Part 1: Program Performance

Measuring what Matters

We've all heard the expression, "You can't manage what you don't measure." It may be an old management adage, but it also applies to recycling. Without performance measurement, it is difficult—if not impossible—for governments and organizations to design and implement effective recycling programs and to ensure that they are meeting their objectives.

When it comes to beverage containers, program performance is typically measured using the collection rate, a calculated value derived from dividing the amount of material collected by the amount of material sold. For DRSs, using the collection rate as an indicator of performance makes sense because the accounting is in units, and because beverage containers are collected separately from other types of packaging. Determining the collection rate is simple since the refund provides an opportunity to track sales and collection to the last unit.

Measuring the success of multi-material collection systems, on the other hand, is much more complex. The complexity lies in that beverage containers are collected commingled with other types of containers, including PET from non-beverage sources, like ketchup bottles and PET thermoformed packaging for foods. Adding to this complexity is the fact that contaminants (e.g., food or liquid left in containers, non-recyclables) are included in the weight of collected containers. This makes the usefulness of the collection rate as a performance measure meaningless since it does not reflect the actual recycling of beverage containers. In order to measure what is actually recycled in these programs, the weight of non-beverage container material must be subtracted from the total tonnage. For this reason, CM Consulting uses *recycling rates* to measure the performance of programs in this report. In order to estimate recycling rates for beverage containers collected via the multi-material program in Ontario, the authors applied reasonable and important assumptions to all available data (see Appendix).

Getting the Numbers Right: Accounting for Contamination

Although it has increased participation and the volume of recyclables collected, one of the challenges of single-stream (also called "commingled") recycling collection is the increase in contamination. Contamination occurs when non-recyclables are mixed with recyclables, or when recyclable items are sorted improperly before they are shipped for processing. For recyclers, higher contamination rates mean higher costs, lower yields, and more material to dispose of. Contamination also leads to downtime in production processes, which costs machine maintenance, work hours, and lost time.

Compared to DRSs, the material collected via single-stream collection is of much lower quality, with more residuals and out-throws. A study of glass recycling showed that only 40% of glass from single-stream

collection is used in the production of new containers and fiberglass. In contrast, colour-sorted glass recovered via deposit systems results in 98% being recycled and only 2% marketed as glass fines.[2] For plastics, recyclers report yield rates of about 68-70% for material collected from single-stream programs, compared to bales of PET from DRSs which generally have a yield rate of about 85%.[3]

Process Loss

All bales of beverage containers will experience some level of yield loss due to the caps, labels, and glue that remain on the containers after sorting. This is true even in DRSs. PET bottles, for example, can lose up to 15% by weight of their material in the system. Some of these losses are fines, which can be sold as a by-product, but most are disposed of in landfill. When it comes to aseptic containers, 20% of the material (by weight) is aluminum and plastic and is considered process loss because it is disposed of after separation from the pulp.

As program operators seek to increase the recovery of beverage containers, it is important that they account for process loss by ensuring that both the numerator (i.e. amount of beverage container material collected) and denominator (i.e. amount of beverage container material sold) include or exclude the weight of this material in a consistent manner. This requires applying the processing efficiency rate (PER) to the collection rate (see Table 1 for definitions). It should be noted, however, that this step is only required for collection rates that are measured in weight, as is the case in Manitoba, Ontario, and Quebec (for non-carbonated beverages), since recycling rates for these programs decrease as the level of contamination rises. Collection rates reported for DRSs are not affected by processing efficiency because they are based on unit counts.

Table 1 Rate Definitions

Collection Rate (CR)	The amount of beverage container material collected (by weight or unit) that is shipped to the recycler by the primary processor (e.g. MRF) expressed as a percentage of the amount of beverage container material placed on the market, excluding exports. Some programs use “recovery rate” and “collection rate” interchangeably. Note: If material is measured by weight, the weight of caps, labels, and glue should be considered in both the numerator and denominator.
Processing Efficiency Rate (PER)	The amount of beverage container material received by the recycler that is used in the recycling process (excluding energy-from-waste) expressed as a percentage of the amount of material shipped to the recycler. The higher the PER, the lower the level of contamination, and vice versa.
Recycling Rate (RR)	The amount of beverage container material used in the recycling process (excluding energy-from-waste) expressed as a percentage of the amount of beverage container material placed on the market, excluding exports. The RR takes into account the weight of materials rejected due to contamination. Note: In DRSs, the collection rate and the recycling rate are the same, because the accounting is in units.

Knowing the PER is critical for accurate performance measurement because it sheds light on what was *actually* recycled, not just how much material was collected and then sent to disposal after secondary processing. CM Consulting estimated PERs based on rates published by industry and through interviews with recyclers that

process beverage container material in Canada. Figure 3 presents typical contamination rates (low and high) that are common in today's bales of recyclables shipped to recyclers.

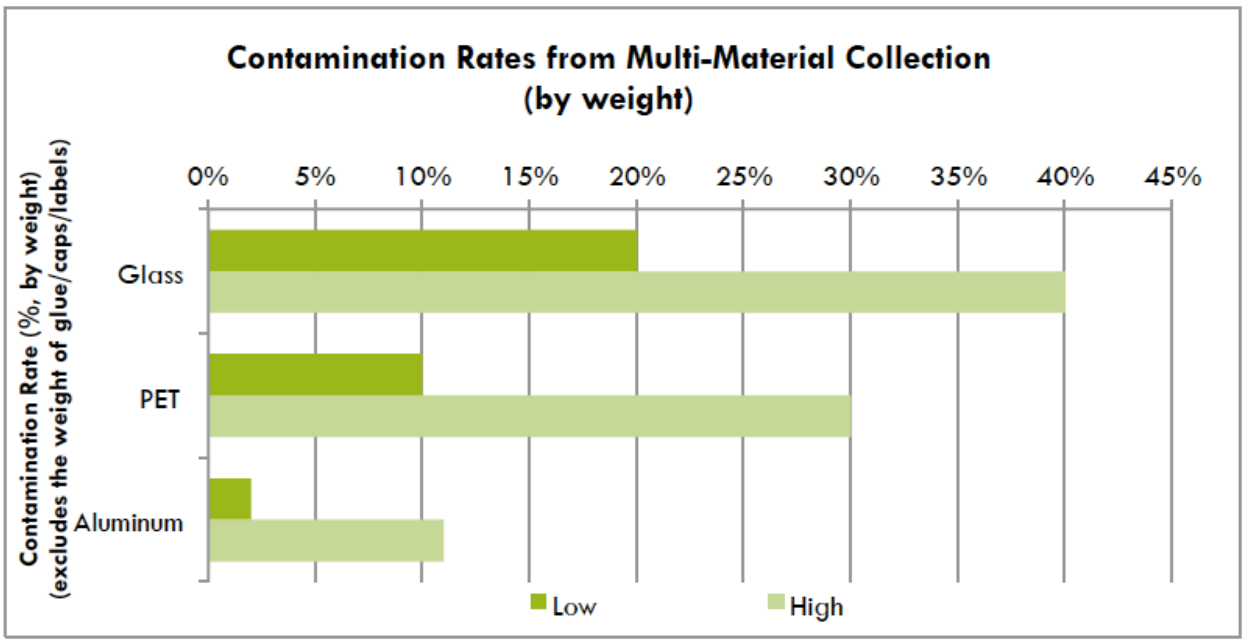

Figure 3 Contamination Rates from Multi-Material Collection (by weight)

Material-Specific Recycling Rates

Refillable Beer Bottles

Provincial operating agencies and the Brewers Association of Canada (BAC) are responsible for monitoring and reporting the collection/recycling rates for refillable beer bottles. These bottles are recycled at a very high rate, both nationally and on a provincial level. The recycling rate of refillable containers has a considerable influence on the trippage rate, which, in turn, determines the environmental benefit to be gained from reuse. "Trippage" is the term used to describe the average number of trips a container makes before it is recycled by the bottler, damaged by the consumer (and thus not returned for deposit), or otherwise landfilled. In Canada, the average trippage rate for industry standard beer bottles (ISB) is 15 times.

Figure 4 summarizes the recycling rates for refillable beer bottles collected through brewer-run provincial programs in fiscal year 2016. Although other types of beverages also come in refillable bottles, including other alcoholic and non-alcoholic beverages like water, milk and soft drinks, collection/recycling rates for these containers are not reported and so are not available to the public.

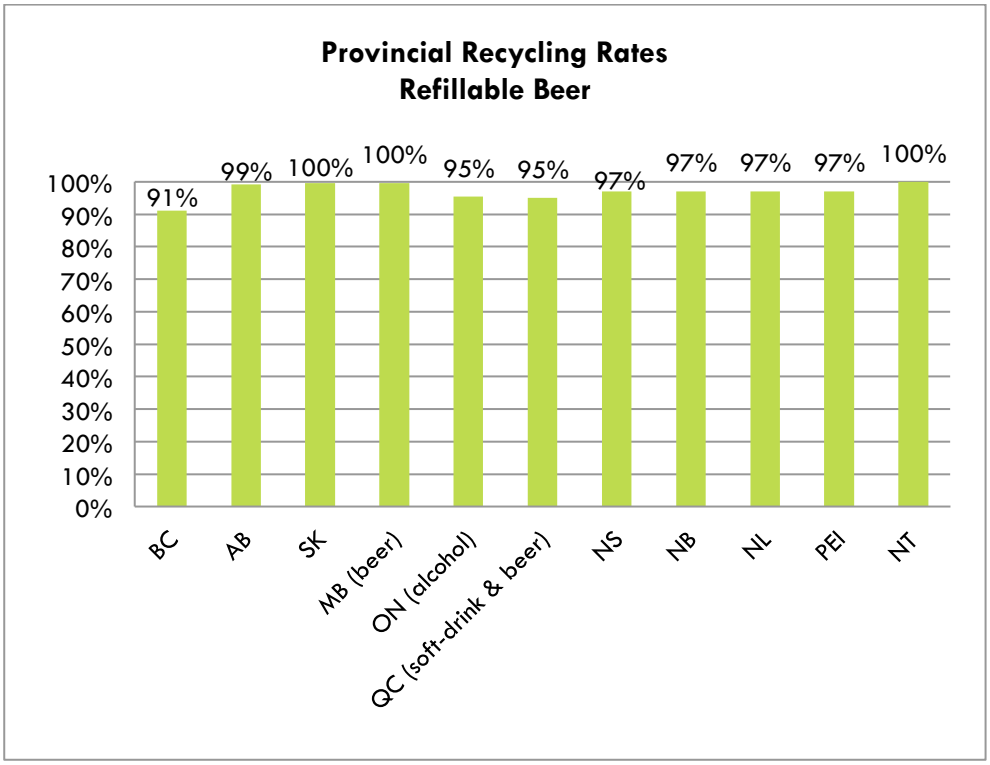

Figure 4 Provincial Recycling Rates, Refillable Beer (2016)

The Decline in Refillable Beer Bottles

Historically, the majority of beer sold in Canada has been sold in The Beer Store's ISB. However, in recent years there has been a dramatic decline in the use of such refillable containers. Statistics from the BAC show that from 2009 to 2017, nationwide market share for beer sold in glass bottles dropped from 59% to 30% of overall hectoliters sold.

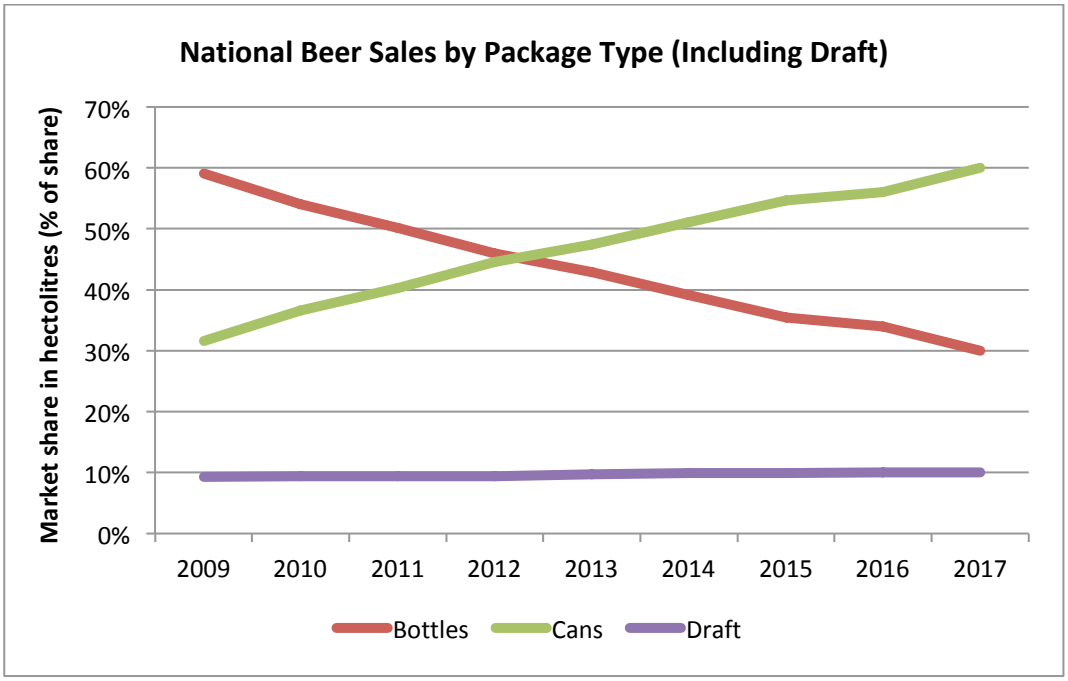

Figure 5 National Beer Sales by Package Type (Including Draft) (2009-2017)

Only in Ontario and Quebec does the refillable beer bottle remain popular, but it is in these two provinces where the greatest decline has occurred. In Quebec, in 2009, 83% of packaged beer was sold in refillable bottles. By 2017, the market share for all glass bottles (including imports) share had dropped to 32%. From 2008 to 2016, the percentage of beer sold in ISBs in Ontario dropped from 76% to 54%. B.C. has experienced a similar decline.

Figure 6 shows how the ISB's market share has declined in Quebec, Ontario, and B.C. from 2009 to 2017. It is worth noting that this only represents sales of domestic bottles vs. domestic cans.

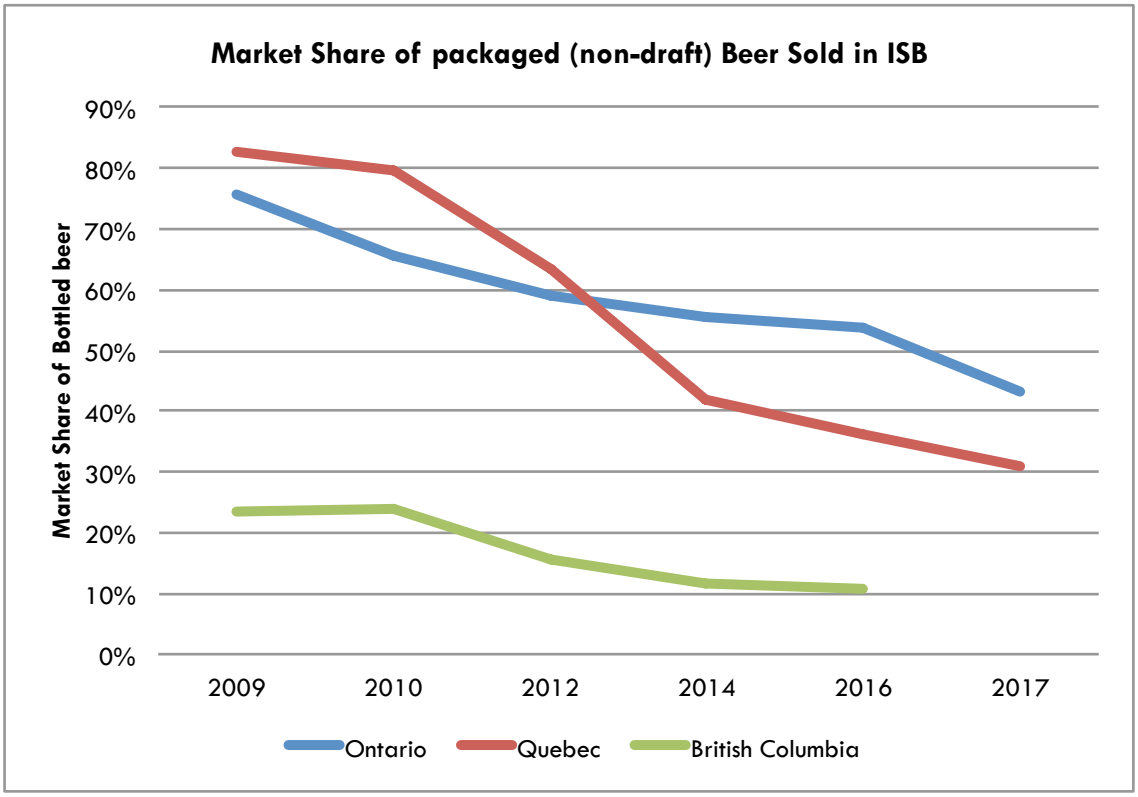

Figure 6 Market Share of Packaged (Non-Draft) Beer Sold in ISB in Ontario, Quebec, and British Columbia (2009-2017)

Several factors can explain this decline, one of which is a shift in the retail landscape towards large retailers or "big box" stores. Without policies in place to promote them, retailers have stopped carrying refillables in an effort to reduce the labour, space and general management requirements associated with having to take them back. Another contributing factor to the decline in refillable beverage packaging and corresponding increase in one-way containers is that refillable systems require a greater level of cost internalization by beverage producers. Whereas producers of beverages in one-way packaging generally only incur a share of the end-of-life management costs, producers of refillable beverage containers incur the full costs of collection and refill. This un-level playing field creates an economic incentive to use one-way containers over reusable ones. Other reasons for the decline include changes in the relative costs of container materials (aluminum and plastic), a shift to lighter packaging, and a change in consumer preference and behavior.

Non-Refillable Containers

Table 2 shows recycling rates for different types of non-refillable containers collected in each province for 2016. Entries of "-" indicate that data for that category of containers was either not available or not applicable for that province. The table includes data for only one non-deposit beverage container collection program, the Blue Box program in Ontario. We can see that nearly all of the deposit programs are running recycling rates of 80% or higher, but that the Ontario Blue Box program has a recycling rate of 45%.

Table 2 Provincial Recycling Rates, Non-Refillable Containers (2016)

	BC	AB	SK	MB (beer)	ON (alcohol)	ON (non-alcohol)	QC (soft-drink & beer)	NS	NB	NL	PEI	NT	YT
Aluminum Cans	87%	91%	88%	79%	80%	41%	71%	89%	79%	65%	87%	84%	-
Non-Refillable Glass	89%	94%	79%	-	85%	42%	70%	86%	73%	66%	77%	101%	-
PET Bottles	74%	81%	79%	-	53%	44%	70%	78%	69%	65%	78%	84%	-
Other Plastics	74%	81%	-	-	-	45%	-	21%	69%	18%	-	84%	-
Bi-Metal/ Sttel Cans	85%	75%	-	-	-	64%	-	44%	-	53%	-	64%	-
Gable top/ Aseptic/BIB	58%	72%	52%	-	25%	35%	-	56%	57%	46%	48%	62%	-
Total Non-Refillables	**82%**	**86%**	**82%**	**79%**	**80%**	**45%**	**71%**	**81%**	**73%**	**62%**	**80%**	**83%**	**82%**

Figure 7 summarizes the total non-refillable recycling rate, by province, for 2016. The visual clearly shows the stark difference between the performance of Ontario's curbside program and the deposit systems, which are much more successful.

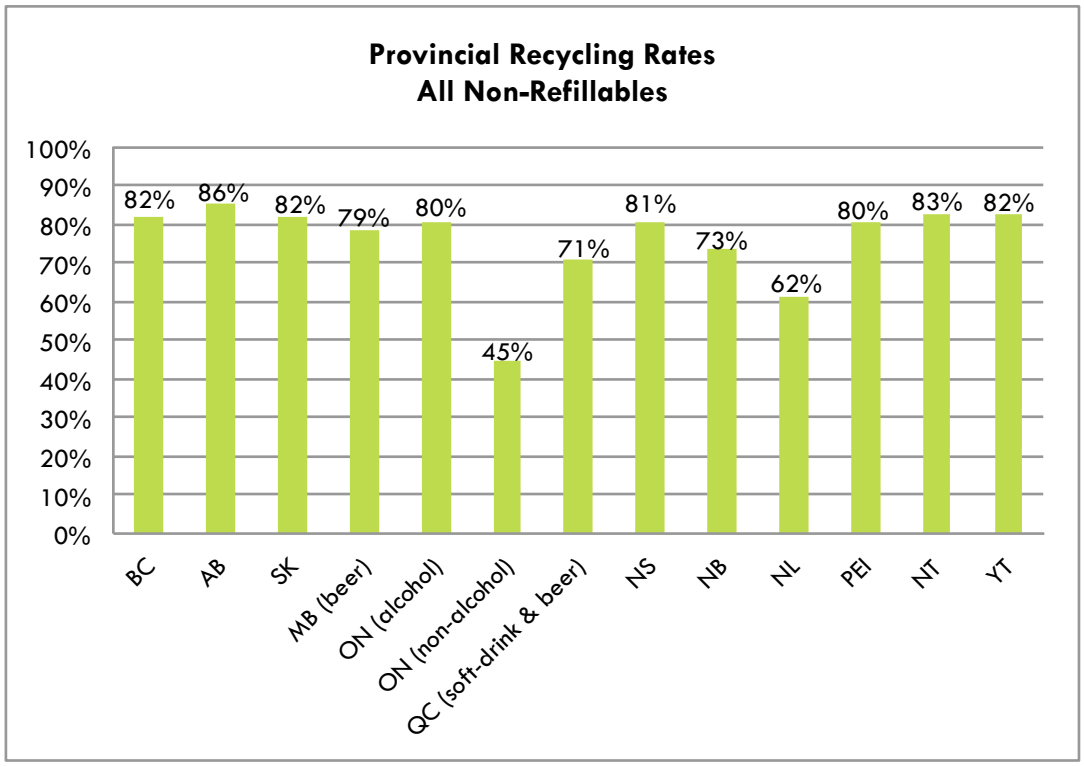

Figure 7 Provincial Recycling Rates, All Non-Refillables (2016)

Figure 8 provides historical data on non-refillable recycling rates for the years 2004 to 2016. Most provinces have seen their rates increase gradually. Alberta stands out with an 11 point increase since 2008, while Ontario, with no DRS, has seen a fall in beverage container recycling rates from 56% in 2012 to 45% (lowest of all available rates) in 2016.

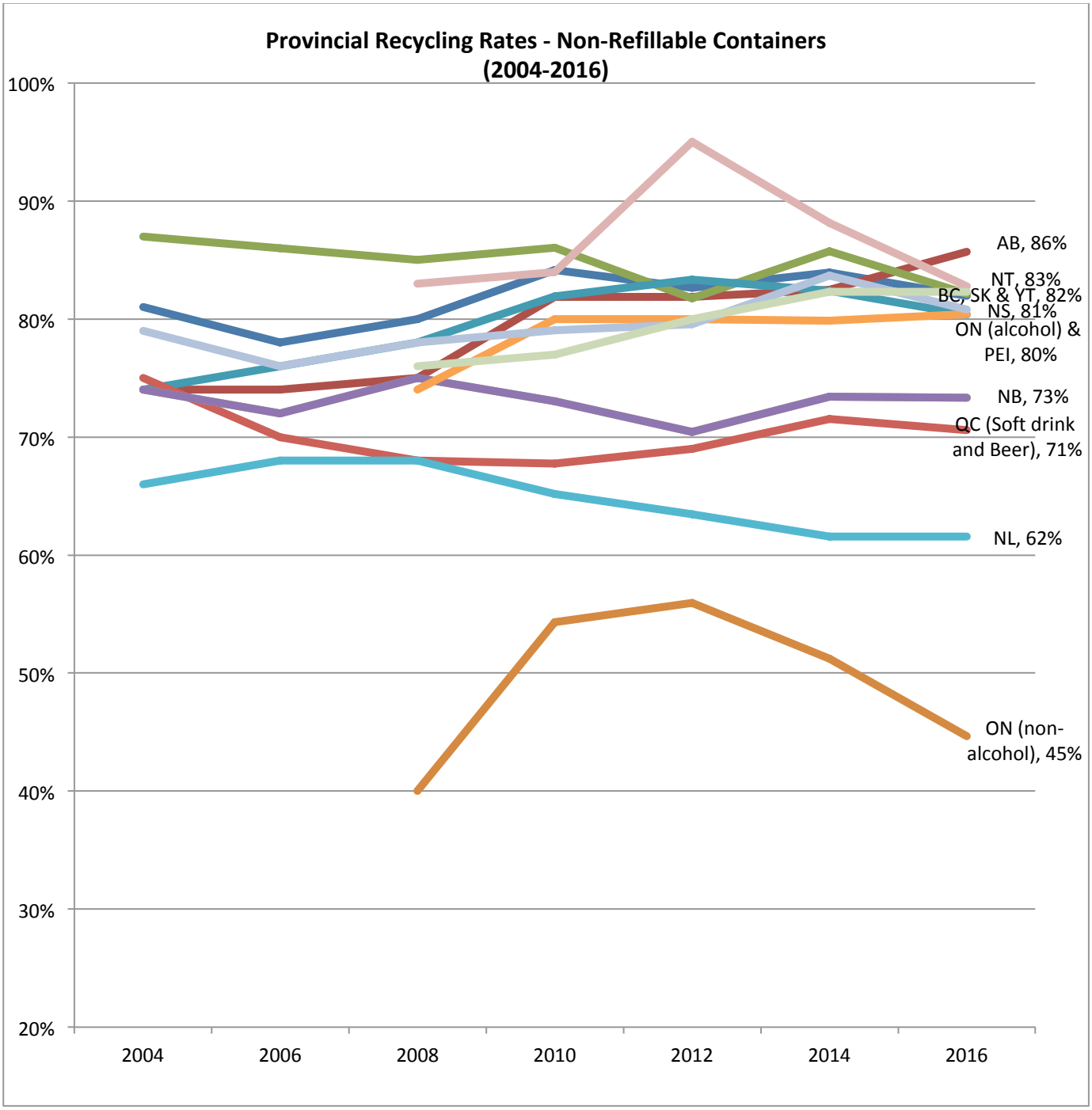

Figure 8 Provincial Recycling Rates, Non-Refillable Containers (2004-2016)

Aluminum Cans

Figure 9 presents 2016 recycling rates for aluminum cans by province. The outlier in the chart is the low rate of curbside collected aluminum cans in Ontario. The aluminum can recycling rate in B.C. is higher than that presented by Encorp because this number also includes beer cans (see Figure 10).

It is worth pointing out Quebec's recycling rate of 71%, which, compared to other deposit jurisdictions, is relatively low. Quebec's poor performance for these containers is likely attributable to the low deposit on beer cans (5-cents, which is expected to be raised to 10-cents, possibly after the 2018 provincial election), which is half the value of the deposit in most other provinces. Another contributing factor is the fact that Quebec's DRS is limited to carbonated beverage cans (i.e. soft drinks and beer). This creates confusion for consumers, which in turn lowers overall performance.

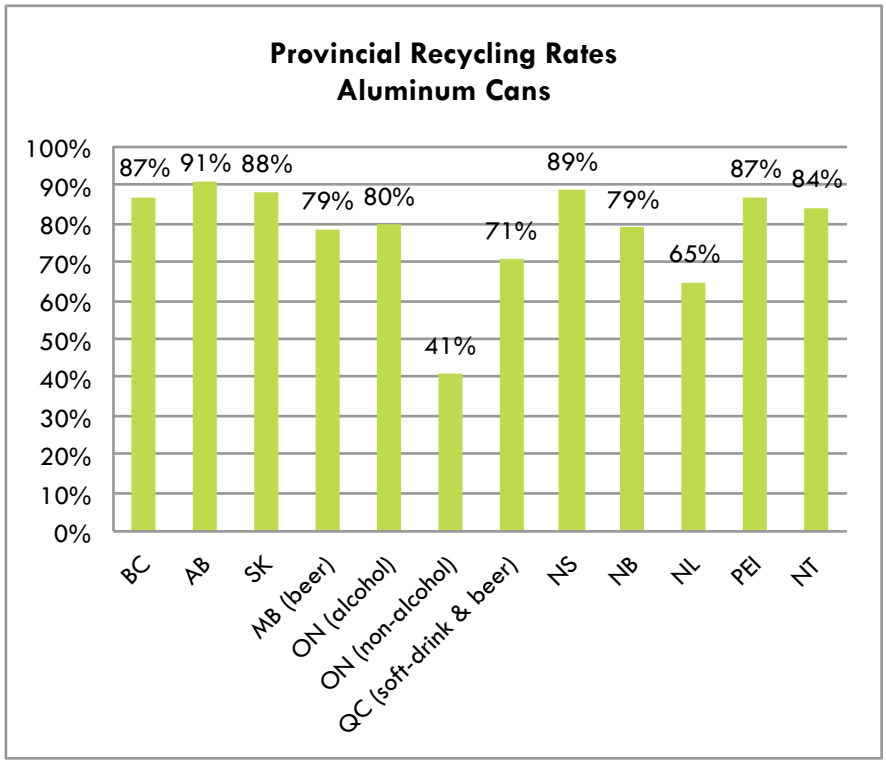

Figure 9 Provincial Recycling Rates, Aluminum Cans (2016)

Figure 10 shows 2016 recycling rates for aluminum beer cans vs. non-alcoholic beverage cans in Ontario and B.C. When comparing these rates, it is important to consider deposit levels, which have a significant influence on rates of return. In B.C., the deposit on beer cans, which show a 91% recycling rate, is 10-cents. This is double the deposit charged on non-alcoholic beverage containers (5-cents), which only show a recycling rate of 82%. It is also important to consider the collection system used to recover each type of container. As shown in the table, there is a clear difference in recycling rates for beer and soft drinks cans in Ontario (80% vs. 41%), where beer cans are on deposit and soft drink cans are collected curbside.

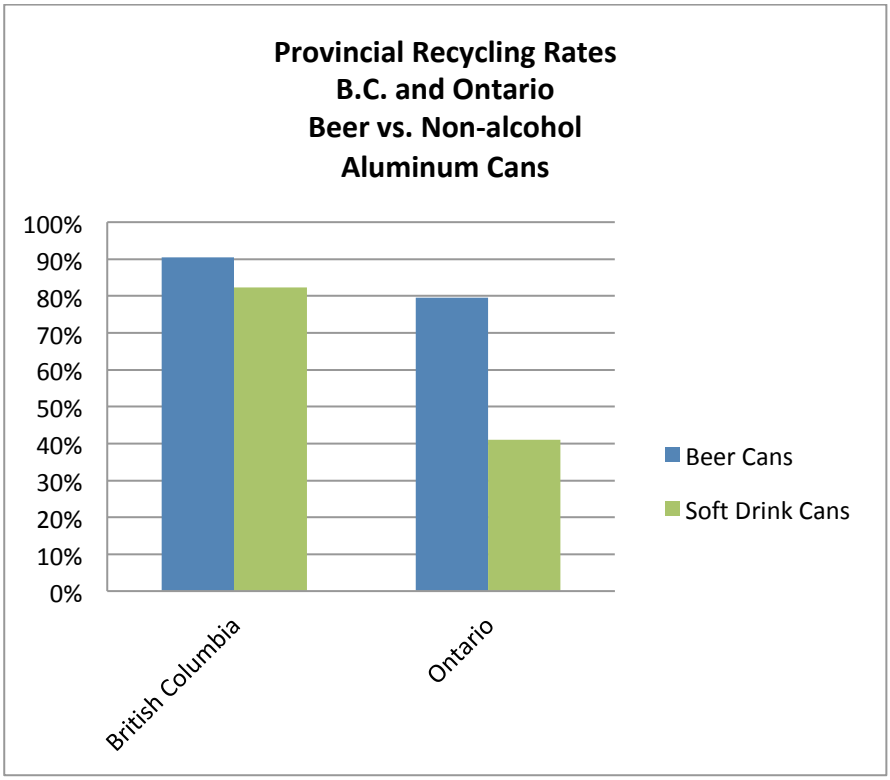

Figure 10 Provincial Recycling Rates, Aluminum Beer Cans vs. Soft Drink Cans, in Ontario and BC (2016)

Figure 11 shows how recycling rates for aluminum beverage cans have changed over time. Some provinces, like Alberta, have seen a significant increase from 2004 to 2016. Alberta now has the highest aluminum can recycling rate in the country due to the higher deposit of 10 cents on all cans. Ontario has seen its aluminum can recycling rate from the curbside system decline rapidly in the last four years. Most other provinces are showing slight increases or declines. The extremely high rate of 100% in Northwest Territories in 2012 is an anomaly that is likely explained by containers being stored longer than usual, rather than put through the system, and creating a bulge in returns during that year.

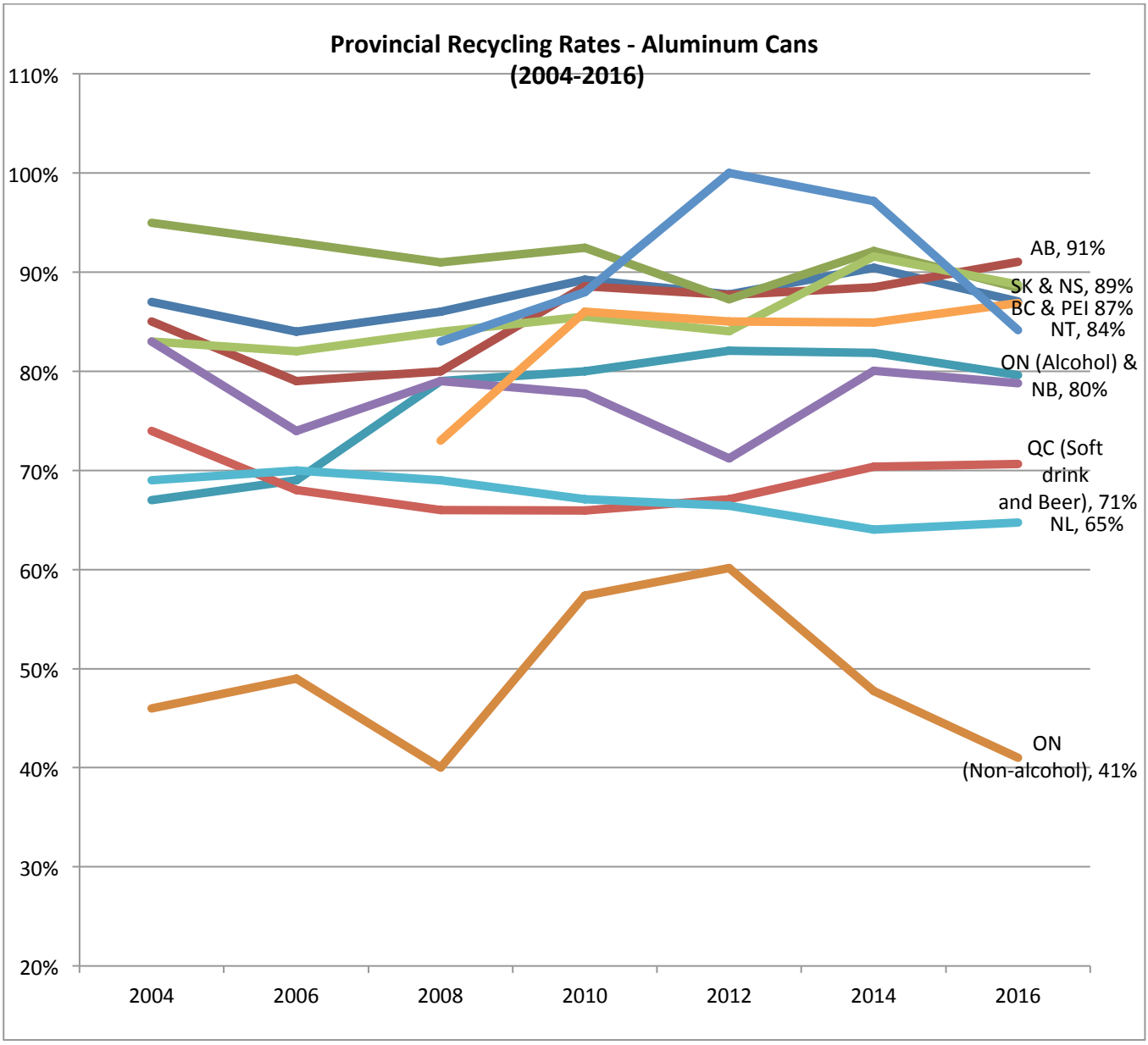

Figure 11 Provincial Recycling Rates, Aluminum Cans (2004-2016)

Non-Refillable Glass

Figure 12 presents provincial recycling rates for non-refillable glass in 2016. The province with the highest recycling rate for this material is Alberta at 94%, followed by B.C. at 89% (It is obvious that the Northwest Territories has a counting issue in this year). For this category of materials, dependable rates could not be obtained for the curbside collection programs in Manitoba or Quebec. It is worth noting that in Manitoba, none of the recovered glass is actually recycled, but is recovered and turned into roadbed.

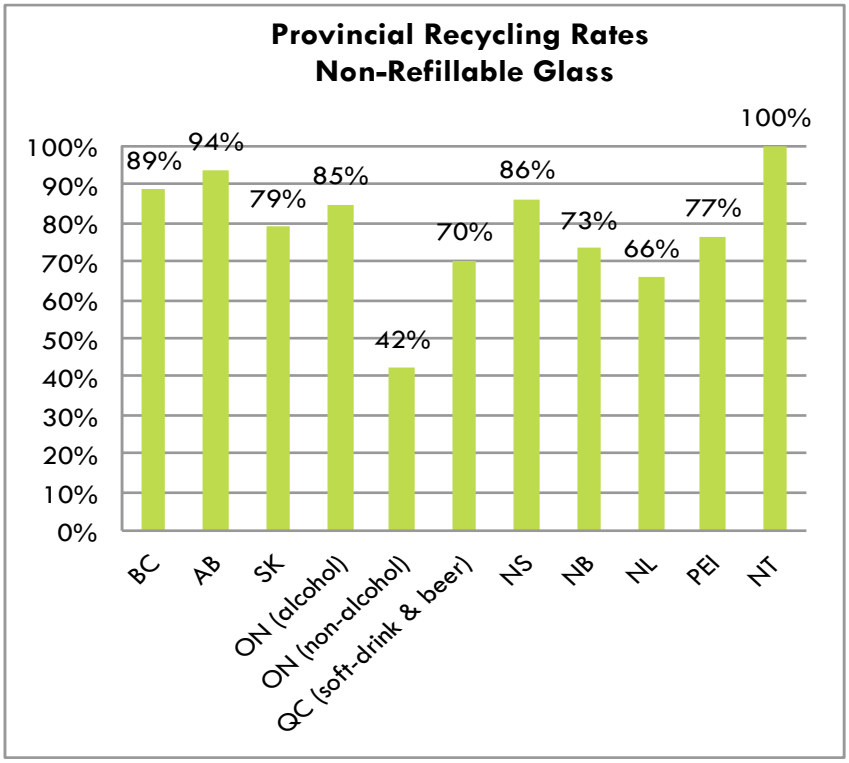

Figure 12 Provincial Recycling Rates, Non-Refillable Glass (2016)

As shown in Figure 13, some provinces have seen recycling rates for non-refillable glass bottles change significantly over the last 12 years. Consider Alberta, for example, whose recycling rate went from 79% in 2004 to 94% in 2016, or New Brunswick, whose rate dropped from 78% to 73% during the same time period.

There are a number of reasons why return rates fluctuate over time. For example, the drop in Ontario from 2006 to 2008 can be explained by the introduction of the Ontario Deposit Return Program (ODRP), which expanded the scope of containers subject to deposit. While the 2006 recycling rate includes only non-refillable glass from beer bottles, the 2008 rate includes glass from wine, spirit, and cooler bottles, which were collected at a lower rate in the early years of the program (2007 and 2008).

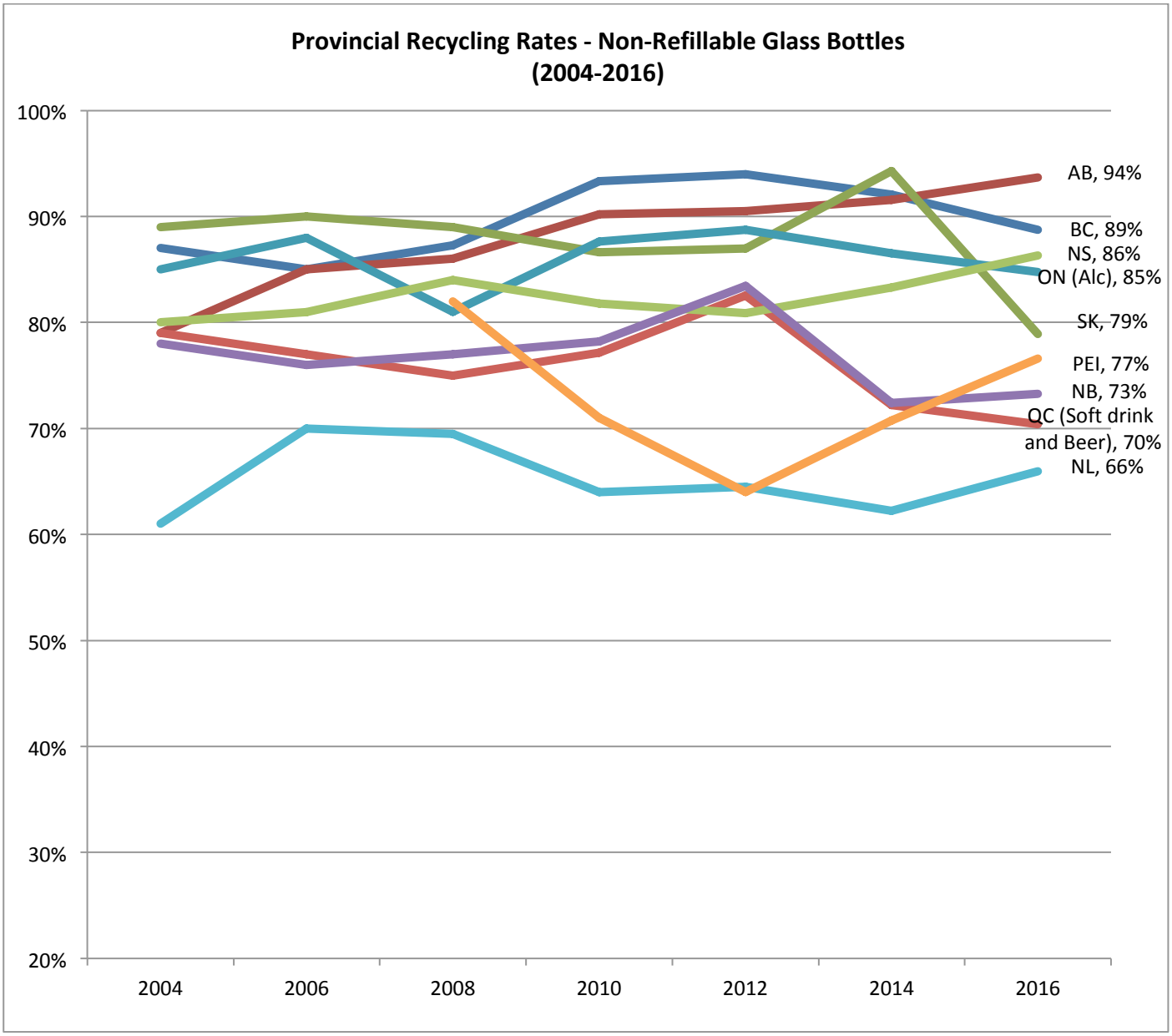

Figure 13 Provincial Recycling Rates, Non-Refillable Glass (2004-2016)

PET Bottles

Figure 14 shows provincial recycling rates for PET beverage bottles in 2016. Like for other materials, dependable rates were not available for curbside programs in Manitoba and Quebec. Most deposit programs show a recycling rate of 70% to 80% for this material. Ontario's ODRP shows the lowest PET recycling rate of all deposit systems, but it only covers PET alcohol containers.

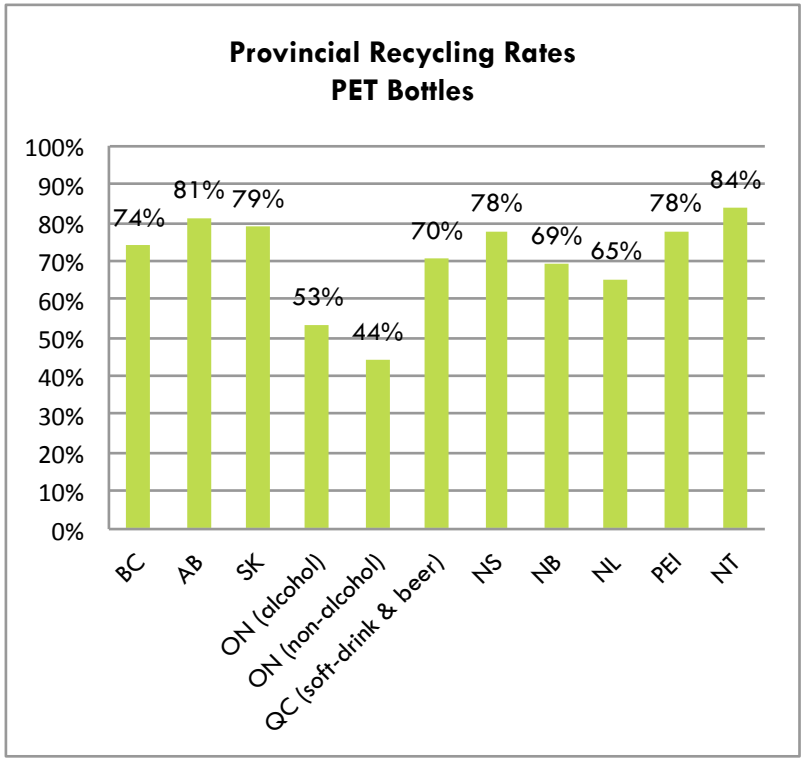

Figure 14 Provincial Recycling Rates, PET Bottles (2016)

Figure 15 shows how PET bottle recycling rates have changed over time. From 2004 to 2016, we can see the recycling rate has increased substantially in Alberta (11 percentage points), while it has decreased in Saskatchewan (9 points) and New Brunswick (6 points). Most other provinces have seen small increases or small decreases during that same time frame.

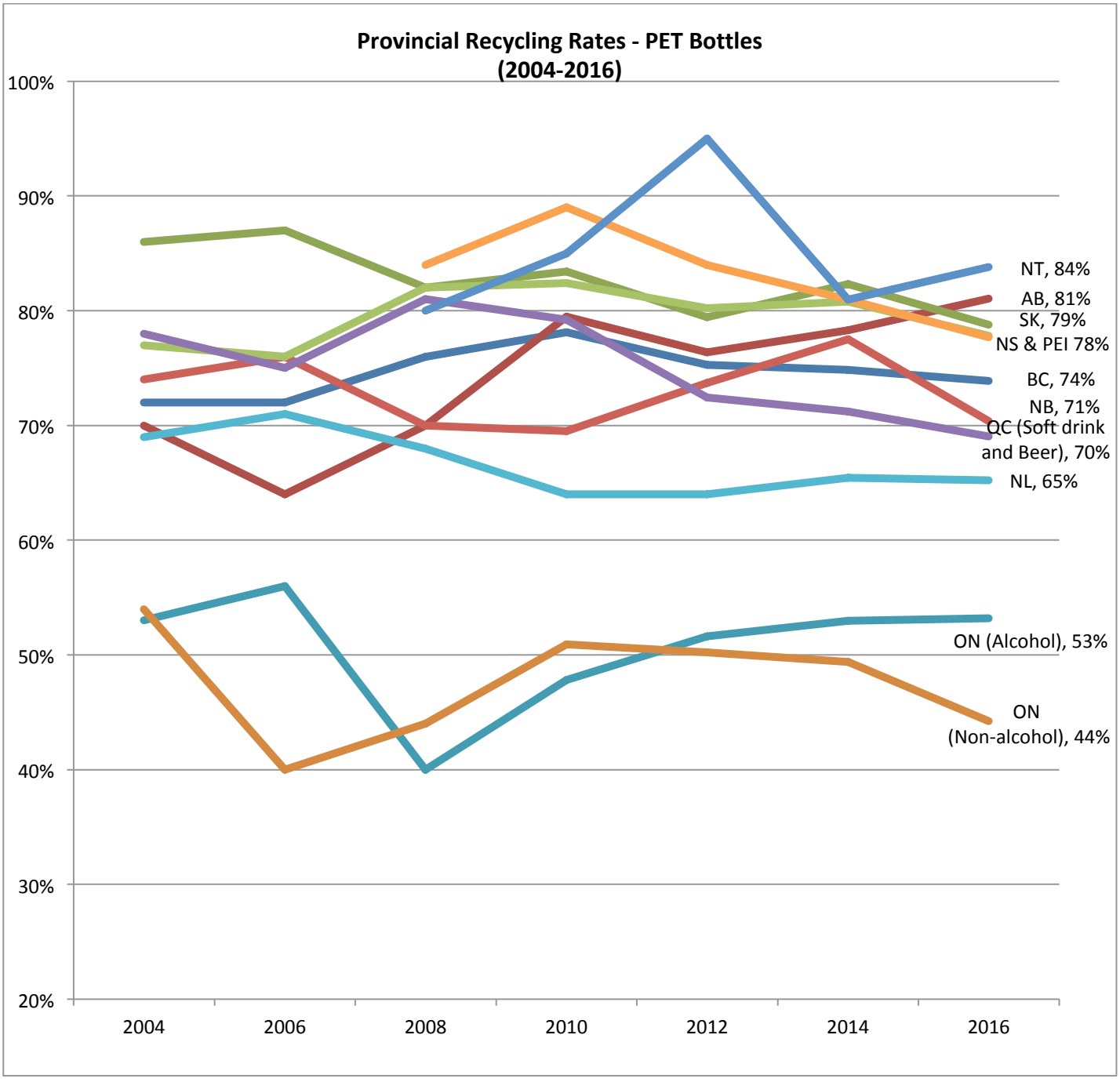

Figure 15 Provincial Recycling Rates, PET Bottles (2004-2016)

Gable Top and Aseptic Cartons, Bi-Metal Cans, and Other Plastics

Overall, the recycling rates for gable top and aseptic cartons, bi-metal cans, and other plastics are on the rise. Most provinces show increases in recycling rates since the last version of this report, which covered 2014 data. Figures 16 and 17 show 2016 recycling rates for these materials in provinces that report them.

When it comes to gable top and aseptic containers, Alberta reports the highest recycling rate at 72%. With the exception of Northwest Territories, all other provinces have recycling rates below 60%.

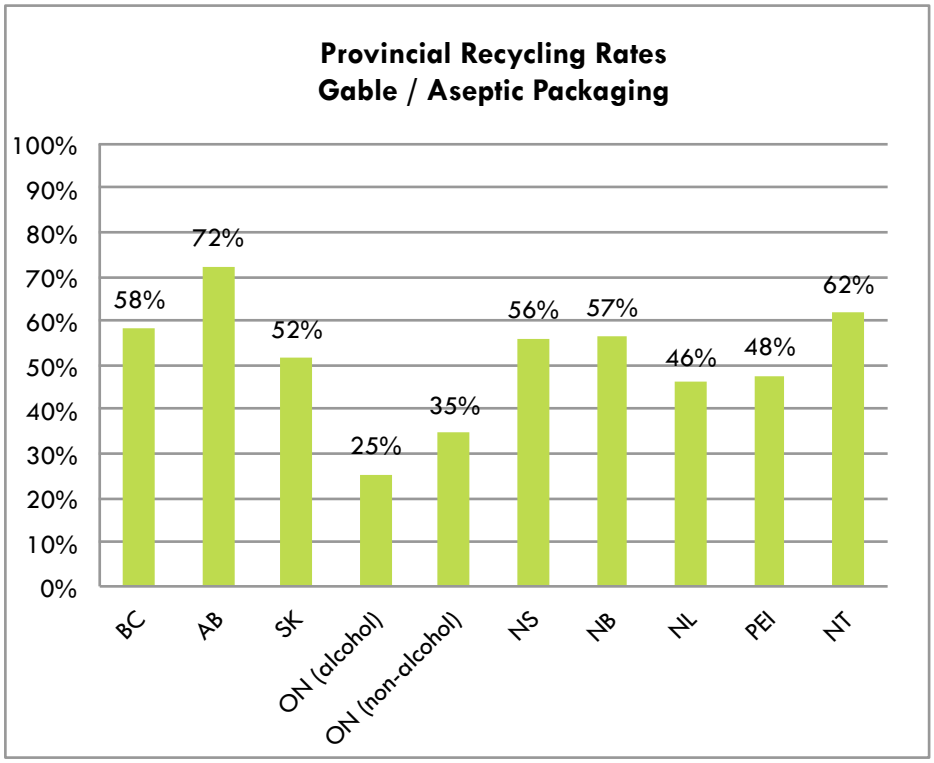

Figure 16 Provincial Recycling Rates, Gable/Aseptic Packaging (2016)

For bi-metal cans, the highest recycling rate was reported in B.C. (85%). Other provinces report rates of between 44% and 75% (see Figure 17).

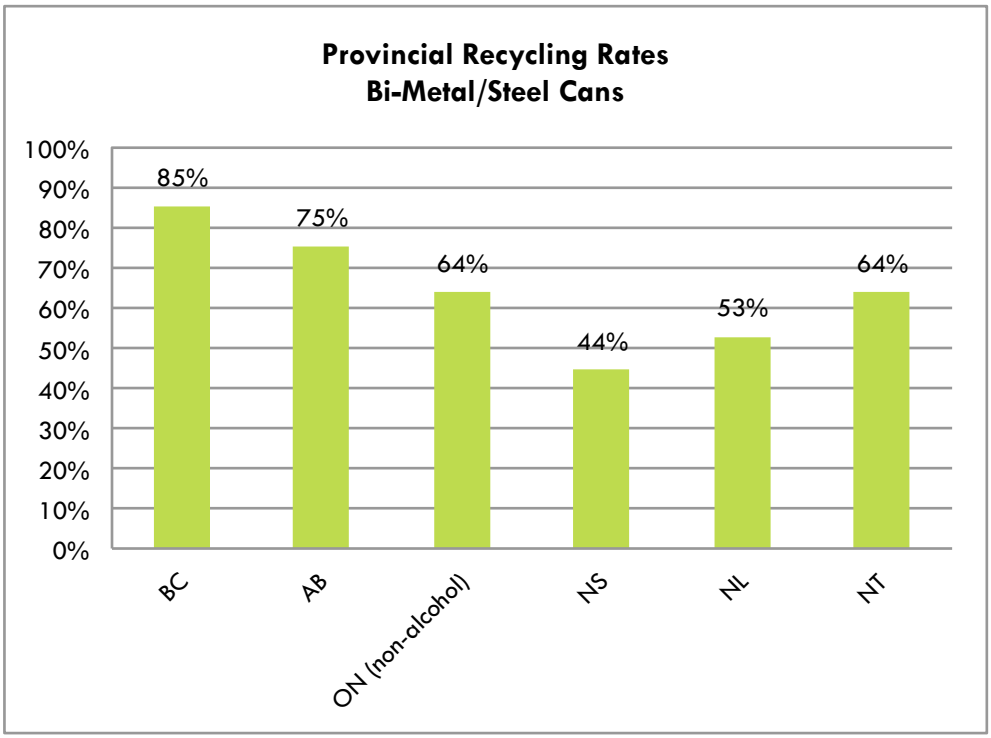

Figure 17 Provincial Recycling Rates, Bi-Metal/Steel Cans (2016)

Milk Containers

Most milk containers are made from high-density polyethylene (HDPE). Overall, milk jugs have a much higher recycling rate than cartons. This may be due to several factors, including the fact that there is a strong secondary market for HDPE material.

The way in which milk container recycling rates are calculated varies by province. In some provinces, the calculation is based on waste audit data, while in others it is based on actual sales and collection data. In some cases, the recycling rates are estimated by extrapolating from the collection rates of a more wide ranging material category, such as “cartons”, which include saseptic and gable top containers. Where milk containers are collected as part of a multi-material collection system, one collection rate is reported for the entire category of materials and no distinction is made between, for example, milk containers and orange juice containers.

In Alberta, because recycling rates are reported by material as opposed to by beverage type, it is impossible to determine a specific rate for milk containers.

The Northwest Territories used to report milk containers alone, but no longer does. As such, no rate is available.

In B.C., Manitoba, Ontario, and Québec, the majority of (if not all) milk containers are collected through municipal curbside programs along with other materials like paper and non-beverage packaging. Because of this, it is impossible to calculate a recycling rate specific to beverage containers. The same can be said for milk container recycling rates in the provinces of PEI and New Brunswick.

While Nova Scotia also collects milk containers via curbside, specific collection rates have historically been available from the Atlantic Dairy Council (ADC). According to the ADC, the collection rate for gable top cartons and HDPE milk jugs was 70.5% in 2012-2013. More recent data is not available at this time.