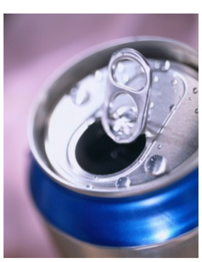
Part 5: End-Use Recycling Methods & Recycled Content

End Markets for Selected Beverage Packaging

It's no secret that China is a leader in international world trade. For years, the country has been a major importer of many types of foreign goods, including timber, dairy products, and petrochemicals. China is also the world's largest importer of waste and recyclables. But as of January 1, 2018, China will no longer import much of the waste we have been shipping there for decades. In July 2017, China notified the World Trade Organization that it would ban imports of 24 categories of solid waste by the end of the year, as part of its campaign against yang laji or "foreign garbage." The ban applies to several plastic resins (including PET, PE, PVC, PS, and "other" plastics), textiles, unsorted mixed paper, and other materials.

In the wake of China's decision, recyclables (specifically, plastic and paper) have been piling up in developed countries as they try to figure out what to do with the material they used to send to China. Several municipalities, particularly in the U.S., have cut back on their list of accepted materials, which has had impact on recycling access. Because most beverage containers in Canada are collected via DRSs, China's ban has had little impact (relative to other countries) on Canada's end markets for beverage packaging, as the materials collected tend to stay within the North American marketplace and command a higher price to due excellent quality. The fact that the material is high quality also means that provinces are still able to meet the new quality standards and have it accepted by China, if need be.

Aluminum Cans



Aluminum cans continue to be the most valuable material in the recycling stream and are considered a very desirable commodity for recyclers. In 2017, the average yearly value for aluminum cans collected in Ontario's Blue Box program was $1,772 per tonne, up from $1,576 in 2016.[83] From January to August 2018, the yearly average value increased again to $1863/tonne.[84]

Aluminum cans have a higher market share than all competing non-refillable package types. This is true in all provinces. In 2016 alone, over 7 billion beverage cans were sold in Canada. The recycling rate for aluminum cans varies sharply by province, but is usually higher in provinces where cans are covered by deposit.

Unlike other package types, aluminum cans are most often recycled in a "closed loop" cycle. Following collection, sorting, and cleaning, the used cans are crushed, compacted into biscuits, and transported to aluminum markets (mostly in the United States) 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 off-cuts or in-house scraps are all recycled. The entire process could take as little as 60 days.[85]

Glass Bottles

The market value of recycled glass depends on the method by which it was collected. In Canada, glass is collected in one of two ways: color-separated collection and multi-material collection.

As the name implies, the first method 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 further processing. The second method collects glass together with other material types, like paper and plastic. The additional handling and truck compaction that come along with this method results in a significant amount of breakage, which means 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, which are used for low-end applications like 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. The average market value for a tonne of mixed glass in Ontario in 2017 was -$42 per tonne, down from -$37 per tonne in 2016 and -$30 tonne in 2015.[86] As of August 2018, the yearly average value for mixed glass in Ontario had decreased to -$43 tonne.[87]

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.

Up until April 2013, about 70% of Quebec's glass was processed at a facility in Longueil, Quebec. Since the plant shut its doors, much of the glass collected through curbside recycling programs has ended up in landfills as roadbed or is used as an aggregate. In an attempt to address this issue, Eco Entreprises Quebec (EEQ) announced its *Innovative Glass Works* plan in January 2016, with the objective of finding a solution to recycling 100% of the glass recovered in Quebec. As part of the implementation of its plan, EEQ selected five sorting centres (EBI Environment Inc. in St-Paul-de-Joliette; Tricentris, tri, transformation, sensibilisation in Terrebonne; La Régie intermunicipale de traitement des matières résiduelles de la Gaspésie in Grande Rivière; Récupération Frontenac in Thetford Mines, and Centre de tri de Québec in Québec) to take part in 15-month pilot projects to test cutting-edge cleaning and sorting equipment for glass collected through curbside recycling in Quebec. The sorting centres enrolled in the experimental projects now process close to 25% of all the glass that Quebecers place in their recycling bins.[88] The glass produced from these centres will facilitate the material's transformation into a range of products, including abrasives, mineral wool, cement and concrete additives, ornamental mulch, water filtration agents, fillers, green paving stone, and cellular glass for use in infrastructure and sports fields.[89]

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.[90]

Glass containers collected in British Columbia are processed and sent to various end markets in Alberta and Washington State where the material is recycled into fibreglass insulation or new glass bottles. Some of the glass collected is also sent to a facility that manufacturers sandblasting material in BC, and municipal sites that use crushed glass as construction aggregates.[91]

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. 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.[92]

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

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 95%, the refillable beer bottle is Canada's most recovered beverage container. No province has a collection rate lower than 91%.

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.[93] 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

Making up over 25% of the beverage market in 2016, PET plastic is the second most common non-refillable package type in Canada (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.

The average yearly value for mixed PET from Ontario's Blue Box program in 2017 was $383 per tonne, up from $265 per tonne in 2016. From January through August 2018, the average yearly market price increased to $411 per tonne.[94] This is still well below the peak of $652 per tonne in 2011.[95]

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 DRSs are melted down and made into new beverage containers. According to recent data, approximately 25% of recycled PET is turned into food and beverage containers, 38% into fibre, 7% into strapping, 24% into sheet and film, and 4% is used for non-food containers. A very small percentage (2%) becomes engineered resin or other materials. [96]

In B.C., collected plastic is sold to Merlin Plastics, and shipped to their facilities in B.C. and Alberta. PET from Saskatchewan and Manitoba is shipped to U.S. 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 B.C. and Alberta.

HDPE (High-density polyethylene) Plastic Bottles

For 2017, the average yearly price for mixed HDPE from Ontario's Blue Box program was reported to be $497 per tonne, down from $533 per tonne in 2016.[97] From January through August 2018, the average value was down to $478 per tonne.

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

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 Canada's beverage container market (approximately 2%). The national recycling rate for these containers in 2016 was 69%.

In 2017, steel cans collected in Ontario's Blue Box program were worth an average of $262 per tonne. The market price for recycled steel cans peaked in 2011 at $335 per tonne, decreasing every year until 2016, when it started rising again. As of August 2018, the yearly average is $322 per tonne.[98]

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

Aseptic Containers

Aseptic cartons or drink boxes are made up of paper, an aluminum lining, and a plastic coating, and are often 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 Aseptic containers alone. If considering the larger category as a whole, however, recycling rates are 45% or higher in each of the deposit provinces and 25% in Ontario.

In 2017, polycoat containers collected in Ontario's Blue Box program were worth an average of $64 per tonne, a significant decrease from $114 per tonne in 2016. As of August 2018, the yearly average market price was $59 per tonne. The value of recycled polycoat material peaked in 2011 at $127 per tonne.[99]

Aseptic 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.

In 2017, polycoat containers collected in Ontario's Blue Box program were worth an average of $64 per tonne, a significant drop from the 2016 average price of $114 per tonne. As of August 2018, the yearly average market price was $59 per tonne The value of recycled polycoat material peaked in 2011 at $127 per tonne.[100]

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 market today, more and more beverage manufacturers are choosing poly pouch drink containers over traditional glass, paper, and metal packaging. A form of flexible packaging, a typical poly pouch container is made up of several layers of plastic (different types), aluminum, and other materials.

Compared to other beverage packages, poly pouches are lighter, less bulky, and take up less volume. They also have a higher product-to-package ratio than other packaging types (35:1, compared to 1:1 for glass and metal containers, 10:1 for plastic PET bottles, and 21:1 for aluminum cans[101]), and require about half of the energy required to produce, reducing CO_2 emissions (by up to 93%[102]) released during production and transport, and taking up less space in landfill.

Notwithstanding the environmental benefits, it is important to note that poly pouches are not recyclable through the current waste management infrastructure. When removed at the sorting facility, these containers typically end up in residuals that go to landfill or EfW facilities. Also, because of their flat shape and light weight, this material acts like paper in an MRF, flowing through with the paper stream, and can therefore contaminate the paper stream.[103]

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.[104]

Cups

Polystyrene or paper-based, plastic lined beverage cups—the kind you find in your local coffee shop—are consumed almost exclusively away-from-home. It is estimated that Canadians consume an estimated 1.5 billion of these coffee cups every year, enough to fill 4,000 full-size garbage trucks.[105] Unfortunately, most of these cups end up in landfill as none of Canada's provinces or territories include them under deposit return legislation, and only a few municipal recycling programs accept these containers for recycling (some municipalities accept them for composting). There is no way to determine a recycling rate for these containers since their sales and returns are not tracked.

Made from paper fiber and coated with an additional plastic layer for waterproofing, recycling these cups is complex and challenging, as each layer must be separated from each other. The plastic lids, designed to stay on tight, make it even more challenging, because if the lid isn't removed by the user, it doesn't always come off in the recycling process and can end up contaminating the paper stream. In addition, the associated cost of shipping, given their large volume to weight ratio, is very prohibitive.

Although it remains expensive to do so, new technologies have allowed paper pulp processors to be able to turn cups into valuable pulp. After being sorted as mixed paper at a recycling facility, the cups and other polycoated papers are sent to a processor where they are shredded. They then enter a 'hydropulper', which agitates the material in a water bath to separate and then filter the layers. The extracted paper fibres are then used to make new paper products such as cereal boxes, egg cartons and more.[106]

The Use of Recycled Content in Beverage Containers

Although the focus of this report is on beverage container collection, *Who Pays What* would be incomplete without a discussion on recycled content. ISO 14021 defines recycled content as "*the proportion, by mass, of recycled material in a product or packaging.*"

Using recycled material in the production of new beverage containers results in significant savings in energy and greenhouse gas emissions because it avoids all of the activities associated with extracting and processing virgin materials. While the material recovered from beverage containers can be used to produce a variety of new products, closed-loop recycling (e.g. where beverage cans are turned into new beverage cans) has been acknowledged as the most beneficial end-of-life scenario for most types of packaging. DRSs are especially suitable for closed loop recycling because they collect containers separate from other materials, eliminating the potential for contamination and increasing quality.

Recycled Content by Material Type

Aluminum

Aluminum cans continue to have the highest recycled content rate of all packaging types. This is not surprising given their high recycling rate and the fact that the high value of the material itself means that, unlike glass or plastic bottles, the aluminum can is most often recycled back into a new aluminum can. Aluminum cans can also be recycled indefinitely without any loss in material or quality, and recycling the cans uses only 8% of the energy needed to tract the same amount of aluminum from virgin material.[107]

According to the Aluminum Association, the average aluminum can contains 70% recycled content, by weight.[108] Forty-three percent of this is post-consumer scrap (used beverage can and other scrap from the consumer waste stream), while 27% is post-industrial scrap (scrap generated from the can manufacturing process and recycled back into the manufacturing process). This figure is based on a 2012 survey of the five main producers of aluminum can sheet in the United States – Alcoa, Logan, Novelis, Tri-Arrows, and Wise. Determining the exact amount of recycled content in aluminum cans is difficult because unlike glass and plastic, the percentage of recycled material in a can is not determined by the company, but by the aluminum supplier. Adding to this ambiguity is the fact that different manufacturers use different standards to define the amount of recycled content in their products (for example, what constitutes post- or pre-consumer material).

PET Plastic

Though the savings aren't as high as with aluminum, making PET bottles out of recycled resin uses roughly 2/3 less energy than creating virgin plastic bottles.[109] For every tonne of plastic produced, this is equivalent to the energy contained in about 11 barrels of oil.[110]

In the absence of recycled-content mandates, many companies have made voluntary commitments to use a certain percentage of recycled material within their products and packaging. Some brands are moving towards using significant recycled PET (rPET) content; for example, Arrowhead, a product of Nestle Waters North America, announced that it would ensure that most of its bottle sizes contain up to 50% rPET by the end of 2016.[111]

However, for the most part, the large manufacturers are not meeting their own self-proclaimed goals on use of rPET. A recent report from Greenpeace found that combined, five of the six largest global soft drink companies (Coca Cola did not participate) use an average of 6.6% recycled plastic in their bottles.

The Coca Cola Company itself has several times stated a goal of increasing recycled content. In 2009 the Sustainability Report commits to "source 25% of our PET plastic from recycled material by 2015". In the 2010-11 Sustainability Report the goal has been changed to "source 25% of our PET plastic from recycled or renewable material by 2015". The progress shown towards that goal touts the growth of using plant bottle material and makes no mention at all of using recycled plastic materials.

Unfortunately, the key variable that determines the amount of secondary PET used in production—besides quality, of course—is price. When energy costs are moderate to high, recycled PET is attractive to producers since it allows them to benefit from a slightly lower price. However, when the price of energy or virgin PET is low, the attractiveness of rPET diminishes, and companies will undoubtedly choose virgin plastic over recycled when procuring their raw materials.

According to the National Association for PET Container Resources (NAPCOR), only 25% of rPET was used for food and beverage containers in 2016. Most rPET available to manufacturers is being used for open-loop applications, such as fiber (43%), sheet and film (19%), strapping (8%), and non-food bottles (4%).[112]

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.[113] 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.[114]

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 in 2014 (most recent year for which data is available) was 33.89%, up from 25% in 2008.[115] This is significantly lower than the Canadian brewery industry's refillable industry-standard bottle (ISB), which is estimated to contain an average of 70% recycled content.[116]

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

One of the most effective ways to increase the demand for and use of secondary materials is through recycled content legislation.

Recycled content laws require that a minimum percentage of recycled material be included in certain new products and packaging. Perhaps the best-known example is California's Rigid Plastic Packaging Container Law. Passed in 1991, the law mandates that product manufacturers use 25% postconsumer recycled content in rigid plastic containers unless the containers are reused or refilled at least five times, or if they are light weighted by 10%. Penalties for non-compliance range up to $50,000 per violation for a maximum of $100,000 per product manufacturer.

The state of Oregon has a law that is very similar to California's; in effect since 1995, Oregon's Rigid Container Recycling Law requires use of 25% postconsumer recycled content in rigid plastic containers (for example, soda bottles, various tubs and pails, jars, etc.) unless the recycling rate for plastic containers in the state is at least 25% (certain food and medical packaging, source-reduced containers, and some others are exempt).

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.