

Viabile and Preferred Alternatives to Plastic Bag Usage in Colorado

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ABSTRACT

Manufacturing, transportation, distribution, recycling, community cleanups and waste disposal of plastic bags have significant socio-economic costs that are ultimately absorbed by society. Plastic bags represent material waste in society and are an obvious source of litter in the marine and terrestrial environments. Ireland and Australia have sought to minimize the impacts of plastic bags, address fossil fuel resource consumption and clean up their country's environments. Ireland legislated the Plastic Bag Environmental Levy in 2002, while Australia currently utilizes a voluntary plastic bag reduction program. This Capstone Project examines Ireland's and Australia's plastic bag reduction strategies, captures those elements that are successful and provides tangible aspects that will direct the implementation of a successful plastic bag reduction policy in Colorado.

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ABBREVIATIONS

ARA	Australian Retailer's Association
CDOT	Colorado Department of Transportation
DEH	Department of Environment and Heritage
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
NGO	Non Governmental Organization
PAYT	Pay As You Throw
U.S.	United States

INTRODUCTION

Statement of problem

Plastic bags are an exorbitant drain on limited petroleum reserves in their manufacture and constitute considerable costs for retailers and consumers alike. The financial cost of plastic bags to consumers has become an issue that is being actively addressed by some U.S. communities. San Francisco, California has implemented a ban on all plastic bags within its City and County limits in an effort to reduce the use of petroleum-based bags. Other major U.S. cities such as New York, New York, and Boston, Massachusetts, are considering the issue as well. The public debate of topics regarding plastic bag use, costs, and environmental effects within the United States is gaining momentum, showing up in written venues such as newspapers, store newsletters that are sent out to members (Costco Connection 2007), and websites like ReusableBags.com (Reusable Bags 2007).

The issue of plastic bags is a complex one that has several distinct facets:

- Plastic bags are manufactured using petroleum products;
- The plastic bag manufacturing industry creates thousands of jobs;
- Manufacturing, distribution, transportation and disposal of bags contributes significantly to the economy;

- Plastic bags are a better alternative than paper bags; and
- Plastic bags do not break down in the terrestrial and marine environment and are often mistakenly ingested by animals and marine life, thereby causing mortality rates to rise among wildlife.

The environmental aspect of plastic bag usage involves a myriad of issues. For instance, landfills are now experiencing greater daily input volume than ever before due in part to the disposal of plastic film that surrounds many new products and convenience products such as plastic bags. The Society of the Plastics Industry's consumer information sheet indicates that plastic bags comprise approximately 4 percent of waste in landfills and take up one seventh the space of paper bags (2007). Costs in the form of time and money are associated with littering and subsequent clean-up along highways, in communities, and in the marine environment. Australian coastal communities are acutely aware of increased mortality rates of marine animals due to accidental ingestion of plastic bags. Extensive research performed by the Algalita Marine Research Foundation finds that "[a]ll plastic introduced into [the] marine environment remains there, getting smaller but never breaking apart" (2006, 5). The Foundation notes that public education regarding the economic and environmental costs of littering will be the single most important factor in minimizing littering and marine debris (2006).

This project will take the plastic bag debate out of the realm of “paper or plastic” and “business or environment” by focusing on the economic implications of policy-induced plastic bag usage reduction in retail outlets. This project critically analyzes resource usage and economic impacts of levies associated with plastic bag reduction programs, and focuses on the strengths and weaknesses of Ireland and Australia’s efforts to reduce plastic bag usage within their borders. Viable and preferred alternatives for Colorado are based on extrapolated data from Ireland and Australia’s policies. The recommendations are intended to minimize the current rate of plastic bag usage through implementation of a statewide plastic bag reduction program that addresses potentially adverse economic impacts. The recommendations are based on the strengths and weaknesses of known policies in comparable communities that can be directly contrasted to Colorado.

Goals and objectives

The goals for this Capstone project are twofold. The first goal is to produce a working document that may serve as a foundation for elected policymakers in all realms of government service, for the exclusive purpose of supplying succinct information regarding the potential for a plastic bag reduction policy. This document is not to be mistaken for a legislative bill. The second goal is to supply viable recommendations to Colorado policymakers for a plastic bag reduction policy based on scientific and

analytical data. The recommendations will be useful as tools that can offer resource reduction, economic savings, and improved environmental stewardship as the final result. The economic aspect of the research is intended to provide merit and validation to the recommendations that will be scrutinized by the business community.

The objectives of this project are to first research the economic implications of plastic bag usage on manufacturers, retailers and consumers, examine natural resource consumption, and then assess the means that will provide the greatest reduction of plastic bags in Colorado. The means to reach the goal of plastic bag reduction in Colorado is complicated and includes three distinct subsections: social awareness, cultural acceptance of sustainable alternatives, and economic balancing of plastic bag reduction within the business, municipal and consumer sectors. Each of these subsections must be carefully considered.

Benefits

This project presents multiple levels of benefits and is portrayed in Figure 1. The first level of benefits has two primary sections, beginning with the case study methodology of research. The first primary benefit is that the research has intrinsic value to elected officials, NGO's, and individuals due to the specific topic of investigation and the interest in the economic factors relating to plastic bag reduction in Ireland and Australia. The second primary benefit is the subsequent recommendations that may lead to implementation

of a plastic bag reduction policy in Colorado. The project will ultimately be worthy of consideration by legislators and other elected officials in Colorado. The project has value to those who seek to reduce our collective reliance on petroleum reserves, groups who seek a higher rate of local sustainability, small businesses who seek new business opportunities as manufacturers or distributors of reusable bags, and communities who seek to lower the financial and environmental costs of litter disposal and cleanup within their boundaries.

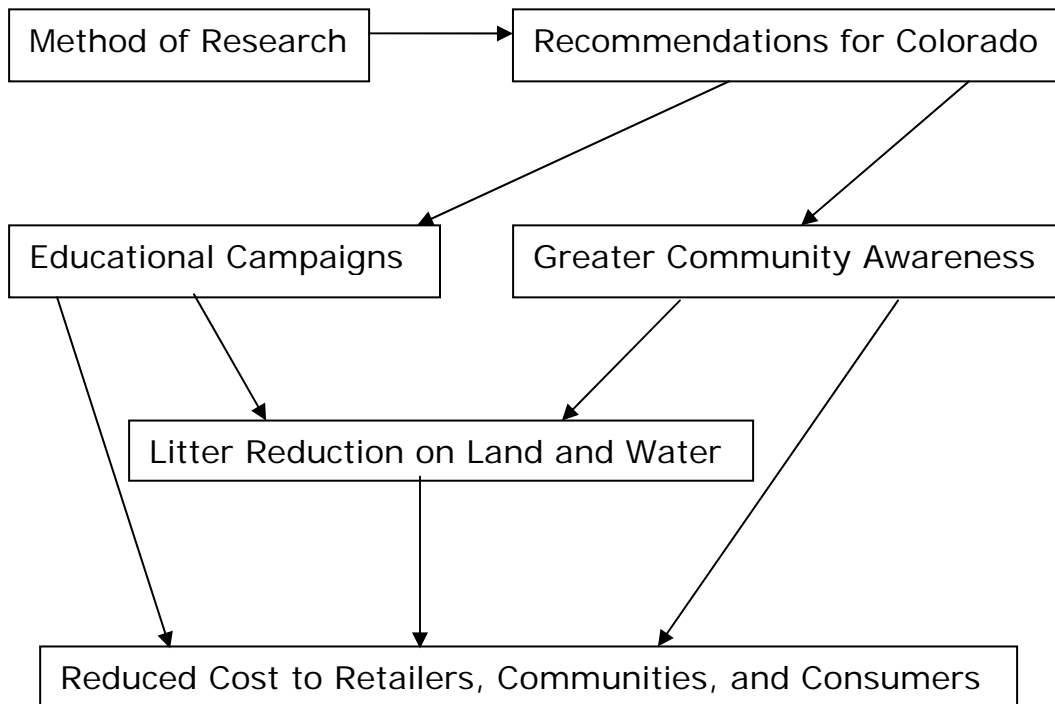


Figure 1. Four levels of benefits for this Project.

The second level of benefits from the project are the educational campaigns and increased community awareness of a convenience product that is created from oil and the influence each person potentially has on the daily

reduction of fossil fuel usage. The third level benefit will be in litter reduction from the land and water environment. The fourth level benefit will be an economic one in which retailers, municipalities, and consumers experience reduced costs from the purchase, waste, and recycling of plastic bags.

The four levels of benefits are significant ways that legislators can communicate the positive attributes of a plastic bag reduction policy to their constituents. Colorado residents have shown interest in reducing greenhouse gases and decreasing the carbon footprint of citizens on the national and global scale by providing funding and human resources to aid in mitigating identified problems. Governor Bill Ritter expressed a desire to stimulate the economy and reduce reliance on fossil fuels:

Fossil fuels will continue to be a major part of our energy economy.

But with our abundant supplies of wind, sun and crops, renewable

energy plays an important role. It's how we create new jobs and

stimulate the ailing economies of the Eastern Plains and San Luis

Valley. It's how we breathe new economic life into our farms. It's one

way to give new economic relevance to our colleges and universities.

It's how we prepare our workforce for 21st century industries (Ritter 2007, 3).

Because of the acknowledged immediate need to find ways to reduce the dependence Americans have on petroleum, it is crucial for legislatures to

take immediate steps toward enacting the resulting recommendations in this project.

Method of research

This project is founded upon an extensive literature review and the discrete analysis of two comprehensive case studies. The literature review is composed of detailed research pertaining to plastic bag usage, resource usage, social and cultural perspectives on plastic bag usage, and quantitative and qualitative economics. There are six sections in the Literature Review: 1) energy and resource consumption; 2) plastic versus paper; 3) plastic versus reusable bags; 4) economy; 5) policy and consumer behavior; and 6) Colorado. These sections discuss the energy used to create plastic bags, the resources used to manufacture plastic, paper, and reusable bags, the impact plastic bags has on the economy, how legislated or voluntary policy affects consumer behavior, and the current status of Colorado's plastic bag usage and recycling rates.

The analysis of the case studies focuses on Ireland and Australia's efforts to reduce plastic bag usage by legislated and voluntary schemes. This method of research is the most effective for this project because of the opportunity to dissect individual components of each case study and analyze the pieces that comprise the whole of the policy being examined. The pieces of the case study and the subsequent lessons that can be learned from them are essential for understanding the entire issue of plastic bag reduction.

William Tillis notes that “the quintessential characteristic of case studies is that they strive towards a holistic understanding of cultural systems of action” (1997, 5). What Mr. Tillis does not state is that a holistic view is unattainable without an extensive understanding of how each of the pieces of the whole functions. After researching and analyzing the various components of each country’s policy, a holistic view of the policy allows an accurate application of knowledge gained from their efforts. Case study analysis allows a methodical review of attributes that may be beneficially applied in Colorado, as well as exposes problems that may be recognized and therefore abated. Ireland and Australia have sought solutions to the environmental pollution and economic costs to society that are embodied by plastic bags. Studying the results of their efforts allows for construction of a statewide policy for Colorado based on real and tangible results, rather than ideology and conjecture.

The case studies will be comprised of five sections: (1) overview; (2) pertinent laws, taxing structure, and administration of the country in question; (3) economic impacts of the ban/tax; (4) strengths of the policy; and (5) weaknesses of the policy.

The same format will be followed for both case studies, thereby allowing better comparison in the search for viable, research-driven recommendations for Colorado. Following the case studies will be the Findings section, in which conclusions regarding the strengths and

weaknesses of Ireland and Australia's plastic bag usage reduction programs will be jointly reviewed. Finally, the Recommendations section will present recommendations for alternative plastic bag usage policy for Colorado and will be formulated based on all preceding sections of research.

LITERATURE REVIEW

Energy and resource consumption

The process of obtaining the by-product that is used to make plastic bags can be succinctly explained:

Plastic bags are made from a by-product of crude oil refining. Supporters of plastic bags would argue that they maximize the benefits from a finite resource, rather than flaring off the excess gases (including ethene) produced by the crude oil cracking process (Scottish Executive 2005, 4).

Once the petroleum by-product is obtained, the process of manufacturing the plastic bags requires an additional input of energy. "[A]pproximately 0.48 megajoules (MJ) of energy is consumed to make one HDPE lightweight grocery bag" (Environment Australia 2002, 29), including the production of the polymer, bag manufacturing and transport. This energy usage is translated into a comparison of energy used to drive the average car, stating that "the fuel consumed by driving a car 1 km is 4.18 MJ, equivalent to 8.7 bags" (Environment Australia 2002, 29).

By making plastic bags out of the by-product of crude oil refining, it may be argued that there is essentially no waste at all and that the finite resource of crude oil is being used frugally. However, the argument for maximizing the benefits of the crude oil by-product by making a disposal item of convenience is ambiguous at best. One might surmise that the secondary product (i.e., plastic bags) that can only be manufactured with crude oil by-products is virtually unsustainable without the constant input of crude oil. That is, the sector of the economy that is represented by workers and manufacturing is directly related to the continued extraction and consumption of oil.

The U.S. has an estimated population of 302 million people (U.S. Census Bureau 2006). It has been projected that "in the U.S. alone, an estimated 12,000,000 barrels of oil are required to produce the 100 billion plastic bags used annually" (Carmichael 2006, 31). According to these figures, each person annually consumes approximately 331 plastic bags. A further breakdown allows an examination of the petroleum used to create each plastic bag. To state the amounts in everyday terms with units of measurement common in the United States, one barrel of oil contains 42 gallons which, when converted from barrels of oil to a liquid measurement of ounces that accounts for the specific density of oil, contains 5,376 ounces. Therefore 12 million barrels of oil contain 64,512,000,000 ounces (Online Conversion 2007). For the sake of this discussion assume that all plastic

bags consumed in the U.S. are manufactured domestically, as foreign manufacturing, transportation and distribution require a separate set of figures that was not available at the time of this writing. Thus, assuming all of the 100 million plastic bags used in the U.S. are manufactured domestically, each of the bags thus requires approximately 0.65 ounces of oil. At \$70.36 a barrel (Bloomberg 2007), a plastic bag would therefore cost approximately \$0.013, or just over one cent each. Each barrel of oil produces roughly 3,494 plastic bags. The one cent cost of each plastic bag consumed in the United States equates to a \$1 billion cost to consumers for the 100 billion plastic bags that are used annually.

Table 1. Ounces of oil required for each plastic bag as compared to the miles a car could drive utilizing the same amount of oil

Ounces of Oil	Plastic Bags	Miles A Car Could Drive
0.65	1	0.07142
5.655	8.7	0.6213712 (1 km)
5276 (1 barrel)	3494	2171
64,512,000,000 (12 million barrels)	1 billion	71,421,954

Sources: Carmichael 2006, Environment Australia 2002, Bloomberg 2007, Online Conversion 2007.

Alternatives to using the crude oil by-product of petroleum can be easily identified. The two main types of plastic bags are LDPE and HDPE. An example of LDPE use can be seen in film wrap, the plastic wrap that goes

around fresh fruits and vegetables at the supermarket. This wrap has extended the shelf-life of food and has helped decrease food-borne illnesses. Another example of beneficial plastic is found in the use of HDPE plastics that are commonly used to make pipes. HDPE pipes serve many needs such as municipal piping, industrial piping, landfill piping, telecommunications piping, culvert liners, and geothermal piping (ISCO Industries 2000). It is beyond the scope of this project to conduct an in-depth investigation into all the uses of LDPE and HDPE plastic. Suffice it to say that certain plastics do positively affect the quality of life for Americans when they meet the criteria of being genuinely useful products that do not have viable or economic alternatives.

Paper versus plastic

Arguments for the continued use of plastic bags have been asserted by the Society of the Plastics Industry (2007). SPI has published information attesting to the merits of plastic bags over paper bags. This information is credible based on economics of manufacturing, resource usage, energy consumption, and costs to transport the finished products. Current debate and political positioning by manufacturers are based on economics and resource usage of plastic and paper bags. Due to the large segment of the market plastic and paper bags currently control, it is crucial to examine the economics and resource usage of plastic and paper bags to discover why neither product is the preferred alternative.

SPI maintains that plastic is the preferred method of packaging when comparing plastic and paper bags. The website lists four bullet points that encompass resource usage, natural gas and petroleum content, materials used in the bag, and transportation costs associated with moving large quantities of paper and plastic bags.

- Paper bags use both renewable and non-renewable resources in their production. Production of plastic grocery sacks uses 20 percent to 40 percent less total energy than paper sacks, and result in 80 percent less waste;
- The manufacture of plastic bags requires only a small amount of natural gas and petroleum;
- Thanks to advances in resins, today's plastic bags use 25 percent less material than bags made in 1987, without compromising strength;
- It takes seven trucks to deliver the quantity of paper bags contained in one truckload of plastic bags (Society of the Plastics Industry 2003).

Further exploration of the comparison of resources between plastic and paper bag reveals that compared to plastic, paper bags:

- Use six times as much raw material;
- Use three times the energy for manufacture;
- Are six times heavier for the same volume;

- Use ten times the storage/warehousing volume;
- Require seven times the amount of transport and associated emissions;
- Consume three times the amount of water during production;
- Create 90% more greenhouse emissions;
- Create 80% more nitrogen oxide (NOx)/sulphur dioxide emissions;
- Produce 80% more solid waste (Scottish Executive 2005).

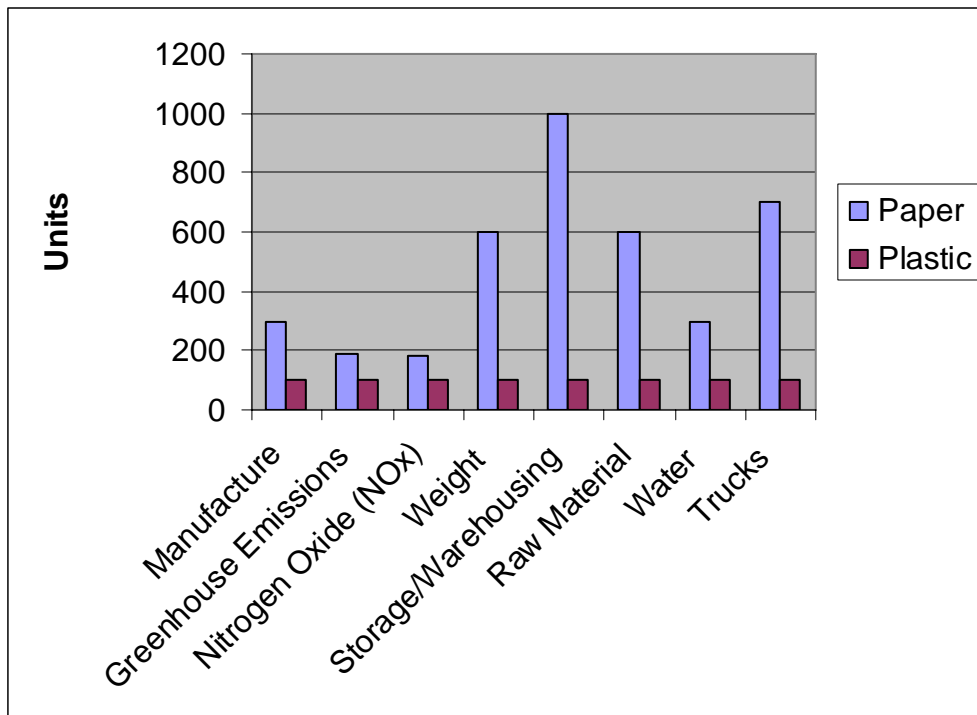


Figure 2. Paper versus plastic compared in units in terms of manufacturing, greenhouse emissions, NOx, weight, storage/warehousing, raw material, water, and trucks used to transport each material (Scottish Executive 2005).

The evidence dictates that retailers should not abandon plastic bags in favor of paper. Data collected from SPI and the Scottish Executive report effectively demonstrates that the amount of resources and energy used to

make paper bags far surpasses the resources and energy used to make plastic bags. Plastic bags have a wide range of compositions and, within that range, there are many features that affect the litter impact of plastic bags, resource depletion and greenhouse impacts due to manufacturing processes. The raw material, energy, water required during production, greenhouse emissions, NOx emissions and solid waste associated with the manufacturing of paper bags indicate that the total cost of paper bags is significantly higher than the total cost of plastic bags. It appears that eliminating plastic bags in favor of paper bags would in fact increase the burden of raw material and energy usage on a society, rather than lower it.

Plastic versus reusable bags

While plastic appears to be a better choice than paper in some instances, that choice still falls short when viewed from a total cost-savings perspective. Reusable bags have come into mainstream consciousness by their appearance in grocery stores, as corporate "give-away's" and as personal symbols of environmental stewardship. Furthermore, reusable bags are increasing in value as a commodity because they are becoming more prevalent every day and consumer demand for them is increasing. Small companies and individuals are recognizing the need and increased market for reusable bags, and are growing businesses that sell reusable bags to consumers.

Lisa Foster started her on-line business in 2005 selling reusable bags to individuals as well as supplying bags to grocery stores to be purchased by consumers (1 Bag At a Time 2005). She astutely concluded that the best way to sell the bags was to convince consumers that using reusable bags was the smartest choice based on personal economics and resource usage. Her website states:

Compare our reusable grocery bags: Our bags use the petroleum resources of 11 plastic grocery bags, but they are designed to replace hundreds of bags. Each bag can replace 4 plastic bags each time it is used. Used once a week for 2 years, it will [keep] 416 bags out of landfills, enough to drive a[n average] car almost 30 miles (1 Bag At a Time 2005, 1).



Figure 3. Comparison of petroleum used to manufacture plastic and reusable bags (1 Bag at a Time 2005).



Figure 4. Comparison of plastic bags that are replaced by one reusable bag over a two year time frame (1 Bag at a Time 2005).

The density of reusable bags is slightly higher than that of a paper bag. Because of the variances of reusable bags there is currently no average cost of resources used to transport the bags to retail outlets. Based on an average density of reusable bags and the transportation costs associated with paper bags, it is assumed that the costs of transporting reusable bags might be slightly greater than the costs of paper bags, which is four times that of plastic. However, the quantity of reusable bags being shipped to retail facilities is much less than the quantity of plastic or paper bags due to the assumed reuse of the reusable bag once it has been purchased. Transportation costs associated with the higher density of reusable bags gradually decline once the majority of shoppers have purchased the number of reusable bags they require.

The initial cost to purchasers of reusable bags is greater based on transportation costs, material used for the construction of the bag, and storage space provided by the retail facility. The costs are ultimately recouped by the individual consumer over the life of the bag due to the decrease in resource usage, transportation costs associated with paper or plastic bags, and storage space provided by the retailer for paper or plastic bags.

Economy

The manufacturing facilities, distribution centers, transportation, recycling and disposal of plastic bags are all industries that contribute to the American economy. However, “[t]he costs are passed on to consumers in the form of higher prices-\$4 billion a year’s worth of higher prices in America alone” (Carmichael 2006, 31). Carmichael’s position is that the cost of plastic bags to consumers only marginally advances business, manufacturing, agriculture, or any other sector of the economy. Rather, the \$4 billion that is spent on plastic bags is a hidden cost that 302 million Americans absorb on an annual basis. Per capita, the higher costs of products associated with plastic bags translates into approximately \$13.24 per person. The \$4 billion that is annually absorbed by U.S. consumers in relation to the manufacture, transportation, storage, and ultimate disposal of the bags is a cost that does little to advance the quality of life for Americans.

The plastics and related industries in the United States employed approximately 2.2 million workers in 2002 and contributed almost \$400 million to the economy during that same year (Lowy 2004). To put the numbers in perspective, plastic bags consume close to \$1 billion in oil. An additional \$400 million is spent in plastics and related industries to manufacture the bags. Using the \$4 billion figure that Carmichael (2006) cites as hidden costs to the American consumer and subtracting the \$1.4 billion used in oil and manufacturing, \$2.6 billion remains for transportation, storage, and warehouse fees. Because plastic bags are given away in retail facilities, the \$4 billion total is the hidden cost of plastic bags that the consumer absorbs. The bottom line is that the manufacturing, distribution, transportation, and storage of plastic bags significantly contribute to the American economy by inputting close to \$4 billion into various sectors.

The textile manufacturing industries are important assets to the American economy as well, and these industries are responsible for manufacturing some of the reusable bags that are sold in this country. The outlook of the textile industry looks increasingly bleak. Some facts about the American textile industry include:

- Approximately one million people work in the textile, apparel and related industries section;
- 722,000 people work directly in textile and apparel manufacturing;

- 50,000 jobs were eliminated by the end of 2003;
- Between 2001 and 2004, 211 textile plants in the U.S. were closed (Sinclair 2004).

The local impact of textiles is essential to the community's tax base, and the employee's ability to purchase goods directly impacts the sustainability of the region. Avondale Mills has a textile plant located in Sylacauga, Alabama, population 12,409 (Sperling's Best Places 2007). In 2003 Sylacauga's Avondale plant employed 1,253 people, roughly 10 percent of the total population, and had a payroll of \$34 million. The Mill continues to constitute a significant portion of employment opportunities to the community and contributes to other industries by purchasing materials required by the company (Sinclair 2004). If reusable bags are to replace plastic bags as the carrier method of choice based on economics and reduced natural resource usage, then the production of such bags has great potential to positively impact manufacturing and employment opportunities within the local economies. When raw materials for the reusable bags are included in the overall total of gross economic gain, a strong potential exists for creating a positive growth industry.

Policy and consumer behavior

Hélène Cherrier of the University of Sydney discusses the effect public policy has on Australian consumers within the realm of their shopping experiences and how shopping experiences allow individuals to define

themselves within their cultural, economic, political, social, and technological environments (2006). She notes that public policy can be the instigator in establishing awareness of issues and ethics relating to a multitude of categories that include plastic bag consumption and consumer behavior.

In addition to economic incentives and promotional campaigns, public policies are found to influence ethical consumerism through social and moral norms...influencing ethical consumerism requires finding a consensus between consumer rights (choice) and moral obligations (solidarity). It implies defining which consumer goods and consumption practices have ethical meanings or standings with respect to cultural, economical, political, social and technological environments (Cherrier 2006, 515).

Cherrier asserts that, after a policy such as plastic bag reduction is established, consumers will continue to be affected because of the changed behaviors associated with consciously bringing reusable bags to the store or on other errands. She notes that consumers align themselves with social and political groups that mirror their position on political, social, or environmental issues. "While experiencing, performing, adopting and sustaining locally based ethical acts during mundane day-to-day activities, consumers develop an awareness of ethical vs. unethical categories. Such awareness allows consumers to position themselves with respect to a more

macro-social structure provided by political discourses" (Cherrier 2006, 522).

While Cherrier's research concludes that a government must adopt a policy of some sort to manage a plastic bag reduction program, not all communities are following that approach. For example, San Francisco, California is a sizable city with a population of 744,041 people (U.S. Census Bureau 2006) that has worked to reduce plastic bag litter by assuming a voluntary stance on plastic bags. The City and County of San Francisco entered into an agreement with the California Grocers Association in 2005 and included seven area grocers that represented 37 stores in its pilot program to reduce plastic bag consumption in 2006. A press release by the California Grocers Association notes that, within the first year of implementation, the participating San Francisco grocers experienced a reduction of 7.6 million grocery bags, though it is not known what the baseline percentage of bags for the previous year was (2007). San Francisco and the California Grocers Association would like to have an even greater impact on plastic bag reduction.

If we are really serious about reducing bag use and increasing recycling efforts, we need to ensure that all merchants who use plastic bags are part of the solution...To really make an impact you can't just include a few grocers. Drug stores, dry cleaners, take-out restaurants and other retailers use the same plastic

bags and with their participation we could collectively reduce and recycle millions of additional bags each year (California Grocers Association 2007, 2).

San Francisco will have to weigh their options at this point, accepting input from leaders such as the California Grocers Association that recognize the need to develop a mandated policy to further reduce plastic bag use. A mandated policy will tip the scale toward government intervention, while a “do-nothing” option would effectively stall the reduction in plastic bag consumption with the City and County of San Francisco due to the current status of the voluntary program.

The argument for voluntary changes, as opposed to legislated reduction measures, is that the real problem of plastic bags lies in apathetic human behavior toward littering and consumption, and that any real changes will not be affected by a levy (Scottish Executive 2005). “Education and awareness raising are seen as the key to the litter problem rather than levying the use of lightweight plastic carrier bags” (Scottish Executive 2005, 4). The fault with this approach is that there is a saturation point in any society regarding patterns of behavior change, as San Francisco has experienced first-hand and as previously noted by the California Grocers Association. Economists have found that the best way to force changes in consumer patterns is to affect market prices, as was seen shortly after

Hurricane Katrina when gas prices rose and fuel consumption temporarily slowed.

Colorado

Colorado has a current population of 4.7 million people that equals roughly 1.5 percent of the national population of 302 million people (U.S. Census Bureau 2006). 100 billion plastic bags are being used in the United States on an annual basis. Assuming each person in the country uses 331 bags per year, Colorado's 4.7 million people consume over 1.5 billion plastic bags each year. At an annual cost of \$13.24 per person, the 1.5 billion plastic bags used by Colorado residents are costing approximately \$62 million every year.

In 2006, the Colorado Department of Transportation spent \$5.6 million on litter cleanup along state highways and removed 145,478 cubic yards of trash (Spruce Up Colorado 2006). Volunteers, prison workers, and Sponsor a Highway programs saved CDOT \$1.5 million in labor and collected an additional 48,049 cubic yards of trash (Spruce Up Colorado 2006). Extrapolated data regarding the quantity of plastic bags within the cubic yards of trash is not available.

The cities of Boulder and Denver are two examples of Colorado communities that recycle, and it is instructive to look at the diversion rates achieved within each community to illustrate the differences in community populations and economic resources available for recycling and waste

diversion. Boulder is an affluent community in Colorado with an approximate population of 100,000 and a land area of 24 square miles (City of Boulder 2002). Denver has a more diverse socio-economic community with a population of 557,000 and a land area of 153 square miles (Denver Profile 2007). Plastic bag consumption and end-of-life recycling and waste disposal of the bags are inherently different based on factors such as, but not limited to, awareness of resource consumption, concern regarding environmental and sustainability issues, and economics of municipal waste and recycling facilities.

Recycling in Boulder, Colorado occurred for decades, officially beginning when Eco Cycle commenced operations in 1976. The website states "Our mission is to provide publicly-accountable recycling, conservation and education services, and to identify, explore and demonstrate the emerging frontiers of sustainable resource management" (Eco Cycle 2006, 1). In support of Eco Cycle's mission and as a measure of what the City of Boulder strives to accomplish, the City of Boulder adopted a Zero Waste resolution in May 2006. The resolution states "an estimated 156,773 tons of waste is generated in the city of Boulder each year by residents, businesses and institutions and approximately 70% of this amount is sent for landfill disposal" (City of Boulder 2006, 1). It is the City of Boulder's desire to reach a point of Zero Waste, where all waste is recycled or composted. The goal is a lofty one that will take time to implement. It is a measure of the

partnership between residents, businesses, the City of Boulder, and Eco Cycle, and the recognition that waste and resource usage for the sake of convenience is not sustainable.

In contrast to the City of Boulder, Denver has achieved a rate of recycling or diverted a significant quantity of recyclable materials that is three times lower than that of the City of Boulder. "Last year, Denver recycled only 10 percent of its municipal waste stream. That's less than Colorado as a whole, which recycled only 12.5 percent of its waste" (Denver Post 2007, 1). Restating the numbers will reflect that on average, Colorado landfills 87 percent of its garbage rather than recycling it (Denver Post 2007). A comparison of the cities of Boulder and Denver indicate that Denver's diverse socio-economic population and larger land area combine to make a similar Zero Waste strategy unreasonable. Denver does not have a dedicated recycling center such as Eco Cycle, and does not have the business partnership the City of Boulder enjoys with Eco Cycle. As well, average rates of recycling and resource consumption awareness are lower.

Colorado recycling statistics suggest that the lack of recycling infrastructure in the majority of local communities can only be remedied by one of two methods. The first method is to invest significant financial resources into building the necessary infrastructure that could support greatly expanded recycling measures across the state. The other method is a policy that emphasizes a reduction of resources used by consumers so that

additional recycling facilities and secondary markets for recycled materials are not necessary. In this case, a reduction of plastic bags would decrease the economic burden on taxpayers by not requiring them to subsidize additional recycling facilities.

Charlotte Pitt, Denver's recycling program manager, said Colorado's low recycling rate reflects a lack of government recycling mandates, lots of space for landfills and the low cost of constructing them.

Landfills are cheap to build here because of high clay levels in the state's soil, which provide natural liners (Denver Post Editorial Board 2007, 1).

Denver's recycling program manager recognizes that lack of government mandates is a key factor in the low levels of recycling (Denver Post Editorial Board 2007). Mandates and policies are a recognized part of recycling and resource usage reduction. Certain communities have Pay-As-You-Throw (PAYT) programs in place, where recycling is free and there is a per-household fee is charged based on the amount of garbage that is collected. The U.S. Environmental Protection Agency (U.S. EPA) recognizes that communities that implement PAYT programs are supporting environmental sustainability, economic sustainability, and economic equity (U.S. EPA 2007). Legislated policies that support recycling, reduce consumption, and make it economically burdensome to create waste are policies that will lead to greater sustainability in all communities.

CASE STUDY-IRELAND

Overview

Prior to the 2002 passage of the Plastic Bag Environmental Levy (Levy), Ireland estimated an annual consumption of 1.2 billion plastic shopping bags. With a 2002 population of approximately 1.7 million, (Northern Ireland Statistics and Research Agency 2003) an average of 706 bags per person was consumed annually.

Government officials cited environmental concerns over unsightly windblown litter in a nation-wide effort to discourage use of plastic bags while encouraging the use of reusable shopping bags. A secondary goal of the framers of the policy was to change people's attitudes toward pollution and litter by creating an awareness of plastic bags and their cost to the general public (Citizens Information 2007). When the Levy was introduced consumers started being charged for every plastic bag they received in retail and grocery stores, excluding bags that carried certain items as discussed in the following section. Revenue generated from the Levy is deposited into the Environmental Fund that was created in conjunction with the Plastic Bag Environmental Levy of 2002. The Environmental Fund's purpose is "to support waste management, litter, and other environmental initiatives" (Citizens Information 2007, 1).

It is important to note here that Ireland chose not to expand recycling programs due to lack of essential infrastructure and secondary markets for

recycled plastic. It was felt that a reduction in plastic bag use was necessary to stop the excessive litter that blew into the countryside, as well as to reduce the petroleum usage associated with manufacturing, transporting, distributing, and providing waste facilities for the bags.

Laws, taxing structure, and administration

The Plastic Bag Environmental Levy was introduced on March 4, 2002.

The charge applies at the point of sale in shops, supermarkets, service stations and all sales outlets. Retailers must pass on the full amount of the levy as a charge to customers at the checkout. The charge for your plastic shopping bags will be itemised on all invoices, receipts or dockets issued to customers (Citizens Information 2007, 1).

The written intent of the law is to “encourage the use of reusable bags and to change people’s attitudes to litter and pollution in Ireland” (Citizens Information 2007, 1). Before the law was passed an estimated 1.2 billion plastic shopping bags were given away annually. Plastic bags were considered the most visible litter around the countryside, which in turn was believed to negatively affect tourism, though solid data attesting to that position is unavailable. Within one year of the Levy being implemented Ireland saw a 90 percent reduction in plastic bag use (Scottish Executive 2005). Five years later, in January of 2007, the tax on plastic bags rose for the first time because plastic bag use steadily increased since its initial

drastic reduction. The Levy was increased by 7 Euro cents [9 U.S. cents] to total 22 Euro cents [30 U.S. cents] on each plastic bag (Creagh 2007).

Revenue generated by the Levy goes into the Environmental Fund that “[is] used to support waste management, litter and other environmental initiatives” (Department of the Environment and Local Government 2002, 2).

Plastic bags that are exempt from the tax are those that are used to store non-packaged goods such as dairy products; fruits, vegetables or nuts; confectionary; cooked food; ice; fresh meat, fish and poultry; bags for life (reusable bags made from plastic, cotton or calico) costing more than 70 Euro cents (96 cents U.S.); bags supplied to intending passengers on commercial aircraft and ships; and items sold in the secure ‘duty free’ zone of airports in Ireland (Citizens Information 2007).

Administration of the Levy is the responsibility of retailers.

Computerized systems are required to track the number of reusable bags that are sold, as well as the plastic bags that are given away. Large retailers that already have computerized systems and greater available resources find that the administration is easier than the smaller retailers (Scottish Executive 2005). “As a minimum, it is anticipated that retailers will need to have an auditable system for:

- Recording carrier bag sales;
- Accounting for bags in stock;
- Reconciling sold versus stock remaining;

- Submitting records quarterly;
- Submitting payments.” (Scottish Executive 2005, 5).

The authors of the Environment Australia report performed case studies on Ireland and other countries that have sought to reduce plastic bag usage, and discuss the Irish retailer’s role in administering the levy. The findings are especially important because they represent a third party’s critique on the management of the Irish policy.

Retailers are required to keep records of bags levied and make payments to the Revenue Commissioners quarterly. The record keeping requirement was framed so as to minimise the compliance burden on the legitimate trader while at the same time ensuring that levy evasion could be combated (Environment Australia 2002, 21).

As a result of efforts by the policy’s framers, retailers do not appear overly burdened with the administration of the Levy, and the effects on the retailers were generally positive or neutral (Scottish Executive 2005).

The result of the Levy has been an increased use in reusable bags by the vast majority of consumers in Ireland. Retailers have experienced economic benefits from the sale of reusable bags and by minimizing their purchasing of plastic and paper bags.

Economic impacts

The Department of Environment and Heritage (DEH) in Ireland has summarized its assessments of the introduction and implementation of the 2002 Levy. The following bullet points are a sampling and are not inclusive of all points quoted by the DEH as reported in the Scottish Executive report:

- The main cost to retailers was updating their software so that till receipts would itemize the sale of plastic carrier bags;
- Approximately [\$1,341,500 U.S.] are raised each month from the Levy;
- Funds have been used to support waste recycling infrastructure, ongoing running costs and the introduction of dedicated staff to enforce waste legislation (with a particular focus on illegal waste dumping) (2005, 4).

Consumers found modest savings in not receiving plastic bags. Plastic bags are not in fact ever truly "free" to customers; rather, the charge for plastic bags is hidden in the higher cost of goods. The estimated cost to Irish consumers in higher prices is an annual average of \$12.21 (U.S.) per person (Scottish Executive 2005). The Irish cost per person is slightly lower than the \$13.24 each person in the U.S. absorbs. The difference is based on manufacturing practices, transportation costs, employment rates, cost of resource usage, and cost to retailers.

The food retail industry appears to be the greatest beneficiary in all sectors when net cost savings from the levy is considered. "The savings

result from having to buy far fewer plastic carrier bags, which are then given away for free, while sales of “bags for life” and bin liners would increase” (Scottish Executive 2005, 5). While the sale of bin liners (trash can bags) did in fact increase, the sale was still low in comparison to the cost of giving away plastic carrier bags.

[There is] a 77% increase in sales of plastic kitchen tidy bags.

The 90% reduction in plastic check-out bags equates to a reduction of one billion plastic bags and a 77% increase in kitchen tidy bags equates to an increase in 70 million bags. The net effect is an overall reduction in plastic bag use of 930 million bags, with apparently insignificant levels of substitution by paper bags (Friends of the Earth Scotland 2005, 2-3).

The result is actual profit from removing the excess plastic carrier bags from monthly store expenditures and increasing salable stock of reusable bags and trash bin liners. In this way grocery retailers stand to gain the most from the Levy. Because of the relatively high margin of profit that is available to grocery retailers it appears that the food retail industry could be the most ardent supporter of the Levy.

Retailers in Ireland have noticed an increase in their overhead costs when they are forced to stock a greater quantity of paper bags because of the Levy on plastic bags. The Scottish Executive report finds that retailer's costs are increased four-fold based on material purchase and transportation

costs associated with bulkier paper bags, and concludes that substituting paper bags for plastic as a response to the Levy would be a serious mistake (2005). The report does not quantify the revenue retailers receive from reusable bags sold in the stores, so a direct comparison of the cost of added paper bags versus added revenue for reusable bags is not available.

Department store retailers have found that when they switched from plastic bags to paper bags the required storage space for the bags was increased, as was the frequency of deliveries to the stores. The overall costs for non-food retailers have increased approximately to four times what the costs were before the Levy was introduced (Scottish Executive 2005).

All retailers reported that their internal costs associated with the administration of the Levy were reasonable. "The additional costs of implementation and bookkeeping were seen as modest and, in actual fact, they were generally less than the savings that retailers were enjoying from buying fewer lightweight plastic carrier bags" (Scottish Executive 2005, 2). This factor is vital for retailer compliance with the Levy. Retailers must enjoy an economic gain as the bottom line of the process in order for there to be sector-wide support of the Levy. If in fact retailers lost money or had to hire additional employees to manage the government mandated tracking procedures associated with the Levy, the Levy would not receive support from retailers and would thus ultimately fail.

The manufacturing sector in Ireland was affected by the Levy, with one manufacturer closing after the Plastic Bag Environmental Levy was introduced (Scottish Executive 2005). It is unknown what the actual economic loss of the manufacturing plant was to the tax base of the community in which it was located nor what the gross figure of the lost wages of the employees was, as they were not quantified in the report. The Scottish Executive Report concludes that importers, distributors of plastic bags, and manufacturers are negatively affected by the Levy as a whole (2005).

Strengths of the policy

Several conclusions regarding the Irish Levy experience are noted.

- Costs to the Government taxation system for set-up, advertising and administration are modest;
- Costs to retailers for collecting and processing the levy are also modest. They are readily subsumed into their accounting procedures and far outweighed by the money gained from buying fewer disposable bags and selling more bin liners;
- There has been a 90 percent reduction in the number of bags used. This has resulted in a publicly perceived, but not proven, reduction in the amount of visible litter;

- There is widespread consumer support for the levy. There is no evidence that the unemployed or people on a low income feel disadvantaged by the levy;
- Awareness of environmental issues in general has been raised nationwide in Republic of Ireland (Scottish Executive 2005, 2).

When the conclusions of the study are compared to the purported ideals of the Levy, it is apparent that the desired outcomes have been achieved. That is, plastic bag usage has been drastically reduced; the use of reusable bags is in the 90th percentile; people's attitudes toward litter and pollution in Ireland have been positively affected; and costs to government and retailers associated with administering the Levy are modest.

Recall that the elimination of windblown litter was a major goal of the Plastic Bag Environmental Levy due to a perceived negative affect the litter had on tourism. Because the government saw a direct link between dwindling tourism and plastic bag litter, a comparison of tourism dollars to plastic bag reduction is illustrative. In 2003 Ireland had tourism revenue of \$7 billion U.S. (Failte Ireland 2004). In contrast, the Levy on plastic bags brought in approximately \$13 million (U.S.), reduced the eyesore of windblown litter around the countryside and provides a measure of pride in local communities at the pristine landscape. Therefore the cost of the Levy is more than compensated for the perceived benefits to the country's economic well-being as a whole.

Weaknesses of the policy

The Plastic Bag Environmental Levy enjoyed widespread support when it was first passed. For the Levy to remain viable it needs to be updated and remain an integral part of people's awareness regarding litter and waste.

Consumer apathy is apparent in the subsequent years of the introduction of the Plastic Bag Environmental Levy. When the Levy was initiated there was widespread support and understanding of why the Levy had been created. Educational campaigns were abundant, and people were pleased to be part of the solution to the litter that so many deemed unsightly.

Five years later, plastic bag usage is on the rise. Educational campaigns have diminished and the results are telling. It has become commonplace to use reusable bags, but the economical impact of the Levy has not kept pace with inflation and the financial impact of using a plastic bag has lessened over time. To make the Levy more effective education and awareness campaigns have to be presented in a fresh way to reach new households, young adults, and emigrants. Other possible solutions are to:

- Increase the scope of the Levy by adding other plastic products to the Levy;
- Increase the Levy charge by a higher rate;
- Institute an annual raise in the plastic bag charge to commensurate with the higher cost of living.

One manufacturer of plastic bags closed after the Plastic Bag Environmental Levy was introduced. Available literature and reports do not indicate whether manufacturers of reusable bags have begun operations in Ireland, or if the sector of employment negatively affected by the Levy has been replaced by other opportunities. This information would be helpful in quantifying the true economic impact the Levy has had on the Irish economy.

CASE STUDY-AUSTRALIA

Overview

Australia's primary reason for addressing the issue of plastic shopping bag consumption and reduction has been simply defined in the following manner: "To reduce the overall environmental impacts of retail carry bags in Australia" (Environment Australia 2002, 3).

20 million Australians used 6.9 billion plastic bags throughout all retail outlets in the year 2002, which equates to 345 bags per person per year (Environment Australia 2002). The Environment Australia report finds that Australian concerns are two-fold.

- Environmental impact, particularly resource consumption and litter;
- Symbolic value of plastics and packaging (2002).

The majority of Australia's environmental impact is centered on the oceans and marine life. Plastic bags are an obvious source of trash on land,

and scientific research has quantified and qualified the degradation of plastic in the oceans and the affect the particles have on the general health of marine life (Algalita Marine Research Foundation 2006). The citizens and elected officials have great social, cultural, and economic incentive to reduce plastic bag usage in order to maximize the stewardship of the land and ocean that are a great source of pride and economic value to the citizens.

The symbolic value of plastic bags and packaging is a social and cultural concept that has importance far greater than resource consumption or the proverbial bottom line of economics. Zero Waste South Australia discusses a consumer and trader focus group that was questioned about plastic bag use, behavior, and attitudes toward bag use and a possibly levy.

They considered a range of issues such as how reusable bags would evolve to meet lifestyle choices, the styles, colours and different materials used for bags...how proud they would be (adults and school children) if South Australia did it [reduced plastic bag consumption] first, and how they had previously gone without plastic bags and could do it again...One trader said 'we are looking forward to it, it is exciting and challenging', and a number of customers queried why it was going to take so long and suggested other things, such as disposable nappies [diapers] that could also be banned. The capacity to imagine a different (and better) future is seen as a strong indicator of the

desire for behavioural or social change (Zero Waste South Australia 2006, 8).

The strength of desire from customers and retailers alike to reduce plastic bag usage and in fact to reduce usage of disposal products as a whole will prove to have the most significant impacts on any policy Australia formulates. The Zero Waste South Australia report indicates an awareness of the need to reduce plastic bag usage and an eagerness for a policy to be implemented. Recycling has been a part of daily life for many Australians, yet it is felt that an expanded recycling program would not be beneficial for Australians due to the abundance of plastic bags that are not properly disposed of and which contributed to litter on the land and in the ocean (Zero Waste South Australia 2006).

Australia has demonstrated political commitment to seeking alternatives to plastic bag use. In addition, funding has been provided to advance research of resources used in the manufacturing of plastic bags and examine consumer behavior and mainstream attitudes toward plastic bags, plastic bag recycling programs, and potential plastic bag reduction policies.

On 1 July, 2005 the Environment Protection and Heritage Council, a Council of all of Australia's environment ministers, agreed to a phase out of lightweight (single use) plastic shopping bags by the end of 2008. In South Australia, legislation

will be introduced to ensure that the phase out occurs by that date (Zero Waste South Australia 2006, 2).

It appears that Australians are ready and eager to implement a legislated policy that would provide economic incentive for continued reduction of plastic bag use.

Laws, taxing structure, and administration

At the time of this writing there is no formal policy in Australia banning plastic bag usage or imposing a tax or levy on their usage. The Australian Retailers Association (ARA) and the NGO group Zero Waste South Australia are working toward the common goal of lowering plastic bag usage by voluntary measures. The ARA cited audited results of a 26.9 percent reduction against the December 2002 baseline of plastic bag usage as attained by four major retailers, Coles, Woolworths, Franklins, and FAL, and hoped to achieve an even greater reduction of 50 percent by 2005. They note that the goal will be a greater challenge than the preceding year's goal due to voluntary participation (Australian Retailers Association 2004). Though unstated, the ARA might consider a lack of regulation in the reduction of plastic bag usage a detriment to the program's success.

An economic analysis of levies in Ireland and other countries where legislated and voluntary levies have been implemented is essential preparation for offering viable recommendations for a successful plastic bag reduction policy. A key point of the study found that an Australian levy set at

13-27 cents (U.S) would be “sufficient to result in a significant behavioural change, and therefore minimal levy imposition” (Environment Australia 2002, 1). Based on the lower-than-expected reduction in plastic bag usage attained by the volunteer compliance of the ARA in 2004 a levy will undoubtedly be applied to any policy that is formulated.

It is unlikely that a voluntary levy would get near full compliance across the whole retail sector due to competition for customers, and it may be more difficult to implement and sustain. Lower reductions would therefore be expected from a voluntary levy as opposed to a legislated levy...To be effective in reducing bags and litter, the levy would need to be implemented on a nationally consistent level across all retail. To enhance the message to consumers and prevent retailers from absorbing the levy, the funds would need to be charged separately and collected through a central administration. For consumer support of the levy, it has been suggested that funds would need to be earmarked for use in environmental or similar programs (Environment Australia 2002, 51).

Economic impacts

Tourism revenue offers a stark contrast to the cost of litter cleanup. “Victoria received 27.2% of all international visitors to Australia” and that major events hosted in Victoria accounted for approximately \$1.2 billion of

the annual economy (Marketing Victoria 2005-06, 27). The tourism board in Victoria aims to reinforce perception of the state as one that is “classically stylish, sophisticated, and romantic” (Marketing Victoria 2005-06, 27). The marketing campaign that is aiding in promoting the tourism industry assumes an aesthetically pleasing city in which litter is minimal. Zero Waste South Australia reports that local and state governments in Australia currently spend in excess of \$172 million (U.S.) per year picking up litter. This figure is not specifically broken down into categories of litter that include plastic bags on land and in the marine environment, though it is noted that plastic bags are considered an “extremely visible and unsightly component of litter items collected” (Zero Waste South Australia 2006, 2). The money spent on litter cleanup does not represent a 100% rate of litter removal, though there is a higher rate of removal on land than in water.

In order to assist in the reduction of plastic bag debris that litters the marine and terrestrial environments, Zero Waste South Australia has conducted focus group research to develop recommendations for the phase out of certain types of plastic bags in South Australia. The group has noted that there appears to be strong retail support for the phase out because of the economic gain in selling reusable bags and in minimizing the purchase of plastic bags. Research conducted by Environment Australia notes that retailers that provide plastic bags to consumers free of charge have the price of plastic bags integrated into the price of merchandise. Therefore, the

plastic bags are not actually free to consumers because the consumers are absorbing the cost of the bags by paying extra for goods that have been marked up to counteract the cost of the bags to the retailer. It is estimated that each household pays approximately \$8.58 to \$12.88 (U.S.) annually in hidden costs for the plastic bags that are supplied at retail facilities due to variations in costs associated with imported and domestically produced bags, transportation, manufacturing and composition (Zero Waste South Australia 2006).

Coles Myer, a retailer in Australia, is concerned that supermarkets will lose money due to the potentially increased checkout time that could occur if reusable bags replace plastic bags (Environment Australia 2002). This is a serious issue for retailers if in fact they stand to lose money on the increased time of each transaction.

Coles Myer has undertaken preliminary estimates that indicate that each transaction would take 5 seconds longer with the use of reusable bags, resulting in a cost of \$82 million to the industry. Nolan-ITU estimates an increase of 5 seconds per transaction would result in a cost of \$52 million to all retailers and \$28 million to supermarkets alone (Environment Australia 2002, 60).

It is important to note that Coles Myer estimates all transactions require a bag and that the paid time of the employee is always used effectively. Coles Myer uses the following assumptions for the calculations:

- A labor cost of \$15.41 (U.S.) per hour;
- A time increase of 5 seconds per transaction for the transactions that no longer use a single use plastic bag;
- A current average of 2.5 bags per transaction (Environment Australia 2002).

The report notes that there will be many transactions that do not require a bag in which case there will be no increase in transaction time. Thus the estimates offered by Coles Myer for the increased cost to retailers are thought to be based on assumptions that are incomplete.

Many consumers report secondary uses of plastic bags in the home, specifically as trash can liners and pet waste receptacles. Because of this reported usage, Australian analysts have questioned the economic impact of replacing the plastic bags that are "recycled" again in the home. Questions arose regarding the overall economic savings of removing plastic carrier bags from general circulation and forcing consumers to purchase plastic bags to meet household needs. To this end, Australian analysts cited the Irish case study which reports that "retailers, though reporting as high as 77% increase in kitchen tidy bag sales, maintain that this increase is not significant in comparison to the reduction in plastic shopping bags. The base

level for the sale of these bags was minor compared to plastic shopping bags, and in addition, larger garbage and garden bag sales have not shown any increase" (Environment Australia 2002, 24).

Retailers currently purchase plastic bags that are either manufactured domestically or imported. Imported plastic bags comprise the bulk of the plastic bags that are used in Australia. 900 million LDPE bags were used in the time period of 2001-2002, of which 25 percent, or 225 million bags, were imported. The other 75 percent of the LDPE bags, or 675 million bags, were domestically produced. HDPE bags had a higher import rate of 67 percent, or 4 billion bags, and a lower domestic production rate of 33 percent, or 2 billion bags. Also important to the issue of resource usage is the recycled content of the bags, with "84 percent of the HDPE bags utilised in Australia (both imported and locally produced) hav[ing] a recycled content of between 30 and 50 percent. This recycled content is mostly from industrial waste sources" (Environment Australia 2002, 5). The remaining content of the bags comes from non-renewable petroleum products. The HDPE bags that are imported originated in south-east Asia "where the primary source of HDPE is oil; the primary source for the locally produced bags is natural gas" (Environment Australia 2002, 29). The following figure shows current production levels of HDPE and LDPE plastic bags that are manufactured domestically and imported.

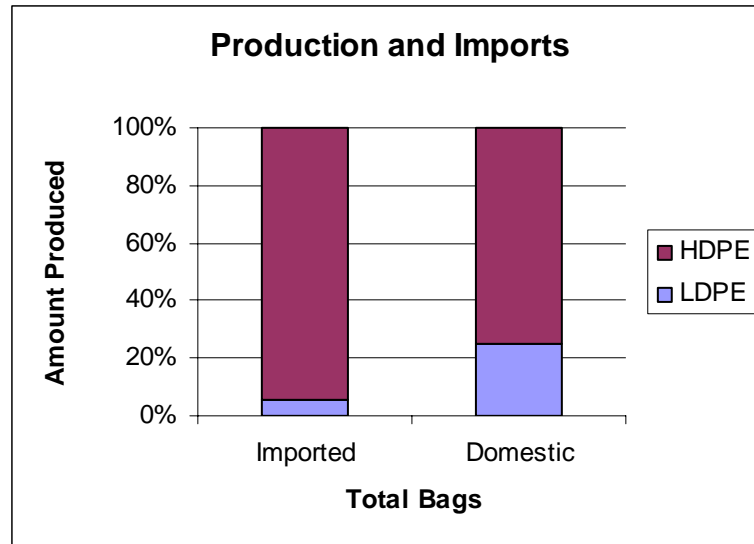


Figure 5. Imported and domestic production of HDPE and LDPE bags, shown in percentages of total amounts. (Data from Environment Australia 2002.)

Current data from the Environment Australia report does not quantify the current impact plastic bag production has on the economy in terms of employment or tax base for local economies. The report also does not quantify the effect any possible changes will have on employment or tax base of local economies due to a decrease in demand for HDPE or LDPE bags, however it notes that a change in carrier bag has the potential to increase domestic reusable bag manufacturing, modify distribution patterns, and otherwise positively affect the economy by creating new jobs and opportunities.

Litter, disposal, and recycling of plastic bags are the final aspects of the plastic bag life cycle. The litter cleanup cost for plastic bags is a little over 2 percent (roughly \$3.4 million U.S.) of the \$171 million (U.S.) spent annually on total litter cleanups by local and state governments in Australia

(Environment Australia 2002). Land-based litter contributes to marine pollution and contributes to mortality rates of marine animals, and though there is no direct monetary figure for marine life mortality there are direct economic impacts to the Australian economy in terms of lost tourist dollars, lower fishing quotas, and unquantifiable impacts of a distressed marine environment on the overall health of the planet. "Pollution from the land contributes up to 80 per cent of all marine pollution and is a major threat to the long-term health of nearshore marine ecosystems. It affects ecological processes, public health and social and commercial use of marine resources" (International Fund for Animal Welfare 2003, 4).

The planned phase out of certain types of plastic bags in Australia will have positive effects on marine resources, and in fact may lead to an increase in health and stability of the resources that are currently utilized for economic purposes. As well, the decrease in plastic litter in the marine environment is expected to contribute to greater enjoyment of the oceans by locals and tourists, which in turn can have a positive affect on the tourism industry of Australia.

Strengths of the policy

Australia currently does not have a legislated plastic bag reduction policy. The current plastic bag reduction programs have been strictly voluntary with a reduction rate of 25-30 percent estimated for 2005 (Department of Environment and Heritage 2005).

Reports by Environment Australia and the Department of Environment and Heritage are comprehensive. Issues pertaining to consumers, retailers, environment, economy, and life cycle analysis of various carrier bags have been extensively researched, as have the case studies of countries that have instigated voluntary reduction programs, levies, or bans. The conclusions obtained in the reports are thoughtful and display an understanding of the complexities of formulating a plastic bag reduction policy that will achieve the greatest rate of reduction while not compromising resource usage and economics. The resultant recommendations for a legislated Australian levy commencing in 2008 appear comprehensive, concise, and viable based on the socio-economic makeup of the country and the existing infrastructure of recycling facilities, among other factors.

There appears to be a higher than average level of consumer support for a plastic bag reduction policy as well as raised awareness of environmental factors that establish plastic bags as a source of litter that can easily be reduced from the waste stream.

Weaknesses of the policy

The voluntary reduction scheme implemented by a few retailers has not achieved the desired reduction rate of 50 percent. There is no widespread acceptance of the need to reduce plastic bag usage in the retail sector. Educational campaigns regarding the environmental threats of plastic

bags have targeted a portion of the population but have not achieved a high enough saturation rate to infiltrate the common consciousness of society.

The main weakness of the voluntary plastic bag reduction program is that there is no legislated policy in place and only a handful of retailers participate in the voluntary plastic bag reduction program. Research by Environment Australia and the Department of Environment and Heritage concur that for a significant reduction of plastic bag usage to occur in Australia there is need for formal legislation instigating a small levy on plastic bags throughout all areas of the retail sector.

ANALYSIS

Strengths of the Plastic Bag Environmental Levy policy of Ireland are summarized as follows:

- Costs to the Government taxation system for set-up, advertising and administration are modest;
- Costs to retailers for collecting and processing the levy are also modest. They are readily subsumed into their accounting procedures and are far outweighed by the revenue gained from buying fewer disposable bags and selling more bin liners;
- There has been a 90 percent reduction in the number of bags used. This has resulted in a publicly perceived, but not proven, reduction in the amount of visible litter;

- Awareness of environmental issues in general has been raised nationwide in the Republic of Ireland. (Scottish Executive 2005, 2).

Strengths of the planned Australian plastic bag reduction policy are summarized below:

- Comprehensive reports detailing issues related to consumers, retailer, the environment, the economy, and life cycle analysis of various types of carrier bags have been generated;
- Case studies of countries that have implemented legislated or voluntary plastic bag reduction programs may be used as models;
- There exists widespread consumer support for a plastic bag reduction policy, as well as some retailer acknowledgment of potential savings associated with reduced plastic bag use;
- High level of awareness of plastic bags as a source of litter in the waste stream is already present;
- A desire to be a leader in the global field of plastic bag reduction currently exists.

Ireland's successful experience with the Plastic Bag Environmental Levy lends credence to the applicability of a similar policy for Colorado. There are many economic reasons to consider a state-wide policy based on the Plastic Bag Environmental Levy and aspects of Australian research.

Ireland's experience with the Levy has practical merit that should be utilized. As well, Australia's meticulous adherence to details relating to the social aspects of a plastic bag reduction policy offer insight into how plastic bags are perceived by many citizens, as well as the level of interest citizens express in considering such a policy.

Australia notes that there needs to be a widespread understanding of why a plastic bag reduction policy should be implemented in the overall quest of waste reduction, which points toward education in the months surrounding the commencement of the policy. As well, Australia notes that there needs to be a high level of citizen awareness that plastic bags are a significant portion of the waste stream due to apathy (intentional littering) or accident (windblown litter) and that there is a simple solution to littering and plastic bag reduction.

The Plastic Bag Environmental Levy in Ireland enjoyed widespread support when it was first initiated as a law. For the Levy to remain viable, it needs a higher tax on plastic bags and an on-going educational campaign that reminds people of the reasons to use reusable bags instead of plastic or paper. If Colorado was to follow suit and implement a plastic bag reduction policy, it would be prudent to institute an educational campaign that was on-going, gradually changing, and expanding, rather than expect a surge campaign to be sufficient to remind people of the importance of reducing plastic bag consumption. Ireland experienced an initial drop in plastic bag

consumption the first year of the Levy was implemented, but the low rate of consumption was not maintained due to, among other things, a gradual fading of the educational campaigns from public consciousness.

The voluntary reduction scheme initiated by the Australian Retailers Association has not achieved the desired goals because of lack of: retailer participation, education campaigns aimed at the public, and penalties to retailers for not adhering to a prescribed code of plastic bag reduction. All areas of the retail sector need to be affected by the levy in order for true plastic bag reduction to occur.

The Irish Plastic Bag Environmental Levy of 2002 and the extensive research available from Australia suggest that voluntary measures to reduce plastic bag usage will not achieve the widespread results that would make such an effort economically or resource efficient. A total ban on plastic bags is also not going to achieve the desired results. Environment Australia's research has shown that "a ban on all plastic bags could lead to the use of less-sustainable alternatives and could be impractical for some retail transactions" and notes that a ban would take essential personal responsibility for making environmentally responsible choices off of the consumer (Environment Australia 2002, 54). Therefore Colorado should not attempt to ban plastic bags, as the unwanted consequence of using less sustainable materials in place of plastic bags might surface and people could

in fact become more apathetic toward their personal choices, rather than embrace their responsibilities as a citizen of a community and of the world.

Australians have realized that their use of plastic bags has unwanted repercussions on systems that have cultural value and economic merit. The reduction of plastic bag use can positively benefit the health of the terrestrial and marine ecosystems that are cherished and necessary for the health and survival of the human species. To this end, the values of Colorado citizens appear directly aligned with Australian's stated concerns. Coloradans have repeatedly acknowledged the crucial role the health of the air, water, and land plays in the ecosystem as a whole, and have used the power of the vote to raise a collective voice demanding action from elected officials.

Before the Plastic Bag Environmental Levy began, Ireland and Australia had annual plastic bag consumption rates of 706 and 345 bags per person, respectively. While Australia's population is 10 times greater than Ireland's, the plastic bag consumption rate in Australia is slightly less than half the consumption rate of Ireland. Colorado's annual plastic bag consumption rate is 331 per person. The state population is 4.7 million, roughly four times less than that of Australia and close to three times that of Ireland.

Ireland and Australia cite environmental concerns about litter and a desire to educate citizens regarding the costs of plastic bags to the general public. Australia's reported concerns also indicate an awareness of the

symbolic value of plastics and packaging as a reason to implement a plastic bag reduction policy. These concerns are aligned with many Coloradoan groups that strive for reuse of items, reduced consumerism, waste reduction, and a cleaner outdoor environment, among other things.

Ireland and Australia present different aspects of concern over their nation's environmental impacts. Ireland's stated concern is reducing windblown litter in the countryside. Australia is concerned about resource consumption and litter in general. Each nation acknowledges the fact that consumption of plastic bags has become unsustainable and harmful to the well-being of the nation's economy and their respective environments.

Ireland has a legislated plastic bag reduction policy that has been in effect since 2002. It has had the positive effect of reducing plastic bag usage over 90 percent in the first year alone, has successfully removed plastic bag litter from the countryside, and has increased community awareness of litter and pollution in general.

Australia does not have a legislated policy for reducing plastic bag usage. At this time there are several major retailers who have implemented a voluntary scheme for reducing plastic bag usage in the hopes that a legislated levy will not be necessary. However, because the voluntary measure did not reduce plastic bags to the extent that was anticipated, a legislated policy is slated to begin in 2008 as a reduction measure for plastic bag usage.

Administration of the Irish Levy is the responsibility of the retailers. Retailers are responsible for recording carrier bag sales, accounting for bags in stock, reconciling sold versus stock remaining, submitting records quarterly, and submitting payments to the government. The administration of the Levy does not appear to cause undue burden to retailers, and is offset by the economic gain retailers experience in the added sales of reusable bags and the minimization of costs for purchasing plastic carrier bags.

Funds received by the Irish government from the Levy go into the Environmental Fund. The Environmental Fund received revenue in the amount of \$8.9 million (U.S.) for the time period of July 17, 2001 to December 31, 2002 (Government of Ireland 2005). The amount was less than expected due to the drastic reduction in plastic bag usage for the same time period.

Australia has experienced a 26.9 percent reduction of plastic bags by the four retailers that have participated in the Australian Retailers Association's voluntary plastic bag reduction program. The goal of a 50 percent reduction rate is stated but not assured due to a lack of the following factors: participation, education awareness, and behavioral change by consumers. This voluntary reduction rate suggests that a significant reduction in plastic bag usage is possible only if a significant number of retailers agree to the reduction program. Applying such a program to Colorado is not suggested due to the high number of retailers and lack of

cohesion among them. It is foreseeable that a retailer would resist joining a voluntary plastic bag reduction program due to competition among retailers for customers. In this case short-sighted economics would be a driving factor in a retailer's quest for survival, rather than a long-term understanding that over time, requiring customers to bring their own bags will ultimately lower costs for the retailer.

Ireland's costs are summarized in the following points.

- \$12.21 (U.S.) spent annually per person on hidden costs associated with plastic bags (Scottish Executive 2005);
- Retailer's primary cost was updating software so that till receipts itemized the sale of plastic carrier bags (Department of Environment and Heritage 2005);
- Approximately \$1.3 million (U.S.) is raised each month from the Levy for use in supporting waste recycling infrastructure, ongoing costs and dedicated staff to enforce waste legislation (Department of Environment and Heritage 2005);
- An average reduction of 90 percent in retailers costs for purchasing plastic bags (Scottish Executive 2005);
- 77 percent increase in kitchen bag and reusable bag sales (Scottish Executive 2005);
- One plastic bag manufacturer closed due to the Plastic Bag Environmental Levy (Scottish Executive 2005).

Australia's costs are summarized in the following points.

- \$8.58 to \$12.88 (U.S.) annually spent per person on hidden costs associated with plastic bags. The cost range is due to variations in imported and domestically produced bags, transportation, manufacturing and composition (Zero Waste South Australia 2006);
- \$172 million (U.S.) spent annually on litter cleanups (Environment Australia 2002);
- Assumed potential reduction in plastic bag costs to retailers and increase in sales of reusable bags and kitchen tidy bags (Environment Australia 2002);
- Assumed potential influx of dollars into an Environmental Fund created for the purpose of receiving monies from a plastic bag levy that would go toward litter cleanup and educational campaigns (Environment Australia 2002).

Colorado's current costs are summarized in the following points.

- At an annual cost of \$13.24 per person, the 1.5 billion plastic bags used in the state are costing Colorado residents approximately \$62 million every year;
- The Colorado Department of Transportation spent \$5.6 million between July 2004 and June 3005 for litter cleanup, and saved \$1.5 million due to the help of volunteers, prison worker, and

Adopt a Highway persons who assisted with litter cleanup. This dollar amount does not include litter that has been recovered in non-CDOT boundaries (Spruce Up Colorado 2006);

- The proposed levy is expected to generate \$62.5 million that will be received into the Environmental Fund.

The costs that Colorado could expect to incur if the state adopted a plastic bag reduction policy are similar to those that Ireland currently experiences and those that Australia expects to see when a legislated policy commences.

The overall price that Colorado residents currently absorb due to plastic bag usage can be expected to dramatically decline if such a policy were implemented. Currently Colorado residents pay upwards of \$62 million in hidden fees for plastic bags that are then funneled into other sectors such as manufacturing, transportation, distribution, warehousing, recycling, waste, and litter cleanup. Should Colorado adopt a plastic bag reduction policy, the revenue that is collected from the sale of plastic bags would go into an Environmental Fund that would be used to support waste cleanup, education, and environmental initiatives. The money that is currently spent by CDOT for highway cleanups could in fact come from the Environmental Fund once it was implemented. CDOT could feasibly save millions by not having to budget for highway cleanups, the taxpayers would save money by not having to absorb the costs of highway cleanups, and if there was less

litter in the environment, highway cleanups would require less time and labor.

The costs to Colorado retailers for a proposed plastic bag reduction policy is thought to be minimal based on observed retail costs in the Irish Plastic Bag Environmental Levy and on careful scientific data collected by separate Australian entities. Irish retailers reported that the primary cost was in updating software so that receipts showed plastic bag costs. Irish retailers also noted that their purchasing expense of plastic bags dropped 90 percent due to the Levy. Irish grocers reported a 77 percent increase in trash bag liners. The various Australian reports used in this Capstone note that retailer expenses and economic gains agreed with the Irish experience and in fact expect similar results when the Australian legislated policy commences in 2008. Based on the actual and expected experiences noted earlier, local Colorado retailers should expect similar experiences in expenses and savings related to plastic bags.

It can be assumed that a plastic bag reduction policy will have a slight effect on the plastics manufacturing and related industries nationwide, however, because the state of Colorado is home to only 1.5 percent of the nation's people, the total effect on the national industry is assumed to be marginal. For there to be a true negative impact on the plastics manufacturing and related industries, a higher percentage of states or the federal government would have to adopt a similar policy.

If Colorado adopted a plastic bag reduction policy, the effects on the local economy could be quite positive. There is room for small businesses to emerge manufacturing reusable bags, creating and running necessary educational campaigns for municipal and state use, and increasing recycling infrastructures on municipal levels. The potential economic gain to the economy more than offsets the costs to retailers for implementing software systems to track plastic bag sales. By legislating a state-wide plastic bag reduction policy, Colorado has the ability to not only reduce plastic bag consumption, but provide new business opportunities that can stimulate the local economy.

RECOMMENDATIONS

The global costs of plastics and plastic bags cannot be ignored. "Plastic is the lubricant of globalization," Captain Moore said, "making it so easy to transport goods. But there is also no take back for plastic...In places like Baja, California, there are no landfills. Plastics, along with the rest of the trash, are scattered on land or dumped into the ocean...plastics don't break down; they simply blow around on land or float around in the ocean" (Algalita Marine Research Foundation 2007, 3). The issue Baja, California, has with inadequate landfills portends the economic strain plastic bags have on human consumption patterns and waste systems. The lessons of environmental strain and subsequent economic costs to communities can be applied to landlocked states such as Colorado. Consumption of an item that

is made of non-renewable resources, does not break down, has financial costs to the community associated with its disposal, and is unknowingly subsidized by consumers is ultimately unsustainable.

Using Ireland's success in reducing plastic bag usage and Australian research, it is feasible for Colorado to implement a similar plastic bag reduction policy based on the conservative reduction rate proposed by Environment Australia. With a targeted reduction rate of 70 percent, Colorado could predict an annual revenue rate of \$67.5 million that would be used to fund a newly created Environmental Fund whose purpose would be aligned with the Irish Environmental Fund goals: "to support waste management, litter, and other environmental initiatives" (Citizens Information, 1).

Based on conclusions of the literature review, the Case Studies of Ireland and Australia, and the Analysis, the following recommendations are offered for a plastic bag reduction policy in Colorado. It is with sincere hope that elected officials will exercise alacrity in implementing the following recommendations.

1. **Legislate a plastic bag reduction policy** that includes a 15 to 25 cent levy on HDPE and LDPE bags at all retail sites. The suggested levy is based on comparative figures used in Ireland and researched by Australia. The levy will be paid by consumers, as seen in the Irish Plastic Bag Environmental Levy. A levy is preferred over a total ban

because a ban could lead to use of unsustainable alternatives and could be considered impractical for some transactions.

2. **Government employees to audit the records** of retailers and ensure compliance of the levy. The manpower needed for collecting revenue from retailers, auditing records and ensuring compliance will be modest. Environment Australia estimates that the levy will produce a 70 percent reduction in plastic bag use in Australia and will require no more than ten full-time governmental workers to manage the levy, equating to one auditor for every 207 million bags that are expected to be used annually based on the projected reduction (Environment Australia 2002). Using these figures, if Colorado enjoys a 70 percent reduction in plastic bag use due to the levy, two auditors would be required to administer the state-wide levy.
3. **Establish an Environmental Fund** to receive revenue from the administration of the levy. The Fund will be used for waste and litter management, education and governmental administration of the levy. Assuming a 70 percent reduction in plastic bag usage, a new annual total of 450 million bags would be consumed based on current population figures. Assuming a levy of 15 cents per bag, the incoming revenue for the Environmental Fund would equal \$67.5 million.
4. **Administration of levy by retailers** will include an auditable system to ensure compliance as seen in Ireland. The Irish administration of

the Plastic Bag Environmental Levy can serve as a template for Colorado's policy.

5. **Website** explaining the reasons for the policy, how it will be implemented, and what plastic bag items will be exempt. The Citizens Information website in Ireland is a good template to follow (www.citizensinformation.ie).
6. **Initiate educational campaigns** that include other waste reduction strategies, resource usage awareness, billboards, television and radio ads and endorsements from national and local celebrities, as well as other high profile people.
7. **Impose a limited ban** on bags with a high litter potential such as those found in the fast food industry and take-out facilities that are often discarded inappropriately after use. Some fast food retailers in Australia have switched to paper bags instead of plastic because plastic bags tend to steam the food, while paper allows ease of transporting the food, biodegradability, and keeps food from steaming. Secondary points that would aid in the ultimate profitability of a plastic bag reduction policy in Colorado are as follows:
 1. Within two years of the start of the plastic bag reduction program, increase the levy as adjusted for inflation and update the education campaigns to maintain public awareness.

2. Explore adding other high-profile petroleum-based products such as one-use water bottles to the levy.
3. Expand the policy to a national scale, as the national scale would see the most benefits from such a policy.

Consumer awareness of petroleum products is now at a critical level. The average citizen wants change and supports government taking the initiative when it comes to resource-usage reduction. For there to be true reduction in plastic bag usage a state-wide plastic bag reduction policy is essential.

It is important to remember that the consumer has every incentive to avoid paying the levy on plastic bags; in fact this behavior is the basis to providing the desired effect of plastic bag use reduction. The levy's purpose is to create an economic incentive for people to choose reusable bags, not to tax people's usage of plastic bags for the purpose of funding a new initiative. As seen in Ireland, the lower income people did not find the levy burdensome because it can easily be avoided.

The stated objectives for this Capstone project are to research the economic implications of plastic bag usage on manufacturers, retailers and consumers, examine natural resource consumption, and assess the means that would provide the greatest reduction of plastic bags in Colorado. The assessment of means that would provide the greatest reduction of plastic bag usage includes social awareness, cultural acceptance of sustainable

alternatives, and economic balancing of plastic bag reduction measures between business, municipal and consumer sectors.

This research has met all stated objectives. Economic implications of plastic bags have been quantified and qualified between manufacturers, retailers and consumers. The natural resources consumed in the manufacturing of plastic bags have been quantified, as has transportation costs, distribution, waste disposal, and cleanup. The Case Studies of Ireland and Australia have revealed the social awareness and cultural understanding that exist in countries that have levied plastic bag usage or contemplated a legislated levy. Finally, this research has successfully explored the economic impacts on business, municipal and consumer sectors of Ireland and Australia, and the strengths and weaknesses of Ireland's policy and Australia's intended policy.

The City and County of Denver and the City of Boulder have shown concern and readiness to implement changes that would lead to a reduction of carbon, a higher level of recycling, and community awareness associated with a more sustainable lifestyle and community. They are two examples of programs that have been implemented in Colorado communities and are not indicative of every Colorado community's dedication to recycling or their level of overall awareness of resource usage and sustainability. The recommendations outlined in this Capstone represent a critical step the State of Colorado must take to reduce our dependence on petroleum and

petroleum-based products. The economic effects of the policy will lead to shifts in the economy that will create a more positive impact at the local and state level.

Colorado has the opportunity to be the first state in the nation to implement a plastic bag reduction policy. The opportunity to highlight Colorado's commitment to economic and resource reduction of petroleum-based products is clear. Elected officials, businesses, NGO's, and individual citizens in Colorado have led the way for decades in promoting sustainability and stewardship for the environment. This policy is a natural extension of the care and commitment Colorado embodies as a true leader in reducing the usage of a petroleum-based product. It is anticipated that other states will look to Colorado for guidance in establishing a similar plastic bag reduction policy.

Human behavior is such that it finds the least costly alternative for almost every imaginable scenario. Economics dictate that it is currently less expensive to landfill waste in Colorado than it is to recycle. Economics dictate that plastic is less expensive than paper, which is why plastic bags became the preferred alternative to retailers. Time-tested economics have proven that the Plastic Bag Environmental Levy in Ireland can have overwhelming success. Indeed, economics run this world and economics will be the true force that drives any change that is made for the sake of a less resource-dependent future.

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