

# Assistance to the Commission to Complement an Assessment of the Socio-economic Costs and Benefits of Options to Reduce the Use of Single-use Plastic Carrier Bags in the EU

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25/10/2012





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## Glossary of Terms

Bags for Life – Multiple-use bags, typically made from LDPE

HDPE (High Density Polyethylene) - This is the material from which single-use plastic carrier bags are typically manufactured. Single-use plastic carrier bags may also be referred to as HDPE bags.

Multiple-use Bags - This term covers LDPE 'Bags for Life', PP bags and other bags made of jute, or cotton intended for multiple-use. Paper bags are not considered to be multiple-use bags.

LCA – Life Cycle Assessment

LDPE – Low Density Polyethylene - Plastic carrier bags made of LDPE are designed for multiple-use and are commonly referred to as 'Bags for Life'

PE - Polyethylene

PP – Polypropylene

SUPB – Single-use Plastic Carrier Bags - These may be biodegradable or non-biodegradable, and are typically made of HDPE

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# 1.0 Introduction

This report sets out to respond to two key tasks as requested by the Commission.

- Task 1: An analysis of the size of the bags producing sector in the EU; and
- Task 2: An assessment of the economic and social impacts of different policy options to reduce the use of single-use plastic carrier bags.

Task 1 requires the collection of data on the size of the EU plastic carrier bags producing sector in the EU, with a specific focus on single-use plastic carrier bag producers. The specification required that the analysis should respond as a minimum to the following questions:

- What is the size and characteristics of the plastic bags producing sector in the EU (e.g. number of companies, turnover, employment rate, share of SMEs, in which Member States are they located)?
- What types of plastic bags and other bags do these companies produce? What is the share between the production of single-use plastic carrier bags and other types of plastic and other bags? How many SMEs are involved in the production of single-use plastic carrier bags and in which Member States are they located.

The findings of the research for this Task are introduced in Section 2.0 with further detail included in appendices. Assumptions that are carried forward into the modelling are indicated where appropriate in Section 2.0 and the associated Appendices.

Task 2 requires a cost-benefit analysis, focusing on the economic and social (not environmental) impacts of a number of policy options:<sup>1</sup>

- Option 1: Introducing an EU level ban on single use plastic carrier bags (100% reduction in single-use bags);
- Option 2: Voluntary commitment of a significant share of the retail sector not to provide single-use plastic carrier bags (55% reduction of single-use bags); and
- Option 3: Setting an EU level prevention target for single-use plastic carrier bags of 35 single-use bags per person in 2020 (80% reduction in relation to the EU average consumption)

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<sup>1</sup> Originally, a fourth option was included, namely the introduction of a legal requirement for Member States to take measures to ensure that single-use plastic carrier bags are not provided for free to the final users. However, it was subsequently agreed that the modelling would focus solely on the impacts associated with *reductions* in consumption of single-use plastic carrier bags, rather than modelling the *means* by which these reductions might be achieved. Accordingly, the impacts of placing levies or charges on single-use plastic carrier bags are discussed qualitatively in Appendix A.13.0. This also means that administrative and compliance costs are not considered in this study.

For the cost-benefit analysis, the Commission requested that the following be addressed by the contractor:

- Assessment of impacts on plastic bag producing companies, especially SME's and retailers, including where possible a differentiation of impacts per Member State. Factors that could be considered include impacts on turnover, profits and employment. This assessment shall also pay attention to possible opportunities for producers to switch production to other types of bags (both re-usable plastic bags and other bags) and products, and their related impacts;<sup>2</sup>
- Assessment of impacts on consumption patterns, including indirect effects of a reduction of single-use plastic carrier bags on consumer behaviour, for example;
  - A possible increase in the use of bin liners.
  - A possible consumption switch to other alternative carrier bags
- Assessment of socio-economic benefits of a reduced use of single-use plastic carrier bags, for example.
  - Reduction of costs for national administrations for litter cleaning.
  - Opportunities for certain sectors.

Table 1 shows the approaches to each of these aspects that were agreed in our response to the specification.<sup>3</sup>

Key findings from evidence gathered in respect of the aspects identified in Table 1 are presented in Section 3.0 with further detail on assumptions contained in appendices. The results of the modelling are shown in Section 4.2.

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<sup>2</sup> It was originally intended that the study would include an assessment of the administrative burden on public authorities from implementing each of the options. However, as it was subsequently agreed that the modelling would focus solely on the impacts associated with reductions in consumption of single-use plastic carrier bags, rather than modelling the means by which these reductions might be achieved, administrative and compliance costs are not considered in this study.

<sup>3</sup> Please note that the original list has been re-ordered so that the impacts on consumption patterns are considered first. This was help understanding of the items to which consumers are likely to switch, and accordingly orient the search for data (e.g. turnover and employment) relating to producers of other types of bags.

Table 1: Approaches to Addressing Aspects of the Study

Aspect	Approach
<p>Assessment of impacts on consumption patterns, including indirect effects of a reduction of single-use plastic carrier bags on consumer behaviour, for example;</p> <ul style="list-style-type: none"> <li>• A possible increase in the use of bin liners.</li> <li>• A possible consumption switch to other alternative carrier bags</li> </ul>	<p>We will seek to establish a quantified shift towards alternatives. This will inform the assessment of possible opportunities for producers to switch production to other types of bags. Evidence of this may be weak but we will seek evidence from cases within and outside Europe in this regard. In the absence of relevant evidence, we will model ‘plausible’ switches from single-use to other bags, based on the anecdotal evidence available.</p>
<p>Assessment of impacts on plastic bag producing companies, especially SME’s and retailers, including where possible a differentiation of impacts per Member State.</p> <ul style="list-style-type: none"> <li>• Factors that could be considered include impacts on turnover, profits and employment.</li> <li>• This assessment shall also pay attention to possible opportunities for producers to switch production to other types of bags (both re-usable plastic bags and other bags) and products, and their related impacts;</li> </ul>	<p>As far as possible this will be a quantitative assessment, with the aim of noting the impacts on turnover and employment associated with a reduction in manufacture of plastic bags within the EU. Guided by the findings from our research into the likely alternatives, we will also look at the sectors producing the bags most likely to be switched to.</p> <p>Establishing a likely change in profitability will be more difficult, as we expect that the sector, and individual firms within it, will be extremely unlikely to disclose their profitability. While they might suggest that profits may reduce by a certain amount, it will be impossible for us to verify this if we are not provided with details of existing profitability and the associated factors.</p> <p>We will seek to quantitatively identify the employment and turnover impacts of a switch to other types of bags, but this will be heavily dependent upon receiving appropriate data from industry and from other Member States already implementing such measures. We highlighted the potential switching effect in work for the Irish Government in 2009 but at the time, there was no information available to indicate the extent of this effect.</p>
<p>Assessment of socio-economic benefits of a reduced use of single-use plastic carrier bags, for example</p> <ul style="list-style-type: none"> <li>• Reduction of costs for national administrations for litter cleaning.</li> <li>• Opportunities for certain sectors.</li> </ul>	<p>The assessment of the reduction in costs for litter cleaning will be in quantitative terms, as far as is possible. We will seek to extrapolate available figures across the EU, although we caution that there will be some uncertainty in this, notably as there will be variation between Member States in the amount that they already spend on cleaning up litter, even if reported levels of litter are similar.</p> <p>We assume that the ‘opportunities for certain sectors’ refers to the opportunities for producers of alternative bags. This is reflected in quantitative terms within the assessment of the potential for manufacturing alternative bags. A descriptive approach will be applied to other opportunities that may be identified.</p>

## 1.1 Definition

The definition of single-use plastic carrier bags, on which the study is focussed, is:

*“lightweight thin-walled plastic bags that are distributed at a check-out and used to carry goods from supermarkets and other shops which are of a thickness less than 49 microns”.*

For clarity, sacks and bags used for fresh food such as fruit and vegetables or in butchers shops are not included in this definition. They usually do not have handles and are placed inside other bags. They are generally excluded from plastic carrier bag policies for reasons of practicality (lack of suitable alternatives), or food safety / hygiene (especially when used for raw meat). Likewise, national data sources and stakeholder estimates tend not to include them.<sup>4</sup>

## 1.2 Types of Bag

The types of bags considered in this analysis, and their typical weights, are shown in Table 2.

Table 2: Bag Types Considered in the Study

Bag Type	Weight
Single-use Non-Biodegradable Plastic Carrier Bag (High Density Polyethylene – HDPE) *	8.5g
Single-use Biodegradable Plastic Carrier Bag *	8.9g
Single-use Paper Bag with Handles **	55.2g
Low Density Polyethylene (LDPE) ‘Bag for Life’ **	35g
Woven Polypropylene (PP) ***	226g
Jute	160g
Cotton **	154g
Bin liner **	9.3g
Source of Bag Weights: * BIO IS ** UK Environment Agency *** Scottish Government	

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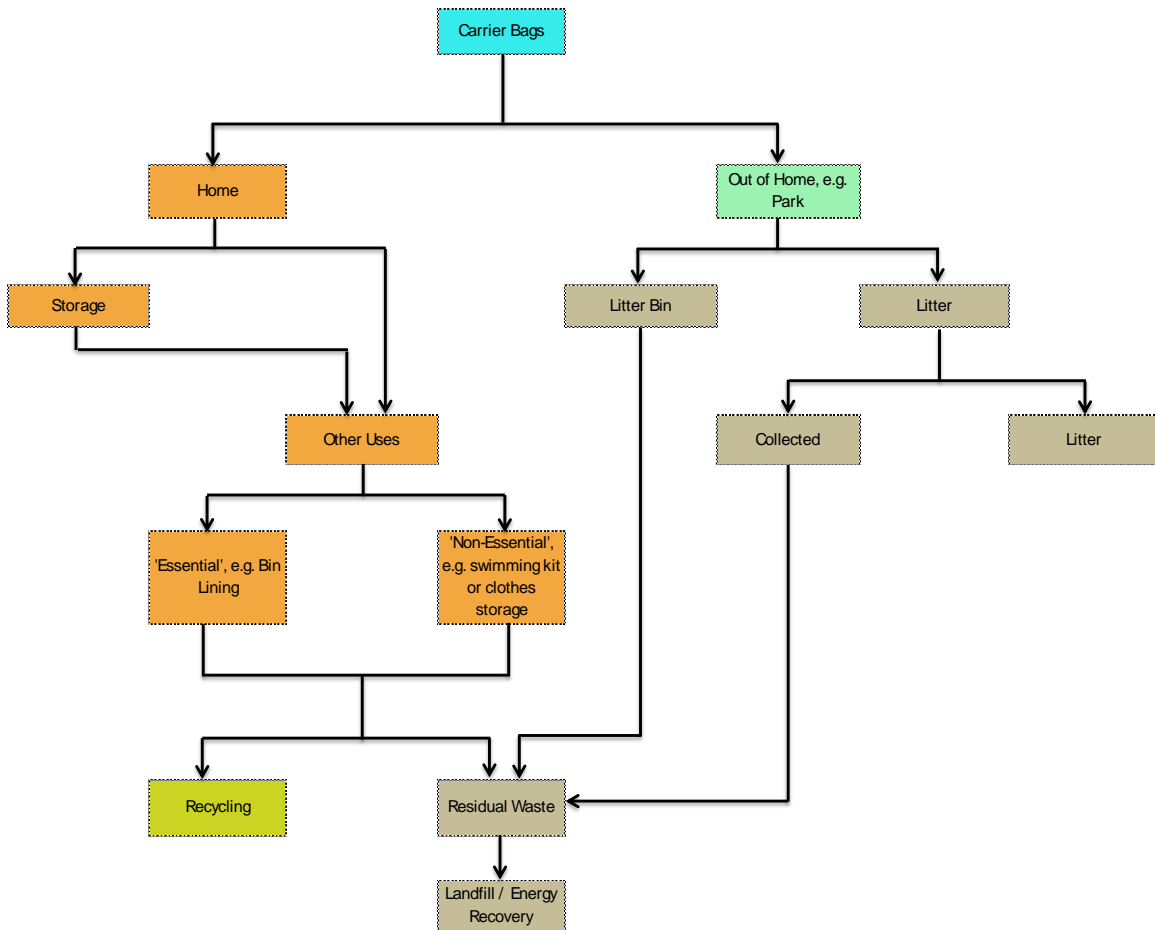
<sup>4</sup> For example, they are not included in estimates in the report by Bio Intelligence Services (BIO IS) (see Bio Intelligence Service (2011) Assessment of Impacts of Options to Reduce the Use of Single-use Plastic Carrier Bags, Final Report to European Commission – DG Environment, 12 September 2011

### 1.3 Single-use Plastic Carrier Bag Pathways

In considering the potential impacts of any measure that reduces the consumption of single-use plastic carrier bags it is important to understand at the outset, in conceptual terms at least, the likely current pathways of such bags. In Figure 1 we present a number of possible options that relate to use (and re-use) both inside and outside the home, and subsequent 'end-of-life' options including as litter or within formal waste management routes.

What becomes clear is that the impacts of reducing consumption will depend to a great extent upon the proportion of single-use plastic carrier bags currently following each specific pathway, and the alternatives to which consumers might switch. These switches will relate both to 'primary uses', such as carrying shopping, and 'secondary uses', such as lining bins. Understanding the magnitude of all such potential flows and switches is required to gain an accurate picture of the changes that will result.

Figure 1: Likely Pathways of Single-Use Plastic Carrier Bags



However, this is an area that remains characterised by a lack of robust information. Accordingly, whilst awareness of the 'conceptual' flow has been uppermost in our thinking, we have been constrained in our ability to clearly identify all elements in terms of their magnitude. Notwithstanding these unavoidable limitations, the analysis

presented below draws on the evidence which is available to us, and makes clear all assumptions that are used in the modelling we have undertaken.

## 1.4 Report Layout

The remainder of the report is structured as follows:

- Section 2.0 reports on the analysis of the EU bags producing sector;
- Section 3.0 reports on the evidence gathering relating to social and economic impacts; and
- Section 4.0 presents the policy options and results.

## 2.0 Task 1: Analysis of the Size of the Bag Producing Sector in the EU

As per the project Specification the first part of the analysis undertaken related to the size of the bag producing sector in the EU. We sought information relating to:

- The size and characteristics of the plastic bags producing sector in the EU;
- The types of plastic bags and other bags produced;
- The share between the production of single-use plastic carrier bags and other types of plastic and other bags; and
- The number of SMEs involved in the production of single-use plastic carrier bags and the Member States in which Member States they are located.

Our approach to this part of the work comprised three main elements:

- Reviewing the BIO IS study<sup>5</sup> and associated spreadsheet, and identifying any shortfalls in data that could be addressed;
- Seeking further data through published reports and databases and through seeking to obtain data directly from industry; and
- Speaking with industry representatives with a view to obtaining greater clarity, by Member State if possible, on the characteristics of the EU plastic carrier bags producing sector. We had initially planned to undertake 5 telephone-based interviews, but actually spoke with a far larger number of industry representatives in our quest for data. Details of the stakeholders with whom we have had contact as part of this process are listed in Appendix A.1.0

In the Sections below we present the key findings for this part of the work. Full details of how the information was derived are provided in the appendices indicated. We also explain which figures are taken forward for use in the modelling.

### 2.1 Size and Characteristics of the Plastic Bags Producing Sector

It is estimated that there are around 250-300 producers of plastic carrier bags in the EU.<sup>6</sup> We sought to verify this figure, and were presented with figures by an advocacy company that there are about 300 producers.<sup>7</sup> Attempts were made to obtain further information from the European Plastics Converters (EuPC) but despite a number of telephone conversations and email exchanges, no further information was forthcoming in the time available for the study.

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<sup>5</sup> Bio Intelligence Service (2011) Assessment of Impacts of Options to Reduce the Use of Single-use Plastic Carrier Bags, Final Report to European Commission – DG Environment, 12 September 2011

<sup>6</sup> Personal communication between BIO IS and Alber & Geiger

<sup>7</sup> Personal communication with Alber & Geiger, 1<sup>st</sup> August 2012

The sector is estimated to employ around 15,000-20,000 workers.<sup>8</sup> Taking account of the whole supply chain, this may be as high as 50,000.<sup>9</sup> We sought further information relating to employment from the EuPC to improve on this data, but again no response was provided. A similar request to Plastics Europe yielded no further information. Based on consultation with an industry stakeholder, it is estimated by BIO IS that 80% of EU plastic carrier bag producers are privately owned SMEs.<sup>10</sup> Production is understood to occur in at least 19 Member States.<sup>11</sup> We sought further information from EuPC on this matter, but received no alternative data. The only information we received was from an advocacy firm suggesting that these figures were broadly correct.<sup>12</sup>

Similar information was requested from the UK's two relevant trade bodies, the British Plastics Federation (BPF), and the Packaging and Film Association (PAFA). Neither was able to supply any information, as they stated that they did not possess such information about their members. If other national trade associations are in a similar position, this may explain the lack of response from the European trade associations, as they were proposing to obtain information from the national associations.

## 2.2 EU Production by Bag Type

In this section we provide a brief overview of EU production by bag type. Further information is provided in Appendix A.3.0.

BIO IS estimates total tonnage of plastic carrier bags produced in the EU in 2010 was 1.12 million tonnes.<sup>13</sup> EU production of plastic carrier bags involves both biodegradable and non-biodegradable single-use HDPE carrier bags, and multiple-use LDPE carrier bags.

Of the total EU production of 1.12 million tonnes in 2010, it is estimated by BIO IS that 0.38 Mt is of single-use non-biodegradable plastic carrier bags, 0.01 Mt of single-use biodegradable plastic carrier bags and 0.73 Mt is of multiple-use LDPE plastic carrier bags.<sup>14</sup> However, as explained in Appendix A.3.0 we believe that the level of imports of single-use non-biodegradable plastic carrier bags is greater than assumed

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<sup>8</sup> Personal communication between BIO IS and Alber & Geiger

<sup>9</sup> EuPC (2006) *EU duties on plastic bag imports applauded by EuPC*, press release available at <http://www.europeanplasticfilms.eu/docs/antidumping.pdf>

<sup>10</sup> Personal communication between BIO IS and an industry stakeholder

<sup>11</sup> BIO IS notes the following where production is known to take place: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Lithuania, The Netherlands, Poland, Portugal, Slovenia, Slovak Republic, Spain, Sweden and the UK.

<sup>12</sup> Written communication from Alber & Geiger, 1<sup>st</sup> August 2012.

<sup>13</sup> Based on PRODCOM data

<sup>14</sup> Bio Intelligence Service (2011) *Assessment of Impacts of Options to Reduce the Use of Single-use Plastic Carrier Bags*, Final Report to European Commission – DG Environment, 12 September 2011



by BIO IS. Our assumption is supported by information provided by a firm working on behalf of plastic bag manufacturers, which reports that:<sup>15</sup>

*“Cotton carrier bags, HDPE plastic carrier bags and PP plastic carrier bags are produced almost entirely in Asian countries due to cheaper production costs....HDPE plastic carrier bags require less material and a simpler production process.....A reduction of HDPE plastic carrier bags by any legal tool within Europe would not greatly affect the European plastic manufacturing industry of the employees of the sector”*

The EU production figures for 2010 used in this analysis, and those used in the BIO IS study, are shown in Table 3.

**Table 3: EU Production of Plastic Carrier Bags in 2010 (tonnes)**

Type of Bag	Tonnages Used by BIO IS	Tonnages Used in Analysis
Single-use Non-Biodegradable Plastic Carrier Bag	384,250	239,250
Single-use Biodegradable Plastic Carrier Bag	10,831	10,831
Multiple Use Plastic Carrier Bag (LDPE)	728,993	873,993
<b>Total</b>	<b>1,124,074</b>	<b>1,124,074</b>

We assume that all polypropylene (PP) bags consumed within the EU are imported.

We have, however, obtained a more recent estimate, for 2012, of the level of EU production of biodegradable single-use plastic carrier bags, which indicates that production currently stands at approximately 120,000 tonnes per annum, with a *potential* manufacturing capacity of between 260,000 and 300,000 tonnes.<sup>16</sup>

Currently approximately 15,000 tonnes of biodegradable single-use plastic carrier bags are imported to the EU annually.<sup>17</sup> Such figures are not entirely inconsistent with the figures presented for 2010 above, as there has been a dramatic increase in demand for biodegradable bags in Italy. In our modelling, we account for the switch to biodegradable bags in Italy, and indeed in Bulgaria from 2013, and our figures are consistent with both the 2010 and 2012 figures reported above.

<sup>15</sup> Written communication from Alber & Geiger, 1<sup>st</sup> August 2012.

<sup>16</sup> Personal communication with Novamont.

<sup>17</sup> Personal communication with Novamont

## 2.3 Number and Location of SMEs Producing Single-use Plastic Carrier Bags

Based on consultation with an industry stakeholder, it is estimated by BIO IS that 80% of the 250-300 EU plastic carrier bag producers are privately owned SMEs.<sup>18</sup> Production is understood to occur in at least 19 Member States.<sup>19</sup> We attempted to extract more information on numbers and location of SMEs from EuPC, and Plastics Europe but nothing further was available. Similar information was requested from the UK's two relevant trade bodies, the British Plastics Federation (BPF), and the Packaging and Film Association (PAFA). Neither was able to supply any information, as they stated that they did not possess such information about their members. As with the attempt to derive more detailed data on production, it seems reasonable to expect that if other national trade associations are in a similar position, then this may explain why the European trade associations consulted did not offer further information since they were proposing to obtain information from the national associations.

## 2.4 Data Used in Modelling

The following data relating to the bag producing sector in the EU is taken forward for use in the modelling:

- The total level of production described in Section 2.2 and the total level of employment as shown in Section 2.1 are used to calculate the employment intensity (i.e. the number of people employed per tonne produced). This calculation is described in Section 3.2.1

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<sup>18</sup> Personal communication between BIO IS and industry stakeholder.

<sup>19</sup> BIO IS notes the following where production is known to take place: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Lithuania, The Netherlands, Poland, Portugal, Slovenia, Slovak Republic, Spain, Sweden and the UK.

## 3.0 Task 2: Social and Economic Impacts – Evidence Gathering

The key findings from the evidence gathering activities in respect of social and economic impacts are presented in the Sections below, with those figures which are emboldened indicating those assumptions that are included in the modelling. Full details of the literature reviewed and sources consulted are in the relevant Appendices as indicated throughout the text.

### 3.1 Possible Switches to Other Types of Bags

We sought evidence regarding the nature of switches that consumers could be expected to make when policies are introduced which restrict the use of SUPBs. It is evident from the examples reviewed in Appendix A.4.0 that reliable data on the nature of such switches (i.e. which bags are used as replacements for SUPBs) is difficult to obtain. Typically figures are provided by retailers, and relate only to reductions in percentage terms. The only source of data which we could find which provided relevant bag consumption numbers was from WRAP, for the UK Carrier Bags Voluntary Agreement. Although based on only UK supermarkets, this still provides some basis for understanding how many bags of other types are used to substitute for SUPBs when analysed alongside Household Expenditure Data. Using this evidence suggests **that for every 1,000 single-use plastic carrier bags avoided, 29 LDPE bags are used, and 4 other multiple-use bags such as those made from cotton are used.** This assumption is used in our modelling.

It is not considered likely that supermarkets will switch to paper bags due to their expense (see Table 5) and relative lack of strength, although it is expected that other sectors will switch to greater use of paper bags if these are not made the subject of the policy, and this has, indeed, been the experience in Ireland (see Appendix A.4.2). However, the extent to which other sectors will switch to paper bags rather than multiple-use bags is not clear. We therefore assume that half (50%) of the plastic bag consumption in non-supermarket sectors will be displaced by paper bag consumption, and half by multiple-use bags. As per the BIO IS assumption, 32% of single-use plastic carrier bag consumption occurs in non-supermarket sectors. Therefore, at a capacity substitution rate of 79.6%<sup>20</sup>, **127 paper bags are assumed to be consumed for every 1,000 SUPBs avoided** ( $32\% \times 50\% \times 79.6\% \times 1,000 = 127$ ).

In light of the fact that no data could be gained to help give a sensible estimate of switches to SUPB-replacement bin liners used in the home, an approach based on interpretation of figures from an LCA study was adopted. The study included data from a 2005 WRAP study which surveyed the various forms of 'second use' for single-use plastic bags. It stated that of all single-use plastic carrier bags consumed, 76%

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<sup>20</sup> Environment Agency (2011), *Evidence: Life Cycle Assessment of Supermarket Carrier Bags: A Review of the Bags Available in 2006*, Environment Agency February 2011.

were used again, of which 53% were put to use as bin liners.<sup>21</sup> Based on this we assume that per 1,000 SUPB reduction, 403 (76% x 53% = 40.3%) equivalent capacity bin liners will be required. The equivalent capacity will be that stated in the EA LCA study of 29 litres,<sup>22</sup> so **we assume a consumption increase of approximately 273 bin liners will occur for every 1,000 SUPBs avoided.**

## 3.2 Impacts on Plastic Bag Producing Companies

### 3.2.1 Employment

Taking the figures on production levels and employment from Section 2.1, we outline below the likely changes in levels of employment related to changes in levels of EU production. Annual EU production is taken to be 1,124,074 tonnes of plastic carrier bags.<sup>23</sup> It is further estimated that there are 15,000-20,000 workers<sup>24</sup> or as many as 50,000 workers if the entire supply chain is included.<sup>25</sup> It is not known whether these are full-time equivalents (FTEs) or total numbers of people employed, including part-time workers. We make the assumption that they are FTEs.<sup>26</sup>

Assuming a mid-point estimate of 17,500 employees working on plastic carrier bag production in the EU, and dividing this figure by annual production, **the number of people employed per tonne produced is 0.015.**<sup>27</sup> This equates to one person employed for every 64.23 tonnes of plastic carrier bags produced. **We do not distinguish between the employment intensity of LDPE and HDPE production as there is insufficient data available to make such a distinction.**

In the absence of further information **we assume the same employment intensity for bin liners, of 0.015 people employed (FTE) per tonne produced.**

It has not been possible to obtain figures for EU-wide paper bag production or employment.<sup>28</sup> However, a rough estimate was obtained from using publicly available data relating to a Scottish manufacturer of paper bags, which employs 210 staff and

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<sup>21</sup> Environment Agency (2011), *Evidence: Life Cycle Assessment of Supermarket Carrier Bags: A Review of the Bags Available in 2006*, Environment Agency February 2011.

<sup>22</sup> Environment Agency (2011), *Evidence: Life Cycle Assessment of Supermarket Carrier Bags: A Review of the Bags Available in 2006*, Environment Agency February 2011.

<sup>23</sup> Bio Intelligence Service (2011) *Assessment of Impacts of Options to Reduce the Use of Single-use Plastic Carrier Bags*, Final Report to European Commission – DG Environment, 12 September 2011

<sup>24</sup> Personal communication between BIO IS and Alber & Geiger

<sup>25</sup> EuPC (2006) *EU duties on plastic bag imports applauded by EuPC*, press release available at <http://www.europeanplasticfilms.eu/docs/antidumping.pdf>

<sup>26</sup> This will have the effect of delivering a higher estimate of job losses than if we assumed a mix of FTE and part-time.

<sup>27</sup> It is not clear whether some of these are part time workers. In the absence of further information we simply assume 17,250 full time equivalents (FTEs).

<sup>28</sup> We have contacted CEPI and EuroSac but no information was available.

produces 50 million bags per week.<sup>29</sup> Given an average paper bag weight of 55.2g, this equates to 143,520 tonnes of production a year. This equates to one person for every 683 tonnes of paper bags produced. **The number of people employed per tonne of paper bags produced therefore is assumed to be 0.0015**, though it is recognised that the dependence on a single source is less than ideal. The assumptions on employment intensity, as used in the modelling, are summarised in Table 4. Assumptions relating to the location of employment are given in Appendix A.8.0

Table 4: Employment Intensity of EU Production by Bag Type (FTE per tonne)

Bag Type	Employment Intensity (FTE per tonne)
HDPE	0.0150
LDPE	0.0150
Paper	0.0015

### 3.2.2 Profits to Manufacturers

We have not been able to establish any evidence relating to the profitability of the bag manufacturing sector in the EU. Therefore, **in the absence of any other information, we make the assumption in the modelling that the profit to manufacturers is approximately 10% of the price paid by retailers (or 9.09% of the price paid by consumers in the case of bin liners, on the assumption that retailers mark up prices by 10%).** We report this profit for EU-based manufacturers for all bag types.

### 3.3 Impacts on Retailers

Retailers have to pay for the single-use plastic carrier bags that they then provide to customers free of charge. It is entirely possible that they will recover this cost through their pricing of other items, in which case the cost is effectively passed on to consumers. Either way, it is a cost that will decline if fewer single-use plastic carrier bags are used.

Table 5 indicates representative unit costs to retailers of purchasing the bags that they subsequently give away or sell. In the subsequent modelling we assume that only the single-use bags (plastic and paper) are given away free of charge, and that for all multiple-use bags, i.e. LDPE, PP, jute and cotton, a charge is made that at least covers the costs to retailers of their provision. Therefore, in our modelling, we only include the cost to retailers for the single-use bags.

We note that an increase in consumption of bin liners, that might be expected to occur as a result of a reduction in consumption of single-use plastic carrier bags, will

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<sup>29</sup> See <http://www.smithandersonpackaging.co.uk/>. Again, in the absence of further information we assume that the 210 staff work full time.

present an increase in costs to consumers. We assume that bin liners cost €79.26 per thousand.<sup>30</sup>

Table 5: Unit Costs to Retailers (per 1,000 bags)

Bag Type	Unit Cost (per 1,000 bags) <sup>31</sup>
Single-use Non-Biodegradable Plastic Carrier Bag	€8.31*
Single-use Biodegradable Plastic Carrier Bag	€82.87*
Single-use Paper Bag with Handles	€97.58*
LDPE 'Bag for Life'	€17.87*
Woven PP	€452.73**
Jute	€1,161.62***
Cotton	€1,111.25*
<b>Notes</b>	
* Costs taken from <a href="http://www.polybags.co.uk/">http://www.polybags.co.uk/</a>	
** Data taken from AEA Study for the Welsh Government <sup>32</sup>	
*** Costs taken from <a href="http://www.midpac.co.uk/jute-bags/natural-jute-bags">http://www.midpac.co.uk/jute-bags/natural-jute-bags</a>	

### 3.4 Assessment of Socio-Economic Benefits

#### 3.4.1 Littering Rates

In order to understand the likely reductions in the costs of collecting litter that may arise from a decline in consumption of single-use plastic carrier bags (and an associated increase in consumption of other types of bags) it is first necessary to consider the proportion of such bag types that are littered in each Member State. Full

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<sup>30</sup> This is based on the average cost of a roll of 25 white pedal bin liners of 30 litres each of €1.98 (Daisy Brand, €1.42 per roll of 25) at [www.tesco.com](http://www.tesco.com). This price is similar to those found at other retailers such as ASDA and online retailers such as [www.binlinersdirect.com](http://www.binlinersdirect.com) (Delhaize, Belgium =€1.79 for 25 litre white thin liners. Carrefour, France has a price range for comparable bags €1.67 - €3.80).

<sup>31</sup> All figures converted to Euros from GBP. Inflation has been accounted for with historical 2009 figures using latest HM Treasury GDP Deflator data. Converted at a £:€ exchange rate of 1:1.27650, ft.com currency converter, 26th July 2012.

<sup>32</sup> AEA Technology plc (2009), *Welsh Assembly Government, Single Use Bag Study: Final, Report for the Welsh Assembly Government August 2009.*

discussion of issues surrounding the calculation of littering rates, and an explanation of the steps used to derive the figures that we apply, are included at Appendix A.5.1.

### 3.4.2 Litter Clean-up Costs

With an understanding of the littering rates, a total cost can then be derived by multiplying the unit cost of litter collection against the total tonnage. A full discussion relating to the costs of cleaning up litter and explaining the derivation of the Member State-specific costs used in the modelling is provided in Appendix A.5.2.

### 3.4.3 Waste Management Routes

The cost of waste management of single-use plastic carrier bags and other bags will depend upon the waste management route taken, and the unit cost of each route, (see Section 3.4.4).

While there are opportunities for recycling of HDPE bags at present, such as take back facilities at supermarkets, the extent to which this currently occurs is not clear. Moreover, with current policies there is no clear reason to believe any significant increase in recycling will take place in the years out to 2020. Therefore, to simplify the analysis, **for the fraction of carrier bags that are not littered, we model, for municipal waste, the split between landfill<sup>33</sup> and incineration<sup>34</sup> by Member State<sup>35</sup>, as shown in Table 45 in Appendix A.6.0.** We hold this split constant from 2010 to 2020.

The same cannot be said for paper bags which are widely recycled. **We therefore assume that approximately 70% of paper bags are recycled, with the remaining proportion split between landfill and incineration as per the breakdown of each Member States' plastic bag disposal route as shown in Table 45.**<sup>36</sup>

### 3.4.4 Collection and Disposal Costs

A full discussion of the factors affecting collection costs, and the way in which we expect disposal costs to change over future years is provided in Appendix A.6.0. A

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<sup>33</sup> This is based on the proportion of the Member State's municipal waste destined for landfill in 2010 according to Eurostat ([http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/main\\_tables](http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/main_tables)) and the forecast proportion of the Member State's municipal waste destined for landfill in 2020 according to European Topic Centre on Sustainable Consumption and Production (2011) Projections of Municipal Waste Management and Greenhouse Gases, ETC/SCP working paper 4/2011, August 2011.

<sup>34</sup> This is based on the proportion of the Member State's municipal waste destined for incineration in 2010 according to Eurostat ([http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/main\\_tables](http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/main_tables)) and the forecast proportion of the Member State's municipal waste destined for incineration in 2020 according to European Topic Centre on Sustainable Consumption and Production (2011) Projections of Municipal Waste Management and Greenhouse Gases, ETC/SCP working paper 4/2011, August 2011.

<sup>35</sup> For the proportion that is not littered, and based on the proportional split between landfill and incineration, we present the figures for the proportion of bags consumed in each Member State that end up in landfill or incineration. For intervening years we interpolate proportions.

<sup>36</sup> Confederation of European Paper Industries (2012) *Key Statistics 2011*, July 2012, <http://www.cepi.org/content/default.asp?pageid=4>



**nominal collection cost of €10/tonne is modelled.** Current (2012) costs of incineration and landfill, as used in the modelling, are shown in Table 48 in Appendix A.7.0.

For recycling of paper bags the average of UK export prices for cardboard for the three years to July 2012, £102 (€131)<sup>37</sup> is taken as the indicative price obtained.

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<sup>37</sup> Prices for cardboard (old kls) from <http://www.letsrecycle.com/prices/waste%20paper/paper-prices-archive/prices?subCategory=2012> adjusted using the UK Treasury's GDP deflator, converted using a £:€ exchange rate of 1:1.27650, ft.com currency converter, 26<sup>th</sup> July 2012.

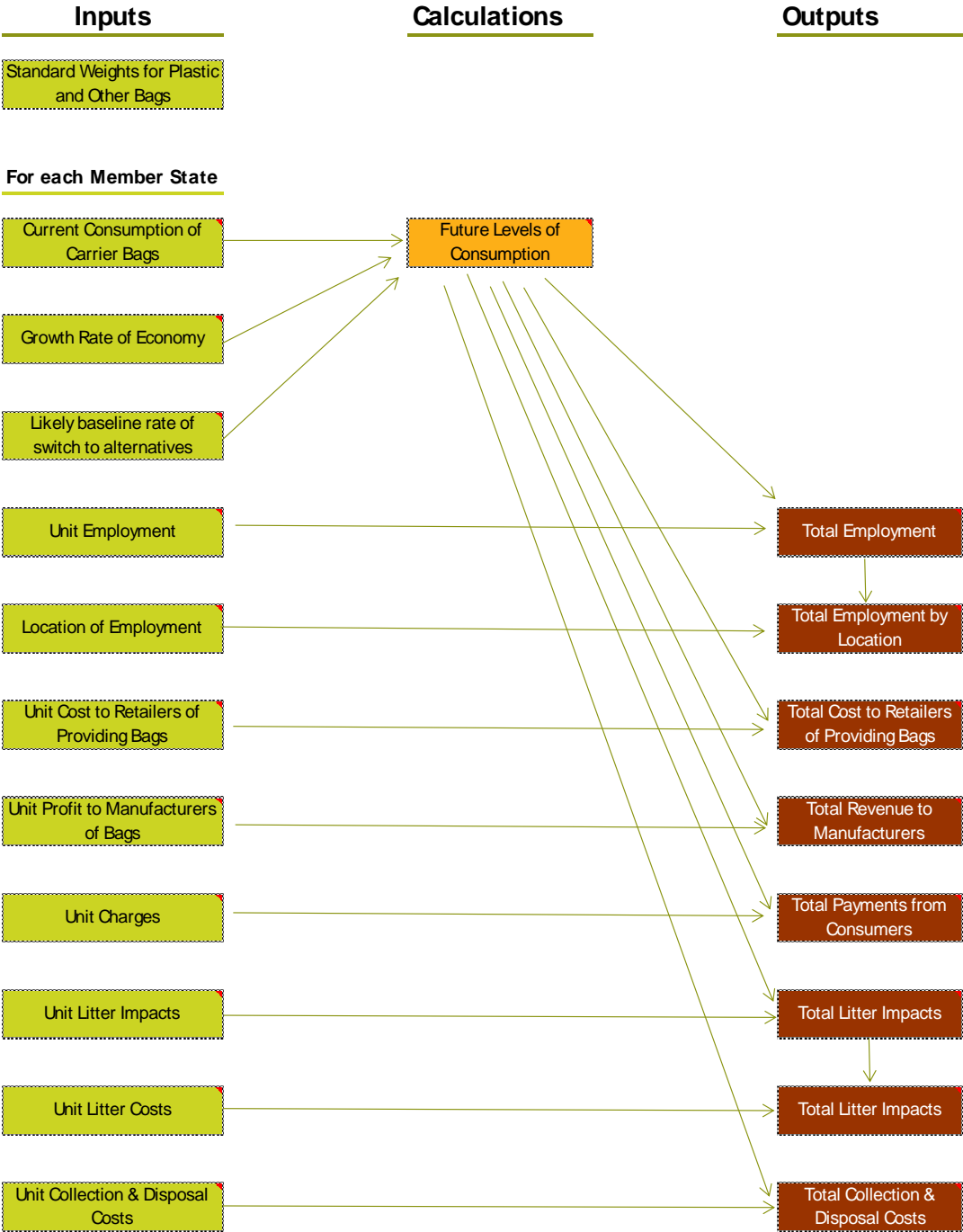


# 4.0 Policy Options and Results

## 4.1 Description of Model

An Excel model has been developed to undertake the analysis. A simplified flow diagram of the model baseline is shown in Figure 2

Figure 2: Flow Diagram of Model Baseline



Further details of the baseline calculations are given in Appendix A.10.0

## 4.2 Baseline and Policy Options

In this Section we first describe the Baseline and Policy Options, and present their effect on the consumption of single-use plastic bags. We then present the impacts of the Policy Options in Section 4.3. Diagrams showing the reduction in consumption of single-use plastic bags and associated increase in consumption of other bags are shown in Appendix A.11.0

### 4.2.1 Baseline

The baseline represents a trajectory for the evolution in consumption of single-use plastic bags in future. It represents the expected level of consumption of single-use plastic carrier bags in the EU out to 2020, on the assumption of no further policy intervention. In line with modelled economic growth and population trends (see Section A.2.1) the total consumption of single-use plastic carrier bags would continue to increase, as shown in Figure 3 from 89.2 billion in 2012 to 103.5 billion in 2020.

As noted above, our knowledge of the relationship between consumption of bags and economic growth is rather poor, and it should also be noted that the projections are linked to forecasts of the state of the economy which will have their own limitations.

### 4.2.2 Scenario 1 – EU-Level Ban on Single-use Plastic Carrier Bags

Scenario 1 is one in which a ban is implemented on single-use plastic carrier bags across all Member States. A 100% reduction in single-use plastic carrier bag consumption is modelled, and is assumed to come into effect at the start of 2015. With a ban on single-use plastic carrier bags, we model a switch towards both single-use paper bags and multiple-use bags. As reported in Section 3.1 what evidence is available suggests that supermarkets would switch to multiple-use bags, while for other retailers we model half the single-use plastic carrier bags being replaced by single-use paper bags and half by multiple-use bags.

### 4.2.3 Scenario 2 – Voluntary Commitment by Industry to Reduce Consumption of Single Use Plastic Carrier Bags

Scenario 2 is one in which a voluntary agreement is implemented by the retail and grocery sectors. The commitment is assumed to generate a 55% reduction in consumption of single-use plastic carrier bags. The voluntary commitment is assumed to come into effect in 2015.

### 4.2.4 Scenario 3 – EU-Level Prevention Target

Scenario 3 represents the outcome of an EU-level prevention target for single-use plastic carrier bags of 35 single-use bags per person in 2020 (an 80% reduction in relation to the EU average consumption). Each Member State would, in principle, be free to adopt its own measures in respect of single use plastic bags to deliver the objective. We model this reduction taking effect in 2015.

#### 4.2.5 Scenario Calculations

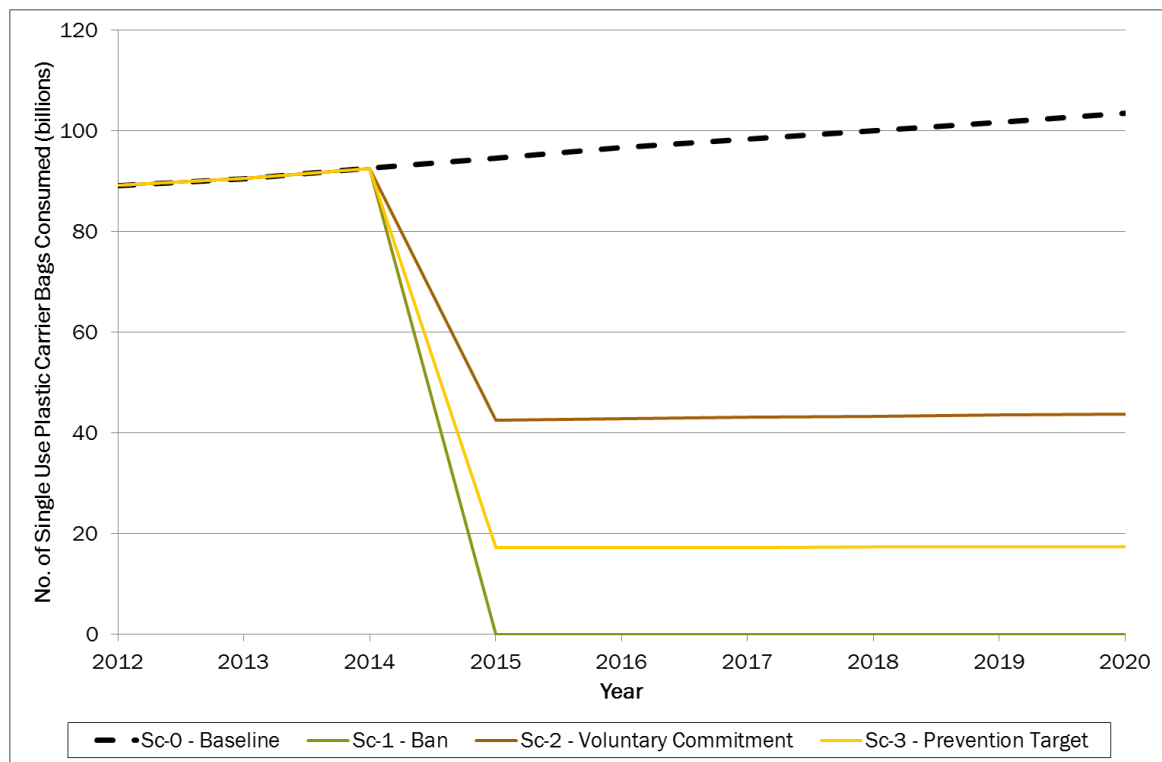
It was agreed with the Commission that in the modelling we would use 2015 as the date of implementation of measures under each of the scenarios.<sup>38</sup>

Under each scenario, the level of per-capita consumption of single-use plastic carrier bags is adjusted to achieve the specified reduction. It is assumed that the measures achieve the full intended reduction in the first year of operation, i.e. 2015.

We then model the associated switches to alternative bags as detailed in Section 3.1. For each scenario, the impacts on employment, costs to retailers, profits to manufacturers, litter and waste management costs are calculated in the same way as described for the baseline (see Appendix A.10.0). The results are compared against the baseline to identify the net impacts.

The number of single-use plastic carrier bags consumed under the baseline and the three scenarios is shown in Figure 3.

Figure 3: Consumption of Single-use Plastic Carrier Bags under the Baseline and Scenarios



<sup>38</sup> Personal communication with Diana Oancea, 24<sup>th</sup> July 2012

### 4.3 Impacts of the Policy Options

The changes relative to the baseline reported above are summarised for the three scenarios, for the period up to 2020 in Table 6. **It is important to note that the changes in employment levels are ‘one-off’ changes, experienced in 2015.**

Negative figures represent a reduction in costs. For consistency and to allow summation, increased profits to EU bag manufacturers have been represented as a negative figure. A full breakdown of the results is provided Sections 4.3.1 to 4.3.5. While costs and benefits are only presented out to 2020, they will continue in subsequent years. Over the period to 2020, the scenarios lead to present value savings ranging from €2.9bn under the voluntary commitment, to €5.4bn under the ban. Employment losses range from 860 FTEs under the voluntary commitment, to 1,641 FTEs under the ban.

**Table 6: Present Value Changes in Costs (2012 prices), Profits (2012 prices) and Employment Levels (for the period up to 2020)**

	Ban (100% reduction)	Prevention Target (80% reduction)	Voluntary Commitment (55% reduction)
Costs to Retailers (€m)	-4,750	-3,899	-2,475
Litter Collection Costs (€m)	-325	-278	-204
Waste Management Costs (€m)	-297	-239	-155
Profits to EU Bag Manufacturers* (€m)	-25	-23	-34
Net Change in Costs (€m)	-5,397	-4,439	-2,868
Net Change in Employment in EU Bag Manufacture in 2015	-1,641 FTE	-1,340 FTE	-860 FTE

\* N.B. While profits to EU manufacturers have increased, for consistency, alongside the savings in litter and waste management costs, they are represented as a negative figure.

#### 4.3.1 Cost to Retailers

The cost to retailers of providing single-use plastic carrier bags for free (see Section 3.2.2) will decrease from the **current level of approximately €1.8 billion** per annum under all scenarios. The reductions in cost seen under the different policy options are directly proportional to the reductions in consumption modelled for each. The costs

for each year out to 2020, modelled in real terms (2012 prices), are shown in Table 7.

**Table 7: Cost to Retailers of Providing Single-use Plastic Carrier Bags (€ billions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ 1.8	€ 1.9	€ 2.0	€ 2.1	€ 2.1	€ 2.2	€ 2.2	€ 2.3	€ 2.4
Ban	€ 1.8	€ 1.9	€ 2.0	€ -	€ -	€ -	€ -	€ -	€ -
Voluntary Commitment	€ 1.8	€ 1.9	€ 2.0	€ 1.0	€ 1.0	€ 1.0	€ 1.0	€ 1.0	€ 1.0
Prevention Target	€ 1.8	€ 1.9	€ 2.0	€ 0.4	€ 0.4	€ 0.4	€ 0.4	€ 0.4	€ 0.4

Discounting these figures at 4%<sup>39</sup> gives present value savings to retailers as shown in Table 8 (i.e. these are the cumulative savings from the period 2015 to 2020, discounted to present values)

**Table 8: Present Value Savings to Retailers Due to Cessation of Free Single-use Plastic Carrier Bag Provision (2012 prices)**

Scenario	Present Value Saving
Ban	€ 10.71 billion
Voluntary Commitment	€ 5.84 billion
Prevention Target	€ 8.82 billion

However, we have assumed that where a switch to the use of single-use paper bags occurs, these are not charged for by retailers, so there is a cost to retailers associated with the provision of these. These additional costs are shown in Table 9.

**Table 9: Cost to Retailers for Provision of Free Single-use Paper Bags (€ billions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 1.2	€ 1.2	€ 1.2	€ 1.2	€ 1.3	€ 1.3
Voluntary Commitment	€ -	€ -	€ -	€ 0.6	€ 0.7	€ 0.7	€ 0.7	€ 0.7	€ 0.7
Prevention Target	€ -	€ -	€ -	€ 1.0	€ 1.0	€ 1.0	€ 1.0	€ 1.0	€ 1.1

<sup>39</sup> This is the discount rate recommended by the European Commission in their Impact Assessment Guidelines, see European Commission (2009) Impact Assessment Guidelines, 15 January 2009, available at [http://ec.europa.eu/governance/impact/commission\\_guidelines/docs/iag\\_2009\\_en.pdf](http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf)

Taking account of this cost delivers a net reduction in costs to retailers (compared with the baseline) as shown in Table 10.

**Table 10: Net Reduction in Cost to Retailers for Provision of Free Single-use Carrier Bags (€ billions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 0.89	€ 0.93	€ 0.96	€ 1.00	€ 1.04	€ 1.08
Voluntary Commitment	€ -	€ -	€ -	€ 0.45	€ 0.48	€ 0.50	€ 0.52	€ 0.55	€ 0.58
Prevention Target	€ -	€ -	€ -	€ 0.73	€ 0.76	€ 0.79	€ 0.82	€ 0.86	€ 0.89

Discounting these figures at 4%<sup>40</sup> gives present value savings to retailers as shown in Table 11.

**Table 11: Present Value Savings to Retailers (2012 prices)**

Scenario	Present Value Saving
Ban	€ 4.75 billion
Voluntary Commitment	€ 2.47 billion
Prevention Target	€ 3.90 billion

#### 4.3.2 Litter Costs

The number of single-use plastic carrier bags being discarded as litter decreases under all scenarios, from the current level (see Section 3.4.1) of approximately 6 billion bags per annum, as detailed in Table 12. A standard litter rate is assumed for each Member State across all the scenarios; therefore the amount littered is directly proportional to the level of single-use plastic carrier bag consumption which the policies are assumed to deliver.

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<sup>40</sup> This is the discount rate recommended by the European Commission in their Impact Assessment Guidelines, see European Commission (2009) Impact Assessment Guidelines, 15 January 2009, available at [http://ec.europa.eu/governance/impact/commission\\_guidelines/docs/iag\\_2009\\_en.pdf](http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf)

**Table 12: Total Number of Single-use Plastic Carrier Bags Littered (billions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	6.0	6.1	6.2	6.4	6.5	6.7	6.8	6.9	7.0
Ban	6.0	6.1	6.2	-	-	-	-	-	-
Voluntary Commitment	6.0	6.1	6.2	2.0	2.0	2.1	2.1	2.1	2.1
Prevention Target	6.0	6.1	6.2	0.8	0.8	0.8	0.8	0.8	0.8

However, there is an increase in littering of single-use paper bags and multiple-use bags under all scenarios, associated with the increased consumption of such bags. This increase is shown in Table 13.<sup>41</sup>

**Table 13: Increased Littering of Paper and Multiple Use Bags Relative to the Baseline (billion bags)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	-	-	-	-	-	-	-	-	-
Ban	-	-	-	0.22	0.23	0.23	0.24	0.24	0.24
Voluntary Commitment	-	-	-	0.15	0.16	0.16	0.16	0.17	0.17
Prevention Target	-	-	-	0.19	0.20	0.20	0.21	0.21	0.22

Combined, these changes lead to a net reduction in litter impacts (in terms of the number of bags littered) for all scenarios, as shown in Table 14.

**Table 14: Net Reduction in Littered Bags as Compared to the Baseline (billion bags)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	-	-	-	-	-	-	-	-	-
Ban	-	-	-	-6.2	-6.3	-6.4	-6.5	-6.7	-6.8
Voluntary Commitment	-	-	-	-4.2	-4.3	-4.4	-4.6	-4.7	-4.8
Prevention Target	-	-	-	-5.4	-5.5	-5.7	-5.8	-5.9	-6.0

<sup>41</sup> Note that units are millions rather than billions

This translates into a reduced cost of collecting and disposing of littered bags (see Section 3.4.2) under each scenario (compared with the baseline), as shown in Table 15.

**Table 15: Net Change in Costs of Collecting and Disposing of Littered Bags (€ millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	-€ 64.0	-€ 65.4	-€ 66.6	-€ 67.8	-€ 69.0	-€ 70.3
Voluntary Commitment	€ -	€ -	€ -	-€ 39.4	-€ 40.7	-€ 41.7	-€ 42.8	-€ 43.9	-€ 45.0
Prevention Target	€ -	€ -	€ -	-€ 54.4	-€ 55.8	-€ 57.0	-€ 58.1	-€ 59.3	-€ 60.5

Discounting these figures at 4%<sup>42</sup> gives present value savings on litter collection as shown in Table 61

**Table 16: Present Value Savings on Litter Collection Compared to the Baseline (2012 prices)**

Scenario	Present Value Saving
Ban	€ 325 million
Voluntary Commitment	€ 204 million
Prevention Target	€ 278 million

### 4.3.3 Waste Collection and Disposal Costs

The cost of collecting and treating single-use plastic carrier bags in formal waste collection systems, i.e. representing the proportion that is not littered, decreases under all scenarios as shown in Table 17. Information on the calculation of the costs of waste collection are provided in Sections 3.4.3 and 3.4.4.

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<sup>42</sup> This is the discount rate recommended by the European Commission in their Impact Assessment Guidelines, see European Commission (2009) Impact Assessment Guidelines, 15 January 2009, available at [http://ec.europa.eu/governance/impact/commission\\_guidelines/docs/iag\\_2009\\_en.pdf](http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf)



**Table 17: Total Cost of Collecting and Disposing of Single-use Plastic Carrier Bags in Formal Waste Management Systems (€ millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ 64.9	€ 66.8	€ 69.1	€ 71.6	€ 74.0	€ 76.2	€ 78.3	€ 80.6	€ 82.8
Ban	€ 64.9	€ 66.8	€ 69.1	€ -	€ -	€ -	€ -	€ -	€ -
Voluntary Commitment	€ 64.9	€ 66.8	€ 69.1	€ 37.5	€ 38.1	€ 38.6	€ 39.1	€ 39.5	€ 40.0
Prevention Target	€ 64.9	€ 66.8	€ 69.1	€ 15.7	€ 15.8	€ 15.9	€ 16.0	€ 16.2	€ 16.3

The increase in waste management costs associated with the bags to which consumers switch under each scenario are shown in Table 18.

**Table 18: Net Increase in Costs of Collecting, Recycling, and Disposing of Multiple-use and Paper Bags in Formal Waste Collection Systems (millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 14.3	€ 15.0	€ 15.6	€ 16.2	€ 16.8	€ 17.5
Voluntary Commitment	€ -	€ -	€ -	€ 5.1	€ 5.6	€ 6.1	€ 6.6	€ 7.1	€ 7.7
Prevention Target	€ -	€ -	€ -	€ 10.3	€ 11.0	€ 11.5	€ 12.1	€ 12.8	€ 13.4

The net reductions in costs for all scenarios, relative to the baseline, are shown in Table 19.

**Table 19: Net Reduction in Costs for Collecting, Recycling and Disposing of All Bags in Formal Waste Collection Systems (millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	-€ 57.3	-€ 59.1	-€ 60.6	-€ 62.1	-€ 63.7	-€ 65.4
Voluntary Commitment	€ -	€ -	€ -	-€ 28.9	-€ 30.3	-€ 31.5	-€ 32.7	-€ 33.9	-€ 35.2
Prevention Target	€ -	€ -	€ -	-€ 45.6	-€ 47.3	-€ 48.7	-€ 50.1	-€ 51.6	-€ 53.2

Discounting these figures at 4%<sup>43</sup> gives present value savings on waste management as shown in Table 20.

**Table 20: Present Value Savings on Waste Management Compared to the Baseline (2012 prices)**

Scenario	Present Value Saving
Ban	€ 296 million
Voluntary Commitment	€ 155 million
Prevention Target	€ 239 million

#### 4.3.4 EU Employment Impacts

The number of people employed in the manufacture of single-use plastic carrier bags declines under all scenarios. The assumptions relating to employment are outlined in Section 3.2.1. This effect on employment is shown in Table 21.

**Table 21: Total Number of People Employed in the Manufacture of Single-use Plastic Carrier Bags in the EU (thousands)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	4.9	5.1	5.2	5.4	5.5	5.6	5.7	5.8	6.0
Ban	4.9	5.1	5.2	0.3	0.4	0.4	0.4	0.4	0.4
Voluntary Commitment	4.9	5.1	5.2	2.6	2.7	2.7	2.7	2.8	2.8
Prevention Target	4.9	5.1	5.2	1.3	1.3	1.3	1.3	1.3	1.3

There is, however, an increase in the number of people employed in the manufacture of multiple-use plastic carrier bags, paper bags, and bin liners. This increase relative to the baseline is shown in Table 22.

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<sup>43</sup> This is the discount rate recommended by the European Commission in their Impact Assessment Guidelines, see European Commission (2009) Impact Assessment Guidelines, 15 January 2009, available at [http://ec.europa.eu/governance/impact/commission\\_guidelines/docs/iag\\_2009\\_en.pdf](http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf)

**Table 22: Increase in the Number of People Employed in the Manufacture of Multiple-use Bags, Paper Bags and Bin Liners in the EU (thousands)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	-	-	-	-	-	-	-	-	-
Ban	-	-	-	3.4	3.4	3.5	3.5	3.6	3.6
Voluntary Commitment	-	-	-	1.9	1.9	2.0	2.0	2.0	2.1
Prevention Target	-	-	-	2.8	2.8	2.9	2.9	3.0	3.0

The net change in levels of EU employment, compared with the baseline, under the three scenarios is shown in Table 23.

**Table 23: Net Change in the Number of People Employed in Manufacture of All Bags in the EU (thousands)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	-	-	-	-	-	-	-	-	-
Ban	-	-	-	-1.6	-1.7	-1.8	-1.8	-1.9	-2.0
Voluntary Commitment	-	-	-	-0.9	-0.9	-0.9	-1.0	-1.0	-1.1
Prevention Target	-	-	-	-1.3	-1.4	-1.5	-1.5	-1.6	-1.6

#### 4.3.5 Profits to EU Manufacturers

The assumed profits to EU manufacturers of single-use plastic carrier bags decline relative to the baseline under each scenario. The changes can be seen in Table 24.

**Table 24: Profits to EU Manufacturer from Single-use Plastic Carrier Bags (€ millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ 124	€ 138	€ 142	€ 147	€ 152	€ 156	€ 161	€ 165	€ 170
Ban	€ 124	€ 138	€ 142	€ 1	€ 1	€ 1	€ 1	€ 1	€ -
Voluntary Commitment	€ 124	€ 138	€ 142	€ 70	€ 72	€ 73	€ 74	€ 75	€ 77
Prevention Target	€ 124	€ 138	€ 142	€ 27	€ 28	€ 28	€ 29	€ 29	€ 30

There is, however, an increase in the profits associated with the manufacture of alternative bags including paper bags, and also from the increase in sales of bin liners. These increases are shown in Table 25.

**Table 25: Increase in Profits to EU Manufacturers from Multiple-use Bags, Paper Bags and Bin Liners (€ millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 156	€ 159	€ 162	€ 164	€ 167	€ 170
Voluntary Commitment	€ -	€ -	€ -	€ 86	€ 89	€ 91	€ 93	€ 96	€ 98
Prevention Target	€ -	€ -	€ -	€ 127	€ 131	€ 133	€ 136	€ 138	€ 141

There is therefore an increase in profits to EU bag manufacturers relative to the baseline under all scenarios, as shown in Table 26.

**Table 26: Net Change in Profits to EU Bag Manufacturers (€ millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 9	€ 8	€ 6	€ 4	€ 2	€ 0
Voluntary Commitment	€ -	€ -	€ -	€ 9	€ 8	€ 8	€ 7	€ 6	€ 4
Prevention Target	€ -	€ -	€ -	€ 8	€ 7	€ 5	€ 4	€ 2	€ 1

#### 4.4 Sensitivity of Results to Switches to Paper Bags

For sensitivity, we assume that for the non-supermarket sectors, all the switches from single-use plastic carrier bags are to paper bags. The main change is the considerable increase in the cost to retailers of providing a greater number of paper bags for free. As can be seen in Table 27 the voluntary commitment leads to the greatest overall increase in costs, of €273 million, followed by the ban, with an increase in costs of €174 million. The prevention target leads to the lowest net increase in costs, of €157 million. The ban leads to the greatest reduction in EU employment in bag manufacture, of 1,343 FTE in 2015, followed by the 80% prevention target, with a loss of 1,097 FTE in 2015. The voluntary commitment results in the loss of 696 FTE in 2015.

Table 27: Present Value Changes in Costs (2012 prices), Profits (2012 prices) and Employment Levels (for the period up to 2020)

	Ban (100% reduction)	Prevention Target (80% reduction)	Voluntary Commitment (55% reduction)
Costs to Retailers (€m)	1,227	1,032	895
Litter Collection Costs (€m)	-314	-268	-197
Waste Management Costs (€m)	-419	-340	-225
Profits to EU Bag Manufacturers* (€m)	-321	-267	-200
Net Change in Costs (€m)	174	157	273
Net Change in Employment in EU Bag Manufacture in 2015	-1,343 FTE	-1,097 FTE	-696 FTE
* N.B. While profits to EU manufacturers have increased, for consistency, alongside the savings in litter and waste management costs, they are represented as a negative figure.			

## 4.5 Sensitivity of Results to Import Assumptions

A key assumption in the analysis above is that 70% of all non-biodegradable single-use plastic carrier bags consumed in the EU are imported (see Appendix A.3.0). We believe this is a more accurate figure than the 50% assumed in a previous study for the Commission.<sup>44</sup> However, in the spirit of sensitivity analysis, the results of assuming that only 50% of such bags are imported are shown in Table 28.

<sup>44</sup> BIO Intelligence Service (2011) *Assessment of Impacts of Options to Reduce the Use of Single-use Plastic Carrier Bags*, Report for DG Environment, European Commission, 12 September 2011

Table 28: Present Value Changes in Costs (2012 prices), Profits (2012 prices) and Employment Levels – Assuming 50% Import of Non-biodegradable Single-use Plastic Carrier Bags (for the period up to 2020)

	Ban (100% reduction)	Prevention Target (80% reduction)	Voluntary Commitment (55% reduction)
Costs to Retailers (€m)	-4,750	-3,899	-2,475
Litter Collection Costs (€m)	-325	-278	-204
Waste Management Costs (€m)	-297	-239	-155
Profits to EU Bag Manufacturers* (€m)	39	31	3
Net Change in Costs (€m)	-5,332	-4,385	-2,831
Net Change in Employment in EU Bag Manufacture in 2015	-3,616 FTE	-2,957 FTE	-1,960 FTE
* N.B. While profits to EU manufacturers have increased, for consistency, alongside the savings in litter and waste management costs, they are represented as a negative figure.			

The key changes are to employment and profits to EU bag manufacturers. With a greater proportion of non-biodegradable single-use plastic carrier bags assumed to be produced in the EU, greater job losses are associated with each of the policy options. Similarly, the profits to EU bag manufacturers decline. This is because the extra profits associated with production of LDPE bags are now set against greater drops in profits from lost HDPE bag production.

## APPENDICES

## A.1.0 Stakeholders Contacted

1. Alber & Geiger – Waltraud Heinrich
2. B&Q – Roy Miller
3. British Plastics Federation – Philip Law
4. Bulgarian Ministry of Water and Environment– Grigor Stoyanov
5. Bunzl - Jaclyn Barker
6. CEPI – Jori Ringman-Beck
7. Cereplast – William Nashi
8. Defra – Ian Atkinson
9. EPI – Tonny Wong
10. EuropaBio – Rosalind Travers
11. European Plastics Converters - Pdraig Nolan
12. Institute for Bioplastics and Biocomposites – Christian Schulz
13. Marks & Spencer - Rowland Hill
14. Morrisons – Mark Stitson
15. NNFCC – Lucy Natrass
16. Novamont – Francesco Degli Innocenti
17. Oxo-biodegradable Plastics Association – Michael Stephen
18. Packaging and Film Association – Sukhraj Poonia
19. Papier Mettler UK – Terry Milne
20. Plastics Europe – Guy Castelan, Pauline Tawil, Adrian Whyte
21. Smith Anderson – Michael Longstaffe
22. Symphony Environmental – Keith Frener
23. Templecombe Ltd – Kate Wells
24. Tesco – Tara Luckman
25. Welsh Government – Helena Bird
26. WRAP – Tom Quested



## A.2.0 EU Consumption of Single-use Plastic Carrier Bags

In this section we review the consumption data from the BIO IS study, and demonstrate our approach to filling in data gaps. BIO IS calculates the total consumption of single-use non-biodegradable bags across the EU by dividing the reported tonnage placed on the market in 2010 (0.73Mt) by the average weight of 8.5g. The same process is undertaken to estimate single-use biodegradable bags, taken to represent 3% of the single-use market share in 2010, using an average weight of 8.9g. Total consumption for single-use plastic carrier bags is therefore calculated as 85.3 billion non-biodegradable bags, and 2.3 billion biodegradable bags.<sup>45</sup>

Dividing these figures by total population of approximately 500 million, BIO IS calculates annual per capita consumption of single-use plastic carrier bags to be 171 (for non-biodegradable bags) and 5 (for biodegradable bags), giving a total of 175 (the figures do not sum exactly due to rounding).

For individual Member States, BIO IS employs a number of different approaches to produce its figures for single-use plastic carrier bags:

- In the majority of cases (e.g. Cyprus, Denmark, Italy) the approach taken is that described in connection with the EU-27 figure at the start of this section, relying on the total tonnage of carrier bags thought to be placed on the market, and the average weight of each bag;
- In three cases (Finland, Ireland, Sweden) BIO IS has uncovered data directly reporting the number of bags used per capita in 2010;
- In several others (e.g. Bulgaria, France, the UK) BIO IS has obtained data on the tonnage of carrier bags placed on the market (or some significant part of the market, typically supermarkets) which is divided by the relevant country's population to produce a per capita figure;
- Where a tonnage figure is not available for 2010, BIO IS uses a number of methods to estimate a likely figure from the data that is available;
- For several countries, BIO IS cannot produce an estimate as they have obtained no data regarding the number, or weight, of bags placed on the market.

Accordingly, there is a lack of data for some Member States. Therefore, we present below our approach to calculating the average per capita consumption of Member States for which data is absent.

The BIO IS IA model breaks down plastic carrier bags into two main types, 'Single Use Plastic Carrier Bags' and 'Multiple-Use Plastic Bags'. This data, where present, can

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<sup>45</sup> Bio Intelligence Service (2011) Assessment of Impacts of Options to Reduce the Use of Single-use Plastic Carrier Bags, Final Report to European Commission – DG Environment, 12 September 2011

then be summed to give the total number of carrier bags consumed ('All Plastic Carrier Bags') in an individual Member State.

Table 29 highlights the known data points, as taken from the BIO IS study. BIO IS also presents an EU per capita average figure. As is immediately clear, there are numerous data points missing for a large number of the Member States.

**Table 29: Known Data Points for Per Capita Plastic Bag Consumption (2010)**

Member State	All Plastic Carrier Bags	Single-Use Plastic Carrier Bags	Multiple Use Plastic Bags
Austria	51	45	6
Belgium	98	97	1
Bulgaria	421	246	175
Cyprus	140	125	15
Czech Republic		297	
Denmark	79	4	75
Estonia			
Finland	77	4	73
France		79	
Germany	71		
Greece	269		
Hungary			
Ireland		18	
Italy	204	181	23
Latvia			
Lithuania			
Luxembourg	20	18	2
Malta	119		
Netherlands	81	71	10
Poland			
Portugal			
Romania		252	
Slovakia			
Slovenia			
Spain	133		
Sweden	111		
United Kingdom	137	129	8
<b>EU-27 average</b>	<b>198</b>	<b>175</b>	<b>23</b>

EuPF figures do not concur with a number of the estimates from BIO IS. EuPF states that:<sup>46</sup>

*In the UK the figure [for consumption] stands at approximately 100 bags per person per year and as many as 60% of individuals reuse all these bags. Similar figures apply in Austria and Germany, whereas France is even lower*

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<sup>46</sup> EuPF (2011) EuPF rejects European Commission figures on plastic bags in EU, press release available at <http://www.europeanplasticfilms.eu/docs/EuPF%20on%20EC%20Consultation.pdf>

with consumption standing at 15-30 bags per individual annually and reuse of these bags being the norm.

EuPF suggest a lower per capita consumption for the UK and France than that suggested by BIO IS. Conversely EuPF's estimate for Austria is at a higher level than that of BIO IS.

However, both of the above figures for the UK are contradicted by a WRAP study reporting 'thin gauge' plastic carrier bag use by supermarket customers.<sup>47</sup> This states that 7.568 billion were used in 2010. The UK population is approximately 60 million, which means per capita consumption in 2010 of 126 single-use bags based on consumption at supermarkets only. BIO IS estimate that UK supermarkets account for 80% of all single-use carrier bags given away, which would mean per capita consumption in 2010 of **158 single-use carrier bags**. Therefore we amend this data point for single-use plastic carrier bags for the UK.

From the known data points it is possible to calculate an average per capita figure for those Member States, and then using the BIO IS EU average per capita figure, it is then possible to calculate an average value that, if attributed to each Member State with no data point, will result in the BIO IS EU average per capita figure. The methodology used is detailed below:

**Legend:**

**MSA** = Member States with KNOWN data points

**MSB** = Member States with MISSING data points

**EU** = Value for the EU as a whole

First, the total number of bags consumed across the EU is calculated using the BIO IS average per capita figure:

$$\begin{aligned} & \textit{Average Per Capita Consumption}_{EU} * \textit{Population}_{EU} \\ & = \textit{Total Bag Consumption}_{EU} \quad (1) \end{aligned}$$

Then, for the Member States that have a known 'Per Capita Consumption' data point, a total bag consumption figure is calculated:

$$\begin{aligned} & \sum \textit{Population}_{MSA} * \textit{Per Capita Consumption}_{MSA} \\ & = \textit{Total Bag Consumption}_{MSA} \quad (2) \end{aligned}$$

The total bag consumption of the remaining Member States can then be calculated:

$$(1) - (2) = \textit{Total Bag Consumption}_{MSB} \quad (3)$$

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<sup>47</sup> WRAP (2012) New figures on carrier bags use released by WRAP – press release, available at <http://www.wrap.org.uk/content/new-figures-carrier-bags-use-released-wrap>

Knowing the population of both the Member States with data points and the Member States where no data was available, it is possible to calculate the average per capita consumption of the two groups:

$$\frac{(2)}{\sum \text{Population}_{MSA}} = \text{Average Per Capita Consumption}_{MSA} \quad (4)$$

$$\frac{(3)}{\sum \text{Population}_{MSB}} = \text{Average Per Capita Consumption}_{MSB} \quad (5)$$

The results of the above for each of the bag-type groups are presented in Table 30.<sup>48</sup> The Table highlights the fact that the average per capita consumption figure for Member States with no available data must be higher than the average for those for which data has been acquired, if the overall quantity consumed in the EU is to match the BIO IS EU figure. This seems plausible on the basis that the countries with data available tend to be those who have an interest in, or already are addressing, the issue of plastic carrier bag (or all carrier bag) use.

Table 30: Average Per Capita Consumption Figures

(Per Capita)	All Plastic Carrier Bags	Single-Use Plastic Carrier Bags	Multiple Use Plastic Bags
BIO IS EU Value	198	175	23
Known Data Points	133	140	32
Implied Average for Unknown Data Points	271	219	20

Taking this a step further, based on the BIO IS figure for the EU, and an average weight of 8.5 grams of single-use plastic carrier bags, there were approximately 745,000 tonnes of single-use plastic carrier bags consumed in the EU in 2010.<sup>49</sup> Then using the per capita figures above, it can be calculated that of the Member States with known data, c.332,000 tonnes of single-use plastic carrier bags were consumed, and consequently over **c.412,000 tonnes of single-use plastic carrier bags can be attributed to the Member States where no data on consumption was available.**

The calculations above for each category of carrier bags were based on the data points available for each specific category individually. When the average per capita

<sup>48</sup> Note that the relevant Member States included in each bag-type group will differ as per the known data points presented.

<sup>49</sup> This differs from the 725,000 tonnes reported as on the market due to rounding in the averages

consumption required for the Member States with no data points of ‘Single-Use Plastic Carrier Bags’ is compared to the Member State’s data point for ‘All Plastic Carrier Bags’ (where known), an anomaly is observed. For example, in Spain, which does not have any data for consumption of ‘Single-Use Plastic Carrier Bags’, but for which a data point exists for ‘All Plastic Carrier Bags’ (133 bags per capita), the figure is significantly lower than the average consumption of ‘Single-Use Plastic Carrier Bags’ that was calculated for the Member States with no data points, i.e. 219 bags per capita.

One approach where a Member State has a data point for ‘All Plastic Carrier Bags’, and no data point for ‘Single-Use Plastic Carrier Bags’, could be to attribute the per capita consumption in the ‘All Plastic Carrier Bags’ category to the ‘Single-use Plastic Carrier Bags’ category. However, from looking at the Member States where separate figures are provided for both ‘All Plastic Carrier Bags’ and ‘Single-Use Plastic Carrier Bags’, it is clear that single-use plastic bags do not represent 100% of all plastic carrier bags. The proportions are shown in Table 31.

**Table 31: Proportions of Plastic Carrier Bags Consumed that are Multiple-use and Single-use**

	All Plastic Carrier Bags (annual per capita consumption)	Single-use Plastic Carrier Bags (annual per capita consumption)	% Single-use	Multiple-use Plastic Bags (annual per capita consumption)	% Multiple-use
Austria	51	45	88%	6	12%
Belgium	98	97	99%	1	1%
Bulgaria	421	246	58%	175	42%
Cyprus	140	125	89%	15	11%
Denmark	79	4	5%	75	95%
Finland	77	4	5%	73	95%
Italy	204	181	89%	23	11%
Luxembourg	20	18	90%	2	10%
Netherlands	81	71	88%	10	12%

The average share represented by multiple-use bags in these Member States is 32%. However, we do not necessarily expect it to be so high in Member States for which we have no such information. Accordingly we make the conservative assumption, for Member States where information is only available for ‘All Plastic Carrier Bags’ that only 10% of bags are multiple-use.

Therefore, in cases where a Member State has a data point for ‘All Plastic Carrier Bags’ and no data point for ‘Single-use Plastic Carrier Bags’, we assume that 90% of all bags consumed are single-use, and 10% are multiple-use. In the cases where we have a data point for single-use plastic carrier bags, but no data on total or multiple-use bags, we recalculate the total consumption and the multiple-use consumption so that multiple-use represents 10% of total consumption, and single-use represents 90% of total consumption.

The amended outputs are shown in Table 32 with figures calculated following the process outlined above shown in bold.

Table 32: Known Data Points for Plastic Bag Consumption (2010) - Adjusted

(per Capita)	All Plastic Carrier Bags	Single-Use Plastic Carrier Bags	Multiple Use Plastic Bags
Austria	51	45	6
Belgium	98	97	1
Bulgaria	421	246	175
Cyprus	140	125	15
Czech Republic	<b>330</b>	297	<b>33</b>
Denmark	79	4	75
Estonia			
Finland	77	4	73
France	<b>88</b>	79	<b>9</b>
Germany	71	<b>64</b>	<b>7</b>
Greece	269	<b>242</b>	<b>27</b>
Hungary			
Ireland	<b>20</b>	18	<b>2</b>
Italy	204	181	23
Latvia			
Lithuania			
Luxembourg	20	18	2
Malta	119	<b>107</b>	<b>12</b>
Netherlands	81	71	10
Poland			
Portugal			
Romania	<b>280</b>	252	<b>28</b>
Slovakia			
Slovenia			
Spain	133	<b>120</b>	<b>13</b>
Sweden	111	<b>100</b>	<b>11</b>
United Kingdom	<b>176</b>	158	<b>18</b>
EU-27 average	198	175	23

Using the same approach as above, the average per capita figures can then be calculated for the Member States with both known and unknown data points. The results are shown in Table 33.

Table 33: Average Per Capita Consumption Figures – Adjusted

(Per Capita)	All Plastic Carrier Bags	Single-Use Plastic Carrier Bags	Multiple Use Plastic Bags
BIO IS EU Value	198	175	23
Known Data Points	144	125	19
Implied Average for Unknown Data Points	515	466	48

Comparison of the results from Table 30 and Table 33 show a dramatic increase in the average per capita consumption (for Single-Use and Multiple Use Bags) that must be applied to the Member States where no data is available.

Table 34 shows the final values for each Member State for consumption of 'Single-Use Plastic Carrier Bags'.

**Table 34: Per Capita Consumption of 'Single-Use Plastic Carrier Bags' for each Member State, based on Eunomia Assumptions and Calculations.**

Member State	Per capita Consumption of Single-Use Plastic Carrier Bags
Austria	45
Belgium	97
Bulgaria	246
Cyprus	125
Czech Republic	297
Denmark	4
Estonia	<b>466</b>
Finland	4
France	79
Germany	64
Greece	242
Hungary	<b>466</b>
Ireland	18
Italy	181
Latvia	<b>466</b>
Lithuania	<b>466</b>
Luxembourg	18
Malta	107
Netherlands	71
Poland	<b>466</b>
Portugal	<b>466</b>
Romania	252
Slovakia	<b>466</b>
Slovenia	<b>466</b>
Spain	120
Sweden	100
United Kingdom	158
EU-27 average	175
Notes:	
1. Value of <b>466</b> is sourced from the average per capita consumption of Member States where no data is available., as shown in Table 33	

### A.2.1 Future Changes in Consumption

There is no sound basis for making a projection as to how the consumption of SUPB will change as the state of the economy changes. The preceding analysis highlights how difficult it is to generate data on consumption for any given year, let alone, a meaningful set of time-series data. We assume that future overall levels of

consumption, in the absence of any interventions, will increase in line with economic growth, as shown in Table 35. Figures for the rates of growth for the years from 2011 to 2013 inclusive are derived from the European Commission's Spring 2012 Economic Forecast.<sup>50</sup> For subsequent years we use recent Commission forecasts.

**Table 35: Real GDP Growth for European Member States**

Member State	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Austria	3.1	0.8	1.7	1.5	1.6	1.7	1.6	1.5	1.5	1.5
Belgium	1.9	0	1.2	1.6	1.6	1.6	1.3	1.3	1.3	1.3
Bulgaria	1.7	0.5	1.9	2.5	2.8	2.9	2.1	1.9	1.6	1.4
Cyprus	0.5	-0.8	0.3	1.6	1.6	1.8	1.4	1.5	1.6	1.7
Czech Republic	1.7	0	1.5	2.9	3.0	3.0	2.2	2.1	2.0	1.9
Denmark	1	1.1	1.4	1.4	1.5	1.6	1.2	1.3	1.3	1.4
Estonia	7.6	1.6	3.8	2.1	2.4	2.4	2.6	2.4	2.2	2.0
Finland	2.9	0.8	1.6	1.8	1.7	1.6	1.2	1.3	1.4	1.5
France	1.7	0.5	1.3	1.9	1.9	2.0	1.3	1.5	1.6	1.8
Germany	3	0.7	1.7	1.4	1.2	1.1	0.9	0.9	0.9	0.9
Greece	-9.9	-4.7	0	2.5	3.1	1.3	1.5	1.7	0.7	1.0
Hungary	1.7	-0.3	1	0.6	0.7	0.8	0.7	0.9	1.1	1.3
Ireland	0.7	0.5	1.9	2.7	3.0	1.6	1.8	2.5	2.8	3.0
Italy	0.4	-1.4	0.4	1.0	1.1	1.2	0.8	0.9	1.1	1.3
Latvia	5.5	2.2	3.6	1.8	2.2	2.3	2.1	2.1	2.0	2.0
Lithuania	5.9	2.4	3.5	1.6	1.7	1.6	1.7	1.6	1.6	1.5
Luxembourg	1.6	1.1	2.1	2.0	2.2	2.3	1.8	1.9	1.9	1.9
Malta	2.1	1.2	1.9	1.0	1.1	1.2	1.5	1.6	1.7	1.8
Netherlands	1.2	-0.9	0.7	2.1	2.3	2.3	1.5	1.4	1.3	1.2
Poland	4.3	2.7	2.6	3.4	3.3	3.2	2.6	2.4	2.2	2.1
Portugal	-1.6	-3.3	0.3	2.1	1.9	1.5	0.8	1.0	1.2	1.4
Romania	2.5	1.4	2.9	3.1	3.2	3.3	2.2	1.9	1.7	1.5
Slovakia	3.3	1.8	2.9	2.9	2.8	2.5	2.2	2.3	2.5	2.6
Slovenia	-0.2	-1.4	0.7	2.0	2.3	2.4	1.6	1.6	1.6	1.5
Spain	0.7	-1.8	-0.3	1.6	1.9	2.1	1.5	1.7	1.9	2.2
Sweden	3.9	0.3	2.1	1.8	1.6	1.7	1.7	1.7	1.7	1.8
United Kingdom	0.7	0.5	1.7	2.1	2.5	2.7	1.7	1.8	1.8	1.9

## A.2.2 Market Share of Biodegradable & Non-Biodegradable Single-use Plastic Carrier Bags

BIO IS assume that the share of biodegradables in single-use plastic bags grows by around 10% per year, from 3% in 2010 to 7% in 2020. BIO IS reports that they see this as a conservative estimate, given that European Bioplastics claims that demand

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<sup>50</sup> European Commission (2012) European Economic Forecast Spring 2012, available at [http://ec.europa.eu/economy\\_finance/publications/european\\_economy/2012/pdf/ee-2012-1\\_en.pdf](http://ec.europa.eu/economy_finance/publications/european_economy/2012/pdf/ee-2012-1_en.pdf)



for bioplastics overall is growing by around 20% per year.<sup>51</sup> While at the time of publication (September 2011), Italy's ban on non-biodegradable carrier bags had already come into effect, Bulgaria had not, at that point, announced its amendment to the Bulgarian eco-tax on plastic bags. Since its implementation in October 2011, all single-use plastic carrier bags of a thickness up to 15 microns have been subject to a levy of €0.08. From October 2012, the levy will be increased to €0.18, and will apply to all kinds of plastic carrier bags. However, compostable and biodegradable bags are not subject to the tax.<sup>52</sup>

We therefore assume that 100% of Italian single-use plastic carrier bags are biodegradable from 2011 onwards, and that 100% of Bulgarian single-use plastic carrier bags are biodegradable from October 2012 onwards.

For other Member States, in the absence of further evidence, we will use the BIO IS figures for growth in the market rising from 3% in 2010 to 7% in 2020, recognising that the overall share for the EU in 2020, given the measures in place in Italy and Bulgaria, will be higher still.<sup>53</sup>

### A.3.0 EU Production of Plastic Carrier Bags

The key reason for seeking to discern data relating to production, import and export, is to enable the attribution of employment impacts associated with changes in consumption of specific types of carrier bags.

BIO IS calculates total tonnage production of plastic carrier bags in the EU in 2010 to be 1.12 million tonnes.<sup>54</sup> Of this it is estimated that 0.38 Mt is of single-use non-biodegradable plastic carrier bags, 0.01 Mt of single-use biodegradable plastic carrier bags and 0.73 Mt is of multiple use plastic carrier bags.

These figures are calculated as follows. For 2010, BIO IS report a stakeholder estimate that **725,000 tonnes of single-use non-biodegradable plastic carrier bags are placed on the market in the EU**. BIO IS then assume that 50% (362,500 tonnes) of such bags are imported, with exports taken to be 3% of total consumption, at 21,750 tonnes. This appears on the face of it to be a reasonable assumption given that net imports of *all* Polyethylene (PE) bags to the EU in 2010 are 472,836 tonnes (578,490 tonnes imported minus 105,653 tonnes exported).<sup>55</sup> However, BIO IS do not give a specific reference for this figure.

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<sup>51</sup> European Bioplastics (2011) Driving the Evolution of Plastics, available at [http://en.european-bioplastics.org/wp-content/uploads/2011/04/EuBP\\_image\\_brochure\\_2011.pdf](http://en.european-bioplastics.org/wp-content/uploads/2011/04/EuBP_image_brochure_2011.pdf)

<sup>52</sup> European Plastics News (2012) Bulgaria to increase plastic bag tax by 233%, available at <http://www.europeanplasticsnews.com/subscriber/newscat2.html?cat=1&channel=430&id=1643>

<sup>53</sup> Manufacturers of biodegradable plastics within the EU were contacted to obtain estimates of current production and consumption. EPI was unable to supply a figure as they are not involved in the sale of finished products and no response was received from Cereplast.

<sup>54</sup> Based on PRODCOM data

<sup>55</sup> Based on PRODCOM data

Production is therefore calculated by BIO IS as 384,250 tonnes: Consumption (725 kT) + Exports (21.75 kT) – Imports (362.5 kT).

EU production of biodegradable single-use bags in 2010 is taken to be 10,831 tonnes, based on a presumed share of all EU single-use carrier bag production of 2.74%. The production of Low Density Polyethylene (LDPE) bags is taken to represent the balance of the assumed total EU production of 1.12 Mt (1,124,074 tonnes), i.e. 728,993 tonnes.

The figure for production of single-use plastic carrier bags is, however, contradicted by EuPF, which states that:<sup>56</sup>

*Production volumes for all kinds of plastic bags (i.e. not only carrier bags but also garbage bags, fruit and veg bags, freezer bags etc.) in the EU stands at approximately 1.8 million tonnes for 2008 and [single-use] carrier bags represent no more than one third of this figure.*

Following through on EuPF's estimate would suggest EU production of up to 600,000 tonnes of single-use plastic carrier bags in 2008, which would mean that EU production accounts for 82% of the EU's stated 725,000 tonnes consumption. This, however, seems a very high figure. Information supplied by an industry stakeholder notes that:<sup>57</sup>

*Thin (so called single-use or HDPE plastic carrier bags with a thickness of 6-20 microns), polypropylene (PP) plastic carrier bags and cotton bags are imported from the Far East to a great extent. A reliable number was only enquired (sic) for HDPE and PP bags for the UK: 98% of the examined plastic carrier bags are imported from Asia.*

The same source notes that:<sup>58</sup>

*Cotton carrier bags, HDPE plastic carrier bags and PP plastic carrier bags are produced almost entirely in Asian countries due to cheaper production costs....HDPE plastic carrier bags require less material and a simpler production process. A reduction of HDPE plastic carrier bags by any legal tool within Europe would not greatly affect the European plastic manufacturing industry or the employees of the sector.*

Discussion with another stakeholder<sup>59</sup> has indicated that single-use HDPE carrier bags given away by supermarkets are typically between 18 and 20 microns in thickness. Given that supermarkets are estimated by BIO IS to represent 68% of the market for single-use plastic carrier bags, this would cast further doubt that 82% of

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<sup>56</sup> EuPF (2011) EuPF rejects European Commission figures on plastic bags in EU, press release available at <http://www.europeanplasticfilms.eu/docs/EuPF%20on%20EC%20Consultation.pdf>

<sup>57</sup> Personal communication from Waltraud Heinrich, Alber & Geiger, 1 August 2012

<sup>58</sup> Personal communication from Waltraud Heinrich, Alber & Geiger, 1 August 2012

<sup>59</sup> Personal communication with Kate Wells, Templecombe Ltd.

EU consumption of single-use plastic carrier bags (based on the figures supplied by EuPF) is met by EU production.

In a LCA undertaken for the UK's Environment Agency, based on conversations with industry experts, it is estimated that all High Density Polyethylene (HDPE) bags (and Polypropylene (PP) bags) used in the UK are imported from the Far East.<sup>60</sup> This does not, however, tally with our own recent contacts with industry, who state that there is a small amount of HDPE manufacture in the UK.<sup>61,62</sup> Moreover, this assumption cannot hold true at the EU level; some large UK retailers import single-use HDPE carrier bags from Germany, for example.<sup>63</sup> However, it is acknowledged that 'the large majority' of single-use HDPE carrier bags used within the EU is imported from the Far East. Discussion with an industry contact indicated that perhaps 90% of HDPE bags used in the UK were imported, and that at the EU level, while there is uncertainty in the figures, an assumption of 70% imports would not be unreasonable.<sup>64</sup>

We assume, therefore, that at the EU level, **70% of single-use non-biodegradable plastic carrier bags consumed (i.e. 507,500 tonnes (70% of 725,000) are imported, this would mean that EU production totalled 239,250 tonnes in 2010.** The implied level of imports (507,500 tonnes) in 2010, is within the total level of PE imports of 578,490 tonnes reported for 2010.<sup>65</sup>

We hold the tonnage of biodegradable bags constant at 10,831 tonnes. The balance of the 1,112,074 tonnes of reported EU production of carrier bags in the EU is taken to be of multiple use bags made of LDPE. Accordingly we assume the production of 873,993 tonnes of LDPE bags in the EU in 2010. .

We have, however, obtained a more recent estimate, for 2012, of the level of EU production of biodegradable single-use plastic carrier bags, which indicates that production currently stands at approximately 120,000 tonnes per annum, with a *potential* manufacturing capacity of between 260,000 and 300,000 tonnes.<sup>66</sup>

Currently approximately 15,000 tonnes of biodegradable single-use plastic carrier bags are imported to the EU annually.<sup>67</sup> Such figures are not entirely inconsistent with

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<sup>60</sup> Intertek Expert Services (2011) Life cycle assessment of supermarket carrier bags: a review of the bags available in 2006, report for the Environment Agency.

<sup>61</sup> Personal communication with Papier-Mettler, July 2012. It was stated by our contact that there is no HDPE manufacture of any significant size in the UK.

<sup>62</sup> Personal communication with Templecombe Ltd., July 2012. They obtain HDPE bags from UK manufacturers if looking for relatively small quantities, but if looking for large amounts, they would source from the Far East due to lower prices.

<sup>63</sup> Personal communication with Marks & Spencer, July 2012.

<sup>64</sup> Personal communication with Papier Mettler, July 2012

<sup>65</sup> Based on PRODCOM data.

<sup>66</sup> Personal communication with Novamont

<sup>67</sup> Personal communication with Novamont

the figures presented for 2010 above, as there has been a dramatic increase in demand for biodegradable bags in Italy. In our modelling, we account for the switch to biodegradable bags in Italy, and indeed in Bulgaria from 2013, and our figures are consistent with both the 2010 and 2012 figures reported above.

## A.4.0 Evidence on Switches to Alternative Bags

In order to understand the impact of any reduction in the consumption of single-use plastic carrier bags, the likely responses from consumers must be analysed. One conceivable behavioural response is that consumers reuse 'single-use' bags. Another is that they switch to alternative type of bag, or to alternative containers such as cardboard boxes. There are a number of pieces of literature focussing on the extent of switches to alternative types of reusable bags

Of the sources presented below, most provide information on the percentage increases in multiple-use bags that occur as a result of a percentage decline in single-use plastic carrier bags. However, they do not include details on the actual numbers of bags involved. The only data source that enables comparison of the number of multiple-use bags consumed against the number of single-use bags consumed is available from WRAP.<sup>68</sup> The figures are derived from reports provided by UK supermarkets participating in the Carrier Bags Voluntary Agreement. This reports sales of HDPE bags, LDPE 'bags for life', and other reusable bags.

### A.4.1 Nolan-ITU et al. 2002

In 2002 a report was produced for the Australian Government<sup>69</sup> analysing levies on plastic shopping bags and their environmental impacts, in order to provide a "*solid base for informed debate and national policy development*". Only the impacts of various policy options are considered with, no recommendations given. The options included a levy (set at one of several levels); a voluntary levy; and variations on codes of practice that were already in place.

The assumptions made in the report with regard to the predicted switching behaviour of consumers under the policy options are shown in Table 36. Scenario 1A and 1B represent a legislated levy of 15 cents and 25 cents (€0.08 and €0.13)<sup>70</sup> respectively. Scenario 2 includes a voluntary levy as part of an expanded existing code of practice. An expanded code of practice alone is considered for Scenario 3, and Scenario 4 represents a business as usual approach, representing the existing code of practice. For each scenario the different switch percentages for reusable bags, no bags and paper bags are given.

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<sup>68</sup> The UK's Waste and Resources Action Programme

<sup>69</sup> Nolan-ITU, RMIT Centre for Design, Eunomia Research and Consulting (2002), Plastic Shopping Bags - Analysis of Levies and Environmental Impacts: Final Report, Report for Environment Australia, Department of the Environment and Heritage December 2002.

<sup>70</sup> At a 2002 exchange rate of 1 Euro to 1.8 Australian Dollars, available at <http://www.xe.com/currencycharts/?from=EUR&to=AUD&view=10Y> accessed August 2012

Table 36: Nolan-ITU Consumption Reduction and Transfers to Alternative Bags

Scenario	1A	1B	2	3	4
% reduction in plastic bag use	75%	85%	54%	25%	10%
Number of plastic bags used per annum (million)	1,727.5	1,036.5	3,178.6	5,182.5	6,219
% transferred to reusable bags	43%	49%	31%	12%	5%
Number of reusable bags per annum (million)	23.7	26.8	17.1	6.9	2.8
% transferred to paper bags	2%	2%	1%	2%	0%
Number of paper bags per annum (million)	140	158.5	100.8	157.5	0
% transferred to 'no bag'	30%	34%	22%	11%	5%
Total number of bags used per annum (million)	1,891.2	1,221.9	3,296.5	5,366	6,221.8
Total tonnes of bags per annum	24,052	19,065	34,504	53,676	55,553

These assumptions are described as estimates based on the number of bags used in different retail sectors which include:

- Supermarket and Other Food and Liquor;
- Fast Food, Convenience Store and Service Station; and
- Other Retail, General Merchandise and Apparel

How these estimates are derived is unclear in the report, considering the specific nature of each percentage rate stated. The only reference describes the assessment of “*sector characteristics*” which could include the review and use of relevant data sets such as sector expenditure or just assumptions made on perceived sector trends. Although the report highlights that the sectors within which different types of bag will be used is an important consideration, without any further detail on the derivation of the switching rates no adequate assumptions can be used.

## A.4.2 Experience from Ireland's Plastic Bag Levy

In March 2002 Ireland implemented a levy of €0.15 for all single-use plastic shopping bags (SUPBs), payable at the point of sale. It was designed to both reduce litter, and also, to promote a consumer switch to reusable bags by setting the charge at six times what a survey showed to be the maximum willingness to pay for a SUPB<sup>71</sup>.

Nolan-ITU et al.<sup>72</sup> identify a 90-95% reduction in SUPB consumption in the first year, which is further confirmed by findings of Convery et al., who note 94% consumption reductions based on the assessment of pre-levy consumption data and post levy figures deduced from revenues generated.<sup>73</sup> In terms of per capita usage this represented an estimated reduction from 328 bags to 21 bags per capita per annum. This report also provides the results of surveys and interviews with key stakeholders in the levy, which include leaders from the Irish retail sector, in order to gauge its success. Results show that a 75% increase in demand for permanent bags was experienced by large supermarket chains (with over 80 outlets). This sharp rise is attributable to the initial situation, in which consumers have a choice to either simply pay the levy, or purchase a permanent bag. However it is not inconceivable that this demand may have dropped and stabilized as the permanent bags continued to be reused. It is also thought that for the non-supermarket sector, the switch is typically towards paper bags.<sup>74</sup>

Post levy analysis has provided an insight into the behavioural change with regard to the alternative use of SUPBs. Less than a year after the Irish levy's introduction retailers reported an increase of 77% in kitchen tidy bag sales but no impact on garbage and garden bag sales.<sup>75</sup> A Scottish Impact Assessment for a proposed levy reported that the Irish Department of Environment, Heritage and Local Government informed the authors of a trebling in sales of plastic bin liners and refuse sacks.<sup>76</sup> These may well also refer the kitchen tidy bags highlighted previously. This information suggests that in some cases where plastic carrier bags had been re-used prior to the levy, consumers switched to purchasing bin liners. Unfortunately no

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<sup>71</sup> Convery et al (2007), The most popular tax in Europe? Lessons from the Irish plastic bags levy, Springer Science + Business Media Jan 2007.

<sup>72</sup> Nolan-ITU, RMIT Centre for Design, Eunomia Research and Consulting (2002), Plastic Shopping Bags - Analysis of Levies and Environmental Impacts: Final Report, Report for Environment Australia, Department of the Environment and Heritage December 2002.

<sup>73</sup> Convery et al (2007), The most popular tax in Europe? Lessons from the Irish plastic bags levy, Springer Science + Business Media Jan 2007.

<sup>74</sup> Personal communication with The Department of Environment, Heritage and Local Government, August 2012

<sup>75</sup> Nolan-ITU, RMIT Centre for Design, Eunomia Research and Consulting (2002), Plastic Shopping Bags - Analysis of Levies and Environmental Impacts: Final Report, Report for Environment Australia, Department of the Environment and Heritage December 2002

<sup>76</sup> AEA Technology Environment (2005), Proposed Plastic Bag Levy – Extended Impact Assessment Volume 2, Report for The Scottish Government August 2005.

<http://www.scotland.gov.uk/Publications/2005/08/1993259/33019>



indication is available as to what these increases mean in terms of 'real numbers' usage of both alternative containment and secondary use impacts.<sup>77</sup>

### A.4.3 Experience from the Welsh Compulsory Charge

The Welsh Government introduced a £0.05 (€0.06)<sup>78</sup> compulsory charge for single-use carrier bags at the point of sale in October 2011. Unlike Ireland this mechanism is not a levy, but a minimum charge that retailers are guided to pass on to local and environmental causes (although this is not mandatory).<sup>79</sup> Additionally it also applies to all single-use bags including those composed of paper and other plant based material, not just plastic.

Nine months after the introduction of the charge, reductions are cited by Welsh Government as between 70% and 96%, depending upon the sector.<sup>80</sup> Retailers in the following sectors reported a range of reductions:

- Food retail – between 96% and 70% reduction;
- Fashion – between 75% and 68% reduction;
- Home improvement – 95% reduction;
- Food service – up to 45% reduction;
- Telecommunications – 85% reduction.

Data released by WRAP in 2011 shows a reduction of 22% in usage across supermarkets in Wales from 2010 to 2011.<sup>81</sup> This would appear to be consistent with the reductions noted by the Welsh Government, bearing in mind that the charge was only in place for the final three months of 2011.

A study produced for The Welsh Government by Cardiff University conducted surveys both before and after the introduction of the charge regarding attitudes and behaviours towards it in England and Wales.<sup>82</sup> Results show that the charge has helped to increase greatly own bag use in Wales with a 21% increase in consumers taking a reusable bag to the supermarket (increased from 61% to 82% of the sample). This also illustrates the scale of reusable bag use prior to the charge which was also confirmed at a similar level of approximately 60.5% in England. The study

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<sup>77</sup> Confirmed by conversations with contacts in Supermarket retail and the Irish Government.

<sup>78</sup>Based on a £:€ exchange rate of 1:1.27650, ft.com currency converter, 26<sup>th</sup> July 2012.

<sup>79</sup> Welsh Government (2012), Carrier Bag Charge Wales, Accessed 19<sup>th</sup> July 2012.  
<http://www.carrierbagchargewales.gov.uk/?lang=en>

<sup>80</sup> Welsh Government (2012), Reduction in Single-use Carrier Bags, Accessed 7<sup>th</sup> August 2012.  
[http://wales.gov.uk/topics/environmentcountryside/epq/waste\\_recycling/substance/carrierbags/reduction/](http://wales.gov.uk/topics/environmentcountryside/epq/waste_recycling/substance/carrierbags/reduction/)

<sup>81</sup> WRAP (2012), UK Supermarket Retailers Voluntary Carrier Bag Agreement: 2011 Carrier Bag Use, Presentation for the WRAP website, WRAP July 2012

<sup>82</sup> Poortinga et al (2012), Evaluation of the Introduction of the Single-Use Carrier Bag Charge in Wales: Attitude and Behavioural Spillover, Report for the Welsh Government, Cardiff University 2012.



however, does not consider the effect of the previous UK voluntary agreement in the baseline figures, which would be expected to have influenced use of reusable bags. The magnitude of the change associated with the implementation of a charge might be expected to be greater in nations with no such agreement already in place, but with a similar 'end point' in terms of uptake.

The Welsh Regulatory Impact Assessment<sup>83</sup> assumed that a 199% increase in demand for reusable bags would occur based on a levy charge of £0.07 (€0.09)<sup>84</sup>, cited from a study commissioned for the Welsh Assembly Government by AEA Technology plc on SUPB's.<sup>85</sup> No supporting rationale for this figure can be gained from reviewing the AEA report and it seems to be slightly at odds with the *Cardiff University* study highlighted above which noted a relatively high level of pre-existing use of reusable bags.<sup>86</sup> Indeed, such a change would, most likely, not have been possible given the pre-existing level of use.

#### A.4.4 Northern Irish Impact Assessment

Although no levy or charge is currently in place, Northern Ireland has produced the most recent (2012) Impact Assessment for a proposed financial mechanism. From the options considered, the preferred approach is to impose a £0.10 (€0.13)<sup>87</sup> levy at the point of sale, starting at £0.05 (€0.06)<sup>88</sup> in the first year to allow householders to adapt behaviour and start using reusable bags.<sup>89</sup>

The assessment assumes that 57.5% of consumers switch to reusable bags at a ratio of 1 reusable bag for every 20 single-use bags. No source or analysis can be found for this assumption but it is similar to the switches reported by WRAP in respect of the UK Voluntary Agreement on carrier bags, in which Northern Ireland is currently included.<sup>90</sup> It therefore appears that the impact assessment assumes that the switches expected under the levy will be the same as the switches indicated by the results from the WRAP VA.

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<sup>83</sup> Welsh Assembly Government (2010), Proposals for a Charge on Single Use Carrier Bags: Regulatory Impact assessment, Welsh Assembly Government May 2010.

<sup>84</sup> Based on a £:€ exchange rate of 1:1.27650, ft.com currency converter, 26<sup>th</sup> July 2012.

<sup>85</sup> AEA Technology plc (2009), Welsh Assembly Government, Single Use Bag Study: Final, Report for the Welsh Assembly Government August 2009.

<sup>86</sup> This may be due to the voluntary agreement on carrier bags between UK Governments and a number of supermarkets.

<sup>87</sup> Based on a £:€ exchange rate of 1:1.27650, ft.com currency converter, 26<sup>th</sup> July 2012.

<sup>88</sup> Based on a £:€ exchange rate of 1:1.27650, ft.com currency converter, 26<sup>th</sup> July 2012.

<sup>89</sup> Department of the Environment (2012), Carrier Bag Levy: Regulatory Impact Assessment, Northern Ireland Department of the Environment 2012.

<sup>90</sup> WRAP (2012), UK Supermarket Retailers Voluntary Carrier Bag Agreement: 2011 Carrier Bag Use, Presentation for the WRAP website, WRAP July 2012. This study reports a substitution rate of 1 reusable bag for every 23 single use bags.

#### A.4.5 Scottish Impact Assessment

Although withdrawn in 2006, the original introduction of the Environmental Levy on Plastic Bags (Scotland) Bill produced an Impact Assessment (IA)<sup>91</sup> in 2005, looking at the potential outcomes of various policy options. The Bill outlined the introduction of a levy on all lightweight plastic bags (including degradable plastic bags), but not paper bags. However, the IA extended this to various options focusing on the additional inclusion of paper bags and the exclusion of various sectors such as Small to Medium Enterprises (SMEs) and charities.

Assumptions made on switching behaviour in order to model each option are evident in the report and are mainly based around original assumptions outlined in the Australian Nolan-ITU study.<sup>92</sup> Of the consumption reduction estimates, the study firstly identifies a quantity of consumers opting to use no bag of 30%. The following 70% is accounted for by looking at 2002/03 ONS census expenditure data by retail sectors likely to use different types of alternative bags (specifically either paper bags or heavyweight plastic or similar; the 'or similar' is assumed to include other reusable bags such as jute, PP and cotton). Findings are stated as a 36% / 64% split of the remaining 70% consumption reduction for paper and heavyweight plastic bags respectively. This analysis finally yields percentage switches of 25% for paper (34% x 70%) and 45% for heavyweight plastic (64% x 70%). In the case where a policy option is a levy including a charge on paper bags, the analysis evenly splits the 25% paper bag switch between the no bag and heavyweight plastic alternatives.

Although logically some correlation between expenditure and bag consumption can be assumed to exist, it is difficult to see how it can be used as the main driver in respect of consumer behaviour in this context. Firstly there are varying quantities and values of goods that consumers can fill a bag with which will also vary within each sector. Secondly, with the value of goods significantly changing over time at varying rates (food for example), the total volume of goods (and volume of bags required for them) that expenditure represents is not constant and could be subject to significant change over a period of time.

#### A.4.6 Experience from the UK Carrier Bags Voluntary Agreement

Under a voluntary agreement (VA) between a number of UK supermarkets and the UK Governments, a number of supermarkets<sup>93</sup> agreed a formal target of reducing carrier bags in the UK by 50% by 2009 from a 2006 baseline.<sup>94</sup> A reduction of 48% was

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<sup>91</sup> AEA Technology Environment (2005), *Proposed Plastic Bag Levy – Extended Impact Assessment Final Report*, A Report for the Scottish Executive, August 2005.

<sup>92</sup> Nolan-ITU, RMIT Centre for Design, Eunomia Research and Consulting (2002), *Plastic Shopping Bags - Analysis of Levies and Environmental Impacts: Final Report*, Report for Environment Australia, Department of the Environment and Heritage December 2002

<sup>93</sup> These include Asda, Somerfield (Now part of the Co-operative), Sainsburys, Tesco, The Co-operative and Waitrose.

<sup>94</sup> WRAP (2012), *UK Supermarket Retailers Voluntary Carrier Bag Agreement: 2011 Carrier Bag Use*, Presentation for the WRAP website, WRAP July 2012.

reported as achieved by 2009. Of relevance to this study is the information on the types of bags subsequently used by consumers. The VA has continued to date, albeit without any new formal targets being set.

According to a case study document released by WRAP,<sup>95</sup> all participating supermarkets removed single-use carrier bags from direct view and introduced alternative reusable bags available for a charge at the point of sale. Various additional schemes were also implemented, with different levels of success. Asda employed a staff incentive scheme with rewards for stores that achieved the greatest reduction in bag use, which, along with the other initiatives, resulted in a reported fall in carrier bag usage of half a billion in the last two quarters of 2008. ASDA reported an increase of 1,200% in the sale of reusable bags over the period, with a similar percentage increase reported by Waitrose (1,100%) where the only measure taken was removing bags from the direct view of customers.

In a different approach, Sainsbury's rolled out a reward scheme for consumers which provide reward card points for every bag reused at the checkout. Although no numbers are stated, 43% of their reward card holders are reported as now reusing bags. Tesco implemented a similar incentive in 2006 which provides reward card points for any bag reused at the checkout, which they claim has led to a reduction in bags used of three billion between 2006 and 2009.

Along with the common initiatives previously outlined, in Oldham the Co-operative introduced a home compostable carrier bag for £0.06 (€0.07)<sup>96</sup> which can also be used as a food waste caddy liner. No direct figures are given but this is reported, anecdotally, to have increased food waste recycling as well as reducing plastic bag use. The Co-operative has also had different schemes running at various different stores across the UK, including bans in Plymouth and the South West which have reportedly produced 426% increases in reusable bag sales.

WRAP has recently produced an update for 2011<sup>97</sup> on the Voluntary Agreement. The update includes data from 2006 to 2011 for consumption of all types of bags within supermarkets in the UK, giving an insight into the switching behaviour of consumers following the reduction mechanisms previously described. However, the bag consumption data by itself cannot be used to determine the level of consumer switching to reusable bags due to the large influence of the economy on household spending. Analysis of Household Expenditure Data<sup>98</sup> in conjunction with bag consumption data allows for a calculation of what the level of bag consumption would be in each year, assuming that there was no consumer change from the base year,

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<sup>95</sup> WRAP (2009), Case Studies: Reducing Carrier Bag Use, WRAP July 2009.

<sup>96</sup> At a 2009 exchange rate of £1:€1.12, available at <http://www.x-rates.com/average/?from=GBP&to=EUR&amount=1&year=2009> accessed August 2012.

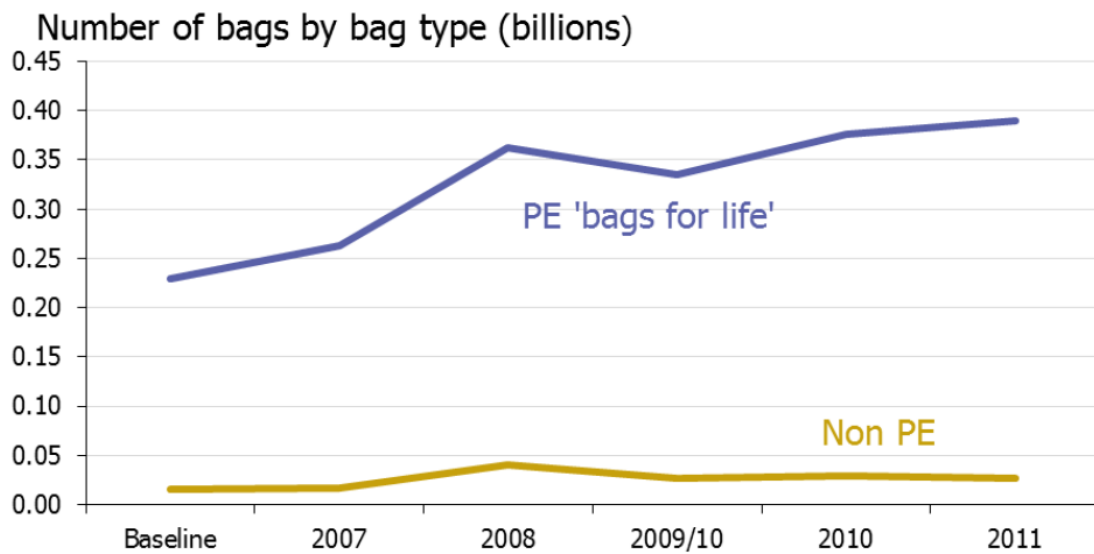
<sup>97</sup> WRAP (2012), UK Supermarket Retailers Voluntary Carrier Bag Agreement: 2011 Carrier Bag Use, Presentation for the WRAP website, WRAP July 2012.

<sup>98</sup> ONS, *Family Spending Surveys*, Accessed 13<sup>th</sup> August 2012 <http://www.ons.gov.uk/ons/rel/family-spending/family-spending/index.html>

2006. Comparison of these calculated figures to the numbers presented in the WRAP report allow for the determination of the likely switch from SUPBs to reusable bags. While this approach does not take into consideration the change in price that many food and drink items have experienced over the same time period, the inclusion of expenditure goes some way to taking account of the impact of the economy on household consumption.

From figures presented and interpolation of the published graphical data (see Figure 4), the total reduction over the 2006-2011 period was 4 billion SUPBs, with 0.175 billion reusable bags issued, of which 92% were LDPE. This represents a switch of approximately 33 reusable bags for each reduction of 1,000 SUPBs.

Figure 4: Bags for Life Issued Throughout WRAP Voluntary Agreement 2006 - 2011



PE = polyethylene

Source: WRAP (2012), UK Supermarket Retailers Voluntary Carrier Bag Agreement: 2011 Carrier Bag Use, Presentation for the WRAP website, WRAP July 2012.

This substitution rate may appear relatively low in terms of the physical capacity of bags required to handle the same purchases (assuming no significant change in retail consumption), i.e. it may seem unfeasible that 33 alternative bags can carry the goods contained within 1000 HDPE bags. However, account must be taken of the possible rates of reuse of LDPE ‘bags for life’, as consumers are incentivised to do so through retail initiatives.<sup>99</sup> This is further considered in Appendix A.4.7

### A.4.7 UK Environment Agency Supermarket Carrier Bags LCA

In 2011 the UK’s Environment Agency (EA) completed a Life Cycle Assessment of supermarket carrier bags that were available in the UK in 2006.<sup>100</sup> This includes valuable data regarding the comparative physical properties of different carrier bags, their primary and secondary uses and consumer shopping behaviour. Using these figures, it is possible to construct a numerical substitution rate between SUPBs and alternative reusable bags, based on the physical limits of capacity for a given consumer’s average monthly shop. In order to provide a further sense check and confidence in derived results, a reuse rate for each type of alternative bag can be calculated that can be compared against substitution data provided by WRAP in respect of the UK voluntary agreement on carrier bags.

The report suggests an average of 483 items in one household’s monthly shop. This figure was obtained from a market research survey. Further supermarket consumer surveys then yield average numbers of items per different type of bags used; dividing the monthly average of items consumed by these figures then gives an average monthly required number of bags (or ‘reference flow’ as described in the report), as shown in Table 37.

**Table 37: EA Assumed Volume, Weight, Items per Bag and Reference Flow for Analysed Bag Types**

Bag Type	Volume per bag (litres)	Weight per bag (g)	Items per bag	Ref flow – No. bags
Conventional high-density polyethylene (HDPE) bag	19.1	8.12	5.88	82.14
High density polyethylene (HDPE) bag with a prodegradant additive	19.1	8.27	5.88	82.14
Starch-polyester blend bag	19.1	16.49	5.88	82.14
Paper bag	20.1	55.2	7.43	64.98

<sup>99</sup> i.e. obtaining reward points for reusing one’s own bag

<sup>100</sup> *Environment Agency (2011), Evidence: Life Cycle Assessment of Supermarket Carrier Bags: A Review of the Bags Available in 2006, Environment Agency February 2011.*

Bag Type	Volume per bag (litres)	Weight per bag (g)	Items per bag	Ref flow – No. bags
Low-density polyethylene (LDPE) bag	21.52	34.94	7.96	60.68
Non-woven polypropylene (PP) bag	19.75	115.83	7.30	66.13
Cotton bag	28.65	183.11	10.59	45.59

Source: Environment Agency (2011), Evidence: Life Cycle Assessment of Supermarket Carrier Bags: A Review of the Bags Available in 2006, Environment Agency February 2011.

Using the reference flow values and comparing both LDPE and an average of the other bags considered in the report (i.e. paper, non-woven PP and cotton) to be consistent with the WRAP VA data) to the HDPE value, a substitution rate based on capacity comparisons for each type can be gained. For LDPE bags this capacity substitution rate equates to 73.5% or 735 LDPE bags per equivalent 1000 HDPE bags required. For other bags considered in the EA report the rate is 68.2% or 682 bags per equivalent 1000 HDPE bags.

These are significantly higher rates than interpolated from the WRAP VA data. However as previously mentioned, the EA analysis does not include any effects of on-going reuse, which is to be expected of the alternative reusable bags.<sup>101</sup> By calculating the number of uses needed to validate the figures from the substitution rate gained from WRAP, some estimate of confidence can be gained in the figures. The number of reuses required to make the two analyses fit are illustrated in Table 38.

**Table 38: WRAP and EA Substitution Data per Thousand HDPE Bags with Required Number of Reuses for Cross Validation**

Type of Bag	WRAP Data Substitution Rate (Per Thousand Bags)	EA LCA Capacity Substitution Rate (Per Thousand Bags)	Desired Reuses to Satisfy EA Figure
LDPE	29	735	26
Other reusable bags	4	682	171

<sup>101</sup> The EA study stated that the reuse rate was excluded from the analysis due to lack of data. Subsequently a reuse rate required to reduce the global warming potential of each bag to below that of a HDPE bag was calculated.

The figures suggest that each of the 29 LDPE bags purchased was reused 26 times in order for the capacity criteria to be fulfilled, which as a sense check seems to be a reasonable rate of reuse. The other alternative bags on average however would require a much greater rate of reuse, with each of the four bags being reused 171 times in a year (based on the annualised figure of 1000 HDPE bags consumed). This rate of reuse initially seems fairly high. However these hardwearing bags are expected to be used for longer periods than a year, meaning that there will be a stock of such bags in circulation. This makes the purchase of four additional bags a year seem more reasonable. Additionally, it seems likely that WRAP's smaller figure of four bags can be further explained by the mix that some consumers may adopt, purchasing a smaller quantity of other types of reusable bags alongside further LDPE bags. Accounting for these assumptions relating to reuse, this analysis does appear to fit with the available data from WRAP.

Paper bags are also considered in the study with a reference flow also given in Table 37. Two factors prohibit the use of paper bags in comparison to the WRAP data; firstly the VA only involves supermarkets, where paper bags are not included in any data for total carrier bags; and secondly paper bags are also assumed to be single-use, requiring no analysis of reuse rates to validate any results. Certain sectors are assumed to primarily use single-use paper bags, and depending on their inclusion in any reduction measure, some switching behaviour may include a move toward paper bag usage. The EA figures show a substitution rate of 79.6% compared to the physical capacity of HDPE bags, which based on their assumed single-use, may be used as a sufficient switch rate for any proportion of reduced HDPE consumption.



## A.5.0 Littering Assumptions

### A.5.1 Littering Rates

The calculation of litter impacts is fraught with difficulty. Often, levels of litter are determined using counts of items. However, it is not always possible to link these counts with a 'flow' of items actually being littered, as there is clearly a 'stock' of littered items already in the environment. Moreover, when it comes to marine litter, such as plastics that are counted on beaches, many of these may have originated from overseas. This further complicates the analysis. Therefore, while estimates of the rate of littering of plastic bags by Member State are highly uncertain, there is even greater uncertainty in the impact that this may have on the total costs of cleaning up litter (due to the existence of stocks noted above). However, all things being equal, a reduction in levels of plastic bags being littered will lead to a reduction in the requirement for, and hence cost of, cleaning up that litter (and at the very least, even if the effect on collection costs may be small, the effects on the subsequent management, e.g. landfill or incineration, will be felt in full).

BIO IS estimates that at an EU-level, 4.6% of plastic carrier bags were littered in 2010.

The 4.6% littering rate is derived from a number of sources, which are not clearly referenced. The model includes apparent individual country estimates for 17 EU Member States as shown in Table 39.

**Table 39: Littering Rate of Plastic Bags by Member State as reported by BIO IS**

Member State	% of Plastic Bags Littered
Belgium	2.0%
Bulgaria	10.0%
Denmark	0.5%
Finland	0.5%
France	2.0%
Germany	2.0%
Greece	10.0%
Ireland	0.5%
Italy	10.0%
Latvia	10.0%
Netherlands	0.5%



Member State	% of Plastic Bags Littered
Poland	10.0%
Portugal	2.0%
Romania	10.0%
Spain	2.0%
Sweden	0.5%
UK	0.5%

On closer inspection, six of these prove to be derived from an alternative estimate that 10% of bags are littered at the EU27 level. The remaining eleven Member State figures derive from two estimates, and are attributed to stakeholders: a 2% litter rate for Germany and a 0.5% rate for Denmark. The 4.6% figure reported is not the mean of the litter rates attributed to the 17 Member States as it also includes summing of a single instance of a 10% value for the EU. Without this the average proportion of plastic bags littered for the Member States for which estimates are provided would be 4.3%, although this is not a weighted mean.

There is clearly considerable uncertainty in respect of litter rates, and whilst it is unfortunate that the overall litter rates are based on only three figures, despite undertaking internet searches for relevant data, no better information than that used by BIO IS has been identified during this subsequent piece of work. However, it is possible to improve how these data are used, notably in respect of differentiation between single-use and multiple use bags.

BIO IS reports different ‘risk of litter’ figures for different types of bag, based on a study for French supermarket chain Carrefour.<sup>102</sup> Although based on data from the 1990s, the data provides a useful indicator of littering behaviour.

The Carrefour study looks at the impacts of other bag types relative to HDPE single-use bags. HDPE bags therefore score 1 against all criteria. On “Risk of litter”, reusable LDPE bags score 0.4 (i.e. only 40% of the risk) while paper bags score even better at 0.2. The rationale for this is explained in the Scottish Government Impact Assessment<sup>103</sup>:

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<sup>102</sup> Ecobilan (2004) Évaluation des Impacts Environnementaux des Sacs de Caisse Carrefour: analyse du cycle de vie de sacs de caisse en plastique, papier et matériau biodégradable. Report for Carrefour, reported in Scottish Government (2005) Proposed Plastic Bag Levy - Extended Impact Assessment Part 5, available at: <http://www.scotland.gov.uk/Publications/2005/08/1993259/33039>

<sup>103</sup> Scottish Government (2005) Proposed Plastic Bag Levy - Extended Impact Assessment Part 5, available at: <http://www.scotland.gov.uk/Publications/2005/08/1993259/33039>

*“For littering risk, the Carrefour study estimates that paper bags will perform best, with a score superior to that of reusable bags from the perspective of persistence in the environment. Both types of bag scored the same for risk of intentional littering and being unintentionally carried away by the wind. Single-use plastic bags performed worse than both paper and reusable plastic bags in this category.”*

We take this to mean that the advantage of LDPE bags over HDPE bags derives from the lower propensity of users to litter them or for them to blow away; while paper bags enjoy this same advantage augmented by their lower environmental impact in the event that they are littered (due to their shorter persistence in the environment). To reflect the lower propensity of LDPE bags to be littered, **we have reduced the litter rate for each bag of this type to 40% of the level assumed for an HDPE bag in each Member State.** For each **paper bag we have reduced the litter rate to 20%** of the level for an HDPE bag. The littering rates applied are shown in Table 40, with estimates drawn from the BIO IS study shown in bold. Where no estimate was provided by BIO IS for a particular Member State we have allocated a percentage based on Member States that have similar waste management systems.

**Table 40: Assumed Littering Rates for Member States by Bag Type**

Member State	% of Single-use HDPE bags littered	% of LDPE bags littered	% of paper bags littered
Austria	2.0%	0.8%	0.4%
Belgium	<b>2.0%</b>	0.8%	0.4%
Bulgaria	<b>10.0%</b>	4.0%	2.0%
Cyprus	10.0%	4.0%	2.0%
Czech Republic	10.0%	4.0%	2.0%
Denmark	<b>0.5%</b>	0.2%	0.1%
Estonia	10.0%	4.0%	2.0%
Finland	<b>0.5%</b>	0.2%	0.1%
France	<b>2.0%</b>	0.8%	0.4%
Germany	<b>2.0%</b>	0.8%	0.4%
Greece	<b>10.0%</b>	4.0%	2.0%
Hungary	10.0%	4.0%	2.0%
Ireland	<b>0.5%</b>	0.2%	0.1%
Italy	<b>10.0%</b>	4.0%	2.0%
Latvia	<b>10.0%</b>	4.0%	2.0%
Lithuania	10.0%	4.0%	2.0%
Luxembourg	2.0%	0.8%	0.4%
Malta	10.0%	4.0%	2.0%
Netherlands	<b>0.5%</b>	0.2%	0.1%
Poland	<b>10.0%</b>	4.0%	2.0%
Portugal	<b>2.0%</b>	0.8%	0.4%
Romania	<b>10.0%</b>	4.0%	2.0%
Slovakia	10.0%	4.0%	2.0%
Slovenia	10.0%	4.0%	2.0%
Spain	<b>2.0%</b>	0.8%	0.4%
Sweden	<b>0.5%</b>	0.2%	0.1%
United Kingdom	<b>0.5%</b>	0.2%	0.1%

## A.5.2 Costs of Clearing Litter

In order to determine the costs of cleaning litter, one approach would have been to seek information from each Member State. However, an initial search revealed very little information, especially in relation to plastic bags. Moreover, of importance for this study is establishing the marginal cost of dealing with an increase or decrease in litter, rather than the total cost, so a bottom-up approach was pursued, using the example of Wales, for which a reasonable amount of information is available.

Wales, prior to the introduction of the charge, plastic bags accounted for 2.7% of litter by weight and cost approximately £1 million annually to remove.<sup>104</sup> In total, there was 26,000 tonnes of litter collected in Wales for 2008/09, of which 702 tonnes (2.7%) was plastic bags.<sup>105</sup> On a per tonne basis, this would indicate a cost of litter cleaning of £1,424.50 per tonne.<sup>106</sup>

The total cost of litter cleaning is likely to be composed of:

1. A labour component, for the individual sweeping/picking up litter, or driving a mechanical sweeper;
2. A cost for the vehicle/plant expenditure and other operational costs; and
3. The cost of disposal of the litter collected.

We make the conservative assumption that the Welsh figure above includes the cost of disposal, taken to be £57/tonne, composed of a landfill gate fee of £25/tonne, plus tax of £32/tonne for 2008/09.

Of the remaining £1367.50, based on industry best practice guidance<sup>107</sup>, we assume that 66% (£902.55) is labour costs, and 34% (£464.95) relates to vehicles/plant and other operational costs.

Uplifted to 2012/13 values using the UK Treasury's GDP deflator<sup>108</sup> and then converted to Euros at a July 2012 exchange rate,<sup>109</sup> the costs for the component parts are:

- €990.64/tonne for labour:

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<sup>104</sup> Welsh Assembly Government (2010) Proposals for a charge on single use carrier bags: A consultation on the draft Single Use Carrier Bag Charge (Wales) Regulations 2010, available at <http://wales.gov.uk/consultations/environmentandcountryside/carrierbagsregs/?lang=en&status=closed>

<sup>105</sup> WastesWork and AEA (2010) The composition of municipal solid waste in Wales, Report to WRAP, available at <http://wales.gov.uk/docs/desh/publications/100526municipalwastecompositionen.pdf>

<sup>106</sup> Please note that we inflate to current prices and convert to € at a subsequent stage in the analysis.

<sup>107</sup> Association for Public Service Excellence (2010) Efficiencies in Street Cleaning, Briefing 10-64, available at <http://www.apse.org.uk/briefings/10/10-64%20Street%20cleansing%20efficiencies.pdf>

<sup>108</sup> UK Treasury (2012) GDP Deflators at Market Prices and Money GDP, 28 June 2012, available at [http://www.hm-treasury.gov.uk/data\\_gdp\\_fig.htm](http://www.hm-treasury.gov.uk/data_gdp_fig.htm)

<sup>109</sup> Based on a £:€ exchange rate of 1:1.27650, ft.com currency converter, 26<sup>th</sup> July 2012.

➤ €510.33/tonne for vehicles/plant and other operational expenditure:

We then amend the labour cost component based on the relative labour costs in EU Member States <sup>110</sup> as shown in Table 41.

Table 41: Member State-specific Litter Collection Costs for Single-use Non-biodegradable Plastic Bags (excluding disposal)

Member State	2011 Hourly Labour Cost	Member State : UK Labour Cost Ratio	Member State Specific Labour Cost Component (per tonne)	Total cost per tonne excluding disposal
Austria	€ 29.2	1.45	€ 1,439.14	€ 1,949.46
Belgium	€ 39.3	1.96	€ 1,936.92	€ 2,447.25
Bulgaria	€ 3.5	0.17	€ 172.50	€ 682.83
Cyprus	€ 16.5	0.82	€ 813.21	€ 1,323.54
Czech Republic	€ 10.5	0.52	€ 517.50	€ 1,027.83
Denmark	€ 38.6	1.92	€ 1,902.42	€ 2,412.75
Estonia	€ 30.1	1.50	€ 1,483.49	€ 1,993.82
Finland	€ 29.7	1.48	€ 1,463.78	€ 1,974.11
France	€ 34.2	1.70	€ 1,685.56	€ 2,195.89
Germany	€ 30.1	1.50	€ 1,483.49	€ 1,993.82
Greece	€ 17.5	0.87	€ 862.50	€ 1,372.82
Hungary	€ 7.6	0.38	€ 374.57	€ 884.90
Ireland	€ 27.4	1.36	€ 1,350.42	€ 1,860.75
Italy	€ 26.8	1.33	€ 1,320.85	€ 1,831.18
Latvia	€ 5.9	0.29	€ 290.78	€ 801.11
Lithuania	€ 5.5	0.27	€ 271.07	€ 781.40
Luxembourg	€ 33.7	1.68	€ 1,660.92	€ 2,171.25
Malta	€ 11.9	0.59	€ 586.50	€ 1,096.83
Netherlands	€ 31.1	1.55	€ 1,532.78	€ 2,043.11
Poland	€ 7.1	0.35	€ 349.93	€ 860.26

<sup>110</sup> Eurostat (2012) Labour costs in the EU27 in 2011: Hourly labour costs ranged between €3.5 and €39.3 in the EU27 Member States, Eurostat News Release, 24 April 2012, available at [http://epp.eurostat.ec.europa.eu/cache/ITY\\_PUBLIC/3-24042012-AP/EN/3-24042012-AP-EN.PDF](http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/3-24042012-AP/EN/3-24042012-AP-EN.PDF)

Member State	2011 Hourly Labour Cost	Member State : UK Labour Cost Ratio	Member State Specific Labour Cost Component (per tonne)	Total cost per tonne excluding disposal
Portugal	€ 12.1	0.60	€ 596.35	€ 1,106.68
Romania	€ 4.2	0.21	€ 207.00	€ 717.33
Slovakia	€ 8.4	0.42	€ 414.00	€ 924.33
Slovenia	€ 14.4	0.72	€ 709.71	€ 1,220.04
Spain	€ 20.6	1.02	€ 1,015.28	€ 1,525.61
Sweden	€ 39.1	1.95	€ 1,927.06	€ 2,437.39
United Kingdom	€ 20.1	1.00	€ 990.64	€ 1,500.97

We assume these costs to be representative for single-use non-biodegradable plastic bags. However it is not correct to assume the same cost per tonne for all bags, especially paper bags, and LDPE 'bags for life'. The main component cost of litter collection relates to the time it takes to pick up the items. Single-use plastic bags are lighter than LDPE bags and paper bags, and therefore to collect a tonne of single-use plastic bags would require more bags to be collected, and this would be expected to take longer. Based on typical weights, the number of bags per tonne is shown in Table 42.

Table 42: Number of Bags per tonne (by type)

Bag Type	Weight	Number of bags per tonne
Single-use Non-biodegradable Plastic Carrier Bag	8.5g	117,647
Single-use Biodegradable Plastic Carrier Bag	8.9g	112,360
Single-use Paper Bag with Handles	55.2g	18,116
LDPE 'Bag for Life'	35g	28,571

From this information it is possible to calculate a cost of picking up one littered bag in each Member State, and to then attribute a cost per tonne for the collection of littered bags by type. The results are shown in Table 43.

Table 43: Member State-specific Litter Collection Costs for Other Bags by Type (excluding disposal)

Member State	Implied Cost per bag pick up (€ cents)	Single-use biodegradable bags (€/tonne)	Paper bags (€/tonne)	LDPE bags (€/tonne)
Austria	1.66	€ 1,861.85	€ 300.19	€ 473.44
Belgium	2.08	€ 2,337.26	€ 376.84	€ 594.33
Bulgaria	0.58	€ 652.14	€ 105.15	€ 165.83
Cyprus	1.13	€ 1,264.05	€ 203.81	€ 321.43
Czech Republic	0.87	€ 981.63	€ 158.27	€ 249.61
Denmark	2.05	€ 2,304.31	€ 371.53	€ 585.95
Estonia	1.69	€ 1,904.21	€ 307.02	€ 484.21
Finland	1.68	€ 1,885.38	€ 303.98	€ 479.43
France	1.87	€ 2,097.20	€ 338.14	€ 533.29
Germany	1.69	€ 1,904.21	€ 307.02	€ 484.21
Greece	1.17	€ 1,311.12	€ 211.39	€ 333.40
Hungary	0.75	€ 845.13	€ 136.26	€ 214.90
Ireland	1.58	€ 1,777.12	€ 286.53	€ 451.90
Italy	1.56	€ 1,748.88	€ 281.97	€ 444.71
Latvia	0.68	€ 765.11	€ 123.36	€ 194.56
Lithuania	0.66	€ 746.28	€ 120.32	€ 189.77
Luxembourg	1.85	€ 2,073.66	€ 334.34	€ 527.30
Malta	0.93	€ 1,047.53	€ 168.90	€ 266.37
Netherlands	1.74	€ 1,951.28	€ 314.61	€ 496.18
Poland	0.73	€ 821.59	€ 132.47	€ 208.92
Portugal	0.94	€ 1,056.94	€ 170.41	€ 268.77
Romania	0.61	€ 685.09	€ 110.46	€ 174.21
Slovakia	0.79	€ 882.78	€ 142.33	€ 224.48
Slovenia	1.04	€ 1,165.21	€ 187.87	€ 296.30
Spain	1.30	€ 1,457.04	€ 234.92	€ 370.51
Sweden	2.07	€ 2,327.84	€ 375.32	€ 591.94
United Kingdom	1.28	€ 1,433.51	€ 231.13	€ 364.52

Table 44: Summary of Member State-specific Litter Collection Costs by Bag Type

Member State	Single-use non-biodegradable bags (€/tonne)	Single-use biodegradable bags (€/tonne)	Paper bags (€/tonne)	LDPE bags (€/tonne)
Austria	€ 1,949.46	€ 1,861.85	€ 300.19	€ 473.44
Belgium	€ 2,447.25	€ 2,337.26	€ 376.84	€ 594.33
Bulgaria	€ 682.83	€ 652.14	€ 105.15	€ 165.83
Cyprus	€ 1,323.54	€ 1,264.05	€ 203.81	€ 321.43
Czech Republic	€ 1,027.83	€ 981.63	€ 158.27	€ 249.61
Denmark	€ 2,412.75	€ 2,304.31	€ 371.53	€ 585.95
Estonia	€ 1,993.82	€ 1,904.21	€ 307.02	€ 484.21
Finland	€ 1,974.11	€ 1,885.38	€ 303.98	€ 479.43
France	€ 2,195.89	€ 2,097.20	€ 338.14	€ 533.29
Germany	€ 1,993.82	€ 1,904.21	€ 307.02	€ 484.21
Greece	€ 1,372.82	€ 1,311.12	€ 211.39	€ 333.40
Hungary	€ 884.90	€ 845.13	€ 136.26	€ 214.90
Ireland	€ 1,860.75	€ 1,777.12	€ 286.53	€ 451.90
Italy	€ 1,831.18	€ 1,748.88	€ 281.97	€ 444.71
Latvia	€ 801.11	€ 765.11	€ 123.36	€ 194.56
Lithuania	€ 781.40	€ 746.28	€ 120.32	€ 189.77
Luxembourg	€ 2,171.25	€ 2,073.66	€ 334.34	€ 527.30
Malta	€ 1,096.83	€ 1,047.53	€ 168.90	€ 266.37
Netherlands	€ 2,043.11	€ 1,951.28	€ 314.61	€ 496.18
Poland	€ 860.26	€ 821.59	€ 132.47	€ 208.92
Portugal	€ 1,106.68	€ 1,056.94	€ 170.41	€ 268.77
Romania	€ 717.33	€ 685.09	€ 110.46	€ 174.21
Slovakia	€ 924.33	€ 882.78	€ 142.33	€ 224.48
Slovenia	€ 1,220.04	€ 1,165.21	€ 187.87	€ 296.30
Spain	€ 1,525.61	€ 1,457.04	€ 234.92	€ 370.51
Sweden	€ 2,437.39	€ 2,327.84	€ 375.32	€ 591.94
United Kingdom	€ 1,500.97	€ 1,433.51	€ 231.13	€ 364.52



## A.6.0 Disposal Routes

Table 45: Disposal Routes for Plastic Bags from 2010 to 2020

Member State	% to Landfill 2010 to 2020	% to Incineration 2010 to 2020
Austria	2.2%	96.2%
Belgium	3.5%	94.5%
Bulgaria	94.7%	0.0%
Cyprus	92.1%	0.0%
Czech Republic	73.2%	16.8%
Denmark	5.9%	93.9%
Estonia	90.0%	0.0%
Finland	67.0%	32.9%
France	46.9%	51.1%
Germany	0.9%	97.1%
Greece	90.0%	0.0%
Hungary	78.6%	11.4%
Ireland	92.8%	6.7%
Italy	70.9%	21.2%
Latvia	90.0%	0.0%
Lithuania	90.0%	0.0%
Luxembourg	32.8%	65.6%
Malta	90.0%	0.0%
Netherlands	1.0%	98.6%
Poland	88.6%	1.4%
Portugal	74.7%	23.3%
Romania	90.0%	0.0%
Slovakia	79.6%	10.4%
Slovenia	88.4%	1.6%
Spain	84.6%	13.4%
Sweden	1.7%	97.8%
United Kingdom	80.5%	19.0%

## A.7.0 Collection and Disposal Costs

The costs of residual waste collection will vary considerably across the EU, both between and within Member States. Much depends upon the nature of the area in which the waste is being collected, be it urban or rural, and the specific logistics of collection. For the purposes of this analysis and based on Eunomia's experience we assume a representative cost of €55/tonne. Plastic bags, however, represent a very small percentage of residual waste, both by weight and by volume (although these percentages are likely to increase over time with increased recycling of other materials currently in the residual waste stream). Given this fact, we do not realistically expect collection logistics to be altered significantly, so that the saving made is likely to be only a small proportion of the total. We model a nominal avoided cost of collection of €10/tonne. Evidently a more detailed analysis would estimate different savings for each country.

We do not consider it likely that plastic carrier bags are recycled to any significant degree at present, and nor do we expect this to be the case by 2020 (in the absence of additional policy drivers). Therefore, to simplify the analysis, for the fraction of carrier bags that are not littered, we model the split between landfill and incineration. The current costs for landfill for each Member State are shown in Table 46.

Table 46: Costs of Landfill Disposal by Member State

Member State	Landfill Tax Rate (€/tonne)	Landfill Gate Fee (€/tonne)	Total Charge for Landfill (€/tonne)
Austria	26	70	96
Belgium	74	50	124
Bulgaria	3	30	33
Cyprus	-	56	56
Czech Republic	20	16	36
Denmark	63	44	107
Estonia	12	40	52
Finland	30	59	89
France	15.5	60.5	76
Germany	-	140	140
Greece	-	24	24
Hungary	-	35	35
Ireland	50	70	120
Italy	30	90	120
Latvia	8	30	38
Lithuania	22	16	38
Luxembourg	-	149	149
Malta	-	20	20
Netherlands	107	25	132
Poland	25	70	95
Portugal	3.5	10.5	14
Romania	-	4	4
Slovakia	49	107	156
Slovenia	-	7	7
Spain	11	106	117
Sweden	16.5	32.75	49
United Kingdom	64	27	91

In order to further incentivise diversion of waste from landfill, we assume that by 2020 all Member States will have total landfill charges of at least €70 per tonne in real terms. Accordingly for all Member States for which total landfill charges are below

this level, we assume charges of €70/tonne in 2020, and with rates increasing linearly for the intervening years.

Current incineration costs for each Member State are shown in Table 47.<sup>111</sup> These are held constant in real terms out to 2020. Where there are blanks in the table, this is because there is no incineration in that Member State.

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<sup>111</sup> The majority of figures for incineration taxes and gate fees are derived from DG Environment (2012) Use of Economic Instruments and Waste Management Performances, Report to European Commission (DG ENV) by BIO Intelligence Service, 10 April 2012, available at [http://ec.europa.eu/environment/waste/pdf/final\\_report\\_10042012.pdf](http://ec.europa.eu/environment/waste/pdf/final_report_10042012.pdf). Figures for Sweden and Finland are derived from industry contacts, and the figure for Ireland is a Eunomia estimate. In the absence of further information the Czech incinerator gate fee is applied to Hungary and Slovakia, and the Spanish gate fee is applied to Portugal.

Table 47: Costs of Incineration by Member State

Member State	Incineration Tax Rate (€/tonne)	Incineration Gate Fee (€/tonne)	Total Charge for Incineration (€/tonne)
Austria	7	125	132
Belgium	8	110	118
Bulgaria	-	-	-
Cyprus	-	-	-
Czech Republic	-	46	46
Denmark	44	36	80
Estonia	7	-	-
Finland	-	70	70
France	7	99	106
Germany	-	174	174
Greece	-	-	-
Hungary	-	46	46
Ireland	-	80	80
Italy	-	125	125
Latvia	-	-	-
Lithuania	-	-	-
Luxembourg	-	97	97
Malta	-	-	-
Netherlands	-	95	95
Poland	-	130	130
Portugal	-	57	57
Romania	-	-	-
Slovakia	-	46	46
Slovenia	-	103	103
Spain	11	57	68
Sweden	-	70	70
United Kingdom	-	88	88

For paper bags, we do expect majority significant proportion to be recycled. We assume a representative revenue for paper bags, the majority of which are

anticipated to be brown, to be that available for cardboard. We take the average of UK export prices for cardboard for the three years to July 2012, which is £102 (€131)<sup>112</sup> as the indicative price obtained.

Table 48: Summary of Costs of Landfill and Incineration by Member State (€/tonne)

Member State	Total Charge for Landfill (€/tonne)	Total Charge for Incineration (€/tonne)
Austria	96	132
Belgium	124	118
Bulgaria	33	-
Cyprus	56	-
Czech Republic	36	46
Denmark	107	80
Estonia	52	-
Finland	89	70
France	76	106
Germany	140	174
Greece	24	-
Hungary	35	46
Ireland	120	80
Italy	120	125
Latvia	38	-
Lithuania	38	-
Luxembourg	149	97
Malta	20	-
Netherlands	132	95
Poland	95	130
Portugal	14	57
Romania	4	-
Slovakia	156	46
Slovenia	7	103
Spain	117	68
Sweden	49	70
United Kingdom	91	88

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<sup>112</sup> Based on a £:€ exchange rate of 1:1.27650, ft.com currency converter, 26<sup>th</sup> July 2012.

## A.8.0 Location of Employment

As explained in Section 2.2 we assume that 30% of the demand for non-biodegradable single-use HDPE plastic bags is met by EU-based production and 70% by imports. We hold this value constant out to 2020.

EU consumption of single-use biodegradable plastic carrier bags is reported by Novamont to be 135,000 tonnes in 2012, with imports estimated to be 15,000 tonnes.<sup>113</sup> This indicates EU production of 120,000 tonnes, or 89% of demand.<sup>114</sup> It was also reported that the EU has potential manufacturing capacity of between 260,000 and 300,000 tonnes.<sup>115</sup> It is therefore assumed that 89% of the demand for biodegradable single-use plastic bags is met by domestic production in 2010, and 11% by imports. We hold this value constant out to 2020.

We assume that 90% of the demand for LDPE 'Bags for Life' is met by EU production and 10% by imports. Given that BIO IS estimate 0.87 Mt of multiple-use plastic carrier bags placed on the market in 2010<sup>116</sup>, and the calculated production figure of 0.87Mt in Section 2.2, it would seem that the correct assumption should be 100%. However, to allow for some uncertainty in respect of this number, and so as not to overstate the employment impacts associated with an increase in consumption of LDPE bags, we assume that 10% are imported. This assumption is held constant out to 2020.

We assume that all cotton, jute, and woven PP bags are imported from outside of the EU. This is consistent with Alber & Geiger's assertion that:<sup>117</sup>

Cotton carrier bags, and PP plastic carrier bags are produced almost entirely in Asian countries, due to cheaper production costs. PP bags production includes weaving and sewing, operations that need to be done manually. Labour costs are far lower in Asian countries than in Europe, which causes the comparative advantage. Similar circumstances apply to the production of cotton bags

For bin liners and paper bags, in the absence of further information, we assume that 50% are produced in the EU, and 50% outside the EU. This assumption is held constant out to 2020.

These assumptions are shown in Table 49.

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<sup>113</sup> Personal communication with Novamont

<sup>114</sup> Personal communication with Novamont

<sup>115</sup> Personal communication with Novamont

<sup>116</sup> Bio Intelligence Service (2011) Assessment of Impacts of Options to Reduce the Use of Single-use Plastic Carrier Bags, Final Report to European Commission – DG Environment, 12 September 2011

<sup>117</sup> Written communication from Alber & Geiger, 1<sup>st</sup> August 2012

Table 49: Location of Manufacture of Bags Consumed in EU

Bag Type	% of EU Consumption met by EU Production	% of EU Consumption met by Imports
Single-use Non-Biodegradable Plastic Carrier Bag (High Density Polyethylene – HDPE) *	30%	70%
Single-use Biodegradable Plastic Carrier Bag *	89%	11%
Single-use Paper Bag with Handles **	50%	50%
Low Density Polyethylene (LDPE) ‘Bag for Life’ **	90%	10%
Woven Polypropylene (PP) ***	0%	100%
Jute	0%	100%
Cotton **	0%	100%
Bin liner **	50%	50%



## A.9.0 Price Elasticity of Demand

Understanding the relationship between consumer demand and charge levels is important not only for any decision concerning what charge or levy to apply, but also in terms of how changes in the value of the charge in real terms may influence behaviour. The best source of information for understanding price elasticity is the case study below, on the Irish Plastic Bag Levy.

### A.9.1 Price Elasticity in Ireland

This situation provides possibly the best source of information for understanding the price elasticity of demand (PED), with analysis having been carried out for the Regulatory Impact Assessment (RIA) on further proposed increases and on-going price control mechanisms

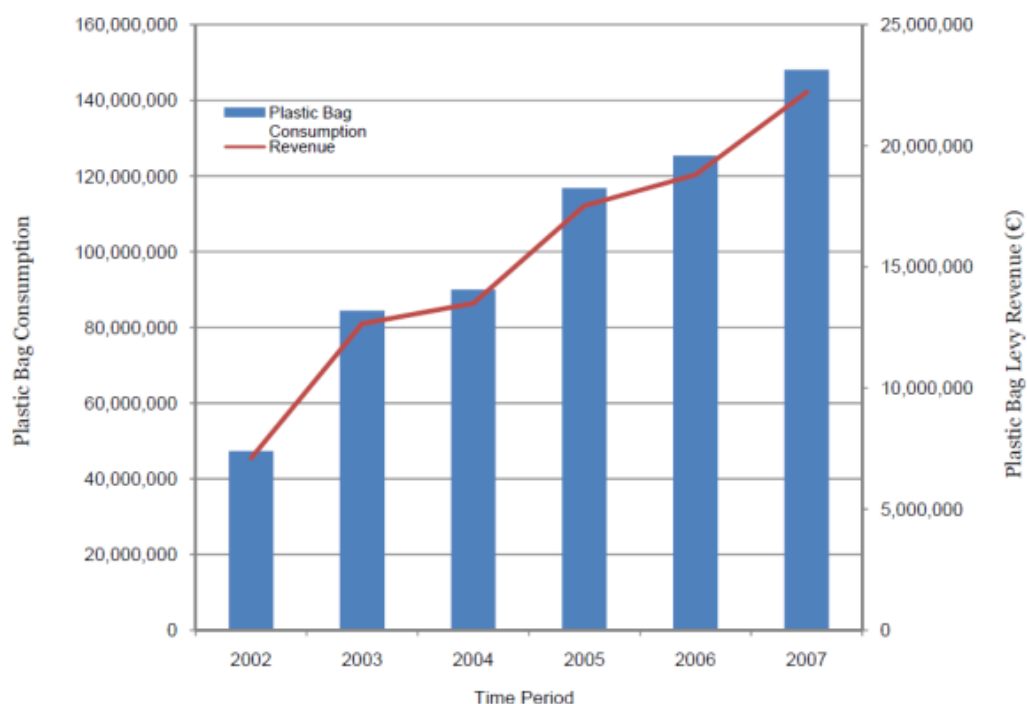
Following the implementation of the Irish Levy in 2002, the initial value of the levy of €0.15 per bag was allowed to fall in real terms over time, until a further increase to the levy was made in 2007.<sup>118</sup>

After a sharp decrease following the first implementation of the levy in 2002, demand for plastic bags steadily increased again over the period of 2003 to 2007, and we assume this was attributable to the previously mentioned decline in the real value of the levy. This can be seen in Figure 5 below which illustrates the increase in consumption and associated increase in levy revenue.

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<sup>118</sup> AP EnvEcon Limited (2008), *Regulatory Impact Analysis on Proposed Legislation to Increase Levies on Plastic Shopping Bags and Certain Waste Facilities*, A Report for the Department of the Environment, Heritage and Local Government November 2008.

Figure 5: Unadjusted Plastic Bag Consumption and Associated Revenue



Source: Department of Environment, Heritage and Local Government, 2008

Over this period the Irish RIA carried out analysis to produce figures for the PED to provide a percentage change in demand of plastic bags resulting from a given percentage price change. The analysis applied a GDP deflator to measure the change in real value of the levy over the time period. This produced a value for the 15 cent levy of **€0.1336 in real terms (2002 prices) by July 2007**. **Consumption volume figures were also used and adjusted with the retail sales index to give a change in demand without the inclusion of any general annual increases in retail sales.** The results from the RIA are presented below in Table 50.

Table 50: Price Elasticity of Demand for Real Declines of the €0.15 levy 2003-2006<sup>119</sup>

	2003	2004	2005	2006
Retail Sales Index Adjusted Bag Demand (number of bags)	83.9m	87.1m	111.1m	118.0m
Price Elasticity of Demand		-1.837	-10.470	-1.805

<sup>119</sup> AP EnvEcon Limited (2008), *Regulatory Impact Analysis on Proposed Legislation to Increase Levies on Plastic Shopping Bags and Certain Waste Facilities*, A Report for the Department of the Environment, Heritage and Local Government November 2008.

The large anomaly in 2005 is explained in the report as attributable to a government audit which increased revenue (and the consumption of bags calculated from this) following compliance by more retailers. The other figures remain consistent for 2004 and 2006 which suggest that demand is elastic to small real changes in price, with a 1% reduction in the levy matched by a 1.8% increase in demand.

With an increase in the levy introduced in 2007 the RIA also looked at the PED for this period, which witnessed a 40% increase (to €0.22) in the levy amount as opposed to small year on year changes in the real value of the levy. In contrast the PED, presented as a 0.72% decrease in demand for every 1% price increase, suggesting a relatively inelastic consumer response to the large increase in the levy.

### A.9.2 Nolan-ITU Report

Although no other examples are present for the actual PEDs for other measures introduced, some comment has been provided regarding its importance in various pieces of post-implementation analysis. The Nolan report for the Australian Government<sup>120</sup> argues that the most useful way to assess at what level to introduce a levy requires consideration of what its objectives are and how they can be efficiently achieved, which subsequently also requires an understanding of how consumer demand reacts to a change in the price of bags. The report also reiterates the difficulty in obtaining data to facilitate such analysis, this only being available from retailers or regions with charges already in place (such as Ireland). In the case of individual retailers, the report suggests that the data can also be skewed by other factors such as the types of surrounding community, as smaller settlements may have a different attitude toward plastic bags than populations in more urban areas, and the types of goods sold, as larger, more costly goods may provide a different demand behaviour towards plastic bags.

### A.9.3 Experience from South Africa

South Africa With the objective of reducing consumption, South Africa introduced regulations and a levy on single-use plastic bags in May 2003, enforcing a fixed price of 46 rand cents (€0.05) for 24 litre bags with a levy of 3 rand cents (€0.004) paid from this charge. A report published by the University of Cape Town<sup>121</sup> asserts that the levy has partially failed in the original objective of reducing consumption despite being enforced comprehensively. It states that in the short term consumption fell sharply, followed by a steady increase in demand for plastic bags over a longer period. Unlike the case in Ireland where the real value of the levy slowly declined, this increase was mainly caused by an initial reduction in the charge (the fixed price was reduced to 17 rand cents (€0.016) in the year following its implementation) following

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<sup>120</sup> Nolan-ITU, RMIT Centre for Design, Eunomia Research and Consulting (2002), Plastic Shopping Bags - Analysis of Levies and Environmental Impacts: Final Report, Report for Environment Australia, Department of the Environment and Heritage December 2002.

<sup>121</sup> Dikgang et al (2010), *Analysis of the Plastic-Bag Levy in south Africa*, University of Cape Town, July 2010.

pressure from plastic bag manufacturers, and subsequent on-going fluctuation in prices charged by different retailers. It concludes that the South African levy was too small, and on the basis of analysis and evidence from the Irish case, which has achieved sustained reduction in consumption by implementing further increases, it suggests any levy should be set sufficiently high so as not to allow increases in demand over the long term.

## A.10.0 Baseline Calculations

As shown in Figure 2, the calculations for the baseline are driven by expectations of future consumption of single-use plastic carrier bags, from 2012 out to 2020. This is based on current levels of consumption (see Appendix A.2.0), expectations of future economic growth (see Appendix A.2.1) and likely baseline shifts to alternatives.<sup>122</sup>

We then model the unit employment impacts by total consumption for future years, accounting for the location of employment (i.e. the proportion of demand met by imports from outside of the EU) to establish the baseline level of EU employment.

The unit costs to retailers of providing single-use plastic carrier bags for free (see Section 3.2.2) are multiplied by overall consumption in order to derive a total cost, and the profit to manufacturers is similarly calculated (see Section 3.2.2). The model has been developed to incorporate charges that might be levied on consumers but this functionality has not been applied, as such an analysis was not requested.

Unit litter impacts (see Section 3.4.1) and unit litter costs (see Section 3.4.2) are multiplied by total consumption in order to determine total litter costs, and a similar process is undertaken to determine collection and disposal costs. See Section 3.4.3 and Section 3.4.4.

Due to the lack of certainty over the consumption of alternative bags, i.e. all bags apart from single-use plastic carrier bags, (see Section A.2.0) we do not seek to analyse the production and consumption of these in the baseline. Regarding these bags, our interest is in the effect of policies in increasing consumption of such bags as a result of reductions in consumption of single-use plastic carrier bags.

The per capita consumption of single-use plastic carrier bags in 2012 that we use in the baseline is shown in Table 51.

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<sup>122</sup> Although we have made provision for it in the model, we do not model any baseline shifts to alternatives

Table 51: Per Capita Consumption of Single-use Plastic Carrier Bags for each Member State in 2012

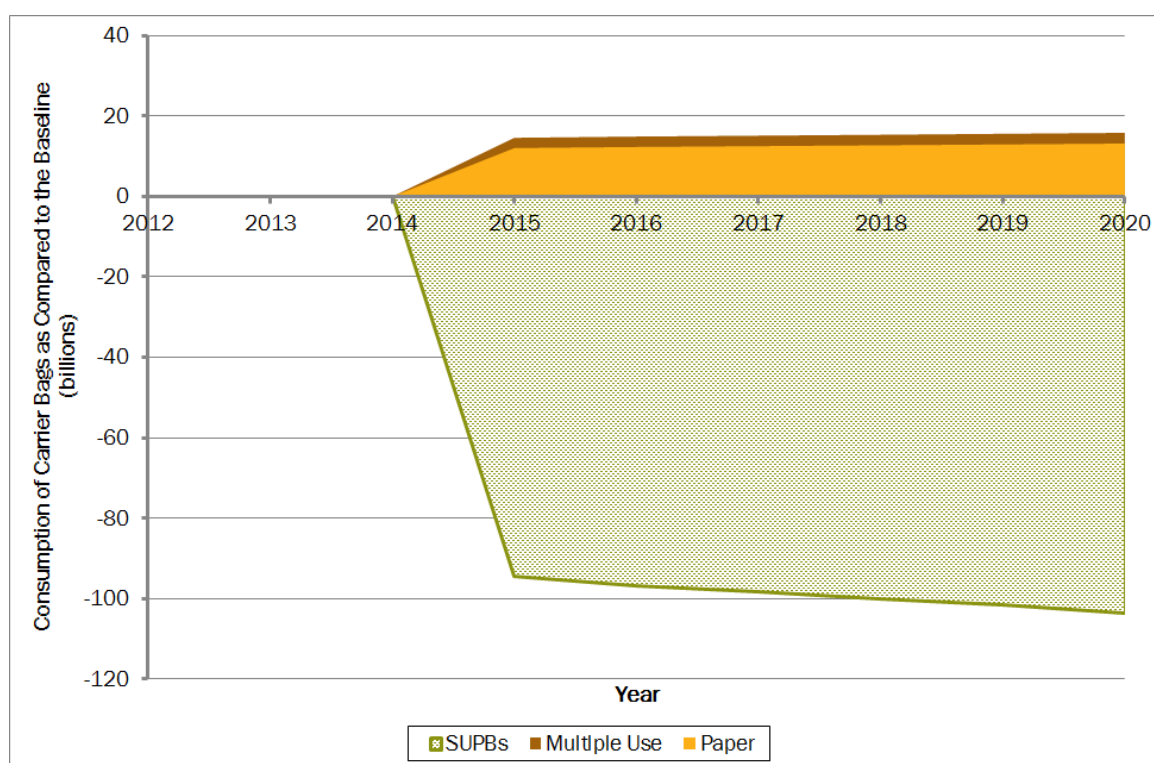
Member State	Single-use Plastic Carrier Bags
Austria	45
Belgium	97
Bulgaria	246
Cyprus	125
Czech Republic	297
Denmark	4
Estonia	466
Finland	4
France	79
Germany	64
Greece	242
Hungary	466
Ireland	18
Italy	181
Latvia	466
Lithuania	466
Luxembourg	18
Malta	107
Netherlands	71
Poland	466
Portugal	466
Romania	252
Slovakia	466
Slovenia	466
Spain	120
Sweden	100
United Kingdom	158
EU-27 average	175

## A.11.0 Consumption by Bag Type for Scenarios

### A.11.1 Scenario 1

Figure 6 shows the effect of the policy relative to the baseline, on consumption of single use plastic bags and substitute bags. The modelled increase in the number of paper bags consumed is represented by the yellow area and multiple-use bags by the brown area. It is worth noting that as this Figure shows changes relative to the baseline, and as it is assumed that in the baseline, consumption of single-use plastic bags keeps growing, when they are banned, over time the reduction in consumption relative to the baseline continues to grow.

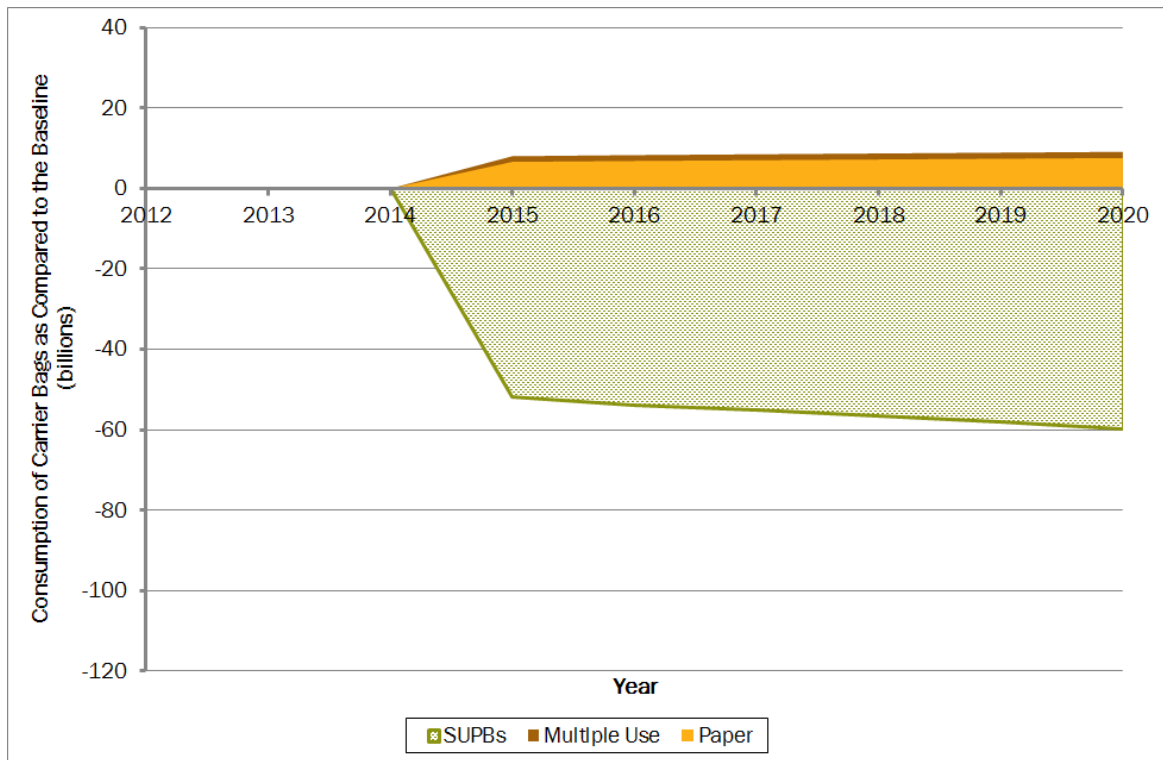
Figure 6: Scenario 1 – Reduction in Number of Single-use Plastic Carrier Bags Consumed and Increase in Consumption of Other Bags Relative to the Baseline (billion bags)



### A.11.2 Scenario 2

Figure 7 shows the effect of the policy, relative to the baseline, on consumption of single-use plastic bags and substitute bags.

Figure 7: Scenario 2 – Reduction in Consumption of Single-use Plastic Carrier Bags and Increase in Consumption of Other Bags Relative to the Baseline

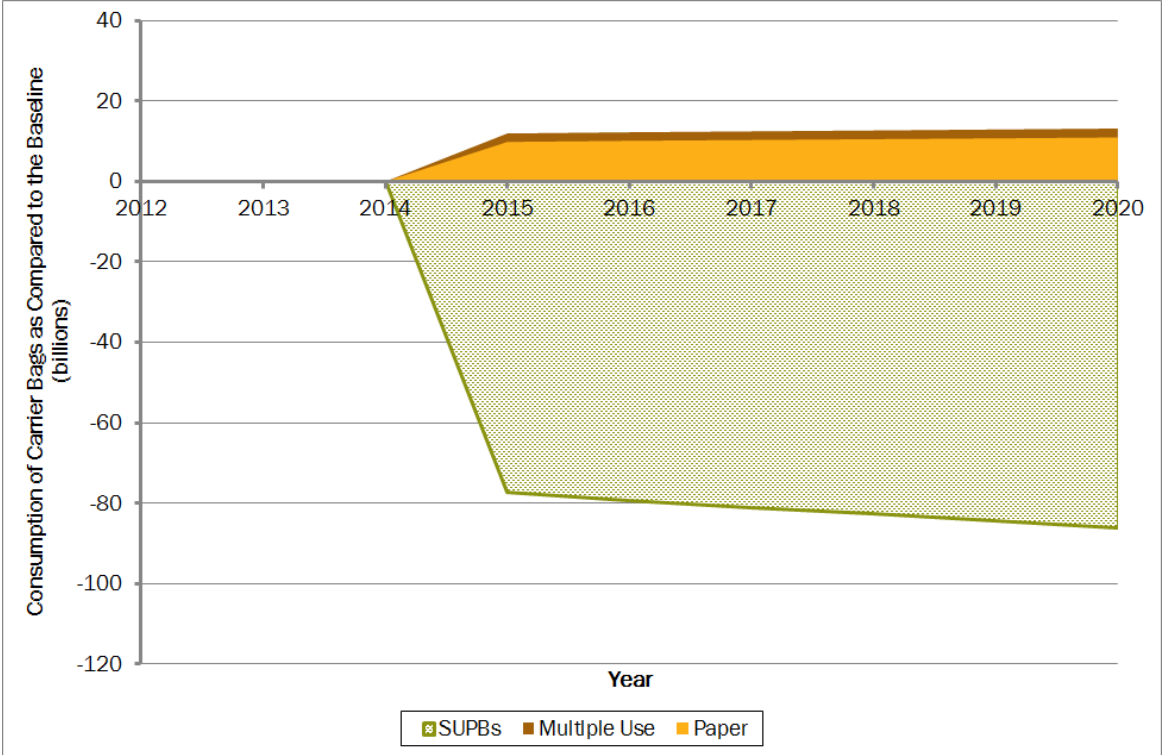


### A.11.3 Scenario 3

Figure 8 shows the effect of the policy, relative to the baseline on consumption of single-use plastic bags and substitute bags.



Figure 8: Scenario 3 – Reduction in Consumption of Single-use Plastic Carrier Bags and Increase in Consumption of Other Bags Relative to the Baseline



## A.12.0 Sensitivity Analysis - Detailed Results of Switch to Paper Bags

We present below the breakdown of results under the assumption that all non-supermarket sectors switch to paper bags.

### A.12.1 Cost to Retailers

The cost to retailers of providing single-use plastic carrier bags for free (see Section 3.2.2) will decrease from the **current level of approximately €1.8 billion** per annum under all scenarios. The reductions in cost seen under the different policy options are directly proportional to the reductions in consumption modelled for each. The costs for each year out to 2020, modelled in real terms (2012 prices), are shown in Table 52.

Table 52: Cost to Retailers of Providing Single-use Plastic Carrier Bags (€ billions)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ 1.8	€ 1.9	€ 2.0	€ 2.1	€ 2.1	€ 2.2	€ 2.2	€ 2.3	€ 2.4
Ban	€ 1.8	€ 1.9	€ 2.0	€ -	€ -	€ -	€ -	€ -	€ -
Voluntary Commitment	€ 1.8	€ 1.9	€ 2.0	€ 1.0	€ 1.0	€ 1.0	€ 1.0	€ 1.0	€ 1.0
Prevention Target	€ 1.8	€ 1.9	€ 2.0	€ 0.4	€ 0.4	€ 0.4	€ 0.4	€ 0.4	€ 0.4

Discounting these figures at 4%<sup>123</sup> gives present value savings to retailers as shown in Table 53 (i.e. these are the cumulative savings from the period 2015 to 2020, discounted to present values)

Table 53: Present Value Savings to Retailers Due to Cessation of Free Single-use Plastic Carrier Bag Provision (2012 prices)

Scenario	Present Value Saving
Ban	€ 10.71 billion
Voluntary Commitment	€ 5.84 billion
Prevention Target	€ 8.82 billion

<sup>123</sup> This is the discount rate recommended by the European Commission in their Impact Assessment Guidelines, see European Commission (2009) Impact Assessment Guidelines, 15 January 2009, available at [http://ec.europa.eu/governance/impact/commission\\_guidelines/docs/iag\\_2009\\_en.pdf](http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf)

However, we have assumed that where a switch to the use of single-use paper bags occurs, these are not charged for by retailers, so there is a cost to retailers associated with the provision of these. These additional costs are shown in Table 54.

**Table 54: Cost to Retailers for Provision of Free Single-use Paper Bags (€ billions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 2.4	€ 2.4	€ 2.4	€ 2.5	€ 2.5	€ 2.6
Voluntary Commitment	€ -	€ -	€ -	€ 1.3	€ 1.3	€ 1.4	€ 1.4	€ 1.4	€ 1.5
Prevention Target	€ -	€ -	€ -	€ 1.9	€ 2.0	€ 2.0	€ 2.1	€ 2.1	€ 2.1

Taking account of this cost delivers a net increase in costs to retailers (compared with the baseline) as shown in Table 55.

**Table 55: Net Change in Cost to Retailers for Provision of Free Single-use Carrier Bags (€ billions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 0.29	€ 0.28	€ 0.26	€ 0.25	€ 0.23	€ 0.21
Voluntary Commitment	€ -	€ -	€ -	€ 0.20	€ 0.19	€ 0.19	€ 0.18	€ 0.17	€ 0.16
Prevention Target	€ -	€ -	€ -	€ 0.24	€ 0.23	€ 0.22	€ 0.21	€ 0.20	€ 0.18

Discounting these figures at 4%<sup>124</sup> gives present value costs to retailers as shown in Table 56.

<sup>124</sup> This is the discount rate recommended by the European Commission in their Impact Assessment Guidelines, see European Commission (2009) Impact Assessment Guidelines, 15 January 2009, available at [http://ec.europa.eu/governance/impact/commission\\_guidelines/docs/iag\\_2009\\_en.pdf](http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf)

Table 56: Present Value Cost to Retailers (2012 prices)

Scenario	Present Value Cost
Ban	€ 1.23 billion
Voluntary Commitment	€ 0.89 billion
Prevention Target	€ 1.03 billion

Of course, faced with such a cost increase, retailers may decide to limit the number of paper bags that they give away freely to customers, perhaps through passing on the costs directly in the form of a charge (even if this does not cover the whole cost). To some extent, the approach is likely to reflect the nature of the policy which motivates the switch.

### A.12.2 Litter Costs

The number of single-use plastic carrier bags being discarded as litter decreases under all scenarios, from the current level (see Section 3.4.1) of approximately 6 billion bags per annum, as detailed in Table 57. A standard litter rate is assumed for each Member State across all the scenarios; therefore the amount littered is directly proportional to the level of single-use plastic carrier bag consumption which the policies are assumed to deliver.

Table 57: Total Number of Single-use Plastic Carrier Bags Littered (billions)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	6.0	6.1	6.2	6.4	6.5	6.7	6.8	6.9	7.0
Ban	6.0	6.1	6.2	-	-	-	-	-	-
Voluntary Commitment	6.0	6.1	6.2	2.0	2.0	2.1	2.1	2.1	2.1
Prevention Target	6.0	6.1	6.2	0.8	0.8	0.8	0.8	0.8	0.8

However, there is an increase in littering of single-use paper bags and multiple-use bags under all scenarios, associated with the increased consumption of such bags. This increase is shown in Table 58.<sup>125</sup>

<sup>125</sup> Note that units are millions rather than billions

**Table 58: Increased Littering of Paper and Multiple Use Bags Relative to the Baseline (billion bags)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	-	-	-	-	-	-	-	-	-
Ban	-	-	-	0.38	0.38	0.39	0.4	0.4	0.41
Voluntary Commitment	-	-	-	0.26	0.26	0.27	0.28	0.28	0.29
Prevention Target	-	-	-	0.33	0.34	0.34	0.35	0.36	0.36

Combined, these changes lead to a net reduction in litter impacts (in terms of the number of bags littered) for all scenarios, as shown Table 59.

**Table 59: Net Reduction in Littered Bags as Compared to the Baseline (billion bags)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	-	-	-	-	-	-	-	-	-
Ban	-	-	-	-6.0	-6.2	-6.3	-6.4	-6.5	-6.6
Voluntary Commitment	-	-	-	-4.1	-4.2	-4.3	-4.4	-4.5	-4.7
Prevention Target	-	-	-	-5.3	-5.4	-5.5	-5.6	-5.7	-5.9

This translates into a reduced cost of collecting and disposing of littered bags (see Section 3.4.2) under each scenario (compared with the baseline), as shown in Table 60.

**Table 60: Net Change in Costs of Collecting and Disposing of Littered Bags (€ millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	-€ 61.8	-€ 63.2	-€ 64.3	-€ 65.5	-€ 66.6	-€ 67.8
Voluntary Commitment	€ -	€ -	€ -	-€ 38.0	-€ 39.2	-€ 40.3	-€ 41.3	-€ 42.3	-€ 43.4
Prevention Target	€ -	€ -	€ -	-€ 52.5	-€ 53.9	-€ 55.0	-€ 56.1	-€ 57.2	-€ 58.4

Discounting these figures at 4%<sup>126</sup> gives present value savings on litter collection as shown in Table 61

**Table 61: Present Value Savings on Litter Collection Compared to the Baseline (2012 prices)**

Scenario	Present Value Saving
Ban	€ 314 million
Voluntary Commitment	€ 197 million
Prevention Target	€ 268 million

### A.12.3 Waste Collection and Disposal Costs

The cost of collecting and treating single-use plastic carrier bags in formal waste collection systems, i.e. representing the proportion that is not littered, decreases under all scenarios as shown in Table 62. Information on the calculation of the costs of waste collection are provided in Sections 3.4.3 and 3.4.4.

**Table 62: Total Cost of Collecting and Disposing of Single-use Plastic Carrier Bags in Formal Waste Management Systems (€ millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ 64.9	€ 66.8	€ 69.1	€ 71.6	€ 74.0	€ 76.2	€ 78.3	€ 80.6	€ 82.8
Ban	€ 64.9	€ 66.8	€ 69.1	€ -	€ -	€ -	€ -	€ -	€ -
Voluntary Commitment	€ 64.9	€ 66.8	€ 69.1	€ 37.5	€ 38.1	€ 38.6	€ 39.1	€ 39.5	€ 40.0
Prevention Target	€ 64.9	€ 66.8	€ 69.1	€ 15.7	€ 15.8	€ 15.9	€ 16.0	€ 16.2	€ 16.3

The waste management costs associated with the bags to which consumers switch under each scenario are shown in Table 63. While collecting and disposing of multiple-use bags represents a cost, the value to reprocessors of the paper bags (shown in Table 64) delivers a net revenue overall for this waste stream. Note that savings are presented as negative numbers.

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<sup>126</sup> This is the discount rate recommended by the European Commission in their Impact Assessment Guidelines, see European Commission (2009) Impact Assessment Guidelines, 15 January 2009, available at [http://ec.europa.eu/governance/impact/commission\\_guidelines/docs/iag\\_2009\\_en.pdf](http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf)

**Table 63: Net Reduction in Costs of Collecting, Recycling, and Disposing of Multiple-use and Paper Bags in Formal Waste Collection Systems (millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	-€ 10.0	-€ 9.8	-€ 9.6	-€ 9.3	-€ 9.0	-€ 8.8
Voluntary Commitment	€ -	€ -	€ -	-€ 8.4	-€ 8.4	-€ 8.2	-€ 8.1	-€ 7.9	-€ 7.7
Prevention Target	€ -	€ -	€ -	-€ 9.6	-€ 9.5	-€ 9.3	-€ 9.0	-€ 8.8	-€ 8.6

**Table 64: Value to Reprocessors of the Additional Paper Bags in the Formal Waste Collection System**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Scenario 1	€ -	€ -	€ -	-€ 43	-€ 44	-€ 45	-€ 46	-€ 46	-€ 47
Scenario 2	€ -	€ -	€ -	-€ 25	-€ 25	-€ 26	-€ 27	-€ 27	-€ 28
Scenario 3	€ -	€ -	€ -	-€ 36	-€ 37	-€ 37	-€ 38	-€ 39	-€ 39

The net reductions in costs for all scenarios, relative to the baseline, are shown in Table 65.

**Table 65: Net Reduction in Costs for Collecting, Recycling and Disposing of All Bags in Formal Waste Collection Systems (millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	-€ 81.5	-€ 83.8	-€ 85.7	-€ 87.6	-€ 89.6	-€ 91.6
Voluntary Commitment	€ -	€ -	€ -	-€ 42.5	-€ 44.3	-€ 45.8	-€ 47.3	-€ 48.9	-€ 50.5
Prevention Target	€ -	€ -	€ -	-€ 65.5	-€ 67.7	-€ 69.5	-€ 71.3	-€ 73.2	-€ 75.1

Discounting these figures at 4%<sup>127</sup> gives present value savings on waste management as shown in Table 66

**Table 66: Present Value Savings on Waste Management Compared to the Baseline (2012 prices)**

Scenario	Present Value Saving
Ban	€ 419 million
Voluntary Commitment	€ 225 million
Prevention Target	€ 340 million

#### A.12.4 EU Employment Impacts

The number of people employed in the manufacture of single-use plastic carrier bags declines under all scenarios. The assumptions relating to employment are outlined in Section 3.2.1. This effect on employment is shown in Table 67.

**Table 67: Total Number of People Employed in the Manufacture of Single-use Plastic Carrier Bags in the EU (thousands)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	4.9	5.1	5.2	5.4	5.5	5.6	5.7	5.8	6.0
Ban	4.9	5.1	5.2	0.3	0.4	0.4	0.4	0.4	0.4
Voluntary Commitment	4.9	5.1	5.2	2.6	2.7	2.7	2.7	2.8	2.8
Prevention Target	4.9	5.1	5.2	1.3	1.3	1.3	1.3	1.3	1.3

There is, however, an increase in the number of people employed in the manufacture of multiple-use plastic carrier bags, paper bags, and bin liners. This increase relative to the baseline is shown in Table 68.

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<sup>127</sup> This is the discount rate recommended by the European Commission in their Impact Assessment Guidelines, see European Commission (2009) Impact Assessment Guidelines, 15 January 2009, available at [http://ec.europa.eu/governance/impact/commission\\_guidelines/docs/iag\\_2009\\_en.pdf](http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf)



**Table 68: Increase in the Number of People Employed in the Manufacture of Multiple-use Bags, Paper Bags and Bin Liners in the EU (thousands)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	-	-	-	-	-	-	-	-	-
Ban	-	-	-	3.7	3.7	3.8	3.8	3.9	4.0
Voluntary Commitment	-	-	-	2.0	2.1	2.1	2.2	2.2	2.3
Prevention Target	-	-	-	3.0	3.1	3.1	3.2	3.2	3.3

The net change in levels of EU employment, compared with the baseline, under the three scenarios is shown in Table 69.

**Table 69: Net Change in the Number of People Employed in Manufacture of All Bags in the EU (thousands)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	-	-	-	-	-	-	-	-	-
Ban	-	-	-	-1.3	-1.4	-1.5	-1.5	-1.6	-1.6
Voluntary Commitment	-	-	-	-0.7	-0.7	-0.8	-0.8	-0.8	-0.9
Prevention Target	-	-	-	-1.1	-1.1	-1.2	-1.2	-1.3	-1.3

### A.12.5 Profits to EU Manufacturers

The assumed profits to EU manufacturers of single-use plastic carrier bags decline relative to the baseline under each scenario. The changes can be seen in Table 70

**Table 70: Profits to EU Manufacturer from Single-use Plastic Carrier Bags (€ millions)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ 124	€ 138	€ 142	€ 147	€ 152	€ 156	€ 161	€ 165	€ 170
Ban	€ 124	€ 138	€ 142	€ 1	€ 1	€ 1	€ 1	€ 1	€ -
Voluntary Commitment	€ 124	€ 138	€ 142	€ 70	€ 72	€ 73	€ 74	€ 75	€ 77
Prevention Target	€ 124	€ 138	€ 142	€ 27	€ 28	€ 28	€ 29	€ 29	€ 30

There is, however, an increase in the profits associated with the manufacture of alternative bags including paper bags, and also from the increase in sales of bin liners. These increases are shown in Table 71.

Table 71: Increase in Profits to EU Manufacturers from Multiple-use Bags, Paper Bags and Bin Liners (€ millions)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 214	€ 219	€ 222	€ 226	€ 230	€ 234
Voluntary Commitment	€ -	€ -	€ -	€ 118	€ 122	€ 125	€ 128	€ 131	€ 135
Prevention Target	€ -	€ -	€ -	€ 175	€ 180	€ 183	€ 187	€ 190	€ 194

There is therefore an increase in profits to EU bag manufacturers relative to the baseline under all scenarios, as shown in Table 72.

Table 72: Net Change in Profits to EU Bag Manufacturers (€ millions)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -	€ -
Ban	€ -	€ -	€ -	€ 68	€ 67	€ 67	€ 66	€ 65	€ 64
Voluntary Commitment	€ -	€ -	€ -	€ 41	€ 41	€ 42	€ 42	€ 41	€ 41
Prevention Target	€ -	€ -	€ -	€ 55	€ 56	€ 55	€ 55	€ 54	€ 54

## A.13.0 Possible Approaches to Achieving an 80% Reduction in Consumption of Single-use Plastic Carrier Bags

A number of potential approaches could be applied to achieving an 80% reduction in the consumption of single-use plastic carrier bags. In principle, of course, individual Member States could implement a ban unilaterally as their means of delivering the target. Other approaches might include:

- Implementing a levy on SUPBs, as happened, for example, in Ireland. Experience indicates that such an approach would be appropriate. It is also an approach that generates data, which enables progress to be tracked;
- National awareness raising programmes seeking to encourage use of alternative bags, and reuse of existing plastic carrier bags. On its own, however, this type of measure seems unlikely to deliver the full level of reduction;
- Subsidised provision (by Governments) of alternative (multiple-use) bags to consumers, in order to reduce the need for them to use single-use plastic carrier bags. Although, in principle, this might have an effect, it would not be efficient and would most likely lead to over-consumption of the multiple-use bags; or
- Voluntary agreements by retailers, who might agree to incentivise reuse through inducements such as giving consumers points on their reward cards for using their own bags or through measures such as hiding bags from public view at checkouts. Whether this approach could achieve an 80% reduction in SUPB use is not clear. A high level of coordination across all retailers would be required, whilst the system of data capture would be heavily dependent upon the retailers providing the information themselves. Furthermore, given the limited reliability of alternative approaches, a voluntary agreement might have to resort to some form of charging anyway.

The UK's Carrier Bags Agreement achieved less than an 80% reduction but it bears pointing out that the Agreement's target was a less challenging 50%, and it applied to the main supermarkets.<sup>128</sup> Not all EU Member States have the same level of concentration in their retailing structures, and across the EU, only 68% of all single-use plastic carrier bags in the EU are given away by supermarkets. Even if an 80% reduction was achieved for this sector, therefore, an overall reduction of only 55% would be achieved. Extending a voluntary agreement to cover all retailers would be

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<sup>128</sup> It is reported by WRAP that the UK Carrier Bags Agreement brought about a 48% reduction in single-use plastic bags consumed between 2006 and 2009, missing the target of a 50% reduction. See WRAP (2012), UK Supermarket Retailers Voluntary Carrier Bag Agreement: 2011 Carrier Bag Use, Presentation for the WRAP website, WRAP July 2012.

administratively complex, and would appear to offer limited advantages over the alternatives. Finally, in order to be relied upon to deliver the stated targets, such an agreement ought to be supported by some form of sanction. The UK agreement's principle sanction is the announcement that the target has not been met, though in principle, the 'sanction' of the application of an alternative policy instrument remains

Given the above discussion, and recognising the responsibility that Member States may have to comply with such policies, although there may be other options not considered above, the role of some form of charging scheme would appear to be significant

### A.13.1 Legal Requirement to Cease Free Provision to Final Users

Charging final users for single-use plastic carrier bags is one option open to Member States to meet their individual targets in order to contribute towards an overall 80% reduction at EU level.

This section, which is mostly discursive in nature, describes the reductions observed where charges have already been put in place, and also considers the effects where inflation means that the real terms value of charges reduce over time.

With few examples to draw from, it is difficult to establish a clear link between the initial level of any form of charge and the percentage reduction in use seen in the first year of operation. Intuitively, it would seem plausible that the greater the level of charge, the greater the level of reduction that would be seen in the first year. This can be appreciated when considering that to a consumer, the marginal value of one plastic carrier bag at a particular point in time, and under specific circumstances, may be higher or lower than the value that they place on an identical plastic bag at a different point in time, or under different circumstances. This value, represented as the willingness-to-pay, varies not only for an individual depending on the circumstances, but will vary from person to person. All things being equal, the higher the charge, the more frequent the occasions when the price to be paid will be greater than the consumer's willingness-to-pay.

This variation in willingness-to-pay was accounted for in the Irish levy. The levy is not a Pigouvian tax, i.e. the rate of the tax was not devised with the intention of internalising the marginal external costs. Instead, the Irish Government's intention was to set a rate of tax which would act specifically to change consumer behaviour. As such, the initial rate of tax was set at six times consumers' average maximum willingness to pay for the purchase of plastic bags.<sup>129</sup>

The Welsh charge<sup>130</sup> of €0.06 in 2012 seems rather low compared with the Irish levy which was set at €0.15 ten years earlier. In 2012 prices, the Irish levy from 2002

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<sup>129</sup> Convery, F., McDonnell, S. and Ferreira, S. (2007) The Most Popular Tax in Europe? Lessons from the Irish Plastic Bags Levy, *Environmental and Resource Economics*, September 2007, Vol. 38, No. 1, pp. 1-11

<sup>130</sup> Which applies to single-use carrier bags made of both plastic and paper

would be equivalent to approximately €0.165.<sup>131</sup> In Ireland, a 94% drop in consumption of single use plastic bags was reported.<sup>132</sup> In Wales, nine months after the introduction of the charge, reductions in single-use bag consumption are cited by Welsh Government as being between 70% and 96%, depending upon the sector, although no figures on total reductions are available.<sup>133</sup>

A potentially important difference here is the inclusion, (in the case of Wales) and exclusion, (in the case of Ireland) of paper bags from the legislation. In Ireland, if single-use paper bags are still provided by retailers, and especially if they are not charged for, achieving a reduction of 94% in single-use plastic carrier bags would appear to be a more straightforward matter than achieving a similar level of reduction in the consumption of *all* single use carrier bags in Wales.

Without being able to compare two legislative instruments (that appear to be identical in all other aspects apart from the level of the charge/levy), it is difficult to establish the precise difference that may be attributable to price. However, as a rough estimate, in the case where single-use paper bags are excluded from the legislation, it would seem reasonable to expect that a €0.05 charge might lead to a reduction of approximately 80-90% (given the reductions seen in Wales where paper bags are included), while a higher charge of €0.15 may be required to achieve reductions approaching 95%.

What does seem to be clear from the evidence in Ireland is the importance of ensuring that the level of charge keeps pace with inflation, so that the effectiveness of the measure, as represented by the magnitude of the charge in real terms, is maintained.

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<sup>131</sup> Based on conversion using the Irish GDP deflator, details of which are available at <http://www.finance.gov.ie/documents/guidelines/bessept2011.pdf>

<sup>132</sup> Convery et al (2007), The most popular tax in Europe? Lessons from the Irish plastic bags levy, Springer Science + Business Media Jan 2007.

<sup>133</sup> *Welsh Government (2012), Reduction in Single-use Carrier Bags, Accessed 7<sup>th</sup> August 2012.* [http://wales.gov.uk/topics/environmentcountryside/epg/waste\\_recycling/substance/carrierbags/reduction/](http://wales.gov.uk/topics/environmentcountryside/epg/waste_recycling/substance/carrierbags/reduction/)