Part 5: Reuse and Recycling Systems for Selected Beverage Packaging

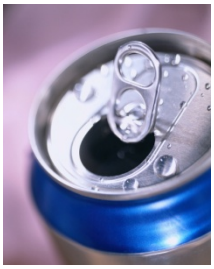
COMMODITY MARKETS

Recovered beverage containers are a global commodity. Supply and demand for recycled container material fluctuates, sometimes drastically, with ever changing market conditions. Markets vary depending on how much of a commodity is available and the consistency of its supply. The quality of the material (degree of contamination) is also a factor.

Following the market crash of 2008, commodity prices for recyclables saw a significant decline (since then, plastic and aluminum prices seem to have recovered). Buyers were increasingly discriminating when it came to contamination levels, and as a result, municipalities with curbside collection programs were hit the hardest. Nevertheless, in most cases, even though revenues were down the material was still able to move as it had in the past. This was partly due to the fact that much of this material was collected through DRSs, which collect the highest quality material and earn the highest commodity price per tonne.

The following is a description, by material, of the supply and demand for empty beverage containers collected in Canada. Also included is a discussion of the recycling process and of the end uses for recycled beverage container material.

Aluminum Cans



The market share for used aluminum beverage cans is higher than all other non-refillable beverage containers in Canada; this is the case in every province. In 2014 alone, 6.9 billion cans were sold in the country.

The recycling rate for aluminum cans varies sharply by province, but is usually higher in those where cans are covered under deposit-return as opposed to curbside collection programs. As of 2014, Ontario and Manitoba were the only two provinces that did not have deposits on soft-drink cans; their collection rates for non-alcoholic beverage cans were 48% and 50%, respectively. This is considerably lower than the collection rates reported by deposit-return jurisdictions. The lowest recycling rate reported for non-alcoholic cans in a deposit system was 64% in Newfoundland.

As with other beverage container materials, the price of aluminum dropped in 2009 (to $1215/tonne), but has since recovered. In Ontario, aluminum cans had an average monthly value of about $1,618 per tonne from 2013-2015. Due to their high market value, aluminum beverage cans are a desirable commodity to the collectors and sellers of recycled scrap.

Following collection, sorting, and cleaning, used beverage containers are crushed, compacted into biscuits, and transported to aluminum markets (mostly in the United States, for example, in states like Kentucky, Tennessee, and New York) where they are melted down and reformed into rolled stock. New aluminum cans are punched out from these sheets at a can production plant, and the offcuts or in-house scraps are all recycled. The entire process could take as little as 60 days.[146]

Glass Bottles

In 2014, the province with the highest recycling rate for non-refillable glass beverage containers is Saskatchewan at 94.3%.

Calculating the recycling rate of glass beverage containers is extremely challenging when bottles are collected via municipal curbside recycling programs. This is because in such jurisdictions, all glass (beverage and food container) is jointly reported. Moreover, collection rates do not account for losses incurred in processing (due to contamination, for example) nor do they consider the fact that different end-use applications have very different environmental impacts (for example, using recycled glass to manufacture new bottles or fibreglass has a higher environmental benefit than using recycled glass as road aggregate).

The market value of recycled glass depends on the method by which it was collected. In Canada, two main glass collection systems are employed: color-separated collection and multi-material collection. The first sorts the material at the point of collection by color type (flint, green, brown, or mixed color) and provides the recycler with a color-specific load that is free of contamination. Given the high quality of the material, it may or may not require additional processing.

The second method collects glass along with all other material types. The additional handling and truck compaction in this method results in a significant amount of breakage, and thereby lower quality and lower value recycled glass. About 20% to 40% of the glass collected in this way ends up in landfill as cover material. Another 20% is marketed as glass fines used for low-end applications such as road aggregate or as a sandblasting base. The remaining 40% to 60% is crushed into small pieces (known as cullet) and is used to manufacture new bottles or fibreglass.

In Ontario, the majority of wine, spirit, and beer container glass that is collected via the DRS is sold to Owens-Illinois for bottle-to-bottle manufacturing at a plant in Brampton, Ontario. Most of the glass collected via the province's Blue Box program becomes a raw material for products like fibreglass insulation, glass bottles, high traction road surfaces and reflective signs, construction aggregate, sandblasting material, or as drainage material. Due to circumstances of geography and low population density, most glass collected in northern Ontario ends up in landfill.

Prior to April 2013, 70% of Québec's glass was processed at a facility in Longueil, Québec.

Since the plant shut its doors in 2013, most of Québec's glass is being used as an aggregate or in landfills operations as roadbed. This could change in the next few years following the announcement of Éco Entreprises Québec (EEQ)'s *Innovative Glass Works* Plan.[147] The new program, announced in 2015, will direct an initial $6.7 million to modernize sorting centres and develop new market outlets for recycled glass. The ultimate goal of the program is to ensure that 100% of the glass collected in Québec's municipal curbside programs goes to recycling.

In Alberta, glass containers are crushed and the glass is formed into tiny glass beads. From there, the recycled glass is spun into thin strings (like cotton candy) and used to produce fibreglass insulation.[148]

Glass from British Columbia is sent to glass recycling plants in BC, Alberta, and Washington State where it is recycled into wine bottles, fibreglass insulation, or sandblasting material.[149]

Glass containers collected in Saskatchewan are shipped to different end-markets depending on color; clear glass is sent to a processing facility in Moose Jaw, Saskatchewan, while the colored glass is sent to a facility in Airdrie, Alberta where it is manufactured primarily into new glass bottles and jars.[150] Some colored glass is also made into fibreglass insulation. Any recycled glass that does not meet the manufacturers' standards to be manufactured into new glass bottles of fibreglass insulation (due to contamination) can be used for various other applications, such as countertops and floors, landscaping, tile, etc.

In Manitoba, glass is usually crushed and used locally as fill in roadways and sidewalks.[151]

Most of the glass collected in the Maritimes is shipped to OI in Montreal for bottle-to-bottle recycling.

In Northern Canada (Yukon and the Northwest Territories), glass is crushed and used as an alternative daily cover at landfills or as a gravel substitute. Some also ends up as sandblasting material.

Refillable Beer Bottles

With a national collection rate of approximately 97%, the refillable beer bottle is Canada's most recovered beverage container. No province has a collection rate of lower than 95%.

Following collection and sorting, industry standard bottles (ISBs) are returned to the brewery for their labels to be scraped off. They are then are washed, refilled, capped, and crated. On average, the ISB can be reused 15 times (the "trippage rate") before it is taken out of circulation. Other than being recycled by a bottler, a bottle may be taken out of circulation because of breakage (e.g. by a consumer) or scuffing.

Scuff marks on a refillable bottle – rings that develop on the bottle as a result of contact with the guide rails of the washing, filling, and bottle-handling equipment – become more

noticeable with each reuse and can have an significant effect on bottle aesthetics, which in turn, can render them less marketable over time.

PET (Polyethylene terephthalate) Plastic Bottles

With 27% of the total beverage market, PET plastic is the second most common material used for non-refillable beverage containers on a unit-sold basis.

It is challenging to estimate sales and collection rates for PET in Canada because many provinces report it within the plastic category as a whole. In deposit-return provinces, PET usually has a recycling rate of 70-80%, but due to the low recycling rate (49.5%) in heavily populated Ontario, the national average is roughly 62%.

The average monthly value for a tonne of mixed PET from Ontario's Blue Box program was $348 for the period of 2013-2015. After dipping to a low of $187/tonne in 2009 the value peaked at $652/tonne in 2011. It has since dropped to $295/tonne in 2015.[152]

Clear PET containers are baled, shredded, and flaked. Plastic flake may be turned into a fibre that can be used to make fleece clothing and carpet underlay or new bottles for detergent, motor oil, and other non-food products. Increasing numbers of PET bottles from deposit-return programs are melted down and made into new beverage containers. According to recent data[153], approximately 41% of recycled PET is turned into a fibre, 8% is used for strapping, 22% for food and beverage containers, 23% sheet and film, and 4% is used for non-food containers. A very small percentage (2%) becomes engineered resin or other materials.

In BC, collected plastic is sold to Merlin Plastics, and shipped to their facilities in BC and Alberta. PET from Saskatchewan and Manitoba is shipped to US and Canadian processors that flake the material. PET from Québec and Ontario is brokered into the market with multiple end destinations. In the Atlantic Provinces, most plastic goes to Novapet Inc., a facility located in Amherst, Nova Scotia. PET from the Northwest Territories and Yukon is sent to markets in BC and Alberta.

HDPE (High-density polyethylene) Plastic Bottles

Like PET, HDPE plastic is generally reported as part of the plastics category as a whole (which may or may not include non-beverage container plastic). For this reason, it is difficult if not impossible to report specific recycling rates for HDPE.

From 2013-2015, the average monthly value for mixed HDPE from Ontario's Blue Box program was reported to be $591 per tonne. The yearly average value in 2015 was $617 per tonne.[154] HDPE markets are very similar to PET markets and follow similar geographical flow patterns (see paragraph on PET Plastic Bottles).

HDPE milk jugs and juice containers are baled, chipped, and washed. The clean chipped plastic is melted at high temperatures and formed into pellets, which are used as resin

feedstock for the manufacture of non-food containers, plastic formed products, furniture, and toys.

Steel and Bi-Metal Cans

Steel and bi-metal cans make up a very small share of the beverage container market (approximately 2%). The national recycling rate for these containers is 73%.

From 2011 to 2013, steel cans collected in Ontario's Blue Box program were worth an average of $245 per tonne. The value of recycled steel cans dropped from a high of $335 per tonne in 2011 to $179 per tonne in 2015.[155]

Steel cans are crushed, baled, and shipped to market (to steel brokers in the U.S. and Canada) where they are melted down with other scrap metal, which can then be used as construction rebar or in the manufacture of other steel products.

Tetra Pak Boxes

Tetra Pak cartons or drink boxes are made up of paper, an aluminum lining, and a plastic coating, and are usually reported as part of a wider "polycoat" or "aseptic and gable top packaging" category. For this reason, it is impossible to quantify sales, returns, and collection rates for Tetra Paks alone. If considering the larger category as a whole, however, recycling rates are 50% or higher in each of the deposit provinces and 30% or less in Ontario and Manitoba.

From 2013 to 2015, polycoat containers collected in Ontario's Blue Box program were worth an average of $86 per tonne. The value of recycled polycoat material dropped from a high of $127 per tonne in 2011 to $79 per tonne in 2014.[156] By 2015, this had increased to $114 per tonne.[157]

Tetra Pak containers are hydro-pulped and separated into different material types. The resulting paper pulp (about 65% of the recycled material) is sent to paper mills in the U.S., China, and Korea where it is made into tissue. The remaining aluminum and plastic mix (about 35% of the recycled material) can be used to manufacture durable products like pallets and paper core plugs, but most end markets currently do not use the aluminum and plastic mix for value-added products.

Gable Top Cartons

Gable top cartons (used for juice and milk) are made up of "polycoat", a lightweight, high-grade paperboard sandwiched between two thin layers of polyethylene film (and sometimes a foil laminate). It is impossible to calculate a specific recycling rate for gable top containers as they are generally reported with Tetra Paks, as part of a larger category of collected material.

Recycling rates for the larger category as a whole are highest in Alberta (65%) and the Northwest Territories (61%), both of which charge deposits on milk containers. Manitoba and Ontario are the poorest performing provinces, with recycling rates below 30%.

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Polycoat is converted into new material by hydro-pulping, which uses a combination of heat, water, and agitation to break down the material to produce pulp or raw fiber. This pulp can be used as feedstock to make new paper products, such as corrugated medium (the inner layer of corrugated cardboard), linerboard, household tissue products, and fine paper. The small amount of residual polyethylene can be screened off for use in other plastic and composite materials.

Most polycoated packaging is sent to facilities in the US, South Korea, Thailand, and Japan for tissue production.

Poly Pouch Containers

Although they represent only a small portion of the beverage container market today, poly pouch drink containers are rapidly increasing in popularity. A typical poly pouch container is made up of an outside PET layer, ink that is printed on the inside of the PET layer, an aluminum foil adhesive layer, and an inside linear low-density polyethylene (LDPE) sealant.

Compared to other beverage container types, poly pouches tape up minimal space in landfill. They are also extremely lightweight relative to their volume, and so the carbon footprint associated with their transportation is comparatively small. In fact, according to a study by the Packaging Machinery Manufacturers Institute (PMMI) trade association, the beverage volume transported in a truckload of quart-sized pouches would require nine trucks of glass or plastic bottles[160]. Because of their associated environmental benefits, the PMMI expects poly pouches to gain a greater share of the beverage container market over the next decade.

Because it is a contaminant in both processes, traditional methods used to recycle aluminum and plastic are not practical for poly pouch containers. When removed at the recycling facility, these containers typically end up in residuals that go to landfill or EfW facilities. Although none currently exists, several recycling agents – particularly in provinces that mandate the recycling of all beverage containers – are attempting to source a large-scale end market for recycling this material. Potential market opportunities in the specialty sector include engineered fuel, lumber core, fuel substitution in cement kilns, and other industrial uses.[161]

Cups

There is another type of container that is used almost exclusively away-from-home and is not covered by deposit-return legislation in any of Canada's provinces or territories—polystyrene or paper-based, plastic-lined cups. There is no way to determine a recycling rate for these containers since their sales and returns are not tracked.

For the most part, these cups are exempt from beverage container regulations, which typically define the beverage container as one that is "sealed by the manufacturer" or "ready-to-drink." Although some provinces like Ontario and Québec require retailers or brand owners of these cups to financially support the recycling of these containers, very few municipal recycling programs are actually accepting and recycling these materials.

There is a challenge with recycling polystyrene cups. For one, the associated cost of shipping, given their large volume to weight ratio, is very prohibitive. In general, polystyrene cups are commingled with other polystyrene materials collected in expanded recycling programs and shipped to facilities in Ontario, the US, and overseas.

Paper cups can be recycled by some paper mills either on their own, mixed with gable top containers, or mixed in with boxboard material. Depending on the end use (which is usually tissue), the yield rate is about 80%[162]. Paper cups can also be composted (cups with a poly-based liner can also go into municipal compost, with the liner being screened out of the final product). Wax-coated cups used for cold beverages provide even greater recycling and composting challenges because of the wax.

THE USE OF RECYCLED CONTENT IN BEVERAGE CONTAINERS

Although the focus of this report is on the *collection* of used beverage containers, *Who Pays What*™ would be incomplete without any reference to the issue of recycled content. The recycled content of a beverage container (or any other product) is the fraction of recycled material in the final material normally expressed as a percentage.

When recycled beverage containers are converted into new products, the need to extract and consume raw materials and energy is significantly reduced because all of the primary resource extraction functions are avoided. The closed-loop system of using recycled beverage container material in the production of new containers has been acknowledged as the most beneficial end-of-life scenario for most types of packaging. Deposit-return programs offer the best chance of closed-loop recycling due to the fact that the containers collected are pre-sorted, eliminating the potential for contamination from other packaging and foodstuff residues.

Recycled Content by Material Type

Aluminum

According to the 2015 "Waste & Opportunity" report, aluminum continues to have the highest recycling rate and recycled content of all beverage containers.[163] Because aluminum can be recycled indefinitely, 75% of all aluminum ever manufactured is still in use today (with no loss in quality)[164] and it is estimated that 50% of all aluminum cans on retailers' shelves have been recycled at least once.[165] This makes sense, given the recycling process for aluminum requires 95% less energy than making a new can from virgin ore.

While, in general, aluminum cans in North America contain a significant portion of recycled content, the exact amount is difficult to ascertain because unlike glass and plastic, the percentage of recycled material in an aluminum can is not determined by the company, but rather by the aluminum supplier. The fact that manufacturers sometimes use different standards to define the amount of recycled content in their products can add to this ambiguity.

PET Plastic

Compacted to using virgin material, plastic bottles made from recycled PET resin require 30% less energy. For every tonne of plastic produced, this is equivalent to the energy contained in about 11 barrels of oil.[166]

Many companies have set goals for recycled PET and have made commitments to increase this percentage over the next few years. Pepsi, for example, has committed to use an average of 10% recycled PET plastic in all of its plastic bottles, and its Naked Juice brand bottle already uses 100% recycled resin.[167] Most companies claim, however, there is a lack of post-consumer PET on the market from which they can make recycled bottles. According to the National Association for PET Container Resources (NAPCOR), of the 1,812 million pounds of PET containers collected for recycling in 2014, only 31% were recycled.[168]

Instead of bottle-to-bottle recycling, much of the recycled PET available to manufacturers is being used to make other containers (open-loop recycling), such as those for non-beverage products (e.g. shampoo, food, etc.). A significant amount of recycled PET is also used for sheet and film, strapping, non-food bottles, and to produce fiber for clothing and carpet.[169]

Glass

Aside from being 100% recyclable, glass is one of the very few materials that can operate forever in a closed-loop system with essentially no loss of quality or purity. Using recycled glass cullet in the production of new glass has been acknowledged as the most beneficial end-of-life scenario for glass packaging, and for good reason. According to the Glass Packaging Institute (GPI) – the trade association representing the North American glass container industry – for every 10% recycled cullet used in the manufacturing process, energy savings of 2% to 3%

are achieved.[170] The greenhouse gas savings are also significant: for every 6 tons of recycled container glass used in the manufacturing process, one ton of carbon dioxide is avoided.[171]

In 2008, the GPI set a goal to use a minimum of 50% recycled material in glass bottles by 2013 (to increase to 60% by 2017). This goal has not yet been met. Although different bottle manufacturers have varying recycled-content levels, the GPI estimates that the average recycled-content incorporation rate of glass containers sold in North America as of December 2014 was 33.89%.[172] The Canadian brewery industry's industry-standard bottle (ISB) contains a higher percentage of approximately 70%.[173]

At the global scale, the average percentage of recycled content is lower than it is in Canada, largely because there is a lack of high-quality cullet available to meet manufacturer demands for new glass containers.

MEASURES FOR INCREASING RECYCLED CONTENT IN BEVERAGE PACKAGING

There are several ways to increase the use of recycled content in the manufacture of new containers. One of the most effective measures is minimum recycled content laws, which specify a minimum amount of recycled material that must be incorporated into products. While no province in Canada has enacted such laws, we can look to the United States and Europe for examples.

In California, manufacturers are required to use at least 35% recycled content for glass food, drink, and beverage containers made, sold, or used in the state (AB 2622, Chapter 1095, Statutes of 1990). The Department of Conservation's Division of Recycling regulates and oversees the container minimum content mandates and receives annual reports about the amount of recycled material that is used.

Other measures to promote markets for recycled-content material include: labeling laws that require products to be labeled with their recycled-content percentage; low-interest loan programs offered to businesses that produce recycled-content materials and products, to site new facilities or expand existing operations; individual producer responsibility, whereby producers are made 100% financially and physically responsible for the end-of-life management of their products; mandated minimum recycling rates; government procurement policies to purchase certain recycled-content products; and, in the case of glass, mandatory color-separation at source.