Governing Polyethylene Reductions

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Abstract

Due to the large volume of polyethylene plastic bags used annually, environmental issues have arisen. Various governments have enacted various policies with varying degree of success. Consumer-awareness campaigns, plastic bag levies and bans were assessed based on ease of implementation, and per capita bag usage reductions. It was concluded that the solution to the plastic bag issue is not finite, neither of the three prevailed. However, as polyethylene reduction methods through government intervention is relatively new. The perfect solution need not necessarily involve the government.

Intro

Annually, over a trillion polyethylene plastic bags are consumed where a large majority end up in landfills. Due to the mobility of polyethylene bags, environmental issues have arisen. Although, there are biodegradable and bioerodable bags, and recycling processes available, various governments across the globe have enacted bans, levies, and other initiatives to address the plastic bag issue. These government efforts include but are not limited to the Australian levy-free efforts, the Irish PlasTax, the Bangladeshi Ban. A good government strategy should be easy to implement, and result in high reductions in per capita plastic bag usage,.

Environmental Impact

The vast amount of plastic bags consumed annually only adds to the need for more landfill space. Furthermore, as most polyethylene bags require petroleum in it's manufacturing, a non-renewable resource is being consumed. In addition, a wide array of marine life such as whales, dolphins and turtles are severely injured or killed because they ingest or become entangled in plastic. Annually, as many as a million birds and 100,000 marine mammals worldwide die from plastic bags [1]. For example, a leatherback turtle was found dead with 57kg of plastic bags in its innards (1998) and a Minke whale was similarly found dead with 800kg of plastic bags (2002) [1]. One of the reasons given for why marine wildlife consume plastic bags is that they may mistake them for jellyfish, a main source of food for marine mammals [1]. The consequence of this error is that the bags block the throat preventing normal feeding [1]. To address these three environmental issues, methods to strongly reduce or phase out the usage of polyethylene plastic bags should be devised.

Biodegradable, Bioerodable, Recycle

Biodegradable bags are made of synthetic polymers and natural starch. The decomposition of such bags rely on micro-organisms to break down the bag [1]. Whereas, bioerodable bags are also synthetic but

decompose through oxidation and erosion [1]. In an anaerobic environment, the bioerodable bag ceases to break down [1]. In both processes, green house gases are emitted [1].

In addition to the separation of biodegradable and bioerodable bags, recycling of polyethylene bags requires the separation between high-density and low-density polyethylene (HDPE, LDPE respectively) [1]. As such, it is inconvenient for the general populace; especially, in since all four kinds of bags can be obtained through various retailers.

Table 1. Properties of Various Bags

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

* Data provided by CBC and Symphony Plastic Technologies plc. Based on average price of an average bag.
**The relative volume of bags (to a conventional lightweight bag) is important for transportation and storage units required compared with plastic carrier bags.
§ The average weight of all paper bags available is 99g (arithmetic mean of 51, 81 and 166g). The values of 51g and 99g are used in the LCA in Section 4 for various analysis sensitivities.

Table 1*: In this table, different bag types are compared and their feasibility for recycling listed. It is important to note that biodegradable and bioerodable bags must be separated to prevent contamination of the recyclate.*

It is argued that plastic bags are recycled around the home for various purposes, such as garbage bags,

shoe storage, and the collection of a pet's organic waste [1]. As demonstrated in the figure below, despite their reuse in the household, 36% end up in landfills without being reused [3].

Figure 1 Australian Disposal Destination of Plastic Bags

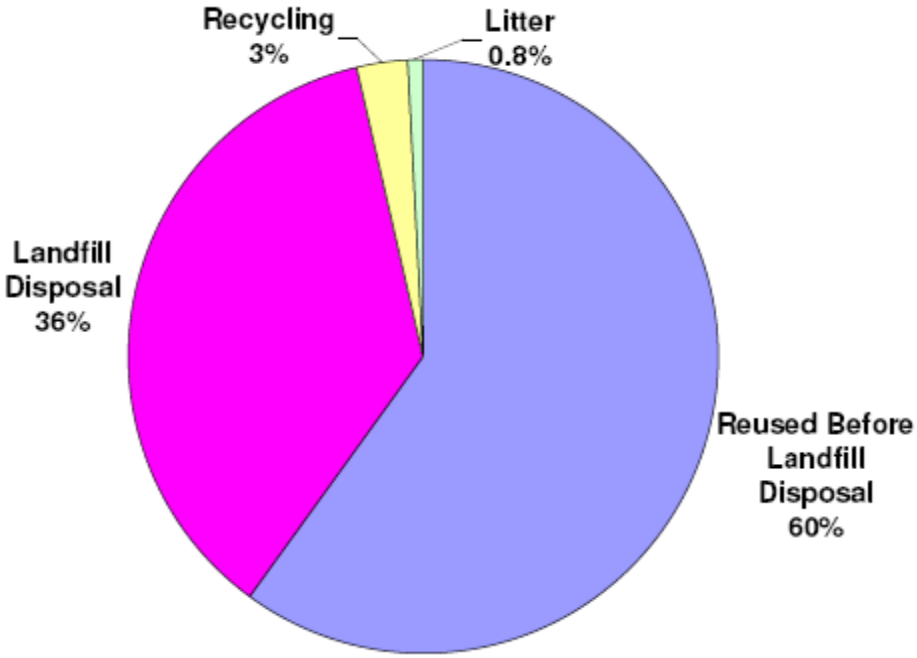

***Figure 1**: High landfill disposal rate despite availability of recycling facilities*

The biodegradable and bioerodable bags addresses the landfill issues very well, as decomposition generally leads to a smaller space requirement. However, we cannot be certain that it the decomposed plastic will be safe for humans, and the environment. We may one day regret having made biodegradable or bioerodable polyethylene bags. Therefore, the goal should be to use reduce polyethylene usage as little as possible regardless of it's ability or inability to decompose.

Australian Efforts

The Australian efforts to reduce polyethylene plastic bag usage arose due to a plastic bag litter issue. Indirectly, this effort has reduced the annual per capita usage of the polyethylene bags. In 2002, it was found that 6.9 billion plastic bags are consumed annually in Australia [3]. 96% of such bags ended up in landfills, 3% were recycled, 0.8% littered [3]. In 2002, HDPE bag usage per capita was 303 bags for a total of 5.95 billion bags [4]. By 2005, the per capita usage of HDPE bags decreased to 192 bags for a total 3.92 billion bags [4]. This decrease in usage is a result of through consumer awareness, and various levy-free initiatives. To further address the plastic bags issue, the Australian Government is negotiating with retailers to phase out plastic bags [5].

Irish PlasTax

Plastic bag consumption experienced a drastic increase in the 1990s [6]. As retailers had no limitations on plastic bag consumption by consumers, the amount of highly visible litter also increased [6]. Due to the nature of most plastic bags, they do not decompose; thus, they became highly persistent pollutants in urban, rural and coastal settings. This trend was also undermining Ireland's clean, green image on which the Irish tourism industry depends [6]. To curb the high plastic bag consumption and to address a litter problem where plastic bags accounted for 5% of litter, a plastic bag levy of 15 cents per bag was passed in December 2001 [7] and introduced in March 2002 [6]. Overnight, estimated plastic bag usage dropped from 328 bags per capita to 21 bags [6]. However, in 2006 the per capita usage rose to 31 bags [6]. In an attempt to curb plastic bag usage, the levy was increased to 22 cents effective July 2007 [6].

The Irish levy on plastic shopping bags does not distinguish between biodegradable plastic bags and other plastic bags. Biodegradable bags require considerable time to degrade and, while their use may be preferable in a final treatment situation, such bags will continue to form a visible nuisance for a significant period of time where discarded as litter [6].

Bangladeshi Plastic Bag Ban

Prior to the bans, Bangladesh consumed 9 million plastic bags a day, of which only 10-15% were placed in bins, with 85% littered into the environment [3]. This resulted in an extensive litter problem that eventually resulted in clogged drains that caused serious flooding and major loss of life [3]. In March 2002, a plastic bag manufacturing and usage ban was introduced [3]. This was the government's third attempt to introduce a ban. The first stage of the ban applied to the capital only, and is to be extended nationally [3].

Ease of Implementation

With consumer-awareness efforts like Australia's, there is virtually no implementation required. The government has to add information to their respective department's websites, have pamphlets designed, and a handful personnel to answer questions. Although initial implementation is relatively straightforward, new campaigns must be continually devised to enforce retainment of the campaign ideas. The challenge with this method is coming up with new innovative campaigns about the reducing polyethylene usage.

Implementation of a levy would be relatively simple. Like the Irish PlasTax, the levy must clearly outline and define various procedures, exceptions, and specifications. Collection procedures can probably be similar to the country's sales tax procedures. For the retailer, implementation would only require new software. Software developers can easily write a patch for the program to include the new levy. As sales tax changes have been implemented smoothly in past, implementation of a plastic bag levy should be relatively straightforward. Once implemented, personnel must be in place to answer questions, to assess the effective of the levy, and to enforce the levy.

Implementing a ban on plastic bags would be difficult. Consumers and retailers are accustomed to having bags to transport the goods from the store back home. It would require implementation over a several phases. One option can be implementing policies on a national level such as the banning of plastic bag imports, followed by plastic bag manufacturing limits. Then ending off with a manufacturing ban altogether. Another option can be like the Bangladeshi ban, where major cities are targeted for ban first, and spread towards rural districts later. Both options will require lots of planning, and strong enforcements of the new policies.

Bag Reduction Effectiveness

The effectiveness of consumer-awareness approach can vary from country to country. In Australia, annual HDPE bag usage per capita was reduced from 303 bags to 192 bags over during the 2002 to 2005 timespan [3]. Although, this method produces paper waste; however, this waste is readily recyclable in many parts of the world. It is possible that these reductions are temporary, plastic bag usage may rise in the future. It is also possible that the campaigning efforts have reached its effective limit; therefore, further reduction in usage will require a different solution.

The effectiveness of a plastic bag levy can also vary from country to country. The Irish PlasTax experienced per capita usage decreases from 328 to 31 from 2002 to 2006 [5]. In 2006, Irish per capita usage was on the rise once more, this suggests that the effects of the levy may be temporary. If the Irish PlasTax increase in 2007 fails to curb plastic bag usage, the levy will fail to accomplish long term results on reducing polyethylene bag usage.

In the plastic bag ban scenario, assuming that everyone is a good law abiding citizen, the reduction in polyethylene plastic bag usage should be 100% reduction in areas where the ban is in effect; therefore,

it is highly effective. However, a ban would result for a need for consumers to find an alternative to line their garbage bins. This may pose additional problems depending on what the new garbage bin liner is.

Conclusion

It is evident that the world recognizes that plastic bags poses an environmental threat; however, none of the government interventions (consumer-awareness, levy, ban) seem to prevail over the others. One would need to know the future in order to determine which of the three options in order to select one. It is possible that a combination of the three will work best. The success of China's ban may hold the answer, only time can tell. It is also possible that a completely different government intervention, or a non-governmental solution will better guide the plastic bags issue for a greener, safer, cleaner tomorrow.

Chinese Free Plastic Bags Ban

In China, 3 billion plastic bags are used per day [8]. The Chinese government will be implementing a ban on free plastic bags on June 1st, 2008 [8]. This ban will require retailers to charge for plastic bags and that the charge be clearly marked and not hidden into the cost of other store items [8]. Furthermore, plastic bags will not be permitted on board public transportation [8]. As such, this ban is very similar to a levy; however, it prohibits the transportation of the plastic bags on public modes of public transportation.

References

[1] James Cadman, Suzanne Evans, Mike Holland, Richard Boyd, AEA Technology Environment (2005) **Proposed Plastic Bag Levy – Extended Impact Assessment Volume 1: Main report** [Online] Accessed 07 March 2008 Available:http://www.scotland.gov.uk/Resource/Doc/57346/0016899.pdf
Note: Table 1 can be found in this report

[2] WWF-UK (2005) **Marine Groups support plastic bag levy to protect Sea Life** [Online]Accessed 07 March 2008 Available: http://www.wwf.org.uk/news/scotland/n_0000001646.asp

[3] Nolan-ITU Pty Ltd (Dec 2002) Plastic Shopping Bags – Analysis of Levies and **Environmental Impacts** [Online]Accessed 07 March 2008 Available:
http://www.environment.gov.au/settlements/publications/waste/plasticbags/pubs/analysis.pdf
Note: Figure 1 can be found here

[4] Peter Allan, Hyder Consulting Pty Ltd (2005) **Plastic Retail Carry Bag Use 2002 – 2005 Consumption** [Online] Accessed 18 Nov 2007
Available:http://www.environment.gov.au/settlements/publications/waste/plasticbags/pubs/report-2005.

pdf

[5] Department of the Environment and Water Resources, Australian Government (2007) A**ction being taken on plastic bag problem** [Online] Accessed 07 March 2008 Available: http://www.environment.gov.au/settlements/waste/plastic-bags/action.html

[6] Department of the Environment, Heritage & Local Government, Ireland (2007) **Plastic Bags** [Online] Accessed 07 March 2008 Available: http://www.environ.ie/en/Environment/Waste/PlasticBags/

[7] Irish Statute Book, Office of the Attorney General (2001) **Waste Management (Environmental Levy) (Plastic Bag) Regulations, 2001** [Online] Accessed 07 March 2008 Available: http://www.irishstatutebook.ie/2001/en/si/0605.html

[8] CNN.com/asia (2008) **China bans free plastic bags** [Online] Accessed 07 March 2008 Available: http://edition.cnn.com/2008/WORLD/asiapcf/01/09/china.plastic.bags/