Kelleher Environmental

CIF Project #722

Diversion Vs Net Cost Analysis For The Ontario Blue Box System

Report

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Executive Summary

This report was commissioned by the Continuous Improvement Fund in to carry out a “high level analysis” of the most cost efficient way in which to add materials and increase diversion through the Ontario Blue Box system.

The impacts of changing Blue Box material composition on diversion rates and the sequence in which materials should be added to the Blue Box to increase diversion over time were also addressed.

The analysis was completed using 2014 PIM (Pay In Model) data by material. These data are based on 2012 reported Blue Box system costs, as well as 2012 reported tonnes diverted.

The following scenarios were considered in the Blue Box Diversion vs Net Cost Analysis:

- 60% Diversion At Lowest Blue Box System Net Cost;
- How to Achieve Highest Diversion at Lowest Blue Box System Net Cost;
- Most Cost Efficient Way to Add Materials To Increase Diversion
- Blank Slate Scenario – The Least Net Cost Way To Achieve 60% If We Were “Starting From Scratch” Today

2012 Ontario Blue Box System Performance and Net Cost

The Ontario Blue Box system diverted almost 893,000 tonnes of residential printed paper and packaging material from landfill in 2012. This system saves considerable landfill capacity in the Province. The Ontario Blue Box system diverted an estimated 62.8% of the residential printed paper and packaging sold into the Ontario residential marketplace in 2012, at a gross cost of $313 million, with revenues of $115 million, for a net system cost of about $198 million.

Most of the 2012 Blue Box system diversion was achieved by recycling of printed paper (52.7% of the total), followed by paper packaging (24.8% of the total), glass packaging (9.8%), plastic packaging (8.0%), with metal packaging (steel and aluminum) accounting for 4.8% of the 893,000 tonnes diverted. Therefore, paper based materials made up 77.5% of diversion achieved in 2012.

Achieving 60% Diversion Today

The analysis shows that in theory 60% diversion could be achieved for a net cost of $158 million per year if the following materials were removed from the Blue Box: polystyrene; plastic and paper laminates; plastic film, other plastic, gabletops and aseptics. In practice, it would take time for the Blue Box system to adapt to not collecting and processing these materials.

Increasing Diversion in the Blue Box System

The analysis concluded that maximizing the recovery of printed paper and paper packaging (rather than adding new materials) is the most cost efficient way to increase diversion performance of the Blue Box system. Recovery of printed paper is already high, therefore maximizing the recovery of printed paper only adds an additional 32,100 tonnes/year (2.3% diversion) at an estimated incremental cost of $3million /year to the Blue Box system, based on 2012 net costs and tonnages. This strategy would increase the diversion of the Blue Box system to 65.1 % for a total system cost of $201 million/year (based on 2012 Blue Box system costs).

Together, maximizing recovery of printed paper, steel packaging, glass packaging and boxboard would result in an overall estimated diversion rate of 73.4% for a total system cost of $221 million/year (measured against 2012 Blue Box system costs as a baseline).

Adding any other materials to the Blue Box will result in more modest increases in diversion at much higher incremental system costs. The addition of some plastic materials, particularly plastic film, adds significant cost to the Blue Box system. Because plastics make up a relatively small percentage by weight of Blue Box material, adding new plastic materials does not significantly increase waste diversion.

Diversion of plastics is considerably more expensive than diversion of other materials in the Blue Box, with a net diversion cost (collection + processing – material revenues) of $723/tonne for HDPE and $855/tonne for PET, based on 2012 data. Costs of recycling other plastic materials in the Blue Box reported in the 2014 PIM (based on 2012 Blue Box system data) are considerably higher - $1,242/tonne for other plastics; $1,861/tonne for plastic film; $1,895/tonne for plastic laminates and $2,255/tonne for polystyrene.

Looking at the most cost efficient way to achieve 60% diversion today, if we were “starting from scratch”, collection of printed paper and some paper packaging (OCC and boxboard but not gable-tops, paper laminates or aseptics) as well as glass, steel and aluminum, but no plastics (including no PET or HDPE) would reach 60% diversion (the current target) at a system cost of $99 million per year (based on 2012 Blue Box data). This option is not possible as the current Provincial 3Rs Regulations require municipalities which provide garbage collection to collect five mandatory materials (newspapers, steel, aluminum, PET and glass) and two additional materials from a longer list (aluminum foil, fine paper, magazines, cardboard, boxboard, rigid plastic containers e.g. HDPE, PS, EPS, plastic film, paper cups and plates, textiles). PET is on the current mandatory list in the current 3Rs Regulations, therefore not collecting PET is not an option for municipalities under current legislation.

The maximum possible diversion theoretically achievable in the Blue Box system today was estimated at 81.9%, for an estimated net Blue Box system cost of $382 million/year.

Future Blue Box Material Composition

The composition of Blue Box materials will change in the coming years because of various lifestyle and packaging format changes (more takeout food, convenience packaging, re-sealable packaging, less print media, etc.). Collecting the same list of Blue Box materials as we collect today will only achieve an estimated 57.7% diversion in the future, as the materials which currently make up a considerable portion of Blue Box weight in tonnes (particularly newspapers) are expected to be less over time with a trend to increased electronic media rather than print media which reduces the generation and consumption of paper. The cost to achieve 60% diversion at a future time is anticipated to be $218 million/year (based on 2012 cost data used in the 2014 Stewardship Ontario PIM workbook), because materials which are more costly to recycle would need to be added to the Blue Box program to reach a 60% diversion target.

With the future Blue Box material composition scenario, the cost of achieving 60% or higher diversion will increase considerably, as an increasing amount of lighter packaging materials (which cost more to collect, process and recycle) will need to be recovered. Based on 2012 Blue Box system costs, reaching a diversion rate of 75% is anticipated to cost $321 million/year (in today's $ and based on 2012 Blue Box data) by 2026, compared to a cost of $242 million at 2012 Blue Box composition values. Comparative net costs of achieving different diversion levels are shown in the table below.

Blue Box System Diversion With Future Material Composition	Estimated Blue Box System Costs Based on 2012 Cost Data ($million/year)	Estimated Blue Box System Costs With Future Composition in 2027 Based on 2012 Cost Data ($million/year)
60%	$158	$218
65%	$201	$224
70%	$211	$252
75%	$242	$321
80%	$325	$433

Conclusions and Recommendations

Increasing Blue Box System Diversion Performance

- Maximizing the recovery rate for printed paper to 80% is by far the most cost efficient way to increase diversion in the Blue Box system.

Adding Materials and Understanding Objectives and Costs

- No new materials should be added to any Blue Box system until the capture rate of the current "least cost to recycle" Blue Box material has been maximized – this is by far the best strategy to increase Blue Box system diversion in a cost efficient manner.

- All Blue Box system operators should clearly understand the cost implications of adding different materials to their existing Blue Box programs.
- In cases where addition of a new Blue Box material to an existing Blue Box program is being contemplated, an analysis of the cost implications should be carried out in all cases so that the cost implications are fully understood by all parties.
- The objectives of adding any new materials to any Blue Box system in Ontario need to be clearly articulated before any materials are added. If the objective is to provide convenient recycling opportunities to residents regardless of cost implications, then the cost implications should be clearly identified before program changes are made.

Increasing the Use of Depots To Provide Some Blue Box System Service

- Some materials which are collected curbside in the Blue Box system might be better suited to convenient depot collection.
- CIF should explore the cost and diversion implications of establishing a convenient depot system for drop-off collection of light weight packaging which is expensive to collect curbside. This is particularly applicable for plastic film and PS, but could apply to all materials above a certain cost threshold. This approach is being adopted in BC.
- The implications of moving all materials which cost > $1,000/tonne to manage curbside to a drop off depot system in Ontario should be explored by CIF.
- A comprehensive drop-off depot strategy could help to control increasing costs of the Ontario Blue Box system.

Analysis Updates

- This analysis should be updated annually when updated PIM data are available from Stewardship Ontario, as the amount of Blue Box materials which are available and recycled, as well as the per unit costs for each material change annually.
- The changing composition of Blue Box materials is likely to have a profound impact on Blue Box system diversion levels and costs over time and needs to be carefully monitored annually.

1. Introduction and Background

The Diversion Vs Cost Analysis study had two main objectives:

- Identify the combination of materials that should be collected in Ontario Blue Box systems to most cost efficiently reach different diversion targets and
- Address the sequence in which materials should be added to the Blue Box system to reach different diversion targets most cost efficiently, taking the changing composition of Blue Box materials into consideration.

The analysis was carried out first using a baseline of current Blue Box waste composition and then taking changing Blue Box waste composition over time into consideration.

2. Approach

The analysis was carried out using the following data inputs:

- **Blue Box Waste Composition:** The most current estimates for residential Blue Box materials supplied into the Ontario marketplace were obtained from the Stewardship Ontario fee setting Excel workbook (2014 PIM). The 2014 fees are based on 2012 estimates for residential printed paper and packaging materials supplied into the Ontario marketplace and 2012 Municipal Datacall tonnage and cost information.

- **Recovery Rates and Density for Blue Box Materials:** The 2014 PIM workbook contains information on recovery rates (%) and density (kg/m^3) for each Blue Box material.

- **Cost and Revenue Data By Blue Box Material:** Cost, revenue and net cost data for the recycling of each Blue Box material were obtained from the 2014 PIM workbook (Stewardship Ontario's 2014 fee setting Excel workbook) and are the most current data available with which to carry out this analysis. The values are based on verified 2012 Blue Box cost and tonnage data.

- **Future Blue Box Material Composition:** The analysis of diversion vs cost with changing Blue Box material composition over time used information from the City of Toronto Future Blue Bin Study (Kelleher Environmental, 2010) and the Ontario MRF Study (StewardEdge and RRS, 2012).

3. Blue Box Baseline (2012) And Assumptions For Blue Box Diversion Vs Net Cost Analysis

Information from the Stewardship Ontario 2014 PIM[1] was used to establish the Blue Box base case and subsequent analyses presented in this study. In 2012, an estimated 1.42 million tonnes of printed paper and packaging were sold into the Ontario residential marketplace. The calculated Blue Box system diversion rate is 62.8% and the total Blue Box system cost was established at $313.5 million gross, with $115.5 million in material revenues, for a net Blue Box system cost of $198 million.

3.1 Net Cost of Diversion By Material In The Existing Blue Box System

The data for the Blue Box baseline is presented in Table 1 which shows the following information for each material:

- Tonnes sold into the Ontario residential marketplace in 2012;
- Tonnes recovered through the Ontario Blue Box system in 2012;
- Percentage recovery achieved by Blue Box material in 2012 and
- Gross costs, revenues and net costs per tonne by material in 2012.

[1] PIM refers to Pay In Model. The Stewardship Ontario PIM workbook is produced each year to calculate steward fees based on full Blue Box system costs and tonnages reported in the most recent Municipal Datacall. The 2014 PIM which was used for this analysis contains 2012 reported and verified Blue Box system data.

Table 1: 2012 Ontario Blue Box Base Case Data

Blue Box Material	2012 Residential Blue Box Material Generation (Sold Into Ontario Marketplace (tonnes)	2012 Residential Blue Box Material Recovery (tonnes)	2012 Gross Cost Per Tonne By Material ($/tonne, rounded to nearest $)	2012 Gross Revenue Per Tonne by Material ($/tonne, rounded to nearest $)	2012 Net Cost or Revenue per tonne By Material ($/tonne, rounded to nearest $)	Contribution to 2012 Blue Box System Costs By Material (rounded to nearest $1,000)
Newsprint - CNA/OCNA	217,375	203,689	$173	$88	$85	$17,383,000
Newsprint - Non-CNA/OCNA	148,405	139,062	$173	$88	$85	$11,868,000
Magazines and Catalogues	78,908	61,776	$173	$88	$85	$5,272,000
Telephone Books	8,329	7,968	$211	$92	$119	$950,000
Other Printed Paper	128,245	57,949	$185	$89	$96	$5,579,000
Old Corrugated Containers (OCC)	169,361	144,539	$483	$118	$365	$52,710,000
Boxboard	163,988	67,998	$288	$89	$199	$13,529,000
Gabletop	14,249	6,833	$1,171	$98	$1,073	$7,330,000
Paper Laminants	39,205	1,264	$960	-	$960	$1,214,000
Aseptic Containers	5,820	955	$960	$96	$865	$826,000
PET bottles	56,848	32,701	$1,281	$425	$855	$27,970,000
HDPE bottles	27,598	16,409	$1,196	$474	$723	$11,857,000
Plastic Film	54,383	4,923	$1,895	$33	$1,862	$9,165,000
Plastic Laminants	35,391	7	$1,895	-	$1,895	$13,000
Polystyrene	21,391	1,448	$2,292	$37	$2,255	$3,266,000
Other Plastics	70,790	16,146	$1,388	$146	$1,242	$20,051,000
Steel Food & Beverage Cans	45,286	29,187	$352	$263	$89	$2,605,000
Steel Aerosols	4,079	942	$352	$263	$89	$84,000
Steel Paint Cans	5,072	696	$352	$263	$89	$62,000
Aluminum Food & Beverage Cans	22,552	10,860	$1,114	$1,400	$(286)	-$3,106,000
Other Aluminum Packaging	4,521	348	$1,114	$1,400	$(286)	-$100,000
Clear Glass	74,522	70,014	$136	$26	$110	$7,703,000
Coloured Glass	25,277	17,210	$125	$21	$105	$1,800,000
Total	**1,421,595**	**892,924**				**$198,000,000**

The table shows that the 2012 Ontario Blue Box system diverted 892,924 tonnes of residential printed paper and packaging from disposal to recycling at a total net system cost of $198 million. The comparative cost/tonne of recycling various Blue Box materials (taken from the 2014 PIM) is presented in Figure 1. Key observations on the net recycling costs by material are:

- **Aluminum** is the cheapest material to recycle (measured as $/tonne). It costs $1,114/tonne to collect and process aluminum in the Blue Box system. This cost is more than offset by revenues of $1,400/tonne for a net credit of $286/tonne for aluminum in the Blue Box system (because of high material revenues).
- **Printed papers** are the "next least expensive" materials to recycle, generally costing in the range of $173-$211/tonne to collect and process, with revenues of about $90/tonne resulting in the following net costs per tonne:
  - Newspaper and magazines - $85/tonne;
  - Other printed paper - $96/tonne and
  - Telephone books - $119/tonne
- **Steel** costs an estimated $352/tonne to collect, but generates revenues of $263/tonne for a net recycling cost of $89/tonne.
- **Glass** costs $125-$136/tonne to collect and process with an average revenue of about $21 to $26/tonne for a net recycling cost of $105-$110/tonne to recycle.
- Within the **paper packaging** category:
  - boxboard ($199/tonne net cost) and OCC ($370/tonne net cost) are the least expensive materials to divert;
  - paper laminates ($960/tonne net cost), gabletops ($1,073 /tonne net cost) and aseptic containers ($865/tonne net cost) are considerably more expensive
- Within the **plastics category:**
  - HDPE (at a net recycling cost of $723/tonne) and PET (at a net recycling cost of $855/tonne) are the least expensive materials to recycle.
  - The category "other plastics" has a net recycling cost of $1,300/tonne;
  - Three plastic materials are considerably more expensive than other materials to recycle in the Blue Box system. These are:
    - plastic film (at a net recycling cost of $1,877/tonne);
    - plastic laminates (at a net recycling cost of $1,904/tonne) and
    - polystyrene (at a net recycling cost of $2,400/tonne).

The relative recycling costs of different materials in the Blue Box system are shown in Figure 1.

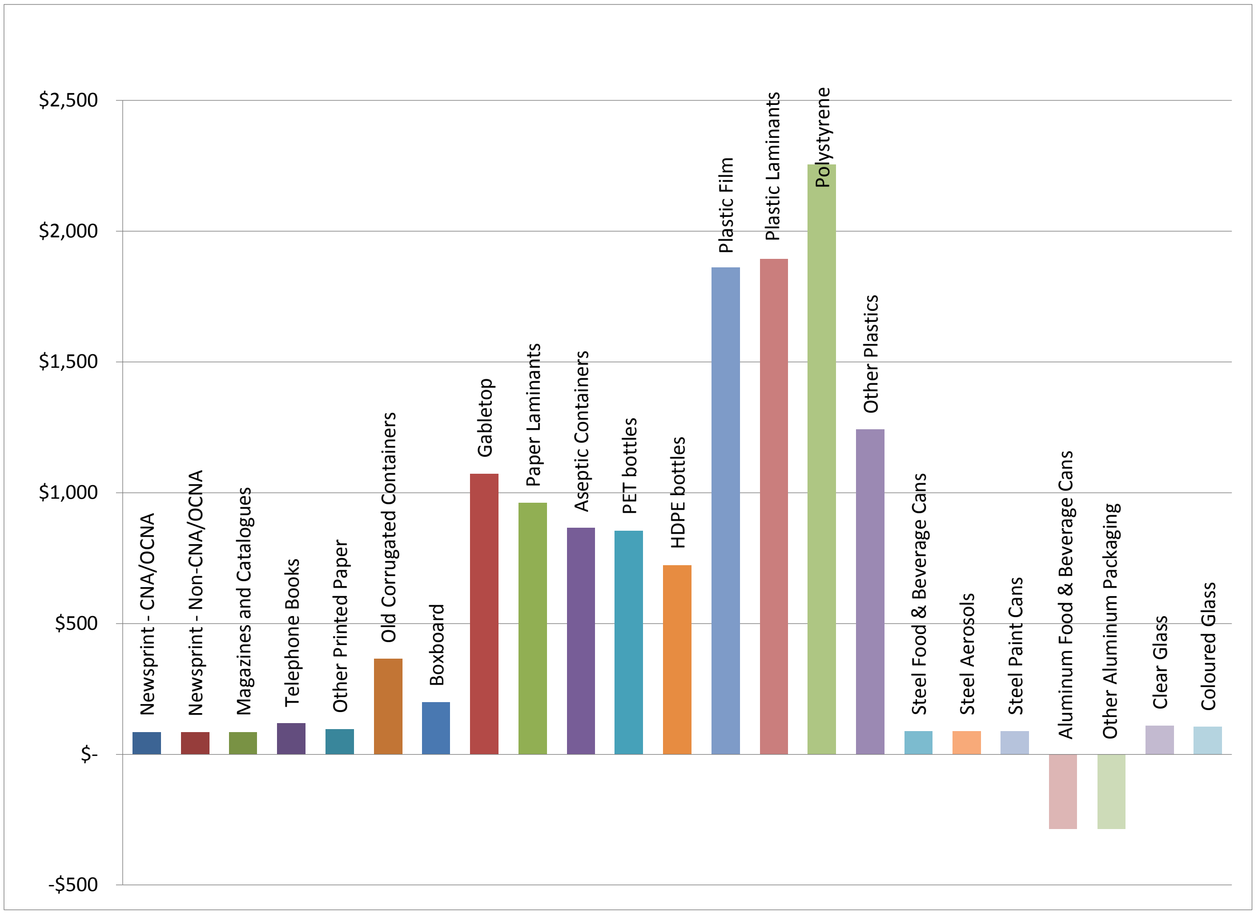


Figure 1: Ontario Blue Box 2012 Net Cost or Revenue per Tonne By Material

3.2 Diversion Contribution By Material WithinThe Ontario Blue Box System

Diversion achieved by the Blue Box system (62.8% in 2012) is currently measured by weight. The extent to which the materials collected in the Blue Box system contributed to the total diversion of tonnes in 2012, as well as the overall recovery by material category (expressed as % recycled) in 2012 are presented in Table 2.

Table 2: Diversion By Material in the Ontario Blue Box, 2012

Material in the Blue Box	2012 Blue Box Materials Sold Into the Ontario Marketplace (tonnes)	2012 Blue Box Materials Recycled (tonnes)	2012 Recovery % By Material	2012 % Of 892,924 Tonnes Recycled
Newsprint - CNA/OCNA	217,375	203,689	93.7%	22.8%
Newsprint - Non-CNA/OCNA	148,405	139,062	93.7%	15.6%
Magazines and Catalogues	78,908	61,776	78.3%	6.9%
Telephone Books	8,329	7,968	95.7%	0.9%
Other Printed Paper	128,245	57,949	45.2%	6.5%
Total Printed Paper	**581,262**	**470,444**	**80.9%**	**52.7%**
Old Corrugated Containers	169,361	144,539	85.3%	16.2%
Boxboard	163,988	67,998	41.5%	7.6%
Gabletop	14,249	6,833	48.0%	0.8%
Paper Laminants	39,205	1,264	3.2%	0.1%
Aseptic Containers	5,820	955	16.4%	0.1%
Total Paper Packaging	**392,622**	**221,589**	**56.4%**	**24.8%**
PET bottles	56,848	32,701	57.5%	3.7%
HDPE bottles	27,598	16,409	59.5%	1.8%
Plastic Film	54,383	4,923	9.1%	0.6%
Plastic Laminants	35,391	7	0.0%	0.0%
Polystyrene	21,391	1,448	6.8%	0.2%
Other Plastics	70,790	16,146	22.8%	1.8%
Total Plastics	**266,401**	**71,634**	**26.9%**	**8.0%**
Steel Food & Beverage Cans	45,286	29,187	64.5%	3.3%
Steel Aerosols	4,079	942	23.1%	0.1%
Steel Paint Cans	5,072	696	13.7%	0.1%
Total Steel	**54,437**	**30,825**	**56.6%**	**3.5%**
Aluminum Food & Beverage Cans	22,552	10,860	48.2%	1.2%
Other Aluminum Packaging	4,521	348	7.7%	0.0%
Total Aluminum	**27,073**	**11,208**	**41.4%**	**1.3%**
Clear Glass	74,522	70,014	94.0%	7.8%
Coloured Glass	25,277	17,210	68.1%	1.9%
Total Glass	**99,799**	**87,224**	**87.4%**	**9.8%**
Total	**1,421,595**	**892,924**	**62.8%**	**100%**

The table shows that printed paper (newspapers, magazines, etc.) made up 470,444 tonnes (52.7%) of the 892,924 tonnes of Blue Box materials recycled in Ontario in 2012. Paper packaging (OCC, boxboard, cereal boxes and shoe boxes etc.) made up an additional 221,589 tonnes (24.8% of the total Blue Box materials recycled). Together, therefore, paper products (printed paper and packaging) contribute 77.5% of the Blue Box tonnage recycled in 2012. The other materials in the Blue Box contribute much smaller tonnages to the total recycled:

- Glass contributed 87,224 tonnes (9.8% of the total) in 2011;
- Plastic contributed 71,634 tonnes (8.0% of the total);
- Steel contributed 30,825 tonnes (3.5% of the total) and
- Aluminum contributed 11,208 tonnes (1.3% of the total).

Table 3 summarizes the information on the contribution of each material category to total Blue Box diversion in 2012, along with the recovery rate (as a %) by broad material category. The information is presented graphically in Figure 2.

Table 3: Summary of Diversion Performance and Contribution to Total Diversion in the Ontario Blue Box, By Broad Material Category, 2012

Ontario 2012	Generation (tonnes)	Current Recovery (tonnes)	Recycling Rate 2012	% Contribution to 892,924 tonnes of diversion
Total Printed Paper	581.262	470,444	80.9%	52.7%
Total Paper Packaging	392,622	221,589	56.4%	24.8%
Total Plastics	266,401	71,634	26.9%	8.0%
Total Steel	54,437	30,825	56.6%	3.5%
Total Aluminum	27,073	11,208	41.4%	1.3%
Total Glass	99,799	87,224	87.4%	9.8%
Total	**1,421,595**	**892,924**	**62.8%**	**100%**

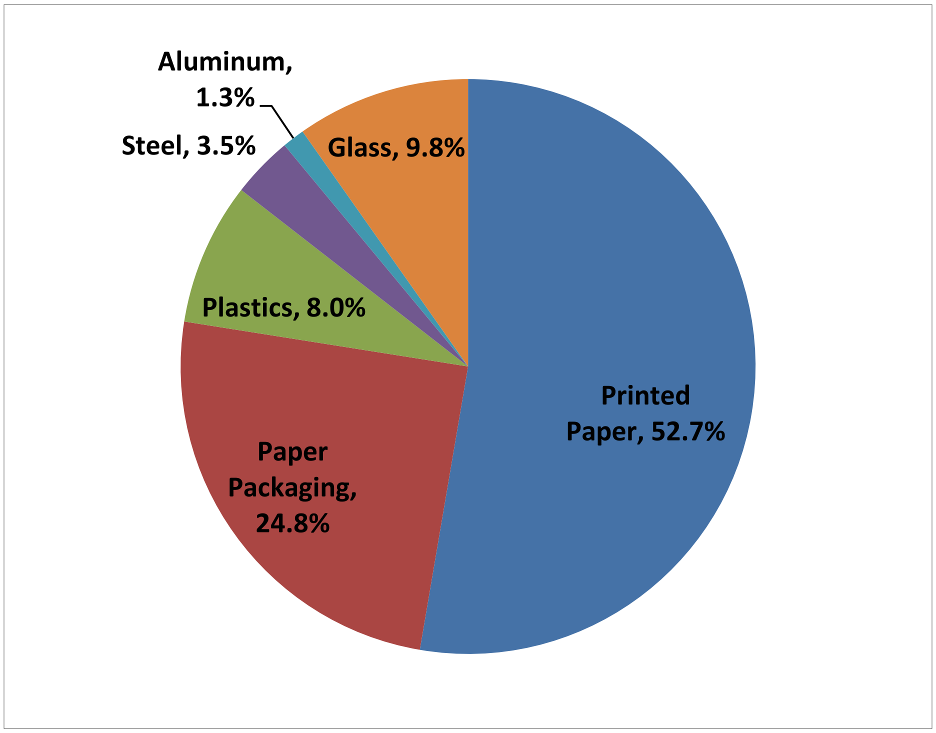


Figure 2: Contribution by Material Category to Blue Box Diversion Tonnage in 2012 (%)

The recycling rate by broad Blue Box material category (printed paper, paper packaging, plastic, steel, glass and aluminum) is presented in Figure 3 which shows:

- High recycling rates for printed paper and glass (80.9% and 87.4% respectively);
- Recycling rates > 50% for paper packaging and steel (56.4% and 56.6% respectively);
- A reported recycling rate of 41.4% for aluminum. The actual recycling rate for aluminum is likely much higher as very little aluminum is found in the garbage stream through residential waste audits. The low reported recycling rate is likely due to high "away from home" consumption of beverages packaged in aluminum, and possibly some scavenging of aluminum containers from Blue Boxes set out at the curb;
- A recycling rate of 26.9% overall for plastics.

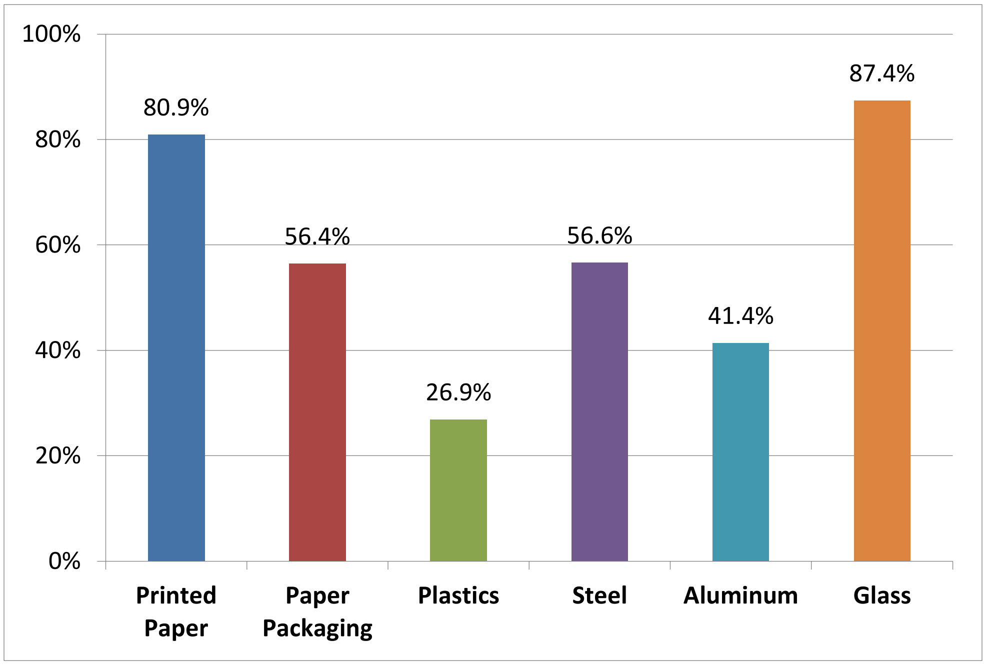


Figure 3: Recycling Rate % by Broad Blue Box Material Category, 2012

3.3 Net Cost ($) Of 1% of Diversion By Material In the Current Blue Box

In 2012, about 1.42 million tonnes of residential Blue Box materials were sold into the Ontario marketplace. Each 1% increase in diversion therefore requires the recycling of an additional 14,200 tonnes of Blue Box material.

Table 4 shows the theoretical cost to achieve 1% of additional diversion in the Ontario Blue Box system (1% of 1.42 million tonnes, which is 14,200 tonnes) for each material in the Blue Box system. The costs shown in the table are considered "theoretical" because in practice, increasing diversion by 14,200 tonnes would not immediately change the system costs by the straight line costs presented in the table. The system costs would gradually change over time to accommodate the new tonnage and mix of Blue Box materials.

The table shows that diversion of an additional 14,200 tonnes of material in the 2012 Ontario Blue Box system varies significantly by the Blue Box material considered. The least cost materials are:

- Aluminum, which is a net benefit to the Blue Box system because of high material revenues, but realistically there is virtually no additional aluminum available for diversion;
- Newspapers and magazines - Diversion of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $1.2 million to the 2012 Blue Box system costs;
- Printed Paper - diversion of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $1.4 million to 2012 Blue Box system costs
- Glass - diversion of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $1.5 million to 2012 Blue Box system costs
- Steel - diversion of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $1.3 million to 2012 Blue Box system costs
- Telephone Books - diversion of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $1.7 million to 2012 Blue Box system costs and
- Boxboard- diversion of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $2.8 million to 2012 Blue Box system costs.

The relative costs of achieving 1% additional diversion by material is presented in Figure 4, which illustrates the dramatically higher cost of achieving an additional 1% diversion through plastic materials compared to paper materials, based on 2012 Blue Box system costs.

Table 4 : Cost of Additional 1% Diversion By Material In Ontario Blue Box System Based On 2012 Net Costs By Material

Ontario 2012	2012 Residential Blue Box Material Generation (Sold Into Ontario Marketplace (tonnes)	2012 Residential Blue Box Material Recovery (tonnes)	2012 Net Cost or Revenue per tonne By Material ($/tonne)	Contribution to 2012 Blue Box System Costs By Material	Theoretical Cost to Divert 14,200 tonnes of material and contribute 1% Additional Diversion To Ontario Blue Box System
Newsprint - CNA/OCNA	217,375	203,689	$85	$17,383,000	$1,213,000
Newsprint - Non-CNA/OCNA	148,405	139,062	$85	$11,868,000	$1,213,000
Magazines and Catalogues	78,908	61,776	$85	$5,272,000	$1,213,000
Telephone Books	8,329	7,968	$119	$950,000	$1,696,000
Other Printed Paper	128,245	57,949	$96	$5,579,000	$1,369,000
Old Corrugated Containers	169,361	144,539	$365	$52,710,000	$5,184,000
Boxboard	163,988	67,998	$199	$13,529,000	$2,828,000
Gabletop	14,249	6,833	$1,073	$7,330,000	$15,249,000
Paper Laminants	39,205	1,264	$960	$1,214,000	$13,654,000
Aseptic Containers	5,820	955	$865	$826,000	$12,291,000
PET bottles	56,848	32,701	$855	$27,970,000	$12,159,000
HDPE bottles	27,598	16,409	$723	$11,857,000	$10,272,000
Plastic Film	54,383	4,923	$1,862	$9,165,000	$26,464,000
Plastic Laminants	35,391	7	$1,895	$13,000	$26,936,000
Polystyrene	21,391	1,448	$2,255	$3,266,000	$32,063,000
Other Plastics	70,790	16,146	$1,242	$20,051,000	$17,654,000
Steel Food & Beverage Cans	45,286	29,187	$89	$2,605,000	$1,269,000
Steel Aerosols	4,079	942	$89	$84,000	$1,269,000
Steel Paint Cans	5,072	696	$89	$62,000	$1,268,000
Aluminum Food & Beverage Cans	22,552	10,860	$(286)	-$3,106,000	-$4,065,000
Other Aluminum Packaging	4,521	348	$(286)	-$100,000	-$4,065,000
Clear Glass	74,522	70,014	$110	$7,703,000	$1,564,000
Coloured Glass	25,277	17,210	$105	$1,800,000	$1,487,000
Total	**1,421,595**	**892,924**		**$198,000,000**	

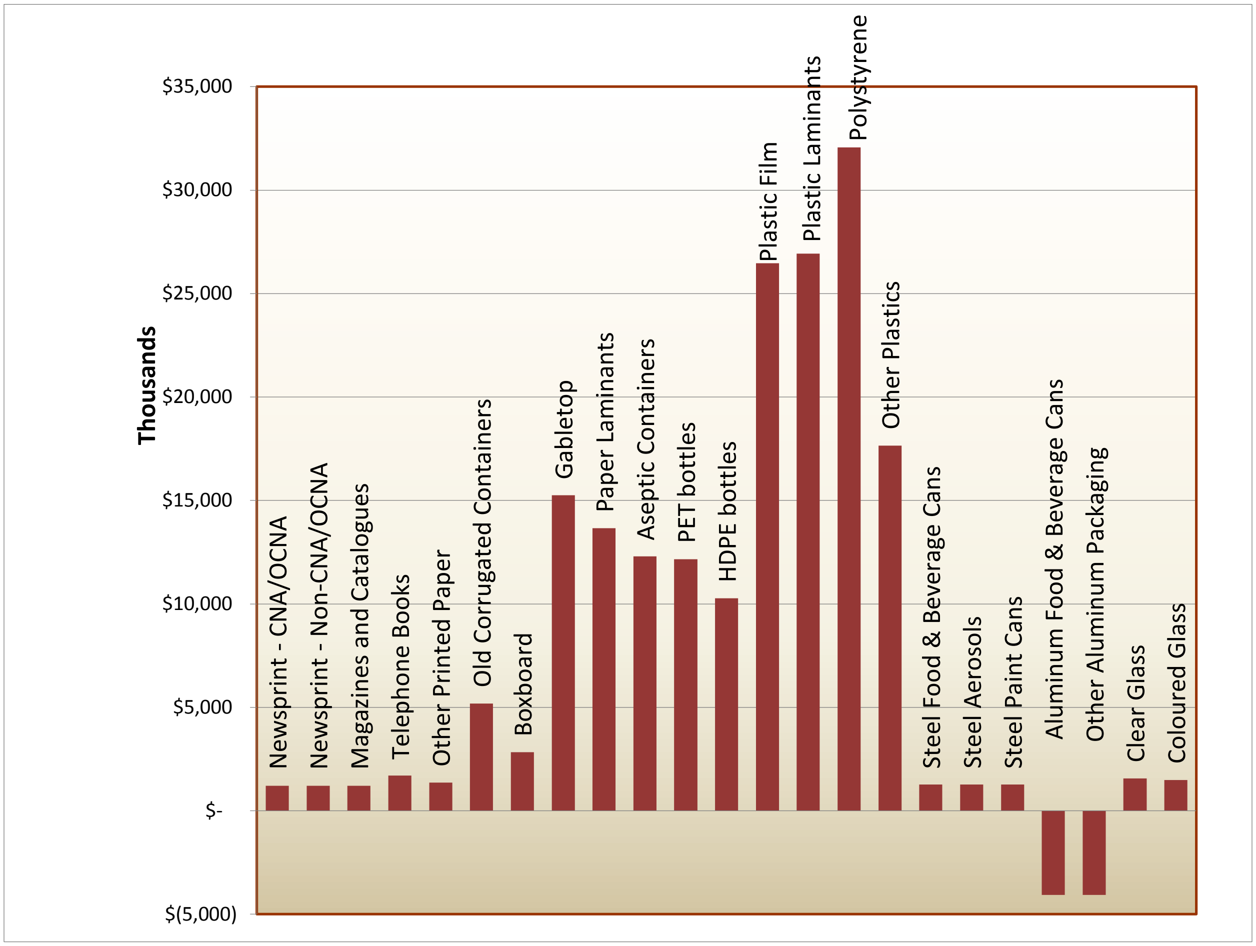


Figure 4: Theoretical Cost Per Additional 1% Diversion By Material in the Ontario Blue Box System (2012)

After the list of least expensive to recycle Blue Box materials (aluminum, printed papers, glass, steel, boxboard) have been added to the Blue Box program, the next least expensive recycling comes from increasing recycling of OCC, where recycling of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $5.2 million to 2011 Blue Box system costs.

After OCC, there is a significant jump in the cost of diverting 14,200 tonnes for an additional 1% diversion performance. The next two materials in the "least cost next tonne" category are:

- HDPE - recycling of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $10.3 million to 2012 Blue Box system costs and

- PET - recycling of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $12.2 million to 2012 Blue Box system costs.

It might be possible to increase diversion less expensively by focussing on increasing diversion PET bottles first rather than PET thermoform containers. There is no breakdown available comparing the cost of recycling PET thermoforms (e.g. salad containers, etc.) compared to recycling PET bottles (e.g. water bottles). This breakdown would likely indicate that the cost of recycling PET bottles is less than recycling PET thermoforms, because PET thermoforms are likely lower density (and therefore more expensive to collect).

The most expensive materials to recycle in the Blue Box system based on 2012 costs are:

- Polystrene –recycling of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $32 million to the 2012 Ontario Blue Box system costs, and
- Plastic Film and Laminates - recycling of an additional 14,200 tonnes (additional 1% diversion) would add an estimated $26.4 to $26.9 million to 2012 Blue Box system costs.

3.4 Maximum Potential Recovery of Least Expensive Blue Box Materials

For the analysis of higher diversion scenarios, a limit was placed on the likely highest recovery practically achievable for each Blue Box material, taking potential increased levels of participation and capture into account. Values assumed by Blue Box material are presented in Table 5, which shows the current amount of each Blue Box material collected, the current recycling rate, the highest recycling rate considered practically achievable based on the highest levels achieved in other programs, and the highest practical limit based on the recovery performance of similar materials, based on professional judgement, as well as the tonnes that could be added to the Blue Box if the highest recycling rate was achieved.

The assumed maximum recovery rates for other materials through targeted education campaigns, and policies such as PAYT (pay as you throw), bag limits, etc. were as follows:

- It was assumed that recovery rate for most paper packaging could reach 85% to 90% (depending on the existing recovery rate; the exception was for paper laminates where the current recovery rate is 1%; a maximum rate of 25% was used for the analysis;
- For plastics, a 25% recovery rate was considered achievable for plastics with an existing low recovery rate; for readily identifiable plastics like PET and HDPE a recovery rate of 85% to 90% was considered achievable, and for plastic film a recovery rate of 60% was considered achievable, based on experience with similar materials in other programs.

Table 5 : Maximum Assumed Potential Recovery Practically Achievable For Each Blue Box Material

Material in Ontario Blue Box	Sold Into the Ontario Residential Market 2012 (tonnes)	Recovery in the Ontario Blue Box 2012 (tonnes)	Recovery Rate in Ontario Blue Box 2012 (%)	Max Realistic Recovery Achievable (%) Through Blue Box	Max Realistic Recovery Achievable Through Ontario Blue Box (tonnes)	Available tonnes for higher diversion scenarios Based on 2012 Blue Box Data
Newsprint - CNA/OCNA	217,375	203,689	93.7%	95%	205,801	2,112
Newsprint - Non-CNA/OCNA	148,405	139,062	93.7%	95%	140,503	1,441
Magazines and Catalogues	78,908	61,776	78.3%	95%	74,706	12,930
Telephone Books	8,329	7,968	95.7%	95%	7,886	0
Other Printed Paper	128,245	57,949	45.2%	75%	96,184	38,235
OCC	169,361	144,539	85.3%	90%	152,425	7,886
Boxboard	163,988	67,998	41.5%	85%	139,390	71,392
Gabletop	14,249	6,833	48.0%	85%	12,112	5,279
Paper Laminants	39,205	1,264	3.2%	25%	9,801	8,537
Aseptic Containers	5,820	955	16.4%	85%	4,947	3,992
PET bottles	56,848	32,701	57.5%	90%	51,163	18,462
HDPE bottles	27,598	16,409	59.5%	85%	23,458	7,049
Plastic Film	54,383	4,923	9.1%	60%	32,630	27,707
Plastic Laminants	35,391	7	0.0%	25%	8,848	8,841
Polystyrene	21,391	1,448	6.8%	25%	5,348	3,900
Other Plastics	70,790	16,146	22.8%	75%	53,093	36,947
Steel Food & Beverage Cans	45,286	29,187	64.5%	85%	38,493	9,306
Steel Aerosols	4,079	942	23.1%	85%	3,467	2,525
Steel Paint Cans	5,072	696	13.7%	60%	3,043	2,347
Aluminum Food & Beverage Cans	22,552	10,860	48.2%	80%	18,042	0[2]
Other Aluminum Packaging	4,521	348	7.7%	60%	2,713	0[3]
Clear Glass	74,522	70,014	94.0%	94%	70,016	2
Coloured Glass	25,277	17,210	68.1%	80%	20,222	3,012
Total	**1,421,595**	**892,924**	**62.8%**		**1,174,289**	**281,365**

[2] Additional aluminum recovery was assumed to be zero to develop a conservative cost estimate for higher diversion scenarios. Additional aluminum recovery actually reduces the Blue Box system costs, but residential audits indicate that very little aluminum remains in the residential waste stream. It is suspected that a lot of product packaged in aluminum is consumed away from home.

[3] See note above re aluminum assumptions for the diversion vs cost scenarios

The table shows that using the 2012 Blue Box performance baseline, about 281,400 additional tonnes is the most that could realistically be collected in the Ontario Blue Box program. Collecting this additional tonnage would increase the recycling rate to about 81.9%, which is considered the highest diversion rate that could practically be achieved in the Blue Box system today.

Because the diversion vs net cost analysis is very sensitive to the assumptions related to aluminum (because of its high value), it was assumed for the analysis that no further aluminum could be recovered through the Blue Box. As shown in Table 6, steward reports indicate that over 27,073 tonnes of aluminum are sold into the Ontario residential marketplace. A reported 11,208 tonnes are recycled. This implies a low recovery rate for aluminum packaging. However, residential waste audits in Toronto and Peel indicate that very little aluminum is left in the residential waste stream and that high recovery rates are already achieved for food and beverage aluminum.

Table 6: Aluminum Values In 2014 PIM (2012 Tonnage Values)

	Reported Tonnage Sold Into Ontario Marketplace (2012)	Tonnage Recovered in Ontario Blue Box system (2012)	Calculated Recovery Rate Based on Reported Information
Aluminum Food & Beverage Cans	22,552	10,860	48.2%
Other Aluminum Packaging	4,521	348	7.7%
Total Aluminum	**27,073**	**11,208**	**41.4%**

4. Blue Box Diversion Vs Cost Analysis With 2012 Blue Box Material Composition

The information presented in the previous sections was used to carry out an analysis of the most cost efficient way to increase or decrease diversion levels in the Blue Box system based on 2012 tonnage and net cost data, using the current mix of materials recovered as the baseline. The following scenarios were considered:

- Remove materials (and net costs) from the Blue Box system to reduce overall Blue Box system performance to achieve 60% (the mandated target); diversion performance was 62.8% in 2012, and
- Add materials to the Blue Box system to achieve higher diversion levels in the most cost effective way by increasing the recovery of the least net cost materials in the Blue Box system first.

4.1 Removing Materials From The Blue Box System To Reduce Net System Costs But Achieve Lower Diversion

The Blue Box achieved a 62.8% diversion rate at a total net cost of $198 million in 2012. The required target is to reach 60% diversion. The theoretical analysis in this section identifies ways to reduce net costs in the Blue Box system by systematically removing the most expensive materials from collection in the system. While removal of one expensive tonne of Blue Box material would not reduce the net system costs by the net cost/tonne to recycle the removed material, over time the Blue Box system would adapt if less tonnes were recycled, or less expensive materials remained in the system and expensive materials were removed. The results of the analysis are presented in Table 7 and Figure 5.

Table 7 shows that in theory a recycling rate of 60.3% could be achieved at a net cost of $158 million per year (based on 2012 Blue Box system net costs and tonnages). This would be accomplished by phasing out the collection of selected materials in the Blue Box system in the following order:

- Polystyrene (PS) first;
- Plastic laminates second;
- Plastic film third;
- Other plastics fourth;
- Gabletops fifth;
- Paper laminates fifth and
- Aseptic containers sixth

It is possible to get slightly above 60% diversion at a Blue Box net system cost of $158 million by removing the six most expensive materials. The next most expensive material is PET. Under the current Ontario Provincial 3Rs regulations it would not be possible to remove PET from existing Blue Box systems as PET is one of the five “Basic Blue Box” materials that must be collected in all Blue Box programs).

In practice it would take a number of years to achieve the theoretical net cost savings as collection routes and processing systems and contracts would need to be redesigned to adjust to changed tonnages and Blue Box material composition.

Table 7: Theoretical Diversion and Net Cost Impacts of Phasing Out Collection Of Selected Materials In The Ontario Blue Box System To Reduce Net Costs

Blue Box Material No Longer Collected in the Blue Box System	Net Cost Reduction By Removing The Material (Millions $/year)	Reduction in Diversion By Removing The Material (%)	Theoretical Blue Box Annual System Net Cost Over Time Following Removal of Selected Materials ($millions/year)	Tonnes Removed By Removing The Material (tonnes)	Blue Box Diversion Rate After Material Phased Out (%)
Polystyrene	$2.24	1.51%	$194.76	1,018	62.7%
Plastic Laminates	$0.01	0.00%	$194.75	7	62.7%
Plastic Film	$9.16	0.35%	$185.59	4,923	62.4%
Other Plastic	$20.05	1.14%	$165.54	16,146	61.2%
Gabletop	$5.77	0.74%	$159.77	6,833	60.4%
Paper Laminates	$1.21	0.09%	$158.56	1,264	60.4%
Aseptics	$0.83	0.07%	$157.73	955	60.3%
PET	$29.53	3.52%	$128.20	32,701	56.8%

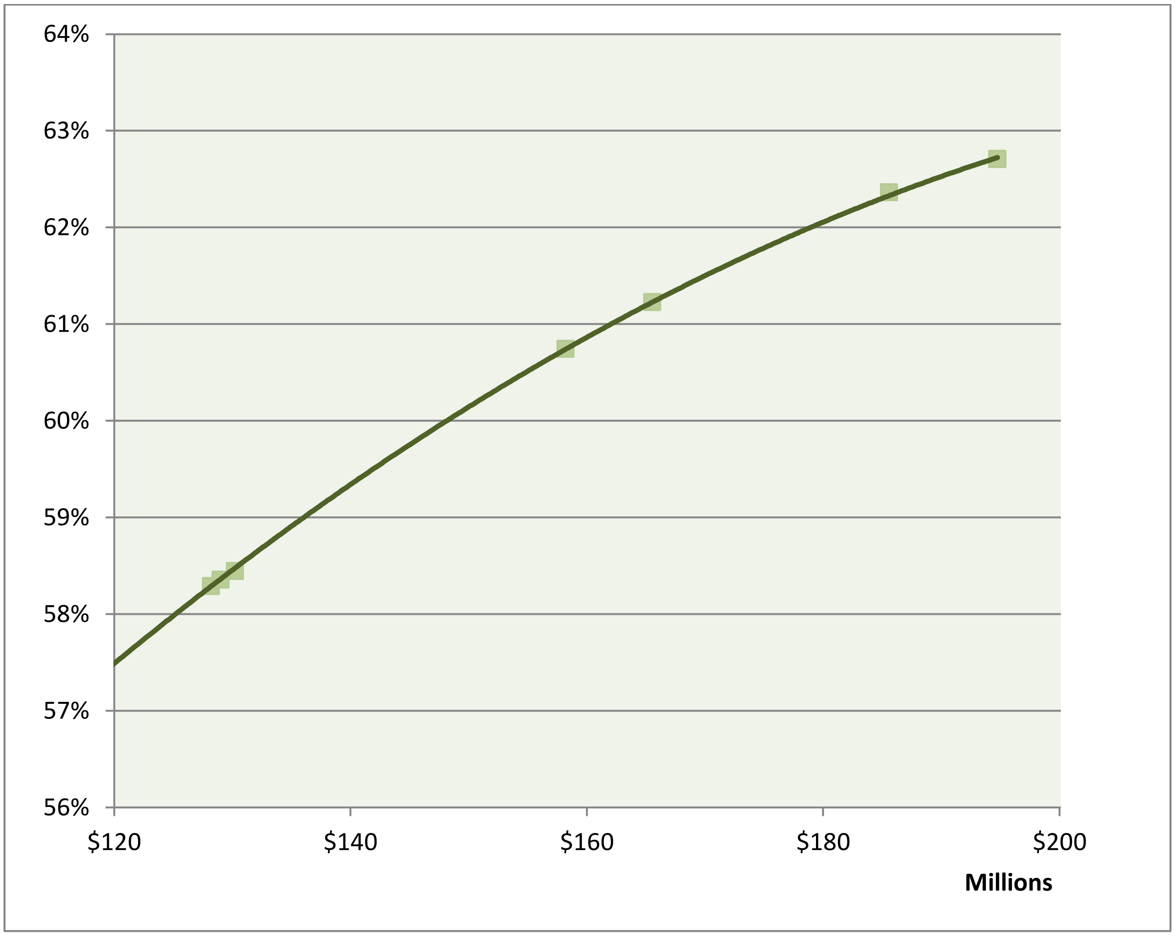


Figure 5: Blue Box System Diversion Performance vs Annual Net System Cost Achieved By Phasing Out Collection of Selected Materials to Reduce System Costs (Based on 2012 Blue Box Costs and Tonnages)

4.2 Least Cost Way To Increase Blue Box System Diversion Rate (Based on 2012 Blue Box System Tonnage and Cost)

The least cost analysis looked at the most cost efficient way of adding materials to the Blue Box, recognizing that there is a limit to the diversion achievable by material. Five scenarios are presented which sequentially lead to 72.9% diversion in a relatively cost efficient manner, based on 2012 Blue Box system tonnages and net system costs. These scenarios focus on increasing the recovery of the least net cost materials (other paper, steel, glass and boxboard) to the highest capture rate considered realistically achievable. Capture rates were chosen which have either been measured in existing programs or are considered achievable based on the measured recovery of other similar materials.

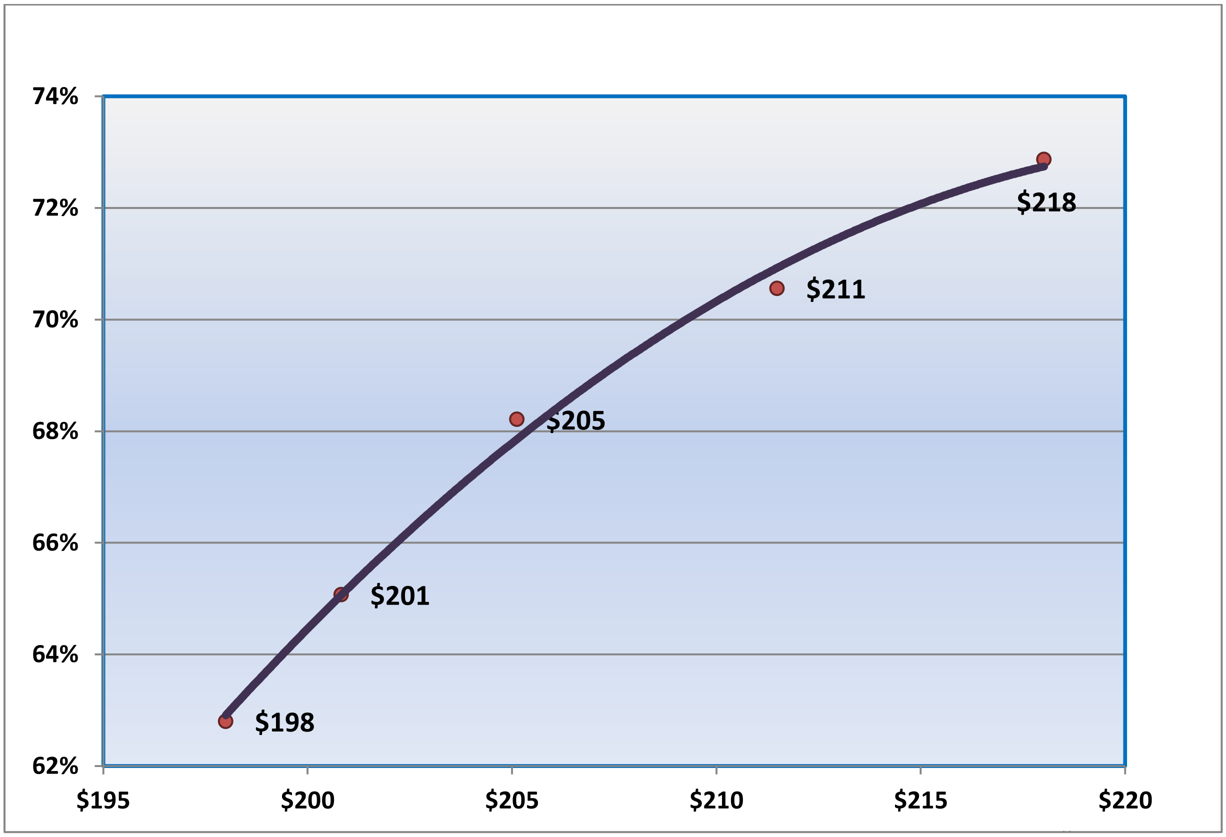
The diversion achieved and the cost incurred by the sequential scenarios is presented in Table 8. The information is presented graphically in Figure 7 and shows that this approach in theory could achieve over 73% diversion (10% above the 2012 Blue Box system performance) for an annual Blue Box net system cost of $218 million based on 2012 Blue Box data (an increase of $20 million/year or 10% above the 2012 Blue Box system cost). If feasible, in theory this scenario would increase diversion at a cost of slightly more than $2 million per 1% diversion point

Table 8: Diversion and Cost Impacts of "Least Cost" Scenarios To Add Materials To The Blue Box System (Based on 2012 Blue Box Diversion Performance and Costs)

Scenario	Additional Tonnes Recycled	Additional $ to 2012 Blue Box System Costs ($/year)	Additional Diversion Achieved (%)	Blue Box System Cost Compared to 2012 Baseline ($)	Total Blue Box Diversion Compared to 2012 Blue Box System Baseline (%)
2012 - Base Case				$ 198,000,000	62.8%
A - Increase recovery of Printed Paper to 95% and Steel Food & Beverage Cans and Steel Aerosols to 85%, and Steel Paint Cans to 60%	32,100	$ 2,800,000	2.3%	$ 201,000,000	65.1%
B - increase Recovery of Other Printed Paper and Coloured Glass to 80%	44,650	$ 4,000,000	3.1%	$ 205,000,000	68.2%
C - Increase boxboard recovery to 60%	33,400	$ 6,000,000	2.4%	$ 211,000,000	70.6%
D - Increase boxboard recovery to 80%	32,800	$ 7,000,000	2.3%	$ 218,000,000	72.9%

In all cases, aluminum was not added to the scenarios as it is likely that capture rates for aluminum are already very high, and only a small amount of additional amount of aluminum recycling would be possible. It is also more conservative for this analysis to assume that no additional aluminum recycling (at zero cost to the Blue Box system) is practically feasible.

Figure 6: Estimated Diversion and Net Cost Impacts of Adding Materials To The Blue Box To Achieve 73% Diversion (Based on 2012 Blue Box System Net Cost and Diversion)



4.3 Sequence In Which To Add Materials To The Blue Box System To Achieve Maximum Achievable Diversion

The maximum diversion rate (%) achievable by the Ontario Blue Box system is estimated to be 81.9% (rounded to 82% for presentation) based on 2012 Blue Box tonnages and waste composition. The sequence in which materials should be added to the 2012 Blue Box system in order to increase diversion starting with the least cost materials is presented in Table 9 and illustrated in Figure 7.

Table 9: Sequence in Which Materials Should Be Added to the Ontario Blue Box System To Increase Diversion From 62.8% To 82% (Based on 2012 Blue Box Data)

Scenario	Blue Box Material	Strategy	Additional Tonnes Diverted (Cumulative)	Additional Tonnes Diverted (Incremental)	Increased Blue Box System Cost Compared to 2012 Blue Box Costs ($ million)	Total Blue Box Diversion Based on 2012 Blue Box Data
2012 Baseline					$ 198,000,000	62.8%
A	Printed Paper	Increase recovery to 95%	17,927	17,927	$ 200,000,000	64.1%
B	Steel	Increase recovery to 85%	32,105	14,178	$ 201,000,000	65.1%
C	Other Printed Paper	Increase recovery to 60%	51,103	18,998	$ 203,000,000	66.4%
D	Other Printed Paper	Increase recovery to 80%	76,752	44,647	$ 205,000,000	68.2%
E	Coloured Glass	Increase recovery to 80%	79,764	3,012	$ 205,000,000	68.4%
F	Boxboard	Increase recovery to 60%	110,158	30,395	$ 211,000,000	70.6%
G	Boxboard	Increase recovery to 80%	142,956	63,192	$ 218,000,000	72.9%
H	OCC	Increase recovery to 90%	150,842	7,886	$ 221,000,000	73.4%
I	HDPE	Increase recovery to 85%	157,891	7,049	$ 226,000,000	73.9%
J	PET	Increase recovery to 90%	176,353	18,462	$ 242,000,000	75.2%
K	Aseptic Containers	Increase recovery to 85%	180,345	3,992	$ 245,000,000	75.5%
L	Paper Laminates	Increase recovery to 25%	188,883	8,537	$ 253,000,000	76.1%
M	Gabletop	Increase recovery to 85%	194,161	5,279	$ 259,000,000	76.5%
N	Other Plastics	Increase recovery to 75%	231,108	36,947	$ 305,000,000	79.1%
O	Plastic Film	Increase recovery to 60%	258,815	27,707	$ 356,000,000	81.0%
P	Plastic Laminates	Increase recovery to 25%	267,655	8,841	$ 373,000,000	81.6%
Q	Polystyrene	Increase recovery to 25%	271,555	3,900	$ 382,000,000	81.9%

The additional system cost associated with higher diversion up to the ceiling of 81.9% is presented in Figure 8. The figure illustrates that the cost of additional diversion increases significantly after a 76%

diversion rate is reached, with the system cost reaching about $256 million/year at a 76% diversion level and almost $382 million per year when 82% diversion is achieved. Therefore, the last 6% diversion points would add $126 million/year to the Blue Box system annual costs, based on 2012 data

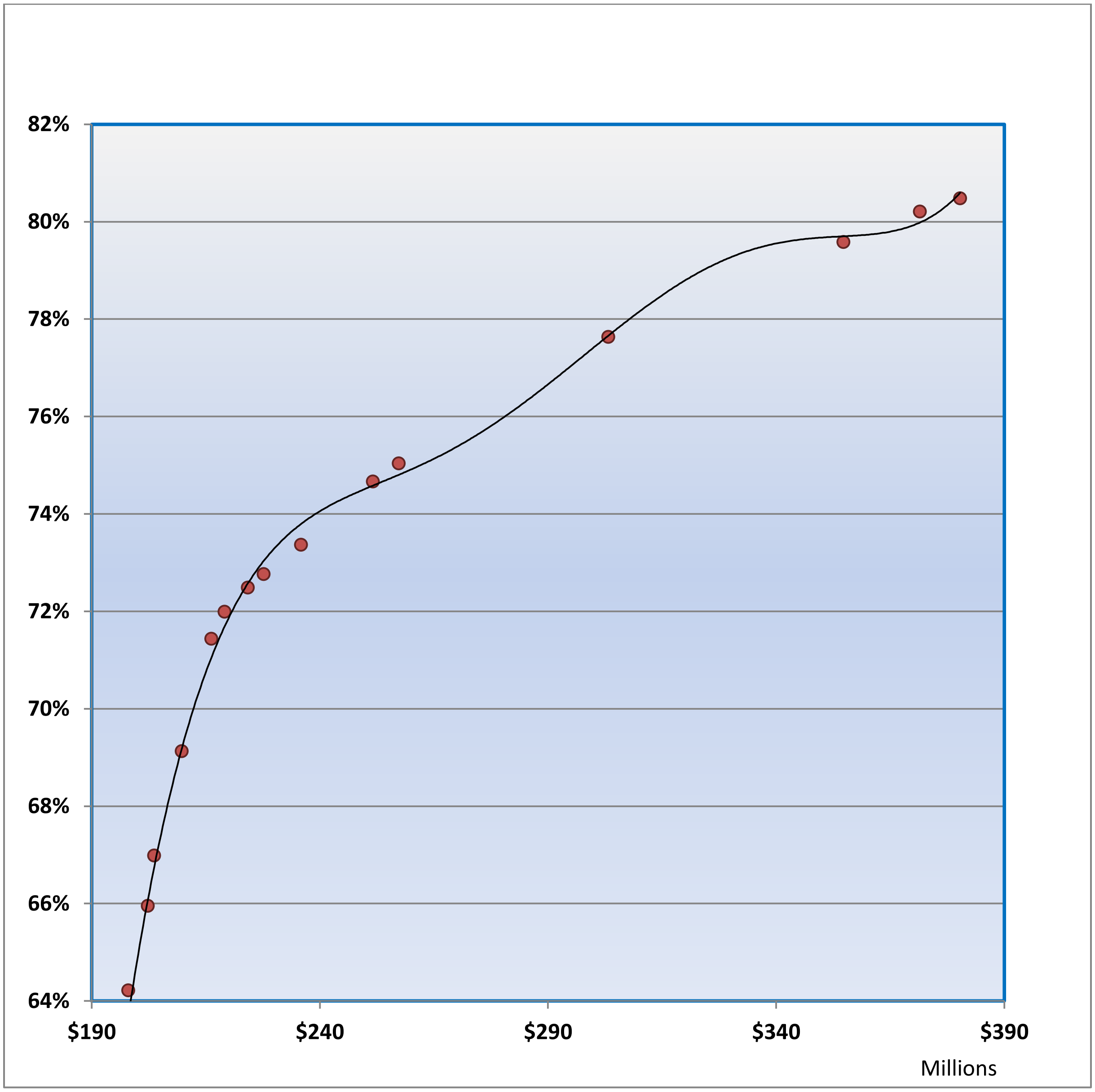


Figure 7 : Estimated Incremental Costs To Increase Ontario Blue Box System Diversion Rate From 62.8% to 82%

5. "Blank Slate" Scenario

A scenario referred to as the "Blank Slate" scenario was developed using 2012 Blue Box data. This is a theoretical scenario which explores how the Blue Box system might be designed if we were "starting from scratch" rather than building on a mature system which is already over 25 years old in most locations.

Figure 8 presents the estimates the net cost of achieving diversion rates of 60% to 75% in the Blue Box system based on 2012 data, if the Blue Box system were "starting from scratch" today and could choose the most cost efficient way to achieve various diversion targets, with no requirement to collect specific materials to be in compliance with the Provincial 3Rs Regulations.

In this scenario, a least cost Blue Box system could achieve the required target of 60% diversion at an estimated net system cost of $99 million (based on 2012 data) , compared to the 2012 Blue Box net system cost of $198 million. Achieving 60% diversion of the 1.42 million tonnes of printed paper and packaging sold into the Ontario residential marketplace in 2012 requires diversion of 853,000 tonnes of Blue Box materials, compared to 893,000 tonnes actually diverted in 2012. Based on 2012 Blue Box system data, focussing on diversion of the least cost materials could result in a Blue Box system that is an estimated half of the cost of the 2012 Blue Box system.

Figure 8: Diversion Rate (%) vs Cost For " Blank Slate" Blue Box Scenario Based on 2012 Blue Box Data

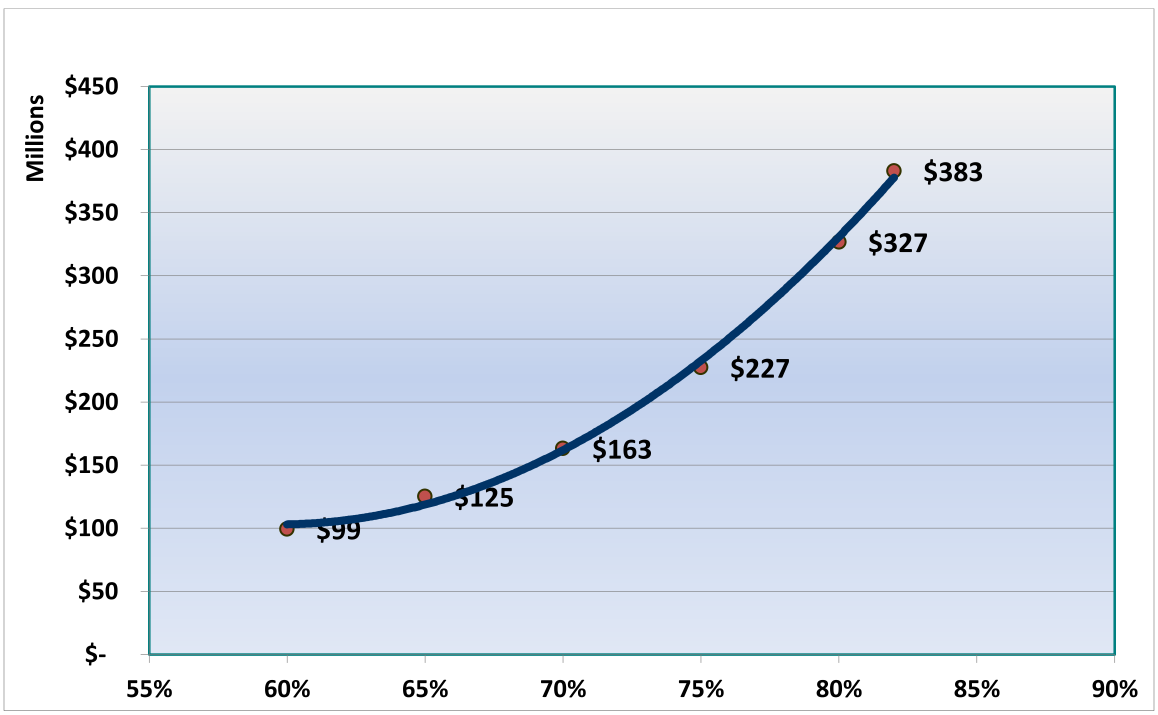


Table 10 presents the list of materials which would need to be collected to achieve 60% diversion in the Blue Box system at lowest net system cost. It should be noted that as with previous scenarios, the recovery of aluminum has been limited to the current Blue Box system recovery level of about 11,208 tonnes. The table includes the estimated tonnage recovered and contribution to reaching the 60% diversion target based on 2012 Blue Box composition and net cost data. About 60% of the total tonnage is contributed by all printed paper, and an additional estimated 20% is contributed by paper packaging (OCC and boxboard).

The table shows that a least cost 60% Blue Box system could be achieved with only the following materials, based on 2012 Blue Box system waste composition (added in the order shown):

- Aluminum Food & Beverage Cans and other Aluminum Packaging
- Newsprint
- Magazines and Catalogues
- Steel Food & Beverage Cans, Aerosols and Paint Cans
- Other Printed Paper
- Coloured and Clear Glass
- Telephone Books
- Boxboard
- Old Corrugated Containers (only 24% of available OCC needs to be recovered to reach the 60% diversion target)

A least cost Blue Box system would not include PET or HDPE based on 2012 Blue Box cost data.

PET is one of the Basic Blue Box list of materials that must be collected by municipalities with populations over 5,000 under Regulation 101/94 (3Rs Regulations). It is the only material in the Basic Blue Box list that would not be collected in a Least Cost Blue Box scenario.

Table 10: Materials Collected To Achieve 60% Diversion At Least Cost Starting From A "Blank Slate" Blue Box System

Blue Box Material	2012 Blue Box Material Generation	Max Collection Rate Assumed	Blue Box Tonnes Collected	Net $ per tonne (2012 Blue Box Data)	Net $ Contribution to 60% Blue Box Blank Slate Scenario	Diversion Percentage contributed By Material
Aluminum Food & Beverage Cans	22,552	Current	10,860	- $ 286	-$3,100,000	0.76%
Other Aluminum Packaging	4,521	Current	348	- $ 286	- $100,000	0.02%
Newsprint - CNA/OCNA	217,375	95.0%	206,506	$ 85	$ 17,600,000	14.53%
Newsprint - Non-CNA/OCNA	148,405	95.0%	140,985	$ 85	$ 12,000,000	9.92%
Magazines and Catalogues	78,908	95.0%	74,963	$ 85	$ 6,400,000	5.27%
Other Printed Paper	128,245	75.0%	96,184	$ 96	$ 9,300,000	6.77%
Coloured Glass	25,277	80.0%	20,222	$ 105	$ 2,100,000	1.42%
Clear Glass	74,522	93.95%	70,016	$ 110	$ 7,700,000	4.93%
Steel Food & Beverage Cans	45,286	85.0%	38,493	$ 89	$ 3,400,000	2.71%
Steel Aerosols	4,079	85.0%	3,467	$ 89	$ 310,000	0.24%
Steel Paint Cans	5,072	60.0%	3,043	$ 89	$ 270,000	0.21%
Telephone Books	8,329	95.0%	7,913	$ 119	$ 900,000	0.56%
Boxboard	163,988	85.0%	139,390	$ 199	$ 27,700,000	9.81%
Old Corrugated Containers (OCC)	169,361	Only 24% needed for 60% target 90% max achievable	152,425 max (Need 40,500 to reach 60%)	$ 365	$14,800,000 based on 40,500 tonnes recovered	2.85%
Total	**1,421,595**				**$ 99,400,000**	**60.0%**

6. Future Blue Box Material Composition Scenarios

The composition of Blue Box materials will change between now and 2027 (15 years from 2012) because of various lifestyle and product and packaging design changes projected to occur in the coming years. The impacts of these changes on the Blue Box system are likely to be significant as heavier material such as newspapers and glass are reduced (because of lifestyle and packaging changes), and lighter materials such as more plastic and light weight packaging are added to the Blue Box material mix. Heavier materials are more cost efficient to collect on a $/tonne basis because of higher density in the collection truck, and in some cases they are less expensive to process. This section addresses the implications of the projected Blue Box material changes on diversion performance and net costs of the Blue Box program in Ontario over time.

6.1 Projected Future Composition of Blue Box By Material

Taking 2012 tonnages as a baseline and applying percentage changes by material identified in other studies (Kelleher Future Blue Bin Study for City of Toronto, 2010 and StewardEdge MRF Optimization Study for CIF, 2012) , the anticipated changes to the baseline Ontario Blue Box system tonnage by 2027 (compared to 2012 and ignoring growth due to population) are presented in Table 11.

The table shows that the generation of Blue Box materials was about 1.42 million tonnes in 2012. This value is projected to drop to about 1.33 million tonnes (a drop of 6.3% in weight) over time. Achieving 60% diversion with the future Blue Box composition mix requires the diversion of 799,000 tonnes of material.

If the materials currently collected in the Blue Box system are collected at current recovery rates, an estimated 57.7% of Blue Box materials would be diverted, therefore other materials would need to be added to the Blue Box system, or the recovery rate of some materials would need to be increased to reach a 60% diversion rate measured by weight.

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Table 11: Anticipated Changes to Blue Box Tonnage Composition By 2027 (Compared to 2012)

	2012 Blue Box Material Generation (tonnes)	Projected 2027 Blue Box Material Generation (% change compared to 2012)	Estimated 2026 Blue Box Material Generation (tonnes)
Newsprint - CNA/OCNA	217,375	-40%	130,425
Newsprint - Non-CNA/OCNA	148,405	-40%	89,043
Magazines and Catalogues	78,908	-20%	63,126
Telephone Books	8,329	-90%	833
Other Printed Paper	128,245	15%	147,482
Old Corrugated Containers	169,361	35%	228,637
Boxboard	163,988	0%	163,988
Gabletop	14,249	45%	20,661
Paper Laminants	39,205	25%	49,006
Aseptic Containers	5,820	45%	8,439
PET bottles	56,848	35%	76,745
HDPE bottles	27,598	-10%	24,838
Plastic Film	54,383	20%	65,260
Plastic Laminants	35,391	15%	40,700
Polystyrene	21,391	-25%	16,043
Other Plastics	70,790	5%	74,330
Steel Food & Beverage Cans	45,286	-20%	36,229
Steel Aerosols	4,079	5%	4,283
Steel Paint Cans	5,072	-20%	4,058
Aluminum Food & Beverage Cans	22,552	-10%	20,297
Other Aluminum Packaging	4,521	65%	7,460
Clear Glass	74,522	-40%	44,713
Coloured Glass	25,277	-40%	15,166
Total	**1,421,595**		**1,331,761**

Table 12 shows the generation of Blue Box materials in 2012, and the future generation rate by material applying the % change in material composition anticipated in various studies. The table shows the 2012 recovery in tonnes, and the future recovery needed to achieve 60% diversion. The combination of materials collected in the Blue Box in 2012 at current recovery rates would only achieve 58% diversion in a future Blue Box composition scenario, because a lot of the heavy materials (particularly newsprint) will be produced in lower quantities over time. Newspapers are not only heavy, but they are relatively inexpensive to divert, so a reduction in ONP tonnage negatively affects the Blue Box program performance in two ways.

Table 12 shows a scenario which reaches 60% diversion (the current target) including all of the materials collected in the 2012 Blue Box program, starting with all materials at their 2012 recovery levels, and adding materials to their maximum recovery potential, starting with the materials which are the least expensive to recycle (papers, steel and boxboard). The table shows that the net estimated cost of achieving 60% diversion by weight would be $218 million per year with the future Blue Box material composition, compared to the estimated cost of $158 million to achieve 60% with 2012 Blue Box composition, and the 2012 net cost of $198 million to achieve 62.8% diversion.

Table 12: Materials Which Need to Be Collected to Reach 60% Blue Box System Diversion With Future Blue Box Composition

Material	Blue Box Generation (2012) (tonnes)	Future Generation (2027) Based on 2012 Data (tonnes)	Blue Box Recovery (2012) (tonnes)	Future Recovery Needed To Reach 60% (tonnes)	Recovery To Reach 60% (%)	$ Net per Tonne (2012)	Future Net Cost for Material in Blue Box System (based on 2012 costs) ($)
Newsprint - CNA/OCNA	217,375	130,425	203,689	123,904	95%	$ 85	$ 11,000,000
Newsprint - Non-CNA/OCNA	148,405	89,043	139,062	84,591	95%	$ 85	$ 7,000,000
Magazines and Catalogues	78,908	63,126	61,776	59,970	95%	$ 85	$ 5,000,000,
Telephone Books	8,329	833	7,968	797	96%	$ 119	$ 95,000
Other Printed Paper	128,245	147,482	57,949	66,641	45%	$96	$ 6,,000,000
Old Corrugated Containers	169,361	228,637	144,539	195,128	85%	$ 365	$ 71,000,000,
Boxboard	163,988	163,988	67,998	75,200	46%	$ 199	$ 15,000,000
Gabletop	14,249	20,661	6,833	9,908	48%	$ 1,073	$ 10,000,000
Paper Laminants	39,205	49,006	1,264	1,580	3%	$ 960	$ 2,000,000
Aseptic Containers	5,820	8,439	955	1,385	16%	$ 865	$ 1,000,000
PET bottles	56,848	76,745	32,701	44,146	58%	$ 855	$ 38,000,000
HDPE bottles	27,598	24,838	16,409	14,768	59%	$ 723	$ 11 ,000,000
Plastic Film	54,383	65,260	4,923	5,908	9%	$ 1862	$ 11 ,000,000
Plastic Laminants	35,391	40,700	7	8	0.02%	$ 960	$ 15,000
Polystyrene	21,391	16,043	1,448	1,086	7%	$ 2,255	$ 2,000,000
Other Plastics	70,790	74,330	16,146	16,953	23%	$ 1,242	$ 2,000,000
Steel Food & Beverage Cans	45,286	36,229	29,187	30,794	80%	$ 89	$ 3,000,000
Steel Aerosols	4,079	4,283	942	3,641	80%	$ 89	$ 300,000
Steel Paint Cans	5,072	4,058	696	2,435	60%	$ 89	$ 200,000
Aluminum Food & Beverage Cans	22,552	20,297	10,860	9,774	current	-$ 286	- $ 2,700.000
Other Aluminum Packaging	4,521	7,460	348	574	current	-$ 286	- $ 160,000
Clear Glass	74,522	44,713	70,014	42,008	94%	$ 110	$ 5,000,000
Coloured Glass	25,277	15,166	17,210	10,326	68%	$ 105	$ 1,000,000
Total	**1,421,595**	**1,331,761**	**892,924**	**799,000**			**$218,000,000**
Diversion			**62.8%**	**60.0%**			

The costs of achieving higher diversion targets (above 60%) with the future Blue Box composition are presented in Table 13 and shown graphically in Figure 9. The analysis shows costs to reach all diversion levels will be significantly higher in the future with the changing Blue Box composition. As an example, reaching 75% diversion would cost $242 million (based on 2012 data) with the 2012 Blue Box material composition but would cost an estimated $321 million/year (based on 2012 data) with the future Blue Box composition.

Considerable planning is needed to fully address the financial and practical implications of the changing Blue Box material composition and the government of Ontario may need to consider policy changes given this factor which was not in play when Regulation 101/94 was promulgated.

Table 13: Estimated Cost of Achieving Different Blue Box System Diversion Levels With Future Blue Box Composition Based on 2012 Data

Blue Box System Diversion With Future Material Composition	Estimated Blue Box System Costs Based on 2012 Cost Data ($million/year)	Estimated Blue Box System Costs With Future Composition in 2027 Based on 2012 Cost Data ($million/year)
60%	$158	$218
65%	$201	$224
70%	$211	$252
75%	$242	$321
80%	$325	$433

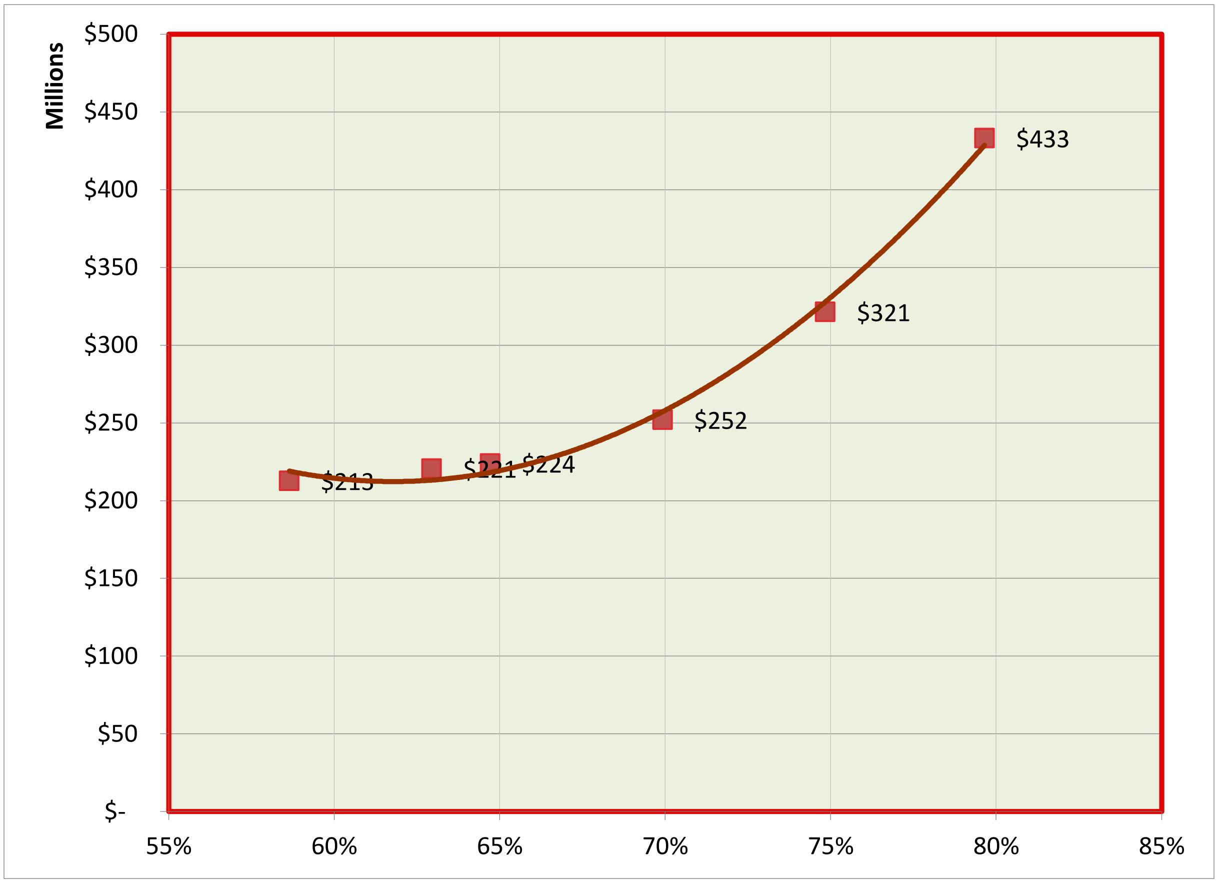

Figure 9: Estimated Diversion Performance (%) vs Blue Box System Net Cost For Future Blue Box Waste Composition Based on 2012 Data

7.Conclusions and Recommendations

2012 Blue Box System

1. The analysis shows that by far the most cost efficient way to increase diversion in the Blue Box system is to increase the recovery of cost efficient materials like printed paper.
2. Maximizing the recovery of printed paper to 80% is by far the most cost efficient way to increase diversion in the Blue Box system;
3. Adding new materials does very little for diversion and substantially increases the Blue Box system cost, as the new materials are light and are expensive to recycle.
4. This message should be clearly communicated to municipalities and stewards by the CIF, so that no additional materials are added to the Blue Box until recovery of "least expensive" materials has been maximized.
5. No new materials should be added to any Blue Box system until capture of the current least expensive material has been maximized – this is by far the best strategy to increase diversion in a cost efficient manner;
6. All Blue Box system operators should clearly understand the cost implications of adding different materials to the Blue Box system;
7. Objectives of adding any new materials to any Blue Box system in Ontario need to be clearly articulated before any materials are added. If the objective is to provide convenient recycling opportunities to residents regardless of cost implications, then the cost implications should be clearly identified before program changes are made;
8. There are some materials in the Blue Box system now which might be better suited to convenient depot collection.

Future Blue Box Material Composition

9. The changing composition of Blue Box materials is likely to have a profound impact on diversion levels and costs over time and needs to be carefully monitored annually.
10. Considerable planning is needed to fully address the financial and practical implications of the changing Blue Box material composition
11. The government of Ontario may need to consider policy changes given this factor which was not in play when Regulation 101/94 was promulgated.
12. Stewards and municipalities need to consider carefully the cost implications of a 60% target as well as higher diversion targets with the changing Blue Box mix of materials and agree on appropriate targets and policies on a go forward basis.

Recommendations

1. CIF should explore the cost and diversion implications of establishing a convenient depot system for drop-off collection of materials such as some plastics which are expensive to collect curbside. This is particularly applicable for plastic film and PS, but could apply to all materials above a certain cost threshold;
2. The implications of moving all materials which cost > $1,000/tonne to manage curbside to a drop off depot system in Ontario should be explored by CIF;
3. The changing composition of Blue Box materials is likely to have a profound impact on Blue Box system diversion levels and costs over time and needs to be carefully monitored annually;
4. A comprehensive drop off depot strategy could help to control in increasing costs of the Ontario Blue Box system.