



Environment Group Research Report
Proposed Plastic Bag Levy -
Extended Impact Assessment
Volume 1: Main report

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Proposed Plastic Bag Levy - Extended Impact Assessment Final Report

Volume 1: Main Report

Final Report

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- Carrier Bag Consortium
- Convention of Scottish Local Authorities (CoSLA)
- Friends of the Earth Scotland
- Scottish Retail Consortium
- Scottish Environment Protection Agency (SEPA)

Glossary

ARA	Australian Retailers Association
BRA	Belgian Retail Association
BRC	British Retail Consortium
CBC	Carrier Bag Consortium
CoSLA	Convention of Scottish Local Authorities
Defra	Department for Environment, Food and Rural Affairs (London)
ERM	Environmental Resources Management
HDPE	high density polyethene (polyethylene)
INCPEN	Industry Council for Packaging and the Environment
KSB	Keep Scotland Beautiful
LCA	Life cycle assessment
LDPE	low density polyethene (polyethylene)
LEAMS	Local Environmental Audit and Management System
MCS	Marine Conservation Society
NO _x	nitrogen oxides
ONS	Office of National Statistics
RMIT	Royal Melbourne Institute of Technology
SME	small-to-medium enterprise
SRC	Scottish Retail Consortium
SWAG	Scottish Waste Awareness Group
UCD	University College Dublin
VOC	volatile organic compound
WRAP	Waste and Resources Action Programme

Executive Summary

Mike Pringle MSP has tabled a Members Bill in the Scottish Parliament to impose an environmental levy on lightweight plastic carrier bags as provided by shops and other retail outlets. It is understood that this would cover all bags made partially or completely of plastic, with the exception of those used for directly packing of fresh meat, fish, fruit and other foods.

This brief study, commissioned by the Scottish Executive and undertaken by AEA Technology Environment and associates, has addressed the likely impacts of such a levy and variants of it on:

- The environment.
- Consumers.
- Business.
- Waste.
- Local authorities.

Advocates of a levy on plastic bags cite the main benefits as being reduced littering (including marine litter), reduced use of resources and energy, lower pollutant emissions and increased public awareness of environmental issues.

Opponents argue that lightweight plastic carrier bags are hygienic, convenient and durable, that they are often reused for other purposes, that they form only a small part of the litter stream and that they have a lower overall environmental impact than paper bags. They also claim that a levy would impact unfairly on poorer households and would lead to job losses in Scotland (from reduced plastic bag manufacturing and importing).

The study has considered these and other arguments for and against a levy, quantifying the probable effects wherever possible. It considered a range of different scenarios:

- Scenario 0: No levy, i.e. business as usual.
- Scenario 1A: A levy of 10p on plastic but not paper bags, covering all businesses (as proposed in the Bill).
- Scenario 1B: A levy of 10p on plastic but not paper bags, covering all businesses except small and medium sized enterprises (SMEs) and charities.
- Scenario 2A: A levy of 10p on plastic and paper bags, covering all businesses.
- Scenario 2B: A levy of 10p on plastic and paper bags, covering all businesses except SMEs and charities.

A wide range of evidence has been used to inform the study. This includes experience from the PlasTax in Ireland and voluntary schemes in the UK along with results from life cycle analysis (LCA) studies from France and Australia.

The study does not make a judgement on whether, on balance, such a levy should be introduced, but provides evidence on the main effects expected under each of the four levy scenarios.

Overall Effects

A levy would cause a set of interacting effects. The study is predicated on evidence that a levy would stimulate a switch away from use of plastic bags (by typically 90%). If only plastic bags were to be levied (scenarios 1A and 1B), then studies and experience elsewhere suggest that there would be some shift in bag usage to paper bags (which have worse environmental impacts). This study is based on this experience of behaviour change.

In each of the areas considered – environment, consumers, business, waste and local authorities - there would therefore be a complicated set of effects, but in general:

Environment The environmental impact of each of the four levy scenarios was assessed using 8 indicators. These include energy, water, waste and litter. Under the levy as proposed (scenario 1A) 5 out of the 8 indicators show an improvement.

There are different impacts under each levy scenario. In particular, including paper bags increases the potential environmental benefits of a levy (e.g. scenario 2A or 2B) where all 8 indicators improve.

In all cases the changes in environmental indicators due to a levy are modest (i.e. 1% or less) in comparison to overall environmental impacts from other activities in Scotland (as shown in Table A3.7).

Consumers Consumers act to reduce the financial impact by switching away from use of carrier bags. This limits the detrimental financial impact for consumers to a maximum of £10 per person per year.

Business The impacts would be positive for food retailers, and detrimental for non-food retailers and other businesses such as plastic bag manufacturers.

Waste Under scenarios 1A and 1B waste increases due to a switch from plastic to paper bags. When paper bags are included in the levy (e.g. scenario 2A or 2B) waste arisings fall. The greatest increase, 5,409 tonnes, is for scenario 1A, while the greatest decrease, 4,993 tonnes, is for scenario 2A. These should be compared against total household waste arisings of 2,094,872 tonnes pa [SEPA], a 0.26% increase and a 0.24% decrease respectively.

In all scenarios litter reduces, but plastic bags are only a small percentage of reported litter.

Local authorities There will be set-up costs and on-going costs to administer the levy. In general the revenue from the levy is expected to cover the on-going administration costs. However there are important differences between the on-going costs and revenues between local authorities. For example smaller authorities could receive lower revenues without a proportional reduction in administration costs.

Impacts on the Environment (Section 4 in the main report)

The study used an LCA approach to evaluate the changes in a range of different environmental indicators (e.g. energy use, water use, waste etc). The analysis shows that there would be an environmental benefit for some of the indicators depending on what consumers choose to use were a levy to be introduced.

In all scenarios where the levy is applied, consumption of non-renewable energy, atmospheric acidification and formation of ground level ozone and the risk of litter would be considerably less than the current situation.

In scenarios 2A and 2B, where the levy is applied to paper bags as well as plastic bags, these environmental benefits increase. In addition there are reduced impacts in terms of consumption of water, emissions of greenhouse gases and eutrophication of water bodies (rivers, lakes, etc.). This is because paper bags have a higher environmental impact in these categories relative to plastic bags.

As these results depend on key assumptions we undertook a sensitivity analysis to assess how this changes the results. This shows that scenarios 1A and 1B, which increase use of paper bags, are more sensitive to key assumptions than scenarios 2A and 2B. Excluding SMEs in the levy (scenarios 1B and 2B) accentuates the impacts.

For each of the environmental indicators used in this study we have assessed the total impact from all activities in Scotland. This analysis shows that the environmental benefits in all indicators from a levy are modest (i.e. 1% or less) when compared to overall environmental impacts from other activities in Scotland.

Impacts on consumers (Section 5 in the main report)

Consumers would obviously have to pay the levy itself overtly, on levied bags they continue to use, but the true additional financial burden of a levy on consumers in Scotland depends on a number of other factors as well. This draws upon experience from Ireland of the change in behaviour and therefore bag use. The total cost was calculated from the amount of levy paid for carrier bags, the relative hidden costs of plastic and paper bags¹, the costs of buying additional heavyweight plastic carrier bags (so-called ‘bags for life’), the costs of buying additional bin liners, and additional VAT.

The cost to the consumer also depends on whether or not certain costs (in particular the ‘hidden costs/savings’) are passed on to the consumer by the retailer.

This leads to a wide range of estimated costs to the consumers, depending on assumptions. In Scenarios 1A and 1B (no levy on paper bags) the estimates ranges from £7.41 to £10.58 per year. In Scenarios 2A and 2B (levy on paper bags as well) the range is from about £2.50 to £6.11 per year.

¹ Hidden costs cover the purchase, transport and storage of bags by a retailer, normally passed on to consumers through the price of goods.

Including paper bags in the levy would therefore reduce the financial burden. Indeed this has a bigger effect on the range than whether or not SMEs are included.

The estimates of financial impact on consumers should be compared with average household expenditure in Scotland, this is £365 per week.

Impacts on business (Section 5 in the main report)

a) Retailers

After taking set-up and administrative costs into account, the food retail industry would benefit from net cost savings from the proposed bag levy. Savings would result from having to buy far fewer plastic carrier bags (now usually given away for free²), while sales of ‘bags for life’ and bin liners would increase.

However, this would not be the case for non-food retailers (e.g. clothing), as experiences in the Republic of Ireland following the introduction of the so-called PlasTax has seen a more pronounced shift to paper bags in these stores.

In terms of systems needed to comply with the proposed levy, larger retailers are expected to find this easier, having computerised systems and greater resource available. Smaller retailers may well not have computerised systems and the levy would thus represent a greater burden

b) Other business

There are an estimated 15–20 manufacturers, importers and distributors of plastic carrier bags in Scotland, most of which are SMEs. All will be affected by the proposed levy. It is believed that the imposition of a plastic bag levy in Scotland would lead to job losses, as it is considered unlikely that plants that currently manufacture plastic carrier bags would switch to alternative products (e.g. production of bin liners). Losses have been estimated at between 300 to 700 direct jobs, with further indirect jobs being affected (e.g. in support and distribution services).

Impacts on Waste (Sections 4 and 5 in the main report)

In all four levy scenarios, the total number of carrier bags (lightweight and heavyweight plastic and paper) used in Scotland per year would decline as a result of the levy. However, if paper carrier bags are not subject to the levy (as in scenarios 1A and 1B), the total tonnage of all carrier bags used and requiring disposal actually increases by 5,409 tonnes for scenario 1A (the proposed levy). Scenario 2A (including paper in the levy) would yield the greatest reduction in the tonnage of waste relative to current levels (a reduction of 4,993 tonnes per year). For comparison, in 2002/03 household waste in Scotland was 2,094,872 tonnes [SEPA] and 5,409 tonnes extra represents a 0.26% increase, whilst 4,993 tonnes less equates to a 0.24% decrease.

² Some stores in independent initiatives already charge for their lightweight carrier bags.

This analysis suggests some potential for an increase in solid waste generation for scenarios that favour a switch to paper bags. This is due to different assumptions about the relative weight of plastic and paper bags, and the fact that the LCA looks at solid waste impacts throughout the bag life cycle rather than just the end-of-life disposal phase.

Impacts on local authorities (Section 6 in the main report)

To determine the costs of set up and administration for local authorities would require a detailed specification of the systems and wider discussions. Our preliminary estimates suggest that the application of the levy to all businesses could cost Scottish local authorities, collectively, about £3–4 million to set up and £3.5 million per year to manage. This would reduce to £1.5–2.5 million to set up and £1.75 million per year to manage if the levy was applied selectively, i.e. based on retailer size or function.

These costs could be more than offset by revenues from the levy estimated at £7.75 million per year for all businesses and £5.5 million per year if applied selectively. However, smaller local authorities could receive lower revenues without a proportional reduction in administrative costs.

The Convention of Scottish Local Authorities (CoSLA) has reservations about the duty of collection falling to the local authorities and its concerns regarding the magnitude and potential administrative costs of the Levy, which they believe needs a full investigation.

Alternatives to the levy (Section 3 in the main report)

In addition to the assessment of the impacts of the levy scenarios, the study examined the details of alternatives to the levy.

The Carrier Bag Consortium (CBC) has developed a draft voluntary code to develop waste reduction and reuse initiatives and to continue product engineering to make further savings in the production, transportation and storage of plastic carrier bags. This has been submitted to the Voluntary Code of Conduct working group set up by the British Retail Consortium (BRC) and the Scottish Retail Consortium (SRC).

A voluntary approach has already been adopted in Australia, where use of carrier bags fell by 20.4% between 2002 and 2004.

Report Structure

This summary provides a brief introduction to the analysis methodology and results of the study. The main sections of the report are:

Volume 1

Section 1 reviews the context for the study.

Section 2 sets out background information on the various types of carrier bags and why they would be subject to a potential levy and reviews experience in Ireland.

Section 3 presents an assessment of the views for and against a levy based on experiences from around the world and from a variety of stakeholders.

Section 4 presents the life cycle assessment (LCA) analysis undertaken for different plastic bag levy scenarios.

Section 5 analyses the impacts a levy would have on consumers and businesses.

Section 6 gives a brief review and commentary on levy collection and its potential impact on local authorities.

Section 7 presents our conclusions.

Volume 2

Appendix 1 reviews international experience.

Appendix 2 provides details of the retail context.

Appendix 3 provides detail information on the LCA approach including the sensitivity analysis.

Appendix 4 provides graphs on the distribution of revenue to local authorities.

Both volumes include a glossary and a full set of references.

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1 Report Context

Mike Pringle MSP (www.mikepringlemsp.com) tabled a Members Bill in the Scottish Parliament for a Member's Bill to enable local authorities in Scotland to impose an environmental levy on specified plastic bags [Pringle]. If passed, this legislation would cover all plastic bags provided by retailers at point-of-sale or from other outlets. The inspiration for this bill was taken from the experience of the plastic bags levy (the so-called PlasTax) in the Republic of Ireland.

The Scottish Executive commissioned this brief study from AEA Technology Environment and associates in order to investigate and assess the range of environmental, business and consumer impacts related to the proposal to introduce a plastic bag levy in Scotland. In doing so, other potential options or variants on the proposed levy have also been researched.

In this study, we used the Irish definition of a lightweight plastic carrier bag, i.e. 'any bag made wholly or in part of plastic, suitable for use by a customer at point of sale in a supermarket, service station or retail outlet'. Heavier weight plastic carrier bags, the so-called 'bags for life', costing more than €0.70 (around £0.48) are excluded from the Irish levy.

This Volume of the report is structured as follows:

Section 2 sets out background information on the various types of carrier bags and why they would be subject to a potential levy.

Section 3 presents an assessment of the views for and against a levy based on experiences from around the world and from a variety of stakeholders.

Section 4 presents the life cycle assessment (LCA) analysis undertaken for different plastic bag levy scenarios. As well as the bill tabled by Mike Pringle, we assessed scenarios that looked at the effect of applying the levy to paper bags as well as plastic bags and focusing only on larger retailers. No new LCA was undertaken for this report. Instead, the results from other suitable LCAs were adapted with Scottish data to show the relative environmental effects of a levy or variants thereof.

Section 5 analyses the impacts a levy would have on consumers and businesses.

Section 6 reviews and comments on levy collection and impacts on local authorities.

Section 7 presents our conclusions.

Volume 2 of the report contains the following Appendices:

Appendix 1 reviews international experience.

Appendix 2 provides details of the retail context.

Appendix 3 provides details on the LCA approach including the sensitivity analysis.

Appendix 4 provides graphs on the distribution of revenue to local authorities.

References are designated in square brackets, e.g. [CBC].

2 Introduction

The estimates for the number of lightweight plastic carrier bags issued in the UK vary from 8 billion [Defra 2003] to 10 billion [WRAP 2005]. From these, a range of 690–860 million has been estimated for use in Scotland based on population statistics. The calculations and assumptions behind this range are given in Section 4.3. The estimated cost of these bags to UK retailers also varies. Some sources suggest the cost to UK retailers is around £1 billion per year [BBC, WRAP 2004b], whereas the Carrier Bag Consortium (CBC) suggests that, based on the unit price of bags, the cost is closer to £64–80 million.

2.1 The Different Types of Carrier Bags

Most outlets currently provide free lightweight bags³ made from conventional polyethene (polyethylene) plastic or bags made from degradable plastic (some outlets do make a charge⁴). Most major supermarket retailers also offer heavyweight reusable bags known as ‘bags for life’, for which they charge a small sum. Some shops also provide paper bags free of charge. The main types of carrier bags are described below; Table 2.1 summarises their key features.

Disposable High-Density Polyethene (HDPE) Bags

These plastic bags offer a thin, lightweight, high strength, waterproof and reliable means of transporting shopping. Research and development by the industry has reduced the average weight of such a bag by 60% compared with 20 years ago, while retaining the same strength and durability. Such bags are currently found in supermarkets and other food retail outlets.

Disposable Low-Density Polyethene (LDPE) Bags

These bags are currently given away free by many UK retailers (e.g. clothing shops). Like their HDPE counterparts, they are made from a by-product of oil refining.

Reusable Low-Density Polyethene (LDPE) Bags,

These are heavier gauge plastic carrier bags, often called ‘bags for life’. Retailers charge for these (typically around 10p). The intention is that the customer uses them repeatedly and then returns them to the store for recycling when they are worn out, receiving a free replacement. Such bags are offered in many UK supermarkets.

³ Throughout this report, the term ‘lightweight’ plastic carrier is used to describe ‘disposable’ plastic carrier bags available at the checkout as opposed to reusable bags such as ‘bags for life’. Bags will vary in size depending upon products purchased. We understand, and have taken into account, the fact that lightweight plastic carrier bags are often reused for a second purpose.

⁴ For example, Lidl and B&Q (see Appendix 2).

Paper Bags

The paper bags issued by shops range from very simple ones for small items (e.g. from newsagents and greengrocers) to larger ones (e.g. issued by fashion and shoe retailers). Some paper bags have plastic handles or plastic coatings. Under the terms of the Irish definition of plastic carrier bags (i.e. a bag with a plastic content), it is assumed that paper bags with a plastic content would be subject to the levy.

It is a misconception that paper bags are environmentally friendly because they are biodegradable. The increased volume of waste and the impact of their manufacture and transportation all need to be taken into account.

Polypropylene Bags

Polypropylene⁵ has many uses for producing rigid and flexible containers, as well as furniture, and is also derived from oil resources. Non-woven polypropylene bags are available at shops such as Marks and Spencers in the UK, where they retail at more than £1. They are strong and durable and, like ‘bags for life’, are intended to be used many times.

Woven polypropylene bags are available at J Sainsbury in the UK as well as in the Republic of Ireland at Tesco and Dunnes stores. Woven bags are produced by stretching the polypropylene in production to form “fibres”, the result is a stronger bag.

Degradable Bags

Bags that can be broken down by chemical or biological processes are described as degradable. Intuitively, degradable bags are expected to be environmentally friendly and a number of retailers are actively pursuing this option. Thus, there is often some surprise when reports suggest that degradable bags are not such an ‘environmentally friendly’ option. Waste management protocols emphasise the need to prevent, reduce, reuse, recycle and then recover energy. Encouraging disposal via degradation runs counter to this approach.

It can also be difficult to agree whether a particular type of bag is degradable or not. This could become significant if biodegradable bags were to be exempt from the levy.

Types of degradable bags

There are two main kinds of degradable bags⁶.

- **Biodegradable** bags are made from natural starch sources such as maize and synthetic polyesters that degrade through the enzymatic action of micro-organisms (bacteria, fungi and algae), essentially rotting down like vegetable matter. However, starch-based biodegradable carrier bags are not available in significant numbers in the UK. They would only be covered by a potential levy on plastic carrier bags if they contained some plastic (some do for bag-strengthening reasons).

⁵ Correct chemical name is polypropene.

⁶ Biodegradable bags can be properly classified by how they decompose (either by microbes or through heat, ultraviolet light and water) and by the material they are made from (e.g. natural starch sources such as maize or wheat, or synthetic polymers from oil). Blended materials are also available, e.g. starch with HDPE or polyester [RMIT].

- **Bioerodable** bags are made from synthetic plastics (oil-based) with trace degradation initiators (HDPE with an approximately 3% content of heavy metals such as manganese and iron⁷) and, as such, would be covered by a plastic bags levy. They bioerode primarily by oxidation and erosion of the plastic through the action of light and heat until very small particles of plastic remain (these often degrade biologically). It is reported that, in an anaerobic environment, the degradation process is halted for some types of bioerodable bags [RMIT, Symphony Plastic Technologies].

Concerns Regarding Bioerodable Bags

- **Recycling.** Conventional polyethene plastic bags (HDPE and LDPE) can be recycled into new products such as other bags and solid items such as ‘plastic’ wood (known as plaswood). It will be difficult to keep the different kinds of bag apart (HDPE and LDPE bags for recycling and bioerodable bags for composting), especially if both are available in the same community. Inevitably, bioerodable bags will get into this plastic bag waste stream and thus contaminate the recyclate. If the resulting recycled item contains a certain percentage derived from bioerodable bags, it will have inherently lower functional properties (i.e. it will start to degrade when in contact with water, ultraviolet light, etc.). This could have serious implications if the recycled plastic is used for pipes for water, gas supply or as fencing posts or seats [RMIT]. Some types of bioerodable bags⁸ are reported not to damage the overall value of the reclaimed material as the degradant initiator is destroyed during reprocessing.
- **Shelf-life and storage.** Bioerodable bags may start to decompose early if exposed to high temperatures, light or moisture. This compromises their carrying ability, though vacuum packaging is reported to prevent this [Symphony Plastic Technologies].
- **A solution to littering problems.** This claim is felt to send the wrong message to the consumer, i.e. it is acceptable to discard these bags because they will eventually rot down. The argument is that consumers should be informed of the need to reuse bags to reduce litter and resource consumption [RMIT]. In addition, the Marine Conservation Society (MCS) reports that any littered bioerodable bags based on HDPE will still cause problems to wildlife as they will break down into smaller pieces that can be ingested [MCS 2005]. This is questioned by Symphony Plastic Technologies, which suggests that degradation to carbon dioxide, water and humus is likely and that, should an animal ingest these smaller pieces, the degradation process will actually continue in its gut.

⁷Also copper, nickel, cobalt and cerium as well as photoactive compounds such as ferrocene.

⁸Oxo-biodegradable plastic bags produced by Symphony Plastic Technologies plc.

- **Provision of appropriate conditions for planned benign degradation.** Bioerodable bags are designed to decompose through the action of sunlight, water, stress and, ultimately, the enzymatic action of microbes in an aerobic environment. Where degradable bags are simply disposed of alongside other ‘household waste’ and then landfilled (like most household waste in Scotland [SEPA]), then the necessary conditions to allow degradation may well be absent and thus the environmental ‘benefits’ lost.

Certification and Labelling

Manufacturers of degradable polymers have signed a voluntary agreement with the European Commission to use environmentally friendly polymers in packaging that “*will effectively guarantee a biodegradability standard for products such as plastic bags, cups and plant pots, enabling them to be turned into compost and soil improvers.*” The agreement includes a certification and labelling scheme to help consumers and manufacturers identify products made from degradable polymers [EU Commission].

Key Features of Carrier Bags

Table 2.1 summarises some of the key features of the various types of carrier bags available, including their costs and relative sizes compared with conventional lightweight plastic carrier bags.

Table 2.1 Key features of carrier bags

Bag type	Features	Average cost to the retailer per thousand bags *	Average weight per thousand bags (kg) *	Relative bag storage volume **	Recyclability
Lightweight plastic carrier	Light, strong, durable, effective when wet	£7.47	8.4	1	Yes – but not all stores have facilities
‘Bag for life’	Light, strong, durable, effective when wet	£60.88	47.4	4	Yes – system of replacement actively encouraged
Fully degradable plastic bag	Light, strong, durable, effective when wet	£6 to £8	6.5	1	Degradable under the right conditions. Problematic if contaminate conventional plastic recycling.
Paper, without handles §	Convenient	£50	51	8	Yes – kerbside collections available
Paper, with handles §	More appealing to customers e.g. for shoes and clothes	£220	124	10	Yes – kerbside collections available but can be more problematic due to mixed materials
Non-woven polypropylene	Durable, strong, effective when wet	£333.33	138.7	20	Not at present
Woven polypropylene	Durable, strong, effective when wet	£433.33	226	20	Not at present

* Data provided by CBC and Symphony Plastic Technologies plc. Based on average price of an average bag.

**The relative volume of bags (to a conventional lightweight bag) is important for transportation and storage units required compared with plastic carrier bags.

§ The average weight of all paper bags available is 99g (arithmetic mean of 51, 81 and 166g). The values of 51g and 99g are used in the LCA in Section 4 for various analysis sensitivities.

2.2 Summary of the Irish Experience

A key motivator for the introduction of a levy on plastic bags in Scotland is the experience from the Republic of Ireland, where a levy known as the PlasTax was introduced in 2002. We consulted the Department of Environment, Heritage and Local Government in the Republic of Ireland for its views on the introduction and operation of the PlasTax. The Department said:

- The PlasTax was primarily an anti-litter measure with the secondary aims of increasing public awareness and changing behaviour. Introduction of the levy coincided with introduction of Ireland's Waste Strategy.
- No documented evidence is available showing a reduction in visible litter in the Republic of Ireland because of the levy. The Department has commented that *"littering of plastic carrier bags is no longer a problem"*.
- Approximately €1 million are raised each month from the levy.
- The decrease in bag usage was initially 90% and is now 95%.
- The main cost to retailers was updating their software so that till receipts would itemise the sale of plastic carrier bags.
- Theft was reported to increase at the outset but, when the Department investigated these claims, they were unable to substantiate them.
- Some increased control measures were introduced to stop trolleys being taken away from stores.
- Although use of paper bags has increased, it is not felt that their exclusion from PlasTax has been to the detriment of the scheme. Paper bags are reported as being used mainly by fashion and shoe shops. The grocery sector has switched largely to reusable bags.
- The advertising campaign, which was high profile and intensive, was considered a successful element in smoothing introduction of the levy.
- There are approximately 30,000 accountable persons registered in the Republic of Ireland. An accountable person is responsible for submitting the required information to the Revenue Commissioners.
- Compliance levels are reported to be very good. There is a facility for 'estimating levy liability' if retailers fail to submit returns or if the return is considered too low.
- There have not been any prosecutions. Any retailer not complying with the law has been visited, their non-compliance verified and a warning issued.

- Funds have been used to support waste recycling infrastructure, ongoing running costs and the introduction of dedicated staff to enforce waste legislation (with a particular focus on illegal waste dumping).
- An independent review of the scheme will be undertaken during 2005, three years after its introduction.
- A voluntary code was considered but the advice received suggested that this would be less effective.

3 The Arguments For and Against a Levy

The focus on plastic bags, in particular, is supported by:

- The high volume used.
- The perception that they are generally supplied ‘free of charge’.
- The fact that they are a secondary form of packaging.
- The assertion that they add to litter in a highly visible manner.
- Their persistence in the environment.
- The view that they are potentially easy to replace.
- The view that they represent an ‘easy target for visible success’.

3.1 The Arguments For a Levy

A bill for levy for certain plastic carrier bags in Scotland has been presented by Mike Pringle MSP [Pringle] following the introduction of the Irish PlasTax as a means of altering behaviour to help protect the environment. A further benefit stressed by Mike Pringle is the reduction of litter while encouraging the reuse of plastic bags. He argues that many plastic bags are not reused but end up in landfill sites or, worse still, as litter on the streets of Scotland.

Proponents of a levy cite the following potential benefits:

- Reduced resource consumption.
- Reduced energy consumption.
- Reduced emissions of greenhouse gases.
- Less litter.
- Increased public awareness of environmental issues in general.
- Strong message to change behaviour.

A Throwaway Society

Mike Pringle asserts that plastic bags contribute significantly to our throwaway culture of waste and argues that their use needs to be curbed, resulting in benefits for both the environment and business. He hopes that, by extension, people would be encouraged to think more about the other products and services they use and become more aware of reuse and recycling issues in general.

The proponents of a levy suggest that plastic carrier bags are only used twice at the most – to take purchases home and then, largely, for rubbish disposal. As such, they argue that plastic carrier bags are a needless waste of resources. This waste includes both the crude oil by-product resource from which the bags are made and the transport resources to deliver them from the manufacturing site⁹ to the retail outlets where they will ultimately be distributed.

⁹ Approximately 90% of plastic carrier bags used in the UK are imported from the Far East/China [CBC, Pringle].

Recycling levels for plastic carrier bags are low in Scotland and supporters of the levy argue that those that are not disposed of responsibly could increase the problems of litter. They often quote the sight and impact of wind-blown bags caught in trees and bushes to illustrate this point.

Litter and Damage to Wildlife

Further problems with littered carrier bags, especially in marine environments, are also cited. The Marine Conservation Society (MCS) conducts annual surveys every September in the UK to collect and remove litter from beaches. During this work, the MCS catalogues the amounts and types of litter found. The results are given in the MCS's Beachwatch reports [MCS 2003, MCS 2004, Independent].

In 2003, the survey covered 135 km of UK coastline and, in 2004, this rose to 145 km. Table 3.1 presents the survey data relevant to plastic bags. This category includes supermarket carrier bags as well as other kinds of plastic bags.

Table 3.1 MCS beach litter survey results

Year	Total number of plastic bags collected	Percentage of total litter	Plastic bags per km of coastline
2003	5,831	2.10%	43.2
2004	5,592	2.03%	38.5

The results show a drop of 4% from 2003 to 2004 in the numbers of plastic bags of all kinds collected. However, it is difficult to say whether this figure is statistically significant as it will depend on which beaches were visited.

It is also stated that a range of marine life such as whales, dolphins and turtles are severely injured or killed because they ingest or become entangled in plastic – as many as a million birds and 100,000 marine mammals worldwide every year [Envt Canada, MCS 2005]. One of the reasons given for why marine wildlife consume plastic bags is that they may mistake them for jellyfish, a main source of food for marine mammals. The consequence of this error is that the bags block the throat preventing normal feeding [Envt Canada, MCS 2005]. In 2004, the helpline run by Scottish Society for the Prevention of Cruelty to Animals (Scottish SPCA) received nine calls relating to animals that had become trapped in plastic bags, this is 0.01% of all calls taken. The Scottish SPCA note that the number of calls received will only represent a fraction of the actual number of wild animals who become entangled.

A survey undertaken in the Bay of Biscay during the early 1990s reported that plastic bags of all kinds, including lightweight plastic carrier bags that had been washed out to sea from land-based sources, accounted for 95% of all litter in sub-surface tows [Galgani].

Charting Progress - An Integrated Assessment of the State of UK Seas [Defra 2005] states:

“Marine litter can pose a hazard to beach users and recreational water users. Fish, seals, cetaceans and seabirds can become trapped (e.g. in sections of discarded fishing nets and plastic or rubber rings). They can also ingest plastic particles and objects, which can be fatal. Marine litter can also degrade the aesthetic quality of the environment, particularly in tourist areas.”

Clearly, this is not all due to plastic carrier bags as they make up only a proportion of this litter.

3.2 The Arguments Against a Levy

A number of organisations have lobbied against imposing taxes on plastic bags in many countries. These include the CBC in the UK, the Australian Retailers Association (ARA) and the Belgian Retail Association (BRA).

The Benefits of the Plastic Carrier Bag

The advantages highlighted by proponents of plastic carrier bags [ARA, CBC, EuroCommerce] include:

- Hygiene.
- Convenience.
- Reliability/efficacy/durability (paper bags often rip and are ‘double-bagged’).
- They can be reused for other purposes in and around the home, e.g.
 - as bin liners;
 - for storing shoes;
 - for collecting pet mess.
- Their disposal results in lower greenhouse gas emissions compared with disposal of bioerodable bags of paper, starch or plastic origin.
- There are lower environmental effects compared with paper bags in terms of production and transport as plastic bags use fewer resources, take up less volume and weigh less.

Hygiene is an important issue and, as is the case in Republic of Ireland, bags for wrapping fresh meat, fish, poultry and loose fruit would need to be excluded and remain free of charge because of their hygienic functional role¹⁰.

Negligible Impacts on the Waste Stream

Plastic films, which include carrier bags and other plastic packaging, make up 4.37% of the household waste stream on average¹¹ in Scotland [SEPA]. To put these figures in context, paper and card makes up almost 25% of the household waste stream by weight while putrescibles (e.g. waste food) nearly 32%. Furthermore, plastic bags alone constitute about 0.3% of the municipal waste stream in the UK [HM Treasury].

The amount of municipal solid waste (household and commercial waste) collected by local authorities across Scotland for disposal in 2002/03 was 2,589,702 tonnes¹². Using the UK data, 0.3% of the municipal waste stream by weight equals 7,769 tonnes per year of plastic bags. Any reduction in the amount of plastic bags disposed of would have very little effect on the overall waste disposal figures. Further analysis of the waste issues is provided in sections 4.6 and 5.2.

¹⁰ It is a statutory requirement under the Food Safety (General Food Hygiene) Regulations 1995 SI 1763 that meats are packed appropriately before supply to the customer.

¹¹ Range of 1.84–6.08% for 2002/03 [SEPA]

¹² Scottish local authorities collected a total of 3,345,458 tonnes of controlled waste (household, commercial and industrial) for disposal or recycling in 2002/03 [SEPA].

One of the aims of the EU Landfill Directive is to reduce the amount of biodegradable municipal waste going to landfill. The imposition of a levy that excluded paper bags is expected to increase the number of paper bags used and disposed. Although some would be recycled by consumers (e.g. through kerbside collections), there would ultimately be more paper bags going to landfill where they would degrade giving off greenhouse gases.

Single Trip or Multi-trip?

The Scottish Waste Awareness Group (SWAG) survey *Public Attitudes to Reduce, Reuse, Recycle in Scotland* (2001) stated that:

“The number of people engaging in this range of practices [reuse] was limited, the most commonly practised behaviour was the reuse of materials. This was achieved primarily through the reuse of plastic bags (84% of respondents), although the majority of these were ultimately used as bin liners”. [SWAG]

A Waste Watch study for the UK reported that 54% of people questioned said that they reuse plastic carrier bags, with secondary reuse as bin liners a typical example [Waste Watch]. This study states that:

“Recent research suggests that four out of five people reuse products. Plastic bags and glass jars or bottles are reused by around half the public and plastic containers or bottles by one in five.”

Both the SWAG and Waste Watch studies suggest that a proportion of respondents reuse lightweight plastic carrier bags, often as bin liners. If so, the majority of bags would only be reused once. It must also be made clear that, when the SWAG survey states that 84% of respondents reuse bags, this does not mean that 84% of bags are reused. What it means is that 84% of people reuse some of their carrier bags at some point; a similar logic applies to the results of the Waste Watch study.

A more recent study undertaken by the Waste and Resources Action Programme (WRAP) found that, of the 1,048 people interviewed, 59% said they reuse all their lightweight plastic bags with a further 16% saying they reuse most of them [WRAP 2005]. The main use by far was as a surrogate bin liner, though other uses were reported such as other shopping, collecting pet mess or carrying other things when going out.

Litter Culprits?

A Local Environmental Audit and Management System (LEAMS) report by Keep Scotland Beautiful (KSB) states that the main items of litter in Scotland are:

- Cigarette litter (cigarette ends, matches, matchboxes, cigarette packaging) found at 70% of sites inspected.
- Confectionary litter (sweet wrappers, chewing gum wrappers and crisp packets) found at 50% of the sites inspected.
- Drinks-related litter (cans, bottles, cups, straws and lids) found at 34% of sites.
- Fast food packaging litter (fish & chip wrappers, polystyrene cartons, burger wrappers, plastic cutlery) found at 10% of sites.

Even though those plastic carrier bags that are littered are visible and persistent in the environment, the report did not mention them specifically [KSB].

Windblown plastic litter in the environment is often from other plastic sources such as the agricultural wrappings for hay bales, etc. [CBC]. WRAP has commented that a reduction in plastic bags used would not result in a noticeable improvement in the overall litter situation [WRAP 2004a].

These results have been echoed elsewhere in the UK by ENCAMS¹³. Its surveys have also shown that the main littering problems in England are from smoking products, food and drinks containers (plastic and glass) and dog mess, with the most prominent commercial litter coming from elastic bands dropped by postmen [ENCAMS].

A further recent survey conducted in England, commissioned by the Industry Council for Packaging and the Environment (INCPEN) and carried out by ENCAMS collected 37 carrier bags out of a total of 58,041 items, which equates to 0.064% of all items of litter found [INCPEN-ENCAMS]. The chief culprits were confirmed as chewing gum and cigarette ends. The data show that lightweight plastic carrier bags are not major contributors to reported land litter in Scotland.

A Finite Resource

Plastic bags are made from a by-product of crude oil refining. Supporters of plastic bags would argue that they maximise the benefits from a finite resource, rather than flaring off the excess gases (including ethene) produced by the crude oil cracking process.

Behavioural Change?

Countries that have not introduced a levy have argued that it is people's littering behaviour which needs to be changed and that this will not necessarily come about from the imposition of a levy [ARA]. The Belgian Retail Association agrees; it believes that the main problem and cause of litter is not in the plastic bag per se, but the public's behaviour in simply discarding it rather than disposing of it properly. Education and awareness raising are seen as the key to the litter problem rather than levying the use of lightweight plastic carrier bags [EuroCommerce].

Job Losses

Those against the levy argue that it will lead to job losses in an industry that has successfully developed and optimised its product to provide an efficient and effective means of transporting goods from place of purchase to the home. This topic is discussed in more detail in Section 5.2.

¹³ The Keep Britain Tidy Group

3.3 The Voluntary Approach

The introduction of a levy at a UK level was reviewed and rejected in 2003. The Department for Environment, Food and Rural Affairs (Defra) has stated that “...we have no current plans for a plastic bag tax, but the Government keeps all taxation under review” [Defra 2003, Hansard 2004]. Various voluntary mechanisms are currently being investigated.

WRAP is working with the British Retail Consortium (BRC) on a ‘reusable bags’ project. The aim of this project is to achieve a united approach across retailers through the creation of a retail partnership. This will provide a high level exposure of ‘reusable bags’ to the consumer at most retail outlets. It is hoped that the ‘reusable bags’ concept can be presented more effectively to consumers, actively encouraging behavioural change in a self-sustaining way that will avoid the introduction of a levy. Actions under consideration include:

- In-store awareness promotions.
- High visibility of store ‘reusable bags’.
- Loyalty points for carrier bag reuse.
- Staff training in carrier bag advice.
- Checkouts without lightweight carrier bags.
- A pilot project in Edinburgh and Bristol in Autumn 2005.

In addition, BRC and the Scottish Retail Consortium (SRC) have formed a working group to look at the possibility of developing a voluntary code of conduct. They will be working with members and other key stakeholders including the CBC. The CBC has submitted a draft Voluntary Code on Best Environmental Practice for the Provision, Use and Disposal of Plastic Retail Carrier Bags for consideration by the working group. While the draft code is not yet available, the CBC note that the draft proposal outlines plans for:

- Encouraging industry and retailers to work together to find ways of further reducing energy, material and environmental impacts in the production, transportation and storage of plastic carrier bags.
- Active support and participation in waste reduction and reuse initiatives.
- Development of new schemes to promote recycling.
- A commitment for separate film collection for degradable bags.
- Development of a customer information campaign.
- An independently audited scheme to monitor, measure and report success.

The CBC strongly supports a voluntary approach for Scotland and the UK as a whole. It suggests that reusable bags should be offered, but that free, disposable lightweight plastic carrier bags should also be available so that consumers can make their own choice.

The imposition of a levy in Australia was considered and then postponed for two years (until the end of 2004) to see if the voluntary take-up of reusable bags and increased rates of recycling could reduce the number of lightweight plastic carrier bags by a target of 50%. A report from the Australian consultants Nolan-ITU published in March 2005 states that bag usage fell by 20.4% between 2002 and 2004 through the voluntary code of conduct agreed by retailers [Nolan-ITU].

This reduction is broken down into supermarkets reducing usage by 25% and non-supermarket retailers reducing usage by 10–15%. This result shows that a voluntary scheme can have a significant effect, given the support and time to get its message across. The Australian Government is determined to continue this trend to the extent of reducing use to 50% by the end of 2005 and ultimately phasing out plastic bag use completely by 2008 [Aus Govt].

3.4 Other Alternatives to a Levy for Reducing the Impacts of Plastic Bags

Degradable bags have been suggested as a possible solution. The issues surrounding their disposal, recycling and littering implications are discussed in Section 2.1.

Other ways of reducing usage include promoting the **reuse** of lightweight plastic bags, the purchase of thicker ‘bags for life’ or rigid boxes as well as recycling plastic bags (either within shops or by local authorities). These alternatives are all fully feasible and in operation, but have only had a small uptake so far.

Recycling is one option for polyethene plastics as a way of reducing their environmental burdens. This would be achieved through replacing raw materials (virgin polymer) with recycled polymer (see Dixons case study below), as well as reducing the (albeit very small) load on landfill at their end-of-life. Recycling of all plastic films – not just carrier bags – currently stands at 300,000 tonnes per year in the UK [CBC].

Dixons plc, in association with Nelson Packaging introduced the UK’s first **fully recycled carrier bag** in 2003 [Dixons]. Rather than being sent to landfill, waste plastic collected from commercial back-of-store and post-consumer in-store sources in the UK is used to make bags for Dixons. An independent LCA of these bags has been undertaken by Nottingham University. This estimates that every tonne of recycled bags produced saves around 1.8 tonnes of oil compared with a tonne of bags made from virgin material [Nottingham]. Dixons argues that using recycled material to produce plastic carrier bags not only reduces the environmental burden directly (through the use of less crude oil by-products and less waste being discarded), but it also educates the consumer to some extent.

Some retailers have adopted **voluntary charging**. Lidl currently charges 5p per bag in its UK stores. B&Q has piloted a scheme in its shops in Scotland at the same level, while IKEA charges 5p per lightweight plastic carrier bag at its Edinburgh store with good success (see Appendix 2 for more details). There is a similar story in Australia where European companies based there such as Aldi and IKEA already charge for their bags [RMIT], although this is a voluntary approach rather than mandatory. Consequently, some shoppers are already aware of, and accustomed to, the idea of paying for carrier bags for their goods.

Where incineration is the main disposal method in preference to landfilling, carrier bags offer high calorific values equal to or greater than that of oil. Hence, energy can be recovered from the bags and put back into the national electricity grid. This would reduce the need for conventional fossil fuels for power – again albeit by a small degree. However, there are currently only two energy-from-waste incinerators in Scotland [SEPA].

4 Life Cycle Assessment

A number of LCAs have been undertaken that compare the environmental impacts of the reusable, plastic, degradable and paper bags typically available in high street shops. The studies have been carried out in the USA, France and Australia (see Appendix 3 for a full list). No studies have been carried out based on data from Scotland or the UK.

We reviewed the studies and identified the French study (carried out by Ecobilan for the retailer Carrefour) as the most relevant to the situation in Scotland (the rationale used for this selection is presented in Appendix 3). We believe that the information available from this study is sufficient to provide a good indication of the likely life-cycle environmental impacts of changing plastic bag usage in Scotland. The Carrefour study (as it will be referred to in this report) is used in the following analysis.

4.1 Stages of the LCA for this Report

The analysis proceeds through the following stages:

1. Development of scenarios that will influence the numbers and types of bag used.
2. Quantification of the number of bags of each type (lightweight plastic, reusable plastic, paper, and bin liners) used under each scenario.
3. Review of the Carrefour study to extract the most relevant data for application in Scotland.
4. Sensitivity analysis – designed to test the robustness of base case results to plausible variations on the assumptions made.

4.2 Plastic Bag Levy Scenarios

Table 4.1 gives details of the five scenarios investigated for this study, including ‘business as usual’.

Table 4.1 Scenarios investigated for this study

Scenario	Summary	Description
0	Current situation	Business as usual
1A	As in the proposed Bill	Based on the introduction of a levy on all lightweight plastic carrier bags including degradable plastic bags, but NOT paper bags. It includes all distribution points: shops, petrol stations, charity shops, on-street promotional give-aways, etc.
1B	As in the proposed Bill, but excluding small-to-medium enterprises (SMEs), charities and promotions	Recognises the logistical problems of collecting a levy from all retail outlets. It assesses the extent of the environmental gain for the anticipated large-scale additional effort. The idea is to focus on the larger companies that use the greatest amount of bags and have the resources to enable them to comply more readily with a levy.
2A	As in the proposed Bill + paper bags	Based on applying the levy to all lightweight carrier bags including plastic, degradable plastic and paper. Includes all distribution points: shops, petrol stations, charity shops, on-street promotional give-aways, etc. Recognises that the levy is aiming to achieve behavioural change and encourage the use of re-usable bags and not simply a switch to, for example, paper bags.
2B	As in the proposed Bill + paper bags but excluding SMEs, charities and promotions	This scenario is the same as scenario 2A, but excludes SMEs, charities and promotions. Like scenario 1B, it looks at the extent of the environmental benefits without the logistical problems of trying to police and enforce the levy across the board.

4.3 Consumption Data Used to Quantify Environmental Impacts

To understand plastic bag consumption, we used published data to produce consumption figures for the different scenarios in conjunction with data on the impacts on consumers (see Section 5). These figures were derived as follows.

Existing Lightweight Carrier Bag Usage

- A Defra report stated that 8 billion plastic bags were used in the UK in 2000 [Defra 2003].
- Other sources [BBC, WRAP 2005] put this figure at 10 billion per year, from which it has been stated that Scotland's consumption is 1 billion plastic carrier bags per year [Pringle]. This estimate presumes an approximate factor of 10%.
- There are no actual figures available for the consumption of plastic bags in Scotland. Therefore, we used population statistics [Stats Scot, Stats UK] to scale UK bag

consumption data to Scotland. Population statistics show that 8.6% of the UK's population lives in Scotland.

- Average annual lightweight plastic carrier bag use in Scotland is estimated at 775 million¹⁴.
- In consultation with the BRC and its members, it was agreed that reusable bag consumption ('bags for life') constitutes an additional 1%¹⁵.
- There were no statistics available on the level of consumption of paper bags¹⁶. We estimated that paper bag consumption is about 5% of all plastic carrier bag consumption¹⁷.

Consumer Behaviour

In essence, the success of the levy will depend upon consumers' wish to avoid paying the levy and the consequent reduction in the use of plastic carrier bags. If fewer people pay the levy, less revenue will be generated.

If a levy is introduced and does not include paper bags, it is anticipated that there will be an increased take-up of paper bags as well as 'bags for life'. Our estimate of the take-up of alternative carrier bag options is based on 'assumed percentage reductions' as used in Australian [DEH] and South African [FRIDGE] studies.

Our interpretation of consumer behaviour is based on the following assumptions:

- A levy would be charged at £0.10 per bag on lightweight plastic or paper carrier bags. This would lead to a 90% reduction in demand for each type of carrier bag, based on the experience in the Republic of Ireland.
- Under scenarios 1A and 1B (in which paper bags are not subject to the levy), it is assumed that of consumers not purchasing a lightweight plastic carrier bag:
 - 30% will not require any type of carrier bag ('no bag');
 - 45% will switch to heavyweight plastic carrier bags (or similar);
 - 25% will switch to paper carrier bags¹⁸.
- Under scenarios 2A and 2B (which include paper bags in the levy base), it is assumed that of consumers not purchasing a lightweight plastic bag:
 - 42.5% of consumers will not require any type of carrier bag;
 - 57.5% of consumers will switch to heavyweight carrier bags (or similar)¹⁹.

¹⁴ Calculated using population scaling on the upper and lower UK bag consumption figures: 8.6% of 8 billion equals 690 million bags, while 8.6% of 10 billion equals 860 million. The average of these two numbers is 775 million.

¹⁵ Waitrose quoted as 1–2%; J Sainsbury's at 0.3%.

¹⁶ Paper bags are normally used in the non-food retail sector for clothing, shoes, etc.

¹⁷ From consultation with BRC.

¹⁸ It is assumed that 30% of the total reduction in the use of lightweight plastic and paper carrier bags is transferred to 'no bag', as adopted for a 15 cent levy in the Australian report [DEH]. The remaining 70% reduction is assumed to be split between paper carrier bags and heavyweight plastic carrier bags. Using information from the UK Expenditure and Food Survey 2002/03 [ONS], we calculated expenditure likely to require a carrier bag and then split it according to (a) those retail categories (e.g. footwear, clothing, etc.) thought most likely to accommodate a switch to paper carrier bags (as seen in the Republic of Ireland) and (b) those retail categories (e.g. food, beverages, etc.) most likely to accommodate a switch to heavyweight plastic carrier bags. On this basis, 36% of total household expenditure is sourced from (a) and 64% from (b). It has therefore been assumed that 25% is transferred to paper carrier bags (i.e. $36\% \times 70\% = 25\%$) and 45% is transferred to heavyweight plastic carrier bags (i.e. $64\% \times 70\% = 45\%$).

- Under scenarios 2A and 2B, the estimated reduction in paper bags is assumed to result in a 70% switch to heavyweight carrier bags (or similar).
- It has been assumed that a typical heavyweight carrier bag is used 20 times before replacement²⁰. Therefore, the 45% of consumers who choose to switch to a heavyweight carrier bag will purchase five such bags in place of 100 lightweight carrier bags. This gives a 1/20th ratio for calculating the numbers of heavyweight carrier bags used under the levy scenarios.
- Spending at SMEs has been assumed to account for 30% of total household expenditure²¹. In order to exclude SMEs from being subject to the levy, we have simply reduced total expenditure by households on items likely to involve the acquisition of a carrier bag (of any type) by 30%.

Bin Liner Consumption

- We included bin liner consumption to account for the displacement effect of people switching to or using additional purpose-made bin liners instead of carrier bags in the event of a levy.
- As no UK or Scotland specific data were available for current bin liner use, Irish data were used and scaled for Scotland along population ratios. An Australian study [DEH] reports a 77% increase bin liner consumption in the Republic of Ireland, from around 91 million to 161 million, following the introduction of the PlasTax. We have assumed a similar 77% increase in bin liner use for Scotland, i.e. from 118 million/year currently to 208 million/year post-levy²².
- We have not included black refuse sacks and disposable nappy sacks as information on the relevant sales volumes was not available. In addition, there were no statistics available for bags made of polypropylene in Scotland. Although retailers felt that a levy would instigate an increase in sales of kitchen swing bin liners, they did not feel that it would alter their sales of black refuse sacks to any great extent [Nolan-ITU Pty Ltd, personal communication].

We combined the assumptions and data discussed above to give the annual bag and bin liner consumption shown in Table 4.2 for the different scenarios.

¹⁹ It is assumed that, of those consumers who transferred to paper bags under Scenarios 1A and 1B, half now transfer to heavyweight plastic bags and half transfer to 'no bag'. We made this assumption because no other suitable evidence was available. Thus, the total proportion of the reduction in lightweight carrier bags now transferred to heavyweight bags is equal to 57.5% (i.e. 45% + (50% × 25%)).

²⁰ Taken from the Carrefour study [Carrefour].

²¹ This is based on share of turnover in SIC(92)52, i.e. the retail trade with less than 250 employees, as determined by the Institute of Retail Studies, University of Stirling. Hence, in scenarios 1B and 2B, the levy is assumed to apply to 70% of the retail base in scenarios 1A and 2A. By adjusting the retail base in this fashion, it has been assumed that a £1 expenditure equals a £1 turnover and that the number of bags issued per £ expenditure at a SME equals the number of bags issued per £ expenditure at a non-SME. This is a crude assumption, but necessary without any data available.

²² Scaled for population [CSO.ie2005, Stats Scot]

Table 4.2 Estimated annual carrier bag consumption under the different scenarios²³

	Total number of bags consumed under each scenario (millions/year)²⁴				
	0	1A	1B	2A	2B
Plastic carrier bag (HDPE, lightweight)	775	78	287	78	287
Plastic reusable bag (LDPE, heavyweight)	8	23	19	29	23
Paper bag (single use)	39	213	161	4	14
Total bags used	822	314	467	111	324
<i>Bin liners</i>	<i>118</i>	<i>208</i>	<i>181</i>	<i>208</i>	<i>181</i>

It is predicted that:

- Under scenarios 1A and 2B, there would be a drop in lightweight plastic carrier bag usage of 697 million/year.
- This decrease would not be so profound if SMEs were excluded (scenarios 1B and 2B) when it would be 488 million/year.
- If paper bags were not included in the levy, there would be annual increases of 174 million paper bags under scenario 1A and 122 million bags under Scenario 1B.
- ‘Bags for life’ would only increase by 11–21 million/year due to them being reused 20 times.
- Bin liner consumption would increase by 90 million/year if SMEs were included in the levy (scenarios 1A and 2A), or 63 million/year if not (scenarios 1B and 2B).

We combined these data on bag consumption with information on the life-cycle environmental impacts of different types of bags to determine the relative environmental impacts of each scenario in Scotland (Sections 4.5–4.7).

4.4 Relevant Results from the Carrefour LCA

The assumptions and scope of the Carrefour analysis are summarised in Appendix 3.

The Carrefour study considered four types of carrier bag:

- HDPE bags made from virgin polymer (lightweight plastic carrier bags).
- Reusable LDPE bags made from virgin polymer (‘bags for life’).
- Paper bags made from recycled fibres.
- Biodegradable starch-based bags.

²³ Numbers calculated as described in Section 4.3.

²⁴ Example calculations. For lightweight carrier bags under scenario 1B: $(30\% \times 775) + (70\% \times 10\% \times 775) = 287$. For heavyweight carrier bags under scenario 2A: $8 + [(775 - 78) \times 58\% \times 5\%] + [(39 - 4) \times 70\% \times 5\%] = 29$

We have not considered biodegradable starch-based bags in the analysis of the Scottish situation because they are not thought to be used in any great numbers. Numbers for plastic bioerodable bags (made from HDPE polymer with trace degradant additives) are used at a few outlets, but considerably more conventional HDPE bags are used. We have assumed that the environmental life-cycle impacts of bioerodable bags are comparable to conventional plastic bags as they are both made from HDPE, albeit with a small addition of degradation-promoting compounds. The consumption of bioerodable bags is included within the consumption of lightweight plastic bags.

The Carrefour study examined energy, resource use and pollutant emissions over the whole lifecycle of the bags, i.e. it included production of the raw materials, manufacture of the bags, transport of the bags to the retailer, and disposal at the bags' end-of-life. For plastic bags, for example, the lifecycle begins with extraction and refining of oil and the production of plastic, pigments ink and glue.

In the Carrefour study, the lightweight plastic bags are manufactured in Malaysia, Spain and France, and the heavyweight 'bags for life' are manufactured in France. Paper bags made from recycled paper are produced in Italy for Carrefour. It has been assumed that the bags are produced from old newspapers/magazines.

The Carrefour study examined both incineration and landfilling of bags at the end of their life. For the base case, we selected data that reflect landfilling of the bags as a large proportion of all waste is sent to landfill in Scotland²⁵. However, we have also performed a sensitivity analysis that considers an alternative waste management strategy (see below).

The Carrefour study assessed the environmental impact of the energy use, resource use, waste generation and pollutant emissions from the lifecycle of each type of bag by examining their contribution to eight environmental indicators (see Appendix 3). Table 4.3 shows the environmental indicator score for each of the different types of bags, relative to the lightweight plastic bag, for the base case with all material sent to landfill at the end of the lifecycle.

The lightweight plastic bag has been given a score of 1 in all categories as a reference point. A score greater than 1 indicates that another bag ('bag for life' or paper) makes more contribution to the environmental problem than a lightweight plastic bag when normalised against the volume of shopping carried. A score of less than 1 indicates that it makes less of a contribution, i.e. it has less environmental impact than a lightweight plastic bag.

The indicators take account of emissions which occur over the whole lifecycle. They can therefore occur in different locations depending on where different parts of the lifecycle are located. For global environmental problems such as climate change, the location of the emission is not important in assessing the potential environmental impact. For other regional or local environmental impacts, however, it can be significant. For example, the impact of eutrophication of a water body will depend on the water characteristics. This is a well-known limitation of lifecycle impact assessment methodology: LCA quantifies the potential risk of environmental damage rather than actual harm.

²⁵ 88.2% was landfilled in 2002/03. Only 2.2% was incinerated, 5.9% was recycled, 2% was composted and the remaining 1.7% was treated by other means [SEPA].

Table 4.3 Environmental impacts of different types of carrier bag relative to a lightweight plastic carrier bag²⁶

Indicator of environmental impact	HDPE bag (lightweight)	Reusable LDPE bag (used 2x)	Reusable LDPE bag (used 4x)	Reusable LDPE bag (used 20x)	Paper bag (single use)
Consumption of non-renewable primary energy	1.0	1.4	0.7	0.1	1.1
Consumption of water	1.0	1.3	0.6	0.1	4.0
Climate change (emission of greenhouse gases)	1.0	1.3	0.6	0.1	3.3
Acid rain (atmospheric acidification)	1.0	1.5	0.7	0.1	1.9
Air quality (ground level ozone formation)	1.0	0.7	0.3	0.1	1.3
Eutrophication of water bodies	1.0	1.4	0.7	0.1	14.0
Solid waste production	1.0	1.4	0.7	0.1	2.7
Risk of litter ²⁷	1.0	0.4	0.4	0.4	0.2

There are two key stages in the overall production process as laid out in the LCA:

- i) Winning the raw materials from nature (e.g. drilling for and then refining crude oil) and converting them into commodities (e.g. polyethene granules).
- ii) Manufacturing the bags themselves from these commodities.

The Carrefour study concluded that, for all bags, the main environmental impacts come from the first of these stages, i.e. the extraction and production of the materials (polyethene and paper) that are then used to make bags. The second stage (i.e. the manufacture of the bags themselves) is generally of less importance though not negligible. The study found that transport contributed very little to the environmental impacts. The end-of-life phase also makes a significant contribution to some indicators – most notably, the production of solid waste.

The overall conclusion from the Carrefour study was that reusable plastic bags (so-called ‘bags for life’) are more sustainable than all types of lightweight carrier bags (plastic, paper, or degradable) if used four times or more (columns 4 and 5 in Table 4.3), offering the greatest environmental benefits over the full lifecycle of any bags used.

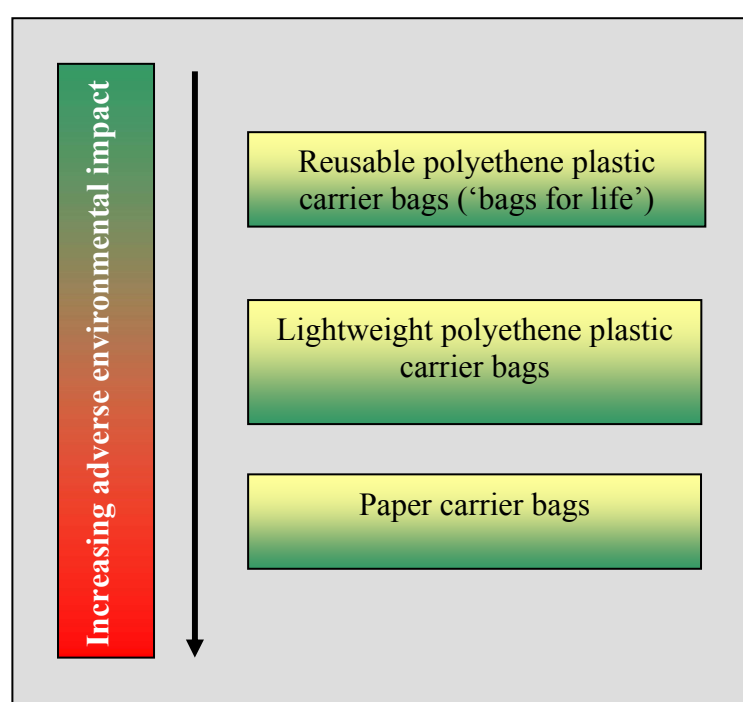
²⁶ From Table 18 in the Carrefour study. Numbers *greater* than one indicate a *greater* environmental impact compared with lightweight plastic carrier bags and numbers *less* than one indicate a *lesser* environmental impact.

²⁷ The Carrefour study used the terms ‘strong’, ‘medium–weak’ and ‘weak’ to describe the risk of littering for each of the bags. We interpreted these terms numerically as 1.0, 0.4 and 0.2, respectively, in order to be able to show graphically how the risk of littering may change under the different levy scenarios.

Figure 4.1 summarises these findings. Paper carrier bags have a bigger environmental impact than lightweight plastic bags in all categories apart from risk of litter. Paper bags have a particularly high impact on the environment in terms of²⁸:

- Eutrophication of water bodies (rivers, lakes, etc.) due to pollutants released to water during the manufacture of the paper.
- Water consumption.
- Greenhouse gas emissions
- Production of solid waste.

Figure 4.1 Summary of the environmental impacts of different carrier bags from the Carrefour LCA



²⁸ As noted in Appendix 3, the scores against these environmental indicators reflect potential risk than actual harm. Some indicators such as eutrophication are very site-specific in terms of actual impact, depending on the level of wastewater treatment employed and the state of the receiving environment. Others (e.g. climate change impacts from greenhouse gas emissions) are not site-specific.

4.5 Applying the Results to Scotland

We used data from Table 4.2 on plastic bag and bin liner consumption in conjunction with the relative environmental impact scores in Table 4.3 to assess the relative environmental impacts of the four levy scenarios compared with the current situation (scenario 0, ‘business as usual’). We used the assumption from the Carrefour study that a reusable bag is reused 20 times²⁹.

To allow an assessment of the predicted change in bin liner consumption, it was assumed that the lifecycle impact of manufacturing bin liners is the same as for HDPE carrier bags per unit weight³⁰. This is an approximation, which may overestimate the environmental impact of bin liners, and hence underestimate the benefits of the four levy scenarios. More details about the calculations are given in Appendix 3.

The results of the base case comparison are shown in Figure 4.2. The base case applies the results from the Carrefour study (Table 4.3) directly to the bag use data in Table 4.2. This implicitly accepts the use of French data on bag weights and volumes. The results give the percentage change in the environmental impact score for each of the levy scenarios compared with the current situation (scenario 0). In all scenarios where the levy is applied, consumption of non-renewable energy, atmospheric acidification, the formation of ground level ozone and the risk of litter fall considerably compared with the current situation.

In scenarios 1A and 1B where paper bags are exempt from the levy, the impacts are greater than the current situation for the consumption of water and eutrophication. However, they are approximately equivalent for the emission of greenhouse gases and the production of solid waste. This is due to a trade-off between the impacts from the additional paper bags consumed and the environmental benefits from the reduction in the use of lightweight plastic bags. The overall environmental impact from scenarios 1A and 1B is therefore predicted to remain very similar to today’s situation. This is because the benefits of reducing plastic carrier bag use are displaced by the increased use of paper bags.

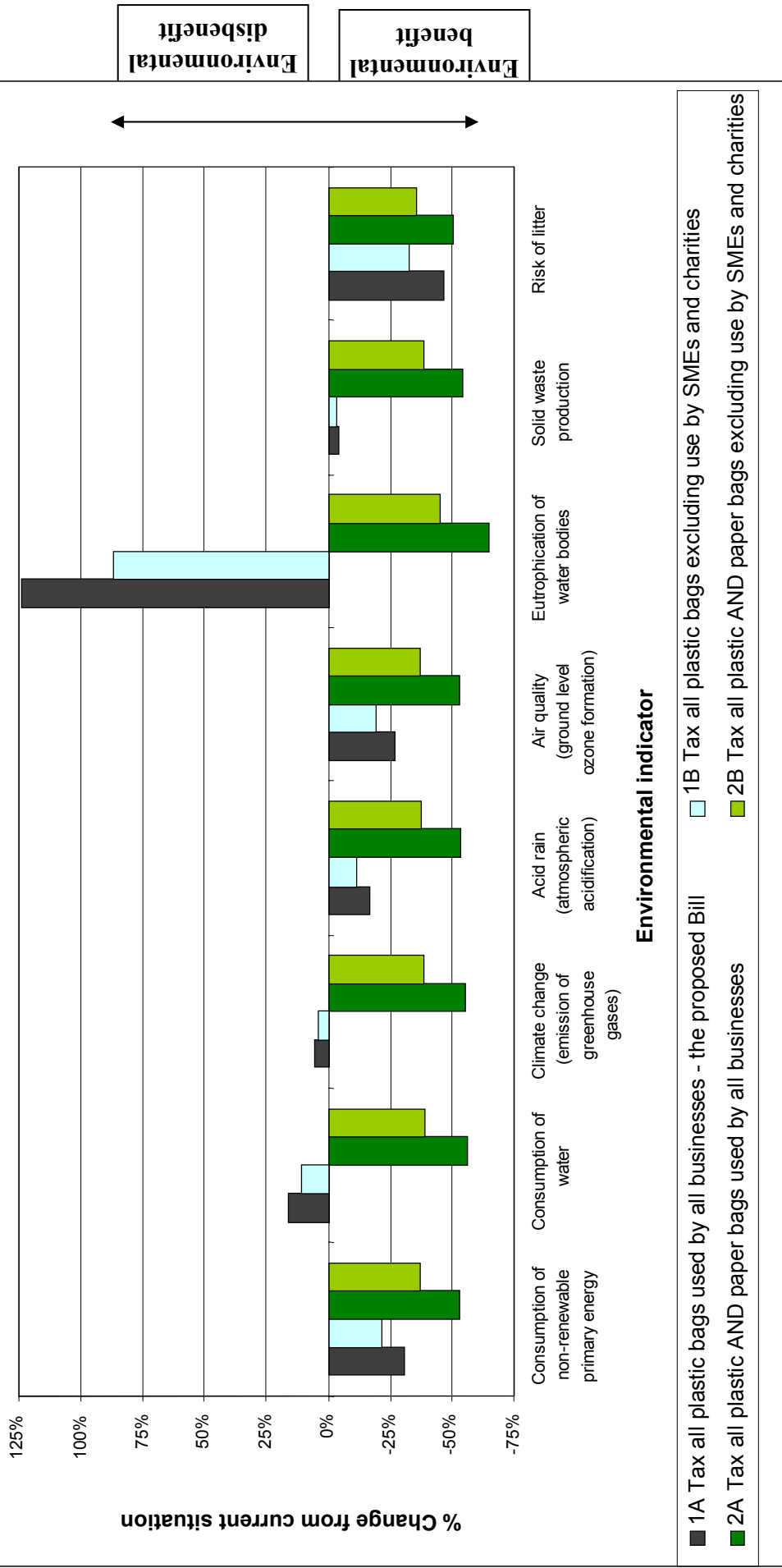
It is only in scenarios 2A and 2B, where the levy is applied to paper as well as plastic carrier bags, that consumption of water, emission of greenhouse gases, eutrophication of water bodies and production of solid waste are significantly reduced. This is because paper bags have a high score in these environmental categories relative to plastic bags (see Table 4.3 and Table A3.1 in Appendix 3).

In all cases, the environmental benefits increase (and environmental impacts reduce) when SMEs are included in the levy.

²⁹ For comparison, the Australian study assumed that reusable ‘bags for life’ are reused around 52 times before being recycled, i.e. once a week in a given year [Nolan-ITU].

³⁰ On average, bin liners weigh 15g each and lightweight plastic carrier bags 8g each. Thus, the environmental impacts of a bin liner were assumed to be 1.9 (=15/8) times greater than a lightweight plastic bag, giving an approximate ratio of 2:1. We have used this ratio throughout our analysis.

Figure 4.2 Change in environmental indicators due to a levy



Key assumptions: In scenarios 1A and 1B, there is a 25% switch from lightweight plastic bags to paper bags. In scenarios 2A and 2B, there is a 90% reduction in paper bag use.

These environmental effects will occur at different locations around the globe depending on where the raw materials are derived, where the bags are manufactured and how far they have to travel. The bulk of plastic bags for the Scottish market are made in the Far East and imported, whereas Scotland has a considerable paper bag manufacturing sector. Furthermore, some of the effects (e.g. ground level ozone formation) are more localised and some are regional (e.g. the consumption of water and emission of acidic gases), while others such as climate change resulting from fossil fuel combustion are global problems.

While we believe these broad messages about relative environmental impacts are applicable to the Scottish situation, there are differences between France and Scotland that mean that specific environmental impacts will differ. This is due to inherent France-specific assumptions in the original LCA work such as the characteristics and usage of bags, and to differences in the environmental impacts of manufacturing and waste disposal in the two countries. In particular, we note the following differences between the assumptions made in the French LCA and the situation in Scotland:

- The Carrefour study assumed that plastic bags weigh 6g as opposed to 8g in Scotland.
- The French study states that the paper checkout bags used by Carrefour weigh 52g. Paper checkout bags³¹ in Scotland weigh 51g [CBC]. In the LCA base case, the Carrefour value was taken as representative for Scotland as it was assumed that checkout bags would be more affected by a levy, in terms of numbers and nationwide coverage, than boutique paper carriers with handles. In the sensitivity analyses (see below), the test used the average weight of 99g for all types of paper bags.³²
- The Carrefour study assumed that a plastic bag has a volume of only 14 litres while a paper bag has a volume of 20.5 litres. This means fewer paper bags are required for the same amount of shopping. For Scotland, however, we would expect no significant difference on average in the volume of shopping carried in the two types of bag. One reason for this is the tendency for ‘double bagging’, where customers use two paper bags instead of one because they are concerned that a single paper bag may rip open.
- The Carrefour study takes for its base case an average waste management scenario for France, i.e. 45% of paper bags being recycled, 25% being incinerated and 26% landfilled. For the base case in this study, we used one of the Carrefour sensitivity analyses in which all waste is sent to landfill; this is much closer to the current Scottish position where 88% of waste is landfilled³³ [SEPA].

³¹ Information provided by the CBC showed that there are three kinds of paper bags in general used in Scotland, depending on size and whether they have handles or not. These weigh 51g (checkout bag, no handles), 81g (carrier bag with handles) and 166g (carrier bag with handles). The arithmetic mean of these is 99g.

³² This analysis suggests some potential for an increase in solid waste generation for scenarios that favour a switch to paper bags. This is due to different assumptions about the relative weight of plastic and paper bags, and the fact that the LCA looks at solid waste impacts throughout the bag life cycle rather than just the end-of-life disposal phase.

³³ Most recent published data (2002/03).

Various sensitivity analyses are presented in Appendix 3 to demonstrate the robustness of results against these factors. These analyses are:

- Sensitivity analysis 1: Assume paper bags weigh 99g instead of 52g.
- Sensitivity analysis 2: Assume on average that paper and plastic bags are used to carry the same volume of shopping.
- Sensitivity analysis 3: Assume lightweight plastic bags weigh 8g instead of 6g.
- Sensitivity analysis 4: Combined effects of sensitivity analyses 2 and 3.
- Sensitivity analysis 5: Assume the same split across recycling, incineration and landfill as in France.

The main results of the sensitivity analyses are:

- Repeating the analysis using a higher bag weight or ‘effective’ volume of paper bags led to a significant worsening in the performance of scenarios 1A and 1B for all categories except for ‘risk of litter’. The categories of solid waste generation and acid rain, for which a small benefit was originally recorded under the base LCA (Carrefour, 100% of end-of-life bags landfilled), became a disbenefit (to a lesser extent for acid rain). The effect on solid waste generation is driven by the greater weight of paper bags compared with plastic bags (this feeds directly through to waste generation at the end of the lifecycle) and by the waste produced during paper production.
- Such effects are counteracted to a large degree by the assumption that lightweight plastic bags in Scotland are 8g compared to 6g in France.
- The assumptions on alternative waste management strategies (sensitivity analysis 5) have little effect on the results.
- The results for scenarios 1A and 1B are affected significantly by the sensitivities explored. This is as a result of encouraging people to switch from plastic bags to paper. Whereas, the results for scenarios 2A and 2B, where paper bags are also subject to the levy, show little change. In all cases studied and for all environmental indicators, scenarios 2A and 2B improved on the business as usual case by between 30% and 70%. The most restrictive scenario (2A, where all outlets including SMEs and charities are subject to the levy) shows a uniform improvement over scenario 2B of around 16% relative to business as usual.

It is important to recognise that the scores from the LCA represent *potential risk* and not actual environmental damage. Quantification of actual damage would require an impact pathway assessment that traces emissions from source to exposure to the quantification of impacts from specific industrial and waste management facilities. Such analysis is outside the scope of this report. It is noted, however, that some categories of effect are much more site-sensitive than others. For example, eutrophication of water bodies is only a problem where effluents are discharged untreated to a nutrient-sensitive water body. Climate change impacts, in contrast, are not sensitive to the site of the greenhouse gas release.

4.6 Displacement of Plastics in Scotland

In this section, we calculate the changes in tonnages of materials consumed in the scenarios based on the bag numbers data from Table 4.2 and the unit weights³⁴ for bags given in Table 4.4.

Table 4.4 Unit bag weights used in this study

	Weight (grams per unit)
Lightweight plastic carrier bags	8
Paper bags	51
Heavyweight plastic carrier bags	47
Bin liners	15

Table 4.5 shows the estimated changes in the weight of carrier bags (tonnes) used across Scotland in scenario 1A compared with the current pre-levy situation (scenario 0). Note that paper bags are not subject to the levy in scenario 1A.

Table 4.5 Change in annual consumption of materials for scenario 1A*

Bag	Pre-levy consumption (tonnes)	Expected post-levy consumption (tonnes)	Expected absolute change³⁵ (tonnes)	Expected % change
Lightweight plastic carrier bags	6,200	620	-5,580	-90%
Heavyweight plastic bags; 'bags for life'	364	1,102	+738	+203%
Bin liners	1,764	3,122	+1,358	+77%
Total for polyethene	8,328	4,844	-3,484	-42%
Total for paper	1,976	10,869	+8,893	+450%

* Numbers have been rounded so may not add up exactly. Negative numbers mean less material used and positive numbers mean more material is used.

For Scotland, there would be a saving of 5,580 tonnes of polyethene from 90% fewer lightweight plastic carrier bags being used. This has to be balanced, however, against the increase in 'bags for life' and bin liners – a total of 2,096 tonnes. Taken together, these data show an estimated net decrease of 3,484 tonnes of polyethene consumed per year in Scotland. Paper bag usage would increase under this scenario by 8,893 tonnes per year.

The summary information for all four levy scenarios is summarised in Table 4.6.

³⁴ Data from CBC and SRC. For paper bags the checkout bag weighing 51g was used for consistency with the LCA base case. If the average weight of 99g, see footnote 31, was used then the waste implications would be greater.

³⁵ As stated earlier, data on black refuse sacks and disposable nappy sacks were not available. **If these figures were included, the net decrease in resource consumption would be less.**

Table 4.6 Change in annual consumption of materials for all four levy scenarios across Scotland

	1A: Proposed levy	1B: Proposed levy excluding SMEs	2A: Proposed levy + paper bags	2B: Proposed levy + paper bags excluding SMEs
Decrease in polyethene consumption (tonnes)*	-3,484	-2,439	-3,214	-2,250
Change in paper consumption (tonnes)*	+8,893	+6,225	-1,779	-1,245
Net change (tonnes)	+5,409	+3,786	-4,993	-3,495

* Does not account for black refuse sacks or nappy bags.

In summary, it is predicted that polyethene amounts would reduce across all four levy scenarios, but that paper amounts would increase in scenarios 1A and 1B and decrease in scenarios 2A and 2B.

If paper carrier bags are not subject to the levy (as in scenarios 1A and 1B), the total tonnage of carrier bags used actually increases. This is because shoppers will switch from the relatively lighter plastic carrier bags to the much heavier paper carriers. Where paper is included in the levy, both show a decrease in the overall tonnage of waste material (paper and plastic) needing disposal. Scenario 2A, where paper and all businesses are levied, shows the best overall reductions (4,993 tonnes) relative to the situation today. Scenario 1A performs worst – waste actually increases by 5,409 tonnes per year.

4.7 Conclusions on Lifecycle Impacts

This study has used an existing published lifecycle study from France to gain an indication of the relative lifecycle environmental impacts of different types of bag. This has then been combined with estimates of changes in bag use under four levy scenarios to examine the resulting changes in environmental impacts from bag usage.

Using the Carrefour study introduces an element of uncertainty into the results owing to national differences between Scotland and France affecting the lifecycle, i.e. the way in which electricity is generated, the amount of transport required and final disposal methods.

However, based on the results of our various sensitivity analyses, we believe the pattern of environmental impacts described in the Carrefour study will be similar to those in Scotland. It is our view that the results described above are sufficiently relevant to Scotland to serve as a useful guide to decision-making on policies concerning carrier bags. However, for the reasons presented above, the findings in this report cannot be used for a precise quantification of environmental impacts. This would require a full lifecycle analysis based on the Scottish situation, which is outside the scope of this study.

The main conclusions from our analysis are:

- The analysis shows that there would be an environmental benefit for some of the indicators depending on what consumers choose to use were a levy to be introduced.
- More specifically, the biggest environmental improvement is seen in scenarios 2A and 2B where paper bags are included in the levy. These occur for all environmental indicators
- In scenarios where paper bags are excluded, the environmental benefits of reduced plastic bag usage are negated for some indicators by the impacts of increased paper bag usage. This is because a paper bag has a more adverse impact than a plastic bag for most of the environmental issues considered. Areas where paper bags score particularly badly include water consumption, atmospheric acidification (which can have effects on human health, sensitive ecosystems, forest decline and acidification of lakes) and eutrophication of water bodies (which can lead to growth of algae and depletion of oxygen).
- Heavyweight, reusable plastic bags (the so-called ‘bags for life’) are more sustainable than all types of lightweight plastic carrier bags **if used four times or more**. They give the greatest environmental benefits over the full lifecycle.
- Paper bags are anywhere between six to ten times heavier than lightweight plastic carrier bags and, as such, require more transport and its associated costs. They would also take up more room in a landfill if they were not recycled.
- The analysis demonstrates that SMEs and paper bags should be included to maximise the potential environmental benefit of the levy. The inclusion of paper bags in the levy makes a greater contribution to maximising environmental benefits than inclusion of SMEs.

5 Impacts on Consumers and Business

Our base assumptions (i.e. scenario 0) are as shown in Table 5.1 and stated below.

Table 5.1 Bag consumption by type in Scotland

Bag type	Annual consumption (millions)	Per capita consumption
Plastic carrier	775	153
Paper	38.75	8
Multi-use	7.75	2
Total	821.5	163

- The population of Scotland is taken as 5,062,011 (from the 2001 census) and the grossed number of households as 2.14 million. This is 2.33 people per household.
- The UK Expenditure and Food Survey 2002/03 [ONS] states that total weekly expenditure in Scotland averaged £365 per household. Of this figure, approximately £110 per week is spent on goods that are likely to be sold with the option of acquiring a carrier bag³⁶.
- It has been assumed that a £ spent by lower income households requires the same number of bags for purchases as a £ spent by higher income households³⁷.
- The two largest sources of carrier bags are ‘food’ and ‘clothing’ retailers, followed by ‘catering services’ (e.g. takeaway).
- Current consumption of bin liners is around 118 million per year.

5.1 Determining the Financial Burden on Consumers

We made the following assumptions concerning unit costs:

- A levy would be set at £0.10 on each bag. We derived the amount that would be paid from this value and the numbers of bags used as given in Table 4.2. We have accounted for the fact that, under scenarios 1B and 2B, SMEs are not included in the levy base.
- Consumers are currently not charged for carrier bags³⁸. This cost element to retailers (which includes the purchase, transport and storage costs of the bags) is known as the ‘hidden’ cost and is accounted for. It is passed on to the consumer, embedded within the price of goods.

³⁶ We assessed the categories within the survey and made a judgement on whether a carrier bag might be required for purchases, e.g. insurance and holidays would not, but household goods and hardware would.

³⁷ In reality it is more likely that a £ spent by a lower income household buys more goods and this requires more bags than a £ spent by higher income households, since the price paid per unit by the latter will be higher. Sufficiently detailed data were not available however to accommodate this complexity.

³⁸ Except in some stores such as B&Q and Lidl (see Appendix 2).

- The ‘hidden’ cost of lightweight plastic carrier bags to the retailer is £7.51 per 1,000 bags³⁹.
- The ‘hidden’ cost of paper carrier bags to the retailer is £163.69 per 1,000 bags⁴⁰.
- Heavyweight plastic carrier bags (or similar) are assumed to sell for £0.65 per bag⁴¹.
- A bin liner is assumed to cost £0.05 per liner. This is the unit price averaged over ten products sold by Tesco.
- For scenarios 1A and 1B, it has been assumed that the additional ‘hidden’ costs incurred by stores are passed on to consumers as they increase due to additional purchase, transport and storage of paper carrier bags.
- Spending at SMEs has been assumed to account for 30% of total household expenditure⁴². In order to exclude SMEs from being subject to the levy, we have simply reduced total expenditure by households on items likely to involve the acquisition of a carrier bag (of any type) by 30%.

The total additional financial burden incurred by Scottish consumers as a result of the levy is therefore made up of the elements shown in Equation 5.1.

Equation 5.1 Financial burden to consumers

Total additional financial burden of levy
=
Payment of the levy on each levyable plastic carrier bag consumed post-levy
+
‘Hidden’ cost of carrier bags
+
Cost of buying additional heavy use carrier bags (or similar)
+
Cost of buying additional bin liners (or similar)
+
Payment of net additional VAT⁴³

³⁹ Derived from data provided by the CBC and survey data reported by researchers from University College Dublin [UCD]. The average cost of lightweight carrier bags to the retailer is £7.47 per 1,000 excluding storage and transport [CBC].

⁴⁰ Derived from data provided by the CBC and survey data reported by researchers from UCD. The average cost of paper bags to the retailer is £163.33 per 1,000 [CBC]. The switch to paper bags is largely assumed to be by the clothing and shoe retailers.

⁴¹ It is recognised that shoppers will have a wide range of options with an equally wide range of unit costs (e.g. currently from £0.10 for a ‘bag for life’ to £2.00 for an unbleached cotton carrier bag purchased privately). CBC suggested a range from 65p to £1.50; we used the lower figure. In addition, only those bags sold for more than €0.70 (approximately £0.48) are excluded from the levy in Republic of Ireland.

⁴² Based on share of turnover in SIC(92) 52 retail trade with less than 250 employees determined by the Institute of Retail Studies, University of Stirling. Hence, in scenarios 1B and 2B, the levy is assumed to apply to 70% of the tax base in scenarios 1A and 2A. By adjusting the tax base in this fashion, it has been assumed that: a £ expenditure = a £ turnover and the number of bags issued per £ expenditure at a SME = the number of bags issued per £ expenditure at a non-SME. This is a crude assumption, but necessary without any data to the contrary.

⁴³ HM Revenue and Customs levy VAT on environmental taxes such as the climate change levy, the aggregates levy, the landfill tax and the oil duties. It is expected that the proposed carrier bags levy would likewise be subject to VAT.

We calculated the total additional financial burden to consumers for the four levy scenarios using:

- Equation 5.1.
- Bag use data under the scenarios from Table 4.2.
- The assumptions outlined above.

Table 5.2 shows how the numbers were derived for scenario 1A.

Table 5.2 Incremental cost to consumers of the levy under scenario 1A

Cost element for Scottish consumers in an average year	Annual cost under scenario 1A (£ million)
Amount of levy paid by consumers (= local authority revenue)	7.75
Additional 'hidden' cost of bags	23.31
Cost of additional heavyweight bags	10.20
Cost of additional bin liners	4.34
Additional VAT	7.98
Total additional financial burden of scenario 1A in Scotland	53.58
Total additional financial burden of levy per person	£10.58/person/year

Table 5.3 shows the results for all four levy scenarios. The greatest effect on the results is from the additional 'hidden' costs, which can vary significantly. In the first instance, we have assumed that, for all four scenarios, any additional 'hidden' costs or savings are passed on to the consumer (see columns 2–5).

The 'hidden' costs increase significantly for scenarios 1A and 1B as, despite fewer plastic bags being used, far more paper carriers are being used. However, costs go down in the scenarios (2A and 2B) where paper is included in the levy (i.e. *hidden cost savings*), as both paper and plastic carrier bag use declines in these cases. At the discretion of the retailer, these savings could be passed on to the consumer, thus reducing the financial load on consumers (see columns 4 and 5). We have added to Table 5.3 the resulting costs in scenarios 2A and 2B assuming that the retailer does not pass on any savings they may accrue (see shaded columns 6 and 7).

Table 5.3 Incremental cost of the levy to consumers for all scenarios, with sensitivity on ‘hidden’ costs

	Scenario					
	1A	1B	2A	2B	2A – sensitivity	2B – sensitivity
	<i>‘Hidden’ costs or savings passed on to consumers</i>				<i>‘Hidden’ savings not passed on to consumers</i>	
Total additional financial burden of levy in Scotland (£ million/year)	53.58	37.51	18.05	12.63	30.91	21.64
Total additional financial burden of levy per person (£ /person/year)	10.58	7.41	3.57	2.50	6.11	4.27

The scale of the estimates of financial burden can be gauged by reference to the results in the UK Expenditure and Food Survey 2002/03 [ONS]. This shows that average weekly household expenditure is £365. Our examination of the categories of expenditure shows that £110 of this is likely to require use of a carrier bag. This can be compared with an annual cost of the levy of between £3.57 and £10.58 per person.

Based on data from the annual UK Expenditure and Food Survey 2002/03 [ONS], it is estimated that the costs given in Table 5.3 will represent a higher proportion of final income for households with lower incomes than for higher income households. Excluding paper bags from the levy base increases the financial burden (compare 1A with 2A and 1B with 2B), more than excluding SMEs (compare 1A with 1B and 2A with 2B).

5.2 Impact on the Business Sector

The proposed levy on plastic carrier bags will affect the economy as well as the environment. Our conclusions on the business and industry effects of the proposed levy are based on:

- Contact with industry.
- Examination of raw data.
- Evidence from previous studies on similar measures worldwide.

Scotland and the Plastic Carrier Bag Industry

CBC estimates that there are 15–20 plastic manufacturers, importers and distributors in Scotland, most of which are SMEs. We have validated this estimate through study of the online Applegate directory of plastics companies in the UK [Apgate]. The geographical distribution of these businesses shown in Table 5.4 indicates their wide distribution in Scotland. Both importers and/or distributors of carrier bags, as well as manufacturers, will be affected by the levy. In the Republic of Ireland, one manufacturer closed after PlasTax was introduced.

Table 5.4 Plastics and plastic bag manufacturers, importers and distributors in Scotland by postcode

Postcode	Total plastic	Plastic bags
AB	11	1
DD	8	1
DG	5	1
EH	22	4
FK	6	1
G	36	3
HS	0	0
IV	4	2
KA	9	0
KW	1	0
KY	11	3
ML	6	1
PA	5	0
PH	0	0
TD	5	0
Total	129	17

Smaller enterprises are considered more likely to suffer greater impacts from a levy as it is anticipated that they have less capacity to adapt. Discussion with industry suggests most of the bin liners produced in the UK are manufactured in England. It is considered unlikely that production could be switched to Scotland to compensate for some of the lost plastic carrier bag production.

Industry estimates that anywhere between 300 to 700 direct jobs could be lost in Scotland alone as a result of a levy being imposed on lightweight plastic carrier bags [CBC]. This estimate is made up of:

- Some 400 jobs at BPI's Greenock plant.
- Some 100 or so jobs at Simpac's plant in Glasgow.
- Jobs at other smaller manufacturers and importers that would either have to:
 - close;
 - move operations to elsewhere in the UK (as in Simpac's case to Hull) or abroad;
 - diversify where possible into other plastic film products.

Another important company that would be affected by a levy is Smith Anderson in Fife⁴⁴, which manufactures large volumes of paper bags from both virgin and recycled sources.

There would also be knock-on effects elsewhere in an industry that employs around 2,500 people in the manufacture, import and distribution of carrier bags and around 12,000 in the wider plastic films sector in the UK.

⁴⁴ www.smithanderson.com

Paper Sector

The extent to which lightweight plastic carrier bags may be replaced by paper carrier bags is an issue of contention. In the Republic of Ireland, some sectors (e.g. fashion and shoes) have switched to paper bags [BRC]. In the scenarios where paper bags are excluded from the levy (1A and 1B), a 25% switch to paper carrier bags has been assumed. A move towards greater use of paper carrier bags would have consequences for those sectors involved in their manufacture, transport, waste management and import. As mentioned above, Smith Anderson is a major company in the paper recycling and bag manufacturing industry in Scotland.

Retail Sector

The estimated cost to UK supermarkets of giving away lightweight **plastic** carrier bags is reported in Section 2 (see Table 2.1).

Evidence from Republic of Ireland and BRC suggests that the food retail industry would benefit from net cost savings from a levy after taking set-up and administrative costs into account. Savings would result from having to buy far fewer plastic carrier bags, which are then given away for free, while sales of ‘bags for life’ and bin liners would increase [BRC, ERM, UCD].

However, this would not be the case for non-food retailers. Evidence from the Republic of Ireland from those retailers that switched to paper bags (mainly ‘high street’ non-food retailers) suggests that greater storage space and more frequent deliveries are now required. This has increased their overhead costs for material purchase and transport by over four-fold [BRC]. There are also different consumption patterns between food and non-food retailers. For the former, people often shop regularly and can thus plan to take reusable bags with them. For the latter, it is often more of an impulse purchase [WRAP 2005].

Larger retailers are expected to find it easier to implement the system needs for compliance as they tend to have computerised systems and greater resources available. There will be a cost associated with administration of the levy, but the experience in the Republic of Ireland suggests that the effects were generally positive or neutral [UCD].

The levy would represent a greater burden to smaller retailers (e.g. newsagents, butchers, etc.) as they may not have computerised systems. As a minimum, it is anticipated that retailers will need to have an auditable system for:

- Recording carrier bags sales.
- Accounting for bags in stock.
- Reconciling sold versus stock remaining.
- Submitting records (quarterly in Republic of Ireland).
- Submitting payments.

Shoplifting and Theft

Theft, as an unwanted side effect of introducing a levy, is often raised as a problem for retailers. Although levels of theft were initially reported to have risen in the Republic of Ireland, they have since gone back to pre-levy levels and are even dropping further (information from the Department of Environment, Heritage and Local Government, Republic of Ireland).

The reported levels of ‘shrinkage’ (the industry term for theft) are calculated each year in the EU [Retail Research]. Table 5.5 shows shrinkage in percentage terms of turnover for 2003 and 2004 for the UK and Republic of Ireland. It is evident that both countries saw a drop in retail theft between 2003 and 2004.

Table 5.5 Changes in retail theft as a percentage of overall turnover for the UK and Republic of Ireland

Retail Shrinkage (as % of turnover)	2003	2004
UK	1.69%	1.59%
Republic of Ireland	1.35%	1.34%

Increased trolley and basket theft has been highlighted by some as a potential cost to industry caused by people wishing to save on paying for bags. Five months after the introduction of the PlasTax, the Retail, Grocery, Dairy and Allied Trades’ Association (RGDATA) for the Republic of Ireland reported that 50 baskets per month were disappearing from shops at a total cost of €450/month.

Impacts for Waste Management

This section uses the changes in the weight and volume of bags under each levy scenario to assess the changes in waste arisings, changes in waste management costs and changes in waste volumes. Note that this is only part of the total waste due to carrier bags, the total waste impact (including waste in the winning of raw materials and production, which will often take place outside of Scotland) is considered in more detail in the LCA and is presented in Figure 4.2 and Appendix 3.

The change in consumption of materials under each levy scenario is considered in section 4.6. To assess the impacts on waste management we then need to add in details of the waste disposal routes.

In 2002/03⁴⁵, 88.2% of all waste arisings in Scotland were disposed of to landfill, 2.2% were incinerated, 5.9% were recycled, 2% were composted and the remaining 1.7% was treated by other means [SEPA].

⁴⁵ SEPA informed us that recycling rates for 2003/04 were 12.3% nationwide (data to be published in June 2005). However, 2002/03 SEPA statistics were used for consistency.

For plastic bags we have assumed that there is a low level of recycling of post-consumer bags and that this would not change significantly if a levy were introduced. Thus, for the purpose of this calculation, all plastic bags would eventually be landfilled or incinerated⁴⁶. We assumed that 97.6% of plastic bags were landfilled and 2.4% were incinerated⁴⁷. It was not possible to estimate the quantity of lightweight plastic carrier bags or heavyweight plastic carrier bags going to each disposal route⁴⁸. Instead, we applied the shares of landfill and incineration in total waste disposal equally to each.

For paper bags we were able to account for recycling in the calculations of waste management using Scottish waste statistic [SEPA]⁴⁹. Paper comes under the heading of ‘paper and card’ in SEPA data. As paper bags are not accounted for separately in SEPA waste statistics, we assumed that recycling rates for paper bags are the same as “paper and card”. We made the following calculation:

- 24.26% of household ‘bin’ waste in Scotland is paper and card.
- 2,094,872 tonnes of household (controlled) waste were collected in 2002/03.
- This means that 508,216 tonnes of paper and card were collected from household waste for disposal (to landfill or incineration).
- 67,660 tonnes of paper and card were collected separately for recycling.
- Therefore, 13.3% of paper and card was recycled (67,660 tonnes/508,216 tonnes).
- The remaining paper is either landfilled (84.6%) or incinerated (2.1%)⁵⁰.

We estimated the change in paper bags waste for each disposal route using:

- Our calculation ratios for landfilling, incineration and recycling of paper in Scotland.
- The net total change in annual paper consumption (and hence waste production) under the four levy scenarios given in Table 4.6.

The amounts shown in Table 5.6 represent changes in the disposal of residual household waste and recycling in an average year under each of the levy scenarios.

Table 5.6 Estimated annual changes in waste disposal routes for residual waste in Scotland under the different scenarios

Scenario	Disposal route (tonnes per year)			
	Landfill	Incineration	Recycling	Net change
1A	4,122	103	1,184	5,409
1B	2,886	72	829	3,786
2A	-4,640	-116	-237	-4,993
2B	-3,248	-81	-166	-3,495

⁴⁶ Plastic *films* are recycled in large amounts, though this is mainly back-of-store packaging, estimated at 300,000 tonnes per year [CBC]. There is very little post-consumer recycling of plastic carrier bags and there are very few facilities to do so. For example, the recycling rate for lightweight carrier bags in Australia in 2002 was 2.7% [DEH].

⁴⁷ Step 1: 88.2% (landfilled) + 2.2% (incinerated) = 90.4%. Step 2: 88.2% / 90.4% = 97.6%

⁴⁸ The facility is known to exist in many food retail outlets for the take-back and recycling of heavyweight bags-for-life, but no data on the level or rate of this was available.

⁴⁹ Recycling of paper bags was not considered for the LCA in Section 4 due to the assumptions in the Carrefour study. This will lead to a difference in the results presented here with those in section 4 under the ‘solid waste’ environmental indicator.

⁵⁰ 13.3% of paper is recycled. This leaves 86.7% going to another route. 97.6% will be landfilled: 97.6% × 86.7% = 84.6% overall. 2.4% will be incinerated: 2.4% × 86.7% = 2.1% overall.

Table 5.7⁵¹ shows estimated changes in landfill and incineration costs for household waste in Scotland as a whole, under each levy scenario. Costs increase under scenarios 1A and 1B, while costs decrease under scenarios 2A and 2B. These cost increases or decreases apply to local authorities who are responsible for household waste disposal.

Table 5.7 Estimated changes in waste management costs for Scotland due to the levy⁵²

Scenario	Cost (£ per year)		
	Landfill	Incineration	Total
1A	227,000	7,000	233,000
1B	159,000	5,000	163,000
2A	-255,000	-8,000	-263,000
2B	-179,000	-5,000	-184,000

The amount of solid waste generated can also be quantified in terms of volume. The Carrefour study only gives information on weight for the full life cycle, though it is clear that this is dominated by the end of life stage. Using data on relative bag storage volume from Table 2.1 it is possible to estimate the relative difference in volume of material sent for disposal (see Table 5.8), though this ignores wastes generated at stages other than end of life disposal. Results show a significant increase for scenarios 1A and 1B for volume relative to the base case. For scenarios 2A and 2B, however, the volume of bags disposed of relative to the base case falls significantly.

Table 5.8 Estimated changes in waste volumes in Scotland due to the levy

Change in Volume – assuming 50 g paper bag occupying 8 times the volume of HDPE lightweight bags					
As % of base case	100%	167%	148%	20%	44%

Charities

In a submission to Mike Pringle MSP, the Association of Charity Shops expressed its belief that the ability of some charity shops to operate successfully would be jeopardised by the proposed levy⁵³. The Association is also concerned that donations by the public would become difficult, as donated stock delivered to shops is usually in plastic carrier bags. These bags are then reused for customer purchases.

⁵¹ Figures have been rounded.

⁵² Savings based on landfill costs of £55/tonne and incineration costs of £65/tonne. The unit costs include collection, transfer and gate fees (including landfill tax in the case of landfill). However, it has not been possible to separate the fixed from the variable elements of the costs. Given the relatively small scale of the changes in waste tonnages, only the latter will be saved. The cost savings will therefore tend to be overestimates. However, landfill costs are likely to rise during the same period as a result of the landfill tax escalator.

⁵³ Response by the Association of Charity Shops to consultation paper issued by Mike Pringle MSP.

6 Administration of the Levy

The mechanism by which local authorities would administer the levy falls within an exception to the reservations in the Scotland Act 1998 (Section A1, Part II, Schedule 5 Fiscal, economic and monetary policy). This states that local taxes to fund local authority expenditure fall within devolved competence. It is this exception which is being investigated by Mike Pringle MSP. We have not considered the validity of this exception, but have considered some of the implications for administering the levy should the Bill proceed.

6.1 System Requirements

A system will be required which will allow for:

- Monies to be collected from ‘retailers’ and held in a local authority account.
- Keeping records of customer transaction.
- Auditing and inspection.
- System checks and interrogation re anticipated income, documentation files and generation of customer queries.
- Development of an appeals system.
- Development of systems to pursue debt and non-payment.

Businesses would need advice on:

- How the levy would operate.
- Definitions of what types of bags the levy covered.
- What information they would be required to submit, e.g. stock of bags at outset, stock remaining at end of submission period and records of bags sold.
- How and when the monies collected should be transferred (ideally electronically) to the administration body.
- The penalties for non-compliance.

System in the Republic of Ireland

In the Republic of Ireland, businesses submit quarterly returns. There are separate and distinct roles and bodies for collection and enforcement. Payment is by electronic debiting of the retailer’s bank account. An online system that allowed this, the Revenue Online System (ROS), was in place prior to the introduction of the PlasTax.

So far, there has been one prosecution for non-compliance. Any retailer not complying with the legislation has been visited, their non-compliance verified and a warning issued. Warnings have been issued to a few hundred out of around 50,000 retailers [communication from Terry Sheridan, the Department of Environment, Heritage and Local Government, Republic of Ireland].

The basic administrative requirements are:

- An opening stock take of plastic bags when the levy is introduced.
- A record of plastic bag purchases.
- A record of plastic bags supplied to customers where the levy applies.

The records must differentiate between:

- Those plastic bags used to contain fresh meat, fish, poultry, fruit, vegetables and other foods that are not otherwise packed, or ice
- Other plastic shopping bags.

The role of enforcement is separate and is undertaken by the local authorities. It involves:

- Visiting retail outlets and talking to retailers.
- Carrying out initial spot checks.
- Monitoring implementation.
- Ensuring that the levy is passed on in full to customers.
- Ensuring that exemptions are not being abused.
- Checking tills to confirm that customers are being charged the €0.15 levy for plastic bags where applicable.
- Taking appropriate action where it has been established that the levy has not been charged to customers, e.g. issuing letters informing retailers of obligations under the regulations and following up where necessary. Following up on any complaints from the public.

The Revenue Commissioners are responsible for:

- Identification of accountable persons⁵⁴.
- Processing returns and payments received from accountable persons.
- Carrying out verification checks relating to the accuracy of returns.
- Pursuing accountable persons who fail to deliver returns and payments within the statutory time limits.
- Raising estimates where returns are not received or where liability is under stated.
- Dealing with appeals against estimates raised.

To minimise compliance costs on retailers, checks carried out by the Revenue Commissioners are, insofar as possible, incorporated with checks carried out in relation to tax liabilities.

⁵⁴ An accountable person is responsible for submitting the required information to the Revenue Commissioners.

6.2 Impact on Local Authorities

CoSLA has recorded its reservations about the duty of collection falling to the local authorities and its concerns regarding the magnitude and potential administrative costs of the levy, which it believes require a full investigation.

We consulted two local authorities and considered three options for implementation of the levy:

- Option 1: Blanket application of the levy

While applying the levy on a blanket basis ensures consistency of application, data from Australia [DEH] suggest that the collection of the levy from small retailers could give marginal returns given the cost of collection and estimated segmentation of bag distribution. Consequently, we also considered:

- Option 2: Selective application of the levy based on retailer size or function.
- Option 3: Selective application of the levy based on rateable value.

As a possible option for making the best use of resources that would support the Scottish Executive's Efficient Government Initiative, we invited the local authorities consulted to consider the benefits and workability of setting up a central billing body to administer the levy on behalf of all authorities. It should be noted, however, that this is not presented as a formal proposal and it is one about which CoSLA has voiced concerns.

The results from these consultations should not be taken as the whole story for Scotland, but as indicative of the potential costs.

Option 1: Blanket Application of the Levy

The levy will apply to all retailers in Scotland (52,690)⁵⁵ and all other outlets distributing bags as part of a business transaction (e.g. exhibitors). This will undoubtedly create a very significant administrative burden for local authorities, as they will have to administer the levy including collection, policing and penalising of defaulters.

Feedback from discussions with the Assessor to the Lothian Valuation Board has been made available to this study. In essence, a national billing body could establish a database of all subjects liable to the levy. Since this would be sourced to valuation roll data, any analysis of levies imposed and collected could be easily calculated for an individual local authority area. Businesses would need to account directly to the billing body. The most efficient process would be self-assessment similar to the collection of VAT, with legislation enabling the billing body to check the records of any individual businesses for accuracy, etc. The self-assessment would also need to be accompanied by payment to streamline the bureaucracy involved and again legislation would be required to encourage compliance, e.g. fines for late payment, etc. The main administrative efforts would be to keep name and address details up-to-date and to police the return of the prescribed information and levy payments.

⁵⁵ Total number of retailers in the all-Scotland Valuation Roll from April 2005. There were 52,690 properties classified by the assessors as 'shops'.

CoSLA is also concerned that, if the levy were successful in its aim of reducing plastic bag usage, expenditure on collecting and enforcing the levy might exceed income and local authorities might have to look to the Executive to cover a funding shortfall. CoSLA believes that additional funding from the Scottish Executive would be required for start-up and has commented that the estimated costs would require detailed analysis.

In the absence of any available detailed analysis, we undertook a **simplistic** estimation of costs of this option using the assumptions given in Table 6.1. This suggests average indicative set-up costs of around £3 – 4 million, and enforcement and ongoing management costs of around £3.5 million per year.

Table 6.1 Simple cost estimates for option 1 (blanket application)

Activity	Cost calculation	Estimated cost
Education campaign		£1 – 2 million
Set-up	1 person for 1 year plus support (£60,000 × 32 local authorities)	~£2 million
Ongoing management	0.5 person/year/local authority (0.5 × 32 × £40,000 = £0.64 million) Billing body team (4 × £40,000 = £0.16 million)	~£1 million
Enforcement/policing	1 person/local authority plus support and travel (£40,000 × 32) + (£20,000 × 32) = £1.92 million Plus legal advice (£0.75 million)	~£2.5 million

Option 2: Selective Application of the Levy Based on Retailer Size or Function

A second option would be to apply the levy based on retailer size. One option for this is to use the EU definition of an SME as the defining point beyond which the levy is applied. The current EU definition of SME is a business with a turnover of €50 million or less. Although this presents a sound solution in terms of practicality, no data are unfortunately readily available to local authorities at present. It would, therefore, have to be sourced from UK Revenue and Customs (formerly HM Customs and Excise). It is also uncertain whether these data would be available at local authority level.

Making a simplistic estimation of costs again for discussion purposes, this option is estimated to require potentially lower set-up costs because less ‘contact’ will be required as a consequence of working with fewer retailers. Similar ongoing annual management costs and less policing and enforcement costs to option are anticipated, as we would expect the major retailers to comply readily with the legislation.

Table 6.2 suggests average indicative set-up costs of £1.5 – 2.5 million and enforcement and ongoing management costs of £1.75 million per year.

Table 6.2 Simple cost estimates for option 2 (selective application based on retailer size)

Activity	Cost calculation	Estimated cost
Education campaign		£1 – 2 million
Set-up	0.25 person for 1 year plus support ($0.25 \times £60,000 \times 32$ authorities)	~£0.5 million
Ongoing management	0.5 person/year/local authority ($0.5 \times 32 \times £40,000 = £0.64$ million) Billing body team ($4 \times £40,000 = £0.16$ million)	~£1 million
Enforcement/policing	0.25 person/local authority plus support and travel ($0.25 \times £40,000 \times 32$) + ($£5,000 \times 32$) = £0.48 million Plus legal advice (£0.25 million)	~£0.75 million

Option 3: Selective Application of the Levy Based on Rateable Value or Square Footage

Another option, which was suggested by the local authorities consulted, would be to apply the levy based on either the rateable value of the retail outlet or its square footage. These are data held by all local authorities and which could be used as the basis for allocating the levy. While the rateable value approach would allow small retailers to be exempt, it could present consistency difficulties in terms of varying rateable values both within and between local authority areas.

6.3 Revenue by Local Authority

Based on average use assumptions (see Table 4.2), each person in Scotland is predicted to pay the amounts shown in Table 6.3. This table also shows the calculated revenue for the whole of Scotland.

Table 6.3 Cost per person per year for levied carrier bags⁵⁶

Scenario	Cost per person per year for all bags	Revenue total in Scotland per year
1A	£1.53	£7.75 million
1B	£1.07	£5.43 million
2A	£1.61	£8.14 million
2B	£1.13	£5.70 million

Revenues are slightly higher from scenarios 2A and 2B than from 1A and 1B because paper bags are also subject to the levy in these cases.

Table 6.4 shows the flow of revenue predicted in Table 6.3 against the costs incurred to set up and run a levy collection scheme. Option 1 (blanket levy) and associated costs have been used together with scenario 1A (the proposed levy) and associated revenue. Table 6.4 shows the set up costs in the year before introduction (year 0) and that from the first year of operation onwards, net revenue is estimated at £4.25 million per year. Under Mike Pringle's Bill, this would be available for environmental schemes across Scotland [Pringle].

⁵⁶ Assumes full payment of the levy.

Table 6.4 Estimated costs versus revenue in Scotland (Scenario 1A, Option 1)

	Cash flow (£ million) in year:			
	0	1	2	3
Set-up costs⁵⁷	-3.50	0	0	0
Annual costs	0	-3.50	-3.50	-3.50
Revenue	0	7.75	7.75	7.75
Net	-3.50	4.25	4.25	4.25
Cumulative	-3.50	0.75	5.00	9.25

Analysis for other scenarios and options shows that:

- More revenue would be generated for scenario 2A because paper bags would be included. However, the costs (Option 1 blanket levy) would be the same, so the annual balance would be greater.
- If SMEs were excluded (Option 2 and scenarios 1B or 2B), there would be lower set-up and ongoing management costs but also lower revenue.
- If plastic carrier bag use fell to 5% of pre-levy volumes, half the revenue estimated in Table 6.4 would be generated. If it is assumed that the 90% reduction is for the first year of operation only and that consumption then drops to 95% of pre-levy amounts⁵⁸, revenue could be expected to fall to around £3.8 million per year. Likewise, if the reduction in carrier bag use is less than anticipated, the revenue generated will be greater.

By applying the costs per person given in Table 6.3 to population data by local authority, it is possible to get some feel for the amount of levy revenue likely to be raised by each authority under each of the scenarios (see Appendix 4)⁵⁹. As expected, the higher the population within a local authority, the more revenue it would collect from the levy. Hence, under all four levy scenarios, the City of Glasgow would raise by far the most revenue (from just under £620,000 per year under scenario 1B to just under £930,000 per year under scenario 2A). Some of the islands (e.g. Orkney and Shetland) would collect as little as £21,000–24,000 per year under scenario 1B.

Comparing these figures with the costs outlined in Tables 6.1 and 6.2 shows that there would be disproportionate costs between local authorities, with a net financial gain to the larger ones but a net cost to the smaller ones. This disparity could be addressed by a national billing body.

⁵⁷ The timescale for set-up is unknown.

⁵⁸ As in Republic of Ireland (see Section 2.2).

⁵⁹ In our calculations, however, we assumed that every individual across Scotland is essentially identical in terms of bag-using behaviour. In addition, the amount of revenue raised by a local authority will be a function of, among other things, the age profile and socio-economic characteristics of its population (and in turn their behaviour as consumers), and not just its total population. Furthermore this ignores the impact of consumers making purchases at outlets not located in the local authority in which they reside.

6.4 Conclusions on the Administration of the Levy

Of the three options presented, Option 1 seems most complicated and will have the greatest resource and cost implications. It is also difficult to envisage a simple and cost-effective policing mechanism. Options 2 and 3 offer a simplified approach, involving less resources and an anticipated reduced requirement for policing. We predict there would be a net gain financially from a levy in all situations, whether or not coverage is restricted.

Having discussed the practical implementation of Option 1 (blanket application of the levy) with two local authorities, their view was that there are clear administrative difficulties and significant costs associated with this course of action. Blanket application was considered to require dedicated staff within each local authority area to administer the levy in terms of informing business of its existence and to carry out subsequent policing of the levy. Such staff would still be required even if a central billing body were set up to collect the revenue.

A discrete billing body was considered a logical option for collecting revenue. This body would be responsible for:

- Collating returns from all retailers.
- Collecting funds.
- Allocating monies by local authority (money must be spent locally to satisfy the requirement in Mike Pringle's Bill for devolved competence).

The success of this model would depend on a high level of trust between retailers and the billing body, i.e. it is assumed that no responsible retailer would wish to be seen to be avoiding its tax liabilities. All businesses liable to pay the levy would be identified and informed of their new duty. The billing body would then expect to be provided, electronically, with information regarding the number of bags distributed and the subsequent levy owing. Most significant retailers in Scotland possess electronic stock systems, which should allow them to transfer information on bag usage easily to the billing body. Billing could be carried out on a monthly or quarterly basis, as required. Electronic data submission by smaller retailers may be more problematic.

It is expected that the cost of running a plastic bag levy collection scheme could be recouped from the revenue generated. It is therefore expected that this cost would not be added to local authority expenditure.

Such a model seems to sit well with local government efficiency initiatives by encouraging shared resources between councils. Discussions with the local authority representatives suggested that such a body could function with around four staff. This would allow the maximum benefit to be accrued from the levy. However, CoSLA is known to have concerns about the shared resource option and is unlikely to support this approach without a more detailed financial appraisal.

As each authority would generate different levels of revenue, a range of 'contributions' to the billing body might be necessary. Otherwise, some authorities would be paying disproportionately.

7 Conclusions

Mike Pringle MSP has stated that the levy “*aims to alter people's behaviour to help protect the environment*”.

Environmental Impact

Our analysis suggests that environmental benefits will be achieved if consumers switch from lightweight plastic bags to reusable bags. In all scenarios where the levy is applied, consumption of non-renewable energy, atmospheric acidification, the formation of ground level ozone and the risk of litter fall considerably compared with the current situation.

However, our analysis also suggests that, in all circumstances, paper bags have a greater negative environmental impact than conventional plastic carrier bags. If paper bags are excluded from the levy, as currently proposed, we estimate that paper bag usage will increase by 174 million bags per year to 213 million per year. This will have associated environmental implications in terms of increased energy use, transport costs, storage space and waste disposal.

The scenario analysis suggests that including both paper bags and SMEs in the levy (scenario 2A) would lead to greater environmental benefits. It would offer more overall savings in bag use and generate more revenue than the levy proposal to include all retailers but exclude paper bags (scenario 1A).

The levy as proposed is estimated to reduce annual lightweight plastic carrier bag use by 697 million bags. However, there would be an increase in annual demand of 15 million ‘bags for life’, 90 million bin liners and 174 million paper bags. This would result in an estimated decrease of 3,484 tonnes of polyethene used in Scotland per year **but** an increase of 8,893 tonnes of paper per year⁶⁰.

Greater environmental benefits will be achieved if paper bags are also subject to the levy. There would be an annual reduction in lightweight plastic carrier bag use of 697 million bags and an increase in ‘bags for life’ by 21 million and bin liners by 90 million, but a decrease in paper bag use of 35 million per year. These savings would result in an estimated decrease of 3,214 tonnes of polyethene used in Scotland per year **and** a decrease of 1,779 tonnes of paper per year.

Although under all levy scenarios there would be a resulting decrease in litter, the fact that plastic bags account for less than 1% of land litter suggests that this would have a minor impact on the overall litter problem in Scotland. The same argument also holds for any reduction in the amount of plastic carrier bag waste going to landfill.

We undertook a sensitivity analysis to examine how the environmental indicators for the levy scenarios change in response to changes in the assumptions used. This shows that environmental indicators for the levy scenarios that include paper bags (scenarios 2A and 2B) are much more robust to changes in the assumptions.

⁶⁰ These estimates do not take into account any increased demand for refuse sacks, as we were unable to source data on current sales levels or the likely increase in demand.

An education and awareness campaign, as used in Republic of Ireland, is seen as beneficial to the introduction of a levy to reinforce to consumers the waste hierarchy's principles:

- To reduce waste.
- Reuse where possible.
- Recycle when reuse is not possible.
- Recover energy.
- And only then to dispose of the item.

Costs to Consumers

Consumers would obviously have to pay the levy itself overtly, on levied bags they continue to use, but the true additional financial burden of a levy on consumers in Scotland depends on a number of other factors as well.

The cost to the consumer also depends on whether or not certain costs (in particular the 'hidden costs/savings') are passed on to the consumer by the retailer.

This leads to a wide range of estimated costs to the consumers, depending on assumptions. In Scenarios 1A and 1B (no levy on paper bags) the estimates ranges from £7.41 to £10.58 per year. In Scenarios 2A and 2B (levy on paper bags as well) the range is from about £2.50 to £6.11 per year. To put this into context the average Scottish household spends some £365 per week [ONS].

Impacts on Industry

An estimated 300 to 700 jobs could be lost in Scotland alone as a direct result of a levy being imposed on plastic carrier bags [CBC]. Knock-on effects would also be felt elsewhere in an industry that employs around 2,500 people in carrier bags manufacture, import and distribution, and around 12,000 in the wider plastic films sector in the UK.

Impacts on Local Authorities

CoSLA has a number of operational concerns, particularly regarding the magnitude of the proposed levy and any proposal for a joint collection body. If the levy were successful in its aim of reducing plastic bag usage, expenditure on collecting and enforcing the levy might exceed income. Local authorities could then be expected to look to the Scottish Executive to cover a funding shortfall. CoSLA also believes that additional funding would be required for set up the administrative systems and that detailed analysis of the potential costs is required.

Impacts on Charities

In a submission by the Association of Charity Shops to Mike Pringle MSP, the Association voiced its belief that the ability of some shops to operate successfully would be jeopardised by the levy. The Association is concerned that donations by the public would become difficult, as donated stock is usually delivered to shops in plastic carrier bags. These bags are then reused for customer purchases.

Impacts on Larger Retailers

After taking set-up and administrative costs into account, the food retail industry would benefit from net cost savings from a bag levy. Savings would come from having to buy far fewer plastic carrier bags that are given away for free, while sales of ‘bags for life’ and bin liners would increase [ERM, UCD].

However, this would not be the case for non-food retailers. Evidence from the Republic of Ireland from those retailers that switched to paper bags (mainly ‘high street’ non-food retailers) suggests that greater storage space and more frequent deliveries are now required. This has increased overhead costs for material purchase and transport by over four-fold [BRC].

There are also different consumption patterns between food and non-food. For the former, people often shop regularly and can thus plan to take reusable bags with them. For the latter however, it is often an impulse purchase [WRAP 2005]. Overall, retailers feel it would be fairer if all bag materials (not just plastic) and all businesses (small or large) were levied UK-wide.

In terms of system needs for compliance, it is envisaged that larger retailers will find this easier, having computerised systems and greater resource available. There will be a cost associated with administration of the levy, but experience in the Republic of Ireland suggests that the effects were generally positive or neutral [UCD]. In general, costs are considered modest and, in some cases, are less than the savings the retailers enjoy from buying fewer lightweight plastic carrier bags. Although there have been some reports of problems with increased theft, it is understood that, after an initial rise in theft, retailers state that levels returned to those before the introduction of the levy.

Impacts on SMEs

The levy would represent a greater burden to smaller retailers (e.g. newsagents, butchers, etc.) because they are less likely to have computerised systems. As a minimum, it is anticipated that retailers will need to have an auditable system recording carrier bags sales, account for bags in stock, reconcile sold versus stock remaining, submit records (quarterly in Republic of Ireland) and submit payment.

Revenue Generated

In an average year, the levy is expected to generate an estimated:

- £7.75 million under scenario 1A (proposed levy).
- £5.43 million under scenario 1B (proposed levy excepting SMEs, charities and promotions).
- £8.14 million under scenario 2A (proposed levy plus levy on paper bags).
- £5.70 million under scenario 2B (proposed levy plus levy on paper bags and excluding SMEs, charities and promotions).

Costs to Introduce

To determine the costs of set up and administration for local authorities would require a detailed specification of the systems and wider discussions. In the absence of any assessments on costing, we generated some estimates based on simplistic assumptions. We did this largely to prompt discussion on this matter. Our calculations suggest indicative set-up costs of around £3 – 4 million, and enforcement and ongoing management costs of around £3.5 million per year.

Alternatives to the Levy

Lightweight plastic carrier bags have undergone considerable design engineering to produce a lightweight, strong and reliable means of transporting goods from the place of purchase to the home.

A draft voluntary code to develop waste reduction and reuse initiatives and to continue product engineering to make further savings in the production, transportation and storage of plastic carrier bags has been proposed and submitted by the CBC to the Voluntary Code of Conduct Working Group set up by the BRC and the SRC. The voluntary approach has been adopted in Australia, where a reduction in use of 20.4% has been achieved.

In addition, WRAP is working with BRC on increasing the uptake of ‘bags for life’, with the aim of reducing the use of lightweight plastic carrier bags and improving recycling rates.

These two projects present an alternative to the levy and a means of altering consumer behaviour – a fundamental aim of the levy proposed by Mike Pringle MSP.

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Small changes in the way we perform everyday tasks can have huge impacts on Scotland's environment.

Walking short distances rather than using the car, or being careful not to overfill the kettle are just two positive steps we can all take.

This butterfly represents the beauty and fragility of Scotland's environment. The motif will be utilised extensively by the Scottish Executive and its partners in their efforts to persuade people they can do a little to change a lot.

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