Code of Practice	HDPE singlet: 1,727.5M Woven HDPE reusable bag: 23.7M Kraft paper bag: 140M	97,100	542,000	2,520,000	32,400	1,160
1B - 25c Legislated Levy with Expanded Code of Practice	HDPE singlet: 1,036.5M Woven HDPE reusable bag: 26.8M Kraft paper bag: 158.5M	82,400	359,000	1,580,000	25,900	940
2 -Voluntary Levy as part of Expanded Code of Practice	HDPE singlet: 3,178.6M Woven HDPE reusable bag: 17.1M Kraft paper bag: 100.8M	128,000	926,000	4,490,000	46,000	1,620
3 -Expanded Code of Practice	HDPE singlet: 5,182.5M Woven HDPE reusable bag: 6.9M Kraft paper bag: 157.5	194,000	1,490,000	7,230,000	66,800	2,390
4 -Current Code of Practice	HDPE singlet: 6,219M Woven HDPE reusable bag: 2.8M Kraft paper bag: 0	188,000	1,720,000	8,620,000	73,800	2,540

## Conclusions

The assessment shows that the legislated 25 cent levy achieves the best environmental outcomes against all of the indicators, followed by the legislated 15 cent levy. Both of these policy scenarios cut energy use by over 50%, and achieved a significant reduction in litter (82% and 71% respectively). The voluntary levy reduces energy consumption and global warming by about a third, and achieves a halving of litter impacts.

The expanded code of practice only produces a small positive environmental outcome. It results in a small increase in litter by mass, due to the increased use of paper bags, but the litter persistence measure falls due to the high degradation rate of paper compared to the other materials.

## **9 OTHER IMPACTS AND ISSUES**

### **9.1 Impact on the Local Bag Industry**

The proportion of plastic shopping bags produced in Australia is around 35%. The local industry is split into three categories:

- Plastic resin manufacture;
- Plastic bag manufacture; and,
- Plastic bag distribution.

In relation to Australian produced bags, Melbourne based Qenos is the sole Australian producer of HDPE and LDPE resin used for bag manufacture, with an annual resin tonnage of approximately 10 000 tonnes. This represents about 3% percent of total polyethylene production of approximately 300 000 tonnes.

Rather than import a reduced number of plastic bags and face set-up and administration costs distributors or retailers may prefer to avoid these additional costs, instead turning to Australian producers of plastic bags who would handle the administration of the levy payment. Australian producers could therefore attain a larger share of the smaller market. A national commitment to use plastic bags with Australian recycled content would enhance this result.

If there was a standard reusable bag identified as the preferred reusable bag by retailers Australian manufacturers could gain the first player advantage by producing this bag as soon as it is identified.

### **9.2 Employment Impacts**

It is estimated that approximately 100 full time equivalents are employed in polyethylene production and 200 full time equivalents are employed in manufacturing polyethylene bags. In total, from the production of polyethylene and manufacture of bags approximately 400 full time equivalents are employed.

It is estimated that a levy that reduced the use of plastic bags by 70% would result in the loss of approximately 250 full time equivalent jobs in the supply chain. In part, this would be offset by the increased production of reusable HDPE bags.

If, as in Scenarios 1A, 1B and 2, there is a requirement placed on fast food outlets to eliminate their use of plastic bags the increased demand that this would create in between around 140 million to 160 million paper bags is likely to increase employment in the industry by approximately 20 people.

In addition the administration of the levy would create a few extra jobs (although this is not expected to be more than ten full time equivalents for government). Also, if it is the case that checkout time would increase by 5 seconds per transaction then this could result in the creation of over 200 full time equivalent jobs. The increased demand in kitchen tidy bags may also increase employment in that industry.

### **9.3 Occupational Health and Safety**

The current plastic shopping bag adequately addresses many OH&S, Food Safety and product integrity issues due to its strength, size, water resistance and, in the case of supermarket bags, packing design. With the aimed reduction of plastic shopping bags and the introduction of alternatives, these issues need to be addressed.

Current HDPE supermarket bags are designed to carry approximately 6kg of product. With the introduction of reusable bags with potentially larger capacities, it must be ensured that the bag is strong enough to take the increased weight and that bags do not get too large to be carried safely when full. A standard bag size would help to alleviate these issues.

Packing systems and infrastructure at supermarket checkouts is also well established with current HDPE singlet bags. Packing issues for both the checkout staff and customer also need to be considered in the design of various reusable bags.

Food safety issues are also a concern in food retailing, particularly relating to fresh meat, detergents and cleaners. Currently, these items are generally not packed into plastic bags with other food stuffs to avoid infectious problems with meat products and the contamination of food with chemicals from cleaning and detergent products. With the use of large bags and customers own bags, this can arise as an issue. In the Irish context, this has been solved by having fresh produce and meat bags exempt from the PlasTax and in SuperQuinn stores, the reusable bags have labels for the separation of meats, detergents and cleaners and other products.

### **9.4 Store Security**

In the past supermarkets have tried to discourage customers from bringing their own bags into the store in order to reduce the incidence of stealing. In many stores, the shopping bag has almost become the informal proof of purchase, and a customer walking out holding a product without a bag would likely be under suspicion of theft. This would have to change with the introduction of levy schemes, with the sales receipt being the solid proof of purchase.

In Ireland before the introduction of the PlasTax, the anticipation of increased theft under the new system was high. However, after more than eight months of the levy being in place, theft has not been found to increase. One supermarket chain however, did experience a high level of theft of in-store carry baskets after the introduction of the PlasTax, due to the fact that the baskets could be carried past the checkout like a trolley would be. Another store has avoided this problem by requiring a deposit for the use of baskets and trolleys.

At the time of writing we are unable to provide a reasonable estimate of any likely increase in costs due to a potential increase in goods or equipment stolen from retailers. As there is likely to be a significant increase in the numbers of consumers bringing their reusable bags to do their shopping, particularly to supermarkets, some retailers are concerned that this will increase the incidence of stock 'shrink' (stolen goods). There is concern that this may occur due to consumers placing items directly in their reusable bags as they walk around the store and walking past the checkouts and out of the store without paying for them. Checkout attendants may be intimidated by customers and not ask if they can search their bags, or they may assume, if it is a recognised reusable bag, that the customer has already paid for the goods.

However in Ireland stores report no noticeable increase in stolen items so far. They reported an initial increase in stolen equipment (supermarket baskets, trolleys etc) however they believe that this has now subsided. It may be that it is still too early for supermarkets to know the extent of any increase in stolen items, if no stock take has been conducted since the introduction of the levy. The extent of stock shrink and stolen equipment is something that should be monitored over time in Ireland.

It is not considered that a levy system in Australia would measurably increase the incidence of theft, however, some stores may need to increase the profile of receipts for checking proof of purchase on leaving the store.

## 10 KEY FINDINGS

The key findings of the study into the impact of levies schemes and the environmental impacts of plastic shopping bags in Australia are as follows;

1. An estimated 6.9 billion plastic shopping bags are used in Australia (this number is an approximation and a more comprehensive audit of sales and imports would be required if targets are to be established for reduced bag consumption). *Section 1.2.*
2. There are currently high levels of community concern about the environmental impacts of single use plastic shopping bags in Australia. *Section 1.2.*
3. Imported bags make up over half of the total Australian bag market and are increasing in market share. *Section 2.3.*
4. Supermarkets account for just over 50% of total bag use with significant volumes also used in general merchandise, apparel and other food retail sales. *Section 2.4.1.*
5. As estimated 10% of bags go to destinations other than residential homes. Approximately 50% of these are likely to be outdoor locations with a resulting higher proportional litter outcome. *Section 2.4.2.*
6. The total weight of plastic shopping bags used is not that significant when compared to:
  - ❑ total household waste (0.7%).
  - ❑ total plastics consumption (2.5%).
  - ❑ total packaging consumption (1.0%). *Section 4.2.*
7. An estimated 60% of bags with an 'at home' destination cascade to a second use before landfill disposal. *Section 2.5.1.*
8. There is currently a low level of recycling of plastic shopping bags due to levels of reuse, inadequacy or inconvenience of recycling return routes and general consumer apathy or misunderstanding. Recycling rates are currently 3%. *Section 2.5.2.*
9. Plastic shopping bags appear to make up to approximately 2% of the Australian litter stream by item. Their light weight is the cause for high levels of inadvertent littering. This impact results from only a small percentage of bags being littered. *Section 2.5.3.*
10. Plastic shopping bags entering the marine environment represent a threat (not quantifiable) to animals along with other packaging and other littered items such as fishing tackle. *Section 4.2.1.*
11. Approximately 200 million dollars are spent annually by local and state governments on litter clean ups. In addition private sector companies such as landfill operators and community organisations, such as Clean Up Australia, also devote considerable resources to litter recovery. *Section 2.5.3.*



12. Most bags end up in landfill, where their volume and environmental impacts are minimal. *Section 4.2.1.*
13. Several countries in Europe and Asia have taken action to reduce plastic shopping bag use. These include bans, consumer levies, product or material levies and restrictions on bag design and weight. *Section 3.1.*
14. The Republic of Ireland is the only current example of a legislated consumer levy being used to achieve a change in consumer behaviour. Information on bag number reductions, levy and revenues, administration and operational impacts and consumer attitudes are available. No litter impact is available. *Section 3.3.1.*
15. There are a number of examples of voluntary levies implemented which have also achieved significant reductions in plastic shopping bags use. *Section 5.6.*
16. The Irish levy has resulted in a minor resource offset through increased kitchen tidy bag sales increases. It has not resulted in an impact on retail sales, product theft levels, or compromises in staff or customer safety. *Section 3.3.6.*
17. The administration and implementation costs for the Irish industry have been minimal. The levy enjoys strong on going support from consumers, retailers and government. *Section 3.3.6.*
18. A quantitative assessment of environmental impacts on alternative shopping bag options showed there is potential to significantly reduce impacts in resource and energy consumption and in littering. *Section 4.3.*
19. The environmental assessment showed that a substantial shift from single use 'disposable' bags to more durable reusable bags would deliver an environmental gain over the full life cycle of the packaging. *Section 4.3.*
20. The environmental assessment showed less significant and consistent gains are made by switching from HDPE to other single use bags, such as paper and biodegradable bags, with potential gains in litter being offset by negative resource use outcomes. *Section 4.3.*
21. There were no significant differences in reusable bag environmental outcomes. Reusable heavy duty plastic bags which can combine low resource use, longevity and recycling came out on top. *Section 4.3.*
22. The use of biodegradable bags would offer some benefits in litter persistence but would not deliver significant resource use gains and would not be compatible with plastic bag recycling. *Section 4.3.*
23. Environmental gains from reusable bags are closely linked to the life expectancy of the bags, their weight-to-capacity ratio and their final destination – low litter, high recycled. *Section 4.3.*
24. A consumer focussed bag levy will result in a substantial shift in consumer behaviour. This will result in lower single bag usage, greater use of reusable bags and an increase in 'no bag' retail transactions. *Sections 5.6, 5.7 & 6.3.*

25. The 'no bag' transactions would more often occur in general merchandise, apparel, fast food and convenience store locations where the number of items per transaction is low. *Section 6.3.*
26. The introduction of a levy would most practically occur at a national level to ensure consistency of approach and constitutional compliance. *Section 5.8.*
27. A voluntary levy could be undertaken at a national level. This approach would need to deal with competition, compliance and regulation issues, and would require a longer time frame for introduction. It is assumed that a lesser overall coverage from a voluntary levy would result in lower changes to bag usage. *Section 5.6.*
28. Some changes to consumer behaviour would be achieved through a comprehensive revamping of the current Code of Practice for Plastic Shopping Bags. The changes would be modest if not combined with a levy and accordingly the environmental benefits would be minimal. *Section 5.2.*
29. Total reliance on the Code of Practice in its current configuration would be likely to have little impact on bag usage or environmental impacts. *Section 5.2.*
30. Recycling rates for single use bags could be expanded significantly under an revamped Code of Practice through a combination of improved infrastructure, better promotion and expansion of focus to all retail bags throughout the country. *Section 5.2.*
31. The introduction of bags into kerbside collections may boost recovery rates but would need to overcome barriers related to low yield, low value and high contamination. A combination of education, increased presented bag density and an advanced disposal fee could achieve this. *Section 5.3.*
32. Education of consumers on plastic bag issues needs to address the following key issues:
  - ❑ levy (if applied);
  - ❑ reuse (bags for life);
  - ❑ for recycling (contamination); and
  - ❑ litter reduction. *Section 5.4.*
33. The introduction of a levy is likely to have a strong degree of public support if it is seen to be effectively achieving its stated environmental goals. *Section 5.7.*
34. The introduction of a levy would require systemic changes in retail stores including infrastructure and staff training. The cost to retailers and therefore to customers is not possible to quantify but is likely to be less than the savings achieved through avoided bag purchases. *Section 7.5.*
35. The ongoing administrative costs to both government and retailers from a levy are likely to be small if procedures are well structured. *Section 5.7.*
36. The imposition of a levy at a supplier level could offer cost savings in collection but the level of compliance may be compromised. *Section 5.7.*

37. A levy set at 15-30 cents per bag is likely to be sufficient to result in comprehensive behaviour change and therefore minimal levy imposition. *Section 6.3.*
38. A levy set at 15 cents a bag on all retail bags resulting in a 75% bag reduction would generate around \$300 million. If a bag reduction outcome similar to Ireland was achieved (>90%) than the revenue would be less than \$150 million. *Section 6.3.*
39. The Australian bag manufacturing industry is geared towards production of single bags at very low margins. Any policy efforts to reduce bag usage should take account of the employment impacts and identify opportunities to re-configure the industry for reusable bag production and lower single use bag production. *Section 9.2.*
40. The existing data on litter would need to be improved in order for performance related targets to be reliably measured. *Section 2.5.3.*

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## **Appendix A**

### **Life Cycle Analysis Detail**

## Assumptions Used in the Life Cycle Assessment Modelling of the shopping Bag Options

### **Functional Unit**

The amount of shopping bags consumed to carry 70 grocery items home from the supermarket each week for 52 weeks. Based on the relative capacity and expected life of each bag provided comparative consumption rates (Table 1).

**Table 1. Consumption rates of shopping bags based on the functional unit**

Option	Relative capacity	Quantity of bags per week in relation to relative capacity	Expected life	Quantity of bags per year adjusted in relation to expected life
Singlet HDPE	1 (6-8 items per bag. Note: 7 items used as average )	10	Single trip	520
50% recycled singlet HDPE	1	10	Single trip	520
Boutique LDPE (single use)	0.8	12.5	Single trip	650
Reusable LDPE	1.5	6.7	12 trips (3 months)	26.8
Coles calico	1.1	9.1	52 trips (1 year)	9.1
Woven HDPE swag	3	3.3	104 trips (2 years)	1.65
PP fibre ‘Green Bag’	1.2	8.3	104 trips (2 years)	4.15
Kraft paper – Coles handled	1	10	Single trip	520
Solid PP ‘Smart Box’	2	5	156 trips (3 years)	1.66
Biodegradable - starch based (Mater-Bi)	1	10	Single trip	520

### **Manufacture**

The manufacturing assessment for each shopping bag included the extraction of raw materials and the processing of them into the final product. Note, for imported bags, overseas LCA data specific to the country of origin was used where possible. See Table 2.

Data for biodegradable bags was sourced from a German report prepared by the Government Office of Environment, Forests and Lands:



**Table 2 Manufacturing processes factored into the LCA modelling**

Option	Weight (g)	Material	Manufacturing processing
Singlet HDPE	6	HDPE	Production of HDPE film
50% recycled singlet HDPE	6	HDPE (50% post-consumer content)	Production of HDPE film
Boutique LDPE (single use)	18.1	LDPE	Production of LDPE film
Reusable LDPE	35.8	LDPE	Production of LDPE film
Coles calico	125.4	Cotton	Cotton processing
Woven HDPE swag	130.7	HDPE	Production of HDPE film
PP fibre 'Green Bag'	PP 65.6 Nylon base 50.3	PP	Production of PP film (assumed to be similar for PP and nylon)
Kraft paper – Coles handled	42.6	Kraft virgin pulp	Production of paper bags
Solid PP 'Smart Box'	250	PP	PP injection moulding
Biodegradable - starch based (Mater-Bi)	7	Starch based biodegradable polycaprolactone (PCL)	Production of generic polymer film

## **Transportation**

The transportation of each shopping bag was also factored into the LCA. This included the international shipping of imported bags to Australia (place of departure to the Port of Newcastle). For internal transportation to retailers ie. supermarkets, a distance of 115km (Newcastle to Sydney) in a 28t articulated truck was used for all bag alternatives. See Table 3.

**Table 3 Transportation of bag alternatives to retailer**

Option	% of imports	Origin and distance travelled (km)	% Made Locally	Domestic distance travelled (km)
Singlet HDPE	67	South-east Asia (Port of Hong Kong): 7231	33	115
50% recycled singlet HDPE	67	South-east Asia (Port of Hong Kong): 7231	33	115
Boutique LDPE (single use)	34	South-east Asia (Port of Hong Kong): 7231	66	115
Reusable LDPE	34	South-east Asia (Port of Hong Kong): 7231	66	115
Coles calico	100	Pakistan (Port of Karachi): 11019	0	115
Woven HDPE swag	100	Taiwan (Port of Taipei): 7198	0	115
PP fibre 'Green Bag'	0	n/a	100	115
Kraft paper – Coles handled	0	n/a	100	115
Solid PP 'Smart Box'	100	Scotland: 16809	0	115
Biodegradable - starch based (Mater-Bi)	100 (note material imported and bag manufactured in Australia)	Italy: 16318	0	115

## **Consumption**

Refer to Table 1 for assumed consumption rates for each bag alternative based on the functional unit.

No allowance has been made for maintenance of bags (washing and ironing) during the use stage.

## **At End-Of-Life**

Due to the variance in expected life and materials of many of the shopping bag alternatives, a number of end-of-life assumptions were required (table 4).

**Table 4 End-of-life Assumptions**

Option	Landfill %	Recycled %	Litter %	Reuse % <sup>21</sup>
Singlet HDPE	78.5	2	0.5	19
50% recycled singlet HDPE	80.5	0	0.5	19
Boutique LDPE (single use)	80.5	0	0.5	19
Heavy duty LDPE (reusable)	80.5	0	0.5	0
Coles calico	99.5	0	0.5	0
Woven HDPE swag	99.5	0	0.5	0
PP fibre 'Green Bag'	99.5	0	0.5	0
Kraft paper – Coles handled	39.5	60	0.5	0
Solid PP 'Smart Box'	100	0	0	0
Biodegradable - starch based (Mater-Bi)	80.5	0	0.5	19

### **Notes on Landfill and Recycling Assumptions**

Based on the current recycling industry it was assumed there would not be a recycling market for the reusable bags at end-of-life due to their relatively low volume.

LCA methodology does not allow for recycling credits to be counted twice, therefore the benefits of recycling (e.g. avoided production of virgin material) are either included at the manufacturing stage (recycled content) or at end of life (recycling). For this LCA:

- One of the HDPE singlet bags was assumed to have 50% recycled content. The recycling rate at end of life was therefore not counted
- The virgin HDPE bag was assumed to have a recycling rate of 2%
- The paper bags were assumed to have a recycling rate of 60%. Most households in Australia have access to a paper recycling service, but the recycling rate for paper bags was assumed to be lower than for newsprint (currently 74%). Any assumption about recycled content would therefore not make any difference to the results unless recycled content was assumed to be higher than the 60% recycling rate.

### **Notes on Litter Assumptions**

All bags, except for the PP 'smart box' due to its size and weight, were assumed to have 0.5% of total entering the litter stream at end-of-life. This percentage was based on existing data relating

<sup>21</sup> Reuse as a bin liner for household waste: subsequent avoided product is a HDPE bin liner

to HDPE singlets entering the litter stream: of the 6 billion produced annually, 30 million enter the litter stream, which equals 0.5% of total output.

### ***Notes on Reuse Assumptions***

Only single use bag options were considered for reuse applications as it was assumed that the long life bags would be used for grocery shopping to the end of their functional life and consequently be disposed of. In regards to the single use bags it was assumed that 19% percent of bags would replace the need for bin liners. This was calculated by using the average amount of household rubbish generated per week of 14kg. 14kg equals 333g/l equalling 42 litres of rubbish per week. One HDPE singlet holds approximately 10 litres therefore a maximum of 5 bags per household per week could be used as bin liners. Therefore as the average Australian household has 2.6 residents and the consumption of single use bags is just under 1 per person per day that equals approximately 16 single use bags collected per household per week. Based on the assumption that 60% of households reuse bags as bin liners the percentage of supermarket shopping bags used for this purpose would be approximately 19%. This reuse results in avoided consumption of bin liner bags.



## **Appendix B**

### **Consumer Costs**

In order to estimate the costs to consumers of the different scenarios, the retail industry was split into three sectors to identify the likely proportions of reusable bags, no bag and paper bags used. The sectors are:

- A: Supermarket and Other Food and Liquor (where 4.41 billion HDPE bags are currently used);
- B: Fast Food, Convenience Store and Service Station (where 0.35 billion HDPE bags are currently used); and,
- C: Other Retail, General Merchandise and Apparel (where 1.25 billion HDPE bags and 0.9 billion LDPE bags are currently used).

In each of the sectors the proportional split between reusable bag and 'no bag' shopping purchases was estimated based on the characteristics of that sector.

In scenario 1A, a 15 cent levy is assessed. It is assumed that for the three sectors described above the shopping split between single use plastic bags, reusable bags, no bag and paper bags are:

- A: 25% in single use plastic bags, 55% reusable bags and 20% in no bag;
- B: 25% in single use plastic bags, 35% in no bag and 40% in paper bags; and,
- C: 25% in single use plastic bags, 25% reusable bags and 50% in no bag.

In total this represents 25% in single use plastic bags, 43% in reusable plastic bags, 2% in paper bags and 30% in no bag.

The 'no bag' option is assumed to include those consumers buying an item or items easily transported without a bag or items that they then put into a bag that they already have or have purchased for some other shopping purchase such as a back pack, or a bag from another store. 20% of shoppers are assumed to use no bag in the supermarket and other food and liquor sector. Some supermarket shoppers shop every day or every second day and buy only a few items on their way home from work or university etc. It is assumed that some of these shoppers will chose not to use a bag and either use a small bag that they have with them or carry their items without a bag, for example where they have only purchased one or two items.

The percentage of no bag users is expected to increase to 35% in the fast food, service station and convenience store sector as this is where transactions usually involve a small number of items and will easily be able to be carried from the store.

In the other retail, general merchandise and apparel sectors it is assumed that 50% of customers will choose no bag, as items are large and infrequently purchased. An example of this is a customer out 'shopping' for clothes or gifts and buying things at more than one store choosing to put all their purchases in the one bag to avoid the levy on every item. Similarly, customers buying a pair of shoes may choose to carry the shoebox rather than the box in a bag, etc.

As 43% of total retail shopping that is currently in single use plastic bags is estimated to shift to reusable bags under the 15 cent levy, some assumptions regarding the likely average longevity and capacity of reusable bags must be made in order to estimate the total number of reusable bags that will be bought in a year. The 'green' HDPE bag (described on pageXXX) has been chosen as a likely industry choice for reusable bags, and as an average representative reusable bag. It performed well in the environmental LCA analysis and is reasonably inexpensive.

The average capacity of the green bag has been found to be 1.2 times that of the average single use plastic bag, and it is assumed that such a bag would be used on average once a week, therefore 52 times in one year.

**Table 1: Quantities of bags used and Consumer Costs for Scenario 1A**

Retail Sector	HDPE & LDPE single use bags	Reusable bags	Paper bags	No bag
A: % of shopping	25%	55%	0%	20%
A: Number of bags in use each year	1,102,500,000	38,900,000	0	0
B: % of shopping	25%	0%	40%	35%
B: Number of bags	87,500,000	0	140,000,000	0
C: % of shopping	25%	25%	0%	50%
C: Number of bags	312,500,000	8,600,000	0	0
TOTAL %, in all sectors	25%	43%	2%	30%
TOTAL: Number of bags	1,727,500,000	47,500,000	140,000,000	0
Cost of individual bag	15 <sup>c</sup> levy, 10% GST, hidden 3 <sup>c</sup>	\$1.50 incl.GST	15 <sup>c</sup> levy, 10% GST, hidden 8 <sup>c</sup>	Bin liner sales up 70%
Total cost to consumers	\$336,863,000	\$35,625,000 (\$71,250,000)	\$34,300,000	\$56,950,000
Cost per Consumer:	\$17.70	\$1.90 (\$3.80)	\$1.80	\$3.00
Average cost per consumer	\$24 (\$26)			
Increase in average cost per consumer	\$14 (\$16)			

Note: these costs do not include any increase in retailers costs which they would be likely to pass on to consumers.

As the estimated life cycle of a reusable bag is two years, or 104 shopping trips, (one a week) the \$3.80 cost of reusable bags is the cost to consumers in the first year. In an average year after the introduction of a levy this cost will be spread over two years, thus halved (to \$1.70 per year). Therefore the average cost per consumer will be approximately \$26 in the first year but \$24 in an average year.

If the price of reusable bags is assumed to be \$2.00 per bag the total cost of reusable bags increases to an average of \$2.50 (\$5 in the first year) per person, and the total cost to consumers of \$25 per year (\$27.50 in the first year).

The cost of single use plastic bags to consumers has been estimated using the 15 cent levy charge, multiplied by the GST plus \$0.03 cost (including GST) of the bag to retailers. The \$0.03 (the average cost of single use bags including GST) is a hidden cost to consumers. Retailers pay this

to bag suppliers and importers but do not attach this cost to the sale of bags, instead it is incorporated into the businesses costs and is passed on to the consumer in the price of the other goods sold by the retailer.

The average cost of paper bags is assumed to be the 15 cent levy plus 10% GST plus an average cost of \$0.08 per bag (hidden cost).

The sale of kitchen tidy bags (bin liners) is estimated to have increased by 77% in Ireland, where the reduction in the use of plastic bags is estimated to be close to 95%. For this example, assuming a 75% reduction in the use of plastic bags a 70% increase in the sales of kitchen tidy bags (\$33,500,000 according to Retail World) is assumed.

This increase in the cost to consumers is offset by the reduction in the hidden cost of all the bags that are currently used. This is estimated to be \$189,750,000 per year, or an average of \$10 per consumer (based on an average cost of \$0.03 per bag including GST for the 6.9 billion bags).

Offsetting the old hidden cost of bags to consumers with the new costs (which include the new hidden costs) the increase in cost to consumers of a 15 cent levy is estimated to be on average \$14 per person per year (or \$16 per person in the first year).

If the assumptions concerning the split of reusable bags and no bags are changed so that, the shopping split between single use plastic bags, reusable bags, no bag and paper bags are:

- A: 25% in single use plastic bags, 65% reusable bags and 5% in no bag;
- B: 25% in single use plastic bags, 30% in no bag and 45% in paper bags; and,
- C: 25% in single use plastic bags, 50% reusable bags and 25% in no bag.

In total this represents 25% in single use plastic bags, 57% in reusable plastic bags, 2% in paper bags and 12% in no bag.

With these changed assumptions the cost of scenario 1A is estimated to increase to \$25 per consumer per average year

Similar assumptions have been made for each of the scenarios described in the report. The results for these scenarios are shown below in tables X.2 to X.6.

**Table 2: Scenario 1B**

Retail Sector	HDPE & LDPE single use bags	Reusable bags	Paper bags	No bag
A: % of shopping	15%	62%	0%	23%
B: % of shopping	15%	0%	45%	40%
C: % of shopping	15%	28%	0%	57%
TOTAL %, in all sectors	15%	48%	2%	34%
TOTAL: Number of bags	1,036,500,000	53,600,000	158,550,000	Bin liner sales up 80%



Cost per Consumer:	\$16.60	\$2.10 (\$4.20)	\$3.00	\$3.20
Average cost per consumer	\$25 (\$27)			
Increase in average cost per consumer	\$15 (\$17)			

**Table 3: Scenario 2**

Retail Sector	HDPE & LDPE single use bags	Reusable bags	Paper bags	No bag
A: % of shopping	46%	40%	0%	14%
B: % of shopping	46%	0%	29%	25%
C: % of shopping	46%	18%	0%	36%
TOTAL %, in all sectors	46%	31%	1%	22%
TOTAL: Number of bags	3,178,600,000	34,200,000	100,800,000	Bin liner sales up 50%
Cost per Consumer:	\$8.20	\$1.40 (\$2.80)	\$1.30	\$2.60
Average cost per consumer	\$13 (\$15)			
Increase in average cost per consumer	\$3 (\$5)			

**Table 4: Scenario 3**

Retail Sector	HDPE & LDPE single use bags	Reusable bags	Paper bags	No bag
A: % of shopping	76%	17%	0%	7%
B: % of shopping	50%	0%	45%	5%
C: % of shopping	80%	5%	0%	20%
TOTAL %, in all sectors	75%	12%	2%	11%
TOTAL: Number of bags	5,201,600,000	13,700,000	157,500,000	No increase in bin liners
Cost per Consumer:	\$7.50	\$0.50 (\$1.00)	\$0.70	\$0
Average cost per consumer	\$9 (\$9)			
Increase in average cost per consumer	-\$1 (-\$1)			

**Table 5: Scenario 4**

Retail Sector	HDPE & LDPE single use bags	Reusable bags	Paper bags	No bag
A: % of shopping	90%	7%	0%	3%
B: % of shopping	90%	0%	0%	10%
C: % of shopping	90%	2%	0%	8%
TOTAL %, in all sectors	90%	5%	0%	5%
TOTAL: Number of bags	6,219,000,000	5,500,000	0	No increase in bin liner sales
Cost per Consumer:	\$9.00	\$0.20 (\$0.40)	\$0	\$0
Average cost per consumer	\$9 (\$9)			
Increase in average cost per consumer	-\$1 (-\$1)			



## **Appendix C**

### **Retail Time Costs**

The cost of a possible increase in transaction time has been estimated making the following assumptions:

- a labour cost of \$18 per hour (equates to a labour cost of \$0.005 per second);
- a time increase of 5 seconds per transaction, for those transactions no longer using single use plastic bags; and,
- a current average of 2.5 bags per transaction.

Assuming a 15 cent levy with a 75% reduction in the use of plastic bags, the number of plastic bags reduces by 5.175 billion (75% of 6.9 billion), which is an average of 2.07 billion transactions (5.175 billion divided by 2.5 transactions). At 5 seconds per transaction, this amounts to an increase in time of 10.35 billion seconds (5 seconds multiplied by 2.07 billion transactions), which at a cost of \$0.005 per second for labour amounts to a total cost of \$51.8 million to the retail industry.

The above calculations assume that all non-plastic bag transactions cause a time increase in 5 seconds whereas in reality there will be many transactions that use no bag and have no time increase (possibly even a time decrease in some types of stores).

To calculate the time cost to supermarkets only, it is estimated that currently 3.68 billion plastic bags are used. These will reduce the use of plastic bags by 2.76 billion bags, which is equivalent to an estimated 1.104 billion transactions, and, if transaction time increases by 5 seconds, is an increase of 5.52 billion seconds at a total cost of \$27.6 million to supermarkets or \$51.8 for all retailers.