



CRI Comments on Natural Logic's White Paper on EPR for Packaging¹

March 2011

Executive summary

Natural Logic recently produced a white paper for the Coca Cola Company that summarizes an industry policy agenda for the next generation of packaging waste management. In line with the principle of extended producer responsibility or "EPR," the proposal incorporates some producer financing and management of packaging waste recovery.

CRI enthusiastically supports both the principle of EPR and the goal of reducing packaging waste, but finds significant problems with the Natural Logic paper in three main areas:

1. Natural Logic is ambiguous about the materials and waste sources targeted: in examining the impressive-sounding "70% recovery of packaging" (and possibly printed paper) goal, we found that it could potentially result in the recovery of as little as 5% of municipal waste.
2. The Natural Logic proposal pits container deposit-refund systems against curbside material recovery systems, continuing the longstanding beverage industry² approach to avoiding product-specific recovery laws. This contradicts the model of advanced material management systems in Europe, Canada, and elsewhere, however, where the principle of EPR is well established and packaging directives are in place. These systems rely on a blend of strategies to achieve high levels of packaging recovery, centrally including curbside systems and deposit-refund programs that complement one another, rather than attempting to rely on a single mechanism.
3. Natural Logic fails to go beyond "diversion" to address the quality and fate of the recovered materials; the recycling priorities associated with different lifecycle greenhouse gas and emissions profiles of products and materials within the packaging class; product- or material-specific recovery goals within the packaging class; and the recovery of packaging litter. These are critical issues, especially within a sustainable materials management framework linked to greenhouse gas reduction imperatives. Beverage container litter in

Founded in 1991, Container Recycling Institute (CRI) is a national non-profit organization that studies and promotes policies and programs that increase recycling of beverage containers and packaging, and shift the social and environmental costs associated with manufacturing, recycling and disposal of container and packaging waste from government and taxpayers to producers and consumers.

particular has lately been subject to greatly increased scrutiny due to rising concern about marine plastic pollution from land-based sources.

CRI believes that U.S. states that are exploring the shifting of financial and possibly physical responsibility for packaging waste to producers and consumers should study existing models, particularly in Canadian provinces that provide the most directly relevant examples. One of the common themes they will find, in contradiction to Natural Logic's claims, is that container deposit-refund systems together with corrugated box recovery systems, both of which recover significant amounts of material from outside residential frameworks, have tended to serve as the backbone of a high-performing approach to comprehensively reducing the flow of packaging waste to landfills and litter.

Background to the issue

Natural Logic, a California consulting firm, recently authored a white paper commissioned by the Coca Cola Company, which proposes a policy agenda for the next generation of packaging (and possibly also printed paper) waste management in the United States. The white paper is part of the ongoing beverage industry strategy to promote curbside recycling collection as the primary mechanism for container recovery, and to block product-specific policy tools such as beverage container deposit-refund laws (a.k.a. "bottle bills"). In the latest instance, the industry adds producer financing to the equation, in line with the principle of Extended Producer Responsibility or "EPR," as discussed more below.

The concept of EPR was first formally articulated by Thomas Lindhqvist (the "father of EPR") in 1990, although its early applications date back to the 1970s. It has been a core concept in European waste management policy for several decades. The last 10–15 years have seen a range of EPR-based laws implemented in Canadian provinces and, more recently, in U.S. states as well as elsewhere around the world. Some of the most extensive work on the theory and application of the approach has been undertaken by the Organization for Economic Cooperation and Development (OECD), who define EPR in their 2001 guidance manual for governments:

OECD defines EPR as an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. There are two related features of EPR policy: (1) the shifting of responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities, and (2) to provide incentives to producers to incorporate environmental considerations in the design of their products. While other policy instruments tend to target a single point in the chain, EPR seeks to integrate signals related to the environmental characteristics of products and production processes throughout the product chain.³

The beverage industry's take on the subject of EPR and packaging, outlined in the Natural Logic paper and elsewhere, appears to be mainly distinguished from others' by:

- The argument that container deposit-refund systems are incompatible with curbside collection programs,

- Unrealistic or ambiguous estimates of the packaging (and printed paper) recovery potential of curbside programs, and
- A lack of product- or material-specific targets within the packaging class.

This agenda is being circulated by lobbyists; in white papers, reports, and articles; and in consultant presentations at conferences and special meetings. It has been dominating discussions in solid waste management policy circles in the United States for the past year, and was legislatively expressed in Vermont HB696 and Delaware SB234 (which successfully repealed Delaware's bottle bill) in 2010, and Vermont H218 and Iowa SF249 in 2011.⁴

The underlying strategy is not new. The beverage industry has been contending that residential curbside collection is *the* solution for packaging waste management for more than 40 years.⁵ However, after two decades of widespread curbside recycling collection service in the United States, proof of failure of this concept is considerable:

- **Two out of three beverage containers sold in the United States today end up in litter or landfills**, which equals nearly ten million tons (and rising) of wasted aluminum, plastic, and glass each year. Beverage containers, which account for 18% of packaging waste by weight in the United States, have a recovery rate of only 29% by weight and 35% by unit.⁶
- **U.S. states that do not have some form of container deposit-refund system recover an average of only 24% of all containers sold in the state**, whereas states *with* container deposit-refund systems consistently recover 66 – 96% of containers included in their programs. The results diverge even more when the markedly higher quality of materials collected under deposit-refund systems relative to curbside collection is fully accounted for.
- **The current 35% beverage container recovery rate (by unit) has declined from 41% in 2000 and an all-time high of 54% in 1992.**
- **Overall, the United States recovers 47% of all packaging waste generated.** Of all packaging recovered, however, 75% is paper and paperboard, due largely to efficient recovery of corrugated boxes from commercial sectors *outside the municipal curbside collection framework*. Excluding paper and paperboard, only 22% of the remaining half of packaging waste generated (which includes beverage containers) is recovered.⁷

The final point above provides some perspective on the beverage industry's preference for focusing on the broad class of *packaging* (almost 40% of which is corrugated boxes) instead of focusing on its own "extended" responsibility for *beverage containers* (18% of packaging). A collective target for packaging recovery without specific targets for products within the packaging class effectively allows the low, declining recovery rates for beverage containers (29%) to hide behind the high recovery rates for cardboard boxes (70%), and paper and paperboard packaging overall (66%). The situation with collective targets is analogous to poor performing baseball players with a star pitcher. Given the pitcher's "weight" in terms of importance to the game, he can bring the team a win on his own.

What is new in the arena are factors like the following, which are exerting an increasing influence on recycling and waste management agendas.

- **The principle of EPR has gained real influence** in the United States in recent years. The beverage industry recognizes it is inevitable that the waste management cost-shifting aspects of EPR (from municipalities and taxpayers to producers and consumers) are coming to the United States.⁸ Despite the fact that EPR has so far been arriving here mostly in the form of product-specific laws (for carpets, e-waste, fluorescent lightbulbs, etc.), the “EPR for Packaging” agenda outlined by Natural Logic can be seen as the industry’s response to this cost-shifting inevitability, tacked onto its longstanding curbside-focused approach to avoiding container-specific requirements.
- **A deep and persistent recession** has gutted municipal budgets and created a receptive local government audience for *any* proposal that bears new producer or consumer financing.
- **A Sustainable Materials Management framework** has, particularly in conjunction with greenhouse gas emissions reduction goals, been moving out of the realm of academic investigation and national commissions, where it has been gestating for decades, and into the world of applied policy. This powerful framework subsumes EPR as one important approach among many needed to go beyond consumer products and wastes to more integrated efforts to reduce the impacts of the billions of tons of materials moving through the economy every year. It has broad goals of dematerialization, detoxification, and value recovery throughout the entire material lifecycle, and is generally associated with an overarching need to reduce the throughput of basic materials like aluminum, wood, and plastic. The state of New York, for example, recently produced a report “Beyond Waste: A Sustainable Materials Management Strategy for New York State,” in which the overriding performance metric proposed is a 7-fold per capita reduction in municipal waste disposal from 4.1 to .6 lbs per day.⁹
- **The problem of ocean plastic pollution** – the central feature of “marine debris” as it is conventionally known in ocean policy – rocketed to public attention in Pacific states a few years ago. Broader worldwide attention to this issue, including concern about microplastic contamination of the ocean food web, has been increasing. Although the information and research associated with this subject is still very limited, there is no doubt that plastic containers that wash into the ocean as litter are a significant (and high visibility) source of marine debris. The first international conference on marine debris to be held in eleven years, known as 5IMDC, will be held in 2011. Organized by the U.S. National Oceanic and Atmospheric Administration and the United Nations Environment Program, the lead financial sponsors are Coca Cola, the American Chemistry Council, and the Ocean Conservancy.¹⁰
- **Interest in bottle bills is on the rise.** As of late February 2011, there were 14 active bills in U.S. statehouses to create or expand beverage container deposit-refund systems—an

unusually large number for such an early point in the legislative calendar. In the last two years, Connecticut, Oregon, and New York substantially expanded their redemption systems to include bottled water, and in 2007 the province of Ontario, Canada expanded its system to include wine and spirits. Both Guam and Australia's Northern Territory passed laws creating new beverage container deposit-refund systems in early 2011.

Problems with Natural Logic's white paper

There are a series of common problems that can cause any discussion about recycling rates specifically, or the comparative performance of end-of-life materials management systems generally, to become confusing or misleading very quickly. They include the following, all of which occur in some form in Natural Logic's white paper:

- a. Lack of clarity about targeted material recovery categories. This problem involves ambiguity in defining the material or product targeted for recovery. For example, comparing "recovery rates" between a program that targets only *packaging*, and one that targets both *packaging and printed paper*. See example 1, below.
- b. Lack of clarity about targeted waste source categories. This problem involves ambiguity in defining the boundaries of the waste stream being targeted. For example, comparing "packaging recovery rates" between a program that targets only packaging from *household waste sources*, and one that targets packaging from *the entire municipal waste stream*. See example 2, below.
- c. Ignoring the effect of parallel material management programs. For example, using recovery rates from mature European systems—some of which have *multi-stream curbside collection*, plus a *container deposit-refund system*, plus a *refillable container quota*, plus *well-developed infrastructure* for public space collection of recyclable materials—as the basis for estimating the recovery rate that can be achieved in an American system with *single-stream curbside collection* only.
- d. Equating recovery or diversion with recycling. There is tremendous complexity and variation in what happens to recovered materials between (a) the point of recovery and (b) the point of having been re-used in a new product. These two points may be 10 miles apart, or on opposite sides of the planet; some fraction of recovered materials will become rejects, and never get to point b; and some materials will be reused to make the products they came from while others will be "downcycled" to low-value uses like landfill cover. Using recovery or diversion rates (results at point a) to compare "recycling" performance (results at point b) is therefore misleading. This occurs, for example, if you use recovery rates as the basis for comparing *a system in which commingled materials collection* is used (in which glass containers are broken, paper grades are mixed and contaminated by glass and plastic fragments, post-recovery yield losses at sorting and reprocessing stages are high, and a large proportion of material is shipped off shore), to *a multi-stream collection system* that produces cleaner, well-sorted materials used locally.

- e. Failing to consider the relative importance of different materials in terms of their embodied energy and emissions. For example, the lifecycle greenhouse gas (GHG) emissions associated with replacing a ton of landfilled aluminum cans are about 12 times greater than those associated with replacing a ton of landfilled newspaper. This is significant in the case of beverage containers, which are a relatively small proportion of the waste stream by weight, but have a large embodied energy and emissions profile due to the high upstream impacts of producing metal and plastic containers in particular.¹¹ This is also significant when talking about EPR, since it carries an explicit goal of reducing upstream impacts, as defined earlier.
- f. Failing to account for the impact of packaging recovery strategies on litter reduction. This is important in calculations pertaining to packaging, since packaging is the main source of litter. A recent study estimated the cost of cleaning up land-based litter at about \$11.5 billion per year in the United States.¹²

In addition to the common analytical problems listed above, which also arise in other reports and presentations associated with the beverage industry's strategy, there are some unique problems and novel arguments that arise in the Natural Logic report. As one example, we look at the "bottle bills aren't comprehensive" line of reasoning in example 3, below.

Overall, the Natural Logic paper has the following general structure:

- Several pages of summary and introduction at the beginning present an inspirational goal to "achieve a whole-system transformation of recycling and resource management."
- The next section, how we get there, provides seventeen pages of a largely unreferenced strategy and implementation plan to get to "70% Diversion of All Packaging," which was apparently constructed on the basis of an "innovation charrette" and brainstorming session (with unidentified participants). A full third of the plan is devoted to dealing with anticipated opposition from those advocating for container deposit-refund systems, although as we discuss below, many of the jurisdictions viewed as leaders on the application of EPR principles to packaging include container redemption schemes as a central element of their strategies.
- The final section—about two thirds of the paper—consists of some forty pages of appendices that provide tables, figures, and anecdotal commentary, though these are largely not referenced in the body of the paper.

The following section looks at a few specific examples as a way to add some understanding to several general points that will be important to consider in the continuing discussion of EPR and packaging in the United States.

Examples

1. Natural Logic is ambiguous or contradictory about what *product categories* are being targeted for recovery. Is the proposed policy approach targeting (a) packaging, or (b) packaging and printed paper?

The opening sentence of the report states: “There is now an opportunity ... to achieve greater than 70% diversion from landfill.” This begs the question, Diversion of *what*? It is answered in some of the following ways by Natural Logic (emphasis added):

- “70% diversion from landfill for packaging from household and industrial, commercial and institutional (ICI) waste streams.” (p 1)
- “70% diversion of recyclable packaging and printed materials from household and commercial waste streams. “ (p 1)
- Section III, titled “Getting to 70% Diversion of Packaging in the United States,” opens with the sentence “Getting to greater than 70% diversion for all packaging and printed paper ...”. (p 9)

Throughout the paper, the terms “packaging” and “packaging and printed paper” are used as if they are interchangeable, but the difference between them is huge.

- According to the U.S. Environmental Protection Agency (EPA), “containers and packaging” (hereafter “packaging”) amounts to 77 million tons, or 31% of total municipal solid waste in the United States (2008).¹³
- Falling into the “nondurable goods” category, printed paper products amount to at least 30 million tons, or 12% of total municipal solid waste.
- Packaging *and* printed paper add up to about 107 million tons, or roughly 43% of municipal solid waste. Packaging and printed paper is therefore at least a 30 million tons (40%) larger baseline target than “packaging” alone.

Which is Natural Logic proposing we aim for, and how can we seriously consider a proposal that does not distinguish between them?

2. Does 70% really mean 5%? Natural Logic is ambiguous or contradictory about what sources of waste are being targeted. Is the proposed policy approach targeting (a) all sources of municipal waste, or (b) only household sources, or (c) only household sources served by curbside recycling?

The title of the paper refers to a “comprehensive packaging recycling strategy” and the proposed policy aims to divert “70% of packaging in the U.S.” (or “70% of packaging and printed paper in the U.S.”) (pp. 8, 9) This seems to imply that packaging (and printed paper) generated from *all sectors* contributing to municipal solid waste in the United States—household *and* ICI—is included in the target.

In some places, all of those sectors are listed; in others, only household sources are listed. It is estimated that household sources account for about 40% of all packaging waste generation, and 44% of total municipal waste generation.¹⁴ Using the latter figure for packaging *and* paper scenarios, we calculate that packaging and printed paper from all sources is about a 60 million ton (130%) larger target than packaging and printed paper from residential sources alone.

However, in various places throughout the report, including in the schematics of the proposed system (pp. 46-48), the emphasis appears to be on curbside collection systems. For example, Natural Logic states: “The EPR system proposed here for recycling of packaging material is 100% funded by Producers, with the Recovery Organization (NPRO) controlling the funds, contracts and details of *curbside recycling programs*” (p. 5) (emphasis added). However, elsewhere they state: “The role of the NPRO with respect to ICI customers is a subject that will require resolution,” and “NPROs may also choose to expand ICI collection.” (p. 14)

According to a recent survey, 63% of the U.S. population has access to a curbside recycling collection program at home, which means that around 37% of *residential* packaging waste, and therefore 75% of all packaging waste is generated outside the curbside system.¹⁵ Combined with the figures calculated above, we conclude that the lack of clarity by Natural Logic about both sources and types of packaging waste targeted leads to an extremely wide range of possibilities in terms of what the overall aims of the proposed policy agenda might be:

- **Low End:** At the low end of the range, packaging only, from residential sources with curbside recycling only, is about a 19 million ton target, or 8% of the total municipal waste stream. 70% recovery of this target would capture about 5% of the total municipal solid waste stream.
- **High End:** At the high end of the range, packaging and printed paper from all sources is about a 107 million ton target, or 5.5 times larger at 43% of the total municipal waste stream. 70% recovery of this target would capture about 30% of the total municipal solid waste stream.

By using terms such as “all” and “comprehensive,” combined with “70% diversion from landfill,” the implication is that Natural Logic is talking about large programs designed to dramatically increase recycling. Our best guess, however, is that the proposal is focused on the low end—curbside collection of packaging from residences. This is an example of how 70% can become 5%.

3. Comprehensive solutions and complementary programs.

Natural Logic asserts that beverage containers are a small part of the waste stream and that container deposit-refund systems, despite high recovery rates, “have a limited overall impact,” don’t “scale,” and fail to provide a “comprehensive solution.” They recommend: “the best option would be to phase out the bottle deposit system over time.” (pp. 22–25)

This is a novel line of reasoning. Beverage container redemption systems are like numerous other specialized material recovery approaches to postconsumer products that make up as little as 1% or less of the total waste stream, and are like most of the EPR requirements imposed in U.S. states to date in that they are *product specific*. The argument that they should be phased out because they fail to provide a comprehensive solution to packaging is like saying “tough drunk driving laws, while highly effective at reducing fatalities associated with drunk driving, should be phased out in favor of a comprehensive solution to reduce all fatalities associated with alcohol.”

Traditional beverage containers (excluding milk jugs and non-traditional containers such as aseptic boxes, gable-top cartons, and foil pouches) amount to an estimated 5.8% of the municipal waste stream in the United States (by weight).¹⁶ Container Recycling Institute has estimated that if a modest ten cent deposit were placed on all carbonated and non-carbonated beverages (excluding dairy) throughout the United States, an 80–90% recovery rate for beverage containers could be achieved across the board.¹⁷ As such, it could recover as much as 5% of total municipal waste—similar to the low end projection we associate with Natural Logic’s proposal—despite targeting less than one-fifth of the same waste stream.

In addition, as mentioned earlier in the context of common analytical problems that arise in recycling analysis (specifically, problems d – f), the Natural Logic strategy fails to account for the high embodied lifecycle GHG emissions and energy use associated with beverage containers; the higher quality of materials recovered in container deposit-refund systems relative to curbside collection; and the fact that the high recovery rates associated with deposit-refund systems, which target all beverage containers, are directly connected to their effectiveness at reducing litter.

Essentially all of the jurisdictions seen as leaders in EPR and packaging today have a combination of two or more complementary programs operating in relation to beverage containers, such as:

- **Residential curbside collection programs** ranging from partially to wholly industry-funded and sometimes industry-managed programs, sometimes with curbside material sorting,
- **Container deposit-refund systems** covering some or most beverage (and occasionally non-beverage) containers,
- **Refillable bottle quotas or voluntary refillable bottle programs** for one or more types of packaged beverages,
- **Other complementary policies and programs** such as fees on one-way containers, funding sources for recycling infrastructure and public education, and others.

This is true, for example, in all of the Canadian provinces whose producer responsibility programs related to packaging are being most closely studied as models for American states, including Ontario, Quebec, Manitoba and British Columbia.¹⁸

Ontario, for example, has a deposit-refund system covering alcohol containers sold in the province (the voluntary refundable deposit on beer bottles has been in place since 1927; wine and spirits were added in 2007), and a partially producer-funded municipal curbside collection program for packaging and printed paper. The results are:

- The container deposit-refund program recovers more packaging by weight than the current curbside program.¹⁹
- The systems work well together and are complementary; with most of the alcohol glass removed from the curbside collection program, other materials have benefited from reduced contamination.
- The City of Toronto reports that the implementation of the expanded deposit-refund program in 2007 has actually resulted in a net savings.²⁰

Conclusion

One of the fundamental omissions in the Natural Logic paper is that in trying to put a new face on an old argument by pitting container deposit-refund mechanisms against a beverage industry view of “EPR for Packaging,” they overlooked the fact that container deposit-refund systems are considered to be one of the earliest forms of EPR, discussed at length by the father of EPR himself, Thomas Lindqvist.²¹

Recently, the OECD articulated a set of broad policy principles to help governments move forward in developing sustainable materials management policies within their own policy contexts.²² Principle 3 of 4 addresses the value of using a diversity of policy instruments, and states in part:

Because each mechanism can deliver benefits, but no mechanism is ideal under all circumstances, a multi-pronged approach applying a diversity of mechanisms is more likely than a single “one-size-fits-all” approach to influence all relevant players. Weaving these diverse policy mechanisms into combinations which would reinforce each other can help to generate more effective, efficient and lasting outcomes.

We agree, and we believe that U.S. states that are exploring the shifting of financial and possibly physical responsibility for packaging waste to producers and consumers should study both the variations and commonalities among existing models, particularly in Canadian provinces that provide the most directly relevant examples. One of the common themes they will find, in contradiction to Natural Logic’s claims and the beverage industry strategy, is that container deposit-refund systems and corrugated box recovery systems, both of which recover significant amounts of material from outside residential frameworks, have tended to serve as the backbone of a high-performing approach to comprehensively reducing the flow of packaging waste to landfills and litter.

¹ Chacón, Lisa, Gil Friend, Nicholas Kordesch, and Steven Reinhardt. 2010. Product Stewardship & Extended Producer Responsibility: Towards a Comprehensive Packaging Recycling Strategy for the US. Report. Natural Logic. 25 Oct. 2010, v. 2.3. Accessed Dec 2010 at: <http://www.natlogic.com/resources/publications/white-papers/epr/>.

² The term “beverage industry” in this paper is used to apply collectively to the policies and actions of several of the larger beverage brand owners and some of the trade associations that represent beverage manufacturers. We recognize that not all companies in this industry share exactly the same policies.

³ OECD. 2001. Extended Producer Responsibility: A Guidance Manual for Governments. Paris: OECD Publications. Accessed Feb 2011 at: <http://browse.oecdbookshop.org/oecd/pdfs/browseit/9701041E.PDF>.

⁴ See CRI’s bottle bill website for the status of current or past campaigns related to container deposit-refund systems including legislative summaries and text of bills at <http://www.bottlebill.org/legislation.htm>.

⁵ For historical perspectives on the beverage industry’s embrace of curbside recycling as the solution to beverage container recovery see: Crittenden, Guy. 1997. “The Blue Box Conspiracy.” *The Next City* 3.9; Saphire, David. 1994. Case Reopened: Reassessing refillable bottles. Report. New York: Inform, Inc.; MacBride, Samantha. 2011 (forthcoming). *Recycling Reconsidered: the Past Failure and Future Promise of Environmental Action in the United States*. Cambridge: The MIT Press.

⁶ All beverage container generation and recovery statistics here are from: Container Recycling Institute. 2008. *Wasting and Recycling Trends: Conclusions from CRI’s 2008 Beverage Market Data Analysis*. Accessed Feb 2011 at: <http://www.container-recycling.org/publications/>. This report is based on 2006 data. Total packaging waste generation and recovery data and detail on paper and paperboard packaging is from: U.S. Environmental Protection Agency, Office of Resource Conservation and Recovery. 2008. *Municipal Solid Waste Generation, Recycling, and Disposal in the United States Detailed Tables and Figures for 2008*. Accessed Feb 2011 at: <http://www.epa.gov/osw/nonhaz/municipal/pubs/msw2008data.pdf>.

⁷ Ibid. On the recovery of paper and packaging outside the residential framework, EPA states: “The largest quantity of recovered materials comes from the commercial sector. Old corrugated containers (OCC) and office papers are widely collected from commercial establishments. Grocery stores and other retail outlets that require corrugated packaging are part of an infrastructure that brings in the most recovered material. OCC is often baled at the retail outlet and picked up by a paper dealer.” U.S. Environmental Protection Agency, Office of Solid Waste. 2010. *Municipal Solid Waste in the United States: 2009 Facts and Figures*. p. 160. Report. Accessed Feb 2011 at: <http://www.epa.gov/osw/nonhaz/municipal/pubs/msw2009rpt.pdf>.

⁸ For example, Kevin Dietly, a consultant associated with the beverage industry, recently stated: “Shifting the cost from municipalities to users and producers of products I think is an inevitable and necessary thing that the US has got to come to grips with.” Product Stewardship Institute, Product Stewardship and Packaging Conference Call Series, February 9, 2011.

⁹ In the United States, two key reports from EPA in 2002 and 2009 advanced the concept of sustainable materials management. The latter estimated that 42 percent of national GHG emissions are influenced by the lifecycle impacts of the products and packaging that become waste. U.S. Environmental Protection Agency. 2002. *Beyond RCRA: Waste and materials management in the year 2020*. Washington, DC. Accessed Feb

2011 at: <http://www.epa.gov/osw/inforesources/pubs/vision.pdf>; and U.S. Environmental Protection Agency. 2009. Sustainable materials management: The road ahead (report and appendix – technical support document). Washington , DC. Accessed Feb 2011 at: <http://www.epa.gov/osw/inforesources/pubs/vision2.pdf>. At the state level, New York's recent “Beyond Waste” plan outlines a fundamental shift from a waste management to a sustainable materials management approach. New York State Department of Environmental Conservation. 2010. Beyond Waste: A Sustainable Materials Management Strategy for New York State. Accessed Feb 2011 at: http://www.dec.ny.gov/docs/materials_minerals_pdf/frptbeyondwaste.pdf. Internationally, the OECD has played a lead role in recent advances in sustainable materials management through a series of workshops and reports. See, for example, the reports from OECD Global Forum on Environment: Sustainable Materials Management, held in October 2010, at http://www.oecd.org/document/29/0,3343,en_2649_34395_44403037_1_1_1_37465,00.html. Accessed Feb 2011.

¹⁰ 5th International Marine Debris Conference. Website. Accessed Feb 2011 at: <http://www.5imdc.org/>.

¹¹ Valiante, Usman. 2000. "Energy to Waste?" Solid Waste & Recycling Apr.-May 2000: 8-11. An unformatted version accessed Feb 2011 at: <http://www.solidwastemag.com/issues/story.aspx?aid=1000146212&type=Print%20Archives>.

¹² For example, a recent study done for Keep America Beautiful identified the following as the main elements of litter: tobacco products, beverage containers, snack food packaging, fast food packaging, other packaging, misc. plastics, misc. paper, and other litter. Keep America Beautiful. 2009 National Visible Litter Survey and Litter Cost Study. Report. Accessed Feb 2011 at: http://www.kab.org/site/DocServer/Final_KAB_Report_9-18-09.pdf?docID=4561. Container deposit-refund systems produce significant reductions in beverage container litter. In Hawaii, for example, beverage container litter collected in beach cleanups declined by 45% within three years of the implementation of Hawaii's container deposit-refund law in 2005. Calculation based on data from: Hawaii Department of Health. 2008. Report to the Twenty-fifth Legislature [on the activities of the Deposit Beverage Container Program]. Accessed Feb 2011 at: http://oeqc.doh.hawaii.gov/sites/LegRpt/20091/DBC_FY2008_12-31-08%20FINAL.pdf, and Ocean Conservancy. 2010. Trash Travels. Report. Accessed Feb 2011 at: http://www.oceanconservancy.org/news-room/collateral/2010_icc_report.pdf.

¹³ U.S. Environmental Protection Agency Office of Resource Conservation and Recovery. 2008. Op. cit.

¹⁴ U.S. EPA does not break down its municipal solid waste statistics in terms of generation by sector (e.g., residential, commercial, etc), so we are using Canadian data that does for an approximation. In Canada, 44% of municipal waste generation (in EPA terms: residential plus ICI) comes from the residential sector. Statistics Canada. 2005. Human Activity and the Environment: Annual Statistics 2005. Ottawa. Print. Catalogue No. 16-201. Accessed Feb 2011 at: <http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=16-201-X20050008657&lang=eng>. It is generally accepted that a proportionately larger fraction of packaging waste is generated in the ICI sector than in the household sector. According to John Mullinder, CEO of Paper & Paperboard Packaging Environmental Council, a rule of thumb for packaging waste generation is 40/60 residential/ICI. Email communication from John Mullinder to Susan Collins, January 24, 2011.

¹⁵ American Forest and Paper Association. 2010. 2010 AF&PA Community Survey, Executive Summary. Accessed Feb 2011 at: http://www.paperrecycles.org/news/exec_summ_2010.html.

¹⁶ Container Recycling Institute. 2008. Op. cit. (total traditional beverage containers generated: 14,030,611 tons in 2006); and U.S. Environmental Protection Agency, Office of Resource Conservation and Recovery. 2006. Municipal Solid Waste Generation, Recycling, and Disposal in the United States Detailed Tables and Figures for 2006. Accessed Feb 2011 at: <http://www.epa.gov/osw/nonhaz/municipal/pubs/06data.pdf>. (total municipal solid waste generated: 251,340,000 tons in 2006).

¹⁷ Container Recycling Institute. 2008. Op. cit.

¹⁸ CM Consulting. 2010. Who Pays What 2010. Report. CM Consulting. Accessed Feb 2011 at: <http://www.cmconsultinginc.com/wpw.html>. For an overview of complementary approaches to beverage container recovery in each Canadian province, see table 1.1 and elsewhere.

¹⁹ Ontario's deposit-refund program collected 493,000 metric tons of alcoholic beverage containers, including refillable bottles, in 2009-2010. See: The Beer Store. 2010. Responsible Stewardship, 2009-2010. Report. Accessed Feb 2011 at: <http://www.thebeerstore.ca/stewardship2010.pdf>. The Ontario residential curbside program collected 431,000 metric tons of household packaging. See "Fee Calculation Tables" for 2010 on Stewardship Ontario's web site. Accessed Feb 2011 at: <http://www.stewardshipontario.ca/stewards/library/Fee-Rate-Archive#Fee%20Calculation%20Tables>.

²⁰ The City of Toronto reported that the cost impact on their existing curbside program of including wine and spirit containers in a deposit-refund system was a net savings of \$448,000 in 2007; and \$381,000 in 2008, due to a reduction in processing and disposal costs. Source: Amendments to Processing Fees Due to LCBO Deposit Return Program, report to Public Works and Infrastructure Committee from General Manager, Solid Waste Management Services: October 29, 2008.

²¹ Lindhqvist, Thomas. 2000. Extended Producer Responsibility for Cleaner Production. Doctoral dissertation. Accessed Feb 2011 at: <http://www.lub.lu.se/luft/diss/tec355.pdf>.

²² OECD Environment Directorate. 2010. OECD Forum on Environment Focusing on Sustainable Materials Management. Policy Report 1. Working document. Accessed Feb 2011 at: <http://www.oecd.org/dataoecd/3/60/46111789.pdf>.