

**SHIFTING STREAMS:
INCREASING RECYCLABLE MATERIAL
RECOVERY IN VANCOUVER**

by

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Abstract

This study examines public policy approaches to increase the recovery of residentially generated recyclable materials in Vancouver, British Columbia. Four policy options are considered: a bylaw-oriented approach, changes to the City's Pay-As-You-Throw (PAYT) garbage system, single-stream recycling, and expanding product deposit programs. Each is analyzed and assessed on a number of key criteria, with ratings and findings based on existing literature and extensive consultation with industry experts. I conclude that changes to the current PAYT fee structure along with a transition from weekly to bi-weekly garbage collection would provide residents strong, effective incentives to increase their recycling efforts. I also recommend improved solid waste container labelling, and continued expansion of deposit programs for appropriate products, primarily as measures to increase the lacklustre recycling performance of multi-family residences.

Keywords: solid waste; recycling; recovery rates; pay-as-you-throw; single-stream recycling; solid waste bylaws; product deposit programs; Vancouver

Executive Summary

Even though recycling services are available to all residents of Vancouver, British Columbia, many still put recyclable waste in the garbage. Their doing so imposes significant economic and environmental costs on society. This study looks at public policy approaches to increase the recovery of residentially generated recyclable materials in Vancouver in order to reduce these costs.

Policy Options

The study considers the following four policy options in detail:

1.) Bylaw-Oriented Compliance

The City of Vancouver currently has regulations on recyclable material in the garbage stream codified in the Solid Waste Bylaw No. 8417. This bylaw restricts all Blue Box acceptable recyclables from household garbage containers and from loads of garbage being tipped at the Vancouver landfill and transfer station. Enforcement is currently concentrated at the landfill and transfer station, and is severely limited when it comes to household garbage cans; it does not go beyond tagging non-compliant containers and possibly not collecting their contents. Public knowledge of the bylaw is also very limited.

A strong bylaw-oriented approach for Vancouver would involve significant investment in both communication and enforcement. This study focuses on communication in the form of improved garbage / recycling container labelling and more broad-based media campaigns

educating the public on the current bylaws. The enforcement component includes random inspection of household containers at the curb, including monetary penalties for noncompliance.

2.) Strengthen Pay-As-You-Throw Garbage Pricing

Pay-As-You-Throw (PAYT) garbage pricing is a user-pay approach to waste where garbage service charges vary according to volume generated. In contrast to fixed fees, the theory is that if required to “pay as you throw” per unit of garbage, people will dispose of as much as they can through lower-cost methods. As recycling remains free or charged at flat rates, people are encouraged to recycle as much as possible to avoid added disposal costs. PAYT can be based on (i.e.) weight, can size, or number of bags / cans. The different forms can vary further in terms of their rate structure design, billing method / cycle, and collection frequency.

The City of Vancouver currently uses a variable-can PAYT program for single-family residences. The recycling incentives it creates, however, are sub-optimal and could be strengthened in a number of ways. The PAYT option considered in this study includes:

- increasing overall fees and adjusting them so that the price increments between container sizes are significantly larger and designed so that fee increases are more proportional to capacity increases, and
- creating either a smaller minimum container size or switching to bi-weekly garbage collection, and
- merging all solid waste fees together on property tax bills, rather than including garbage, recycling, and yard waste as separate line items

3.) Single-Stream Recycling

Single-stream recycling is a system where all recyclables are collected together, with no source-separation beyond keeping them apart from general garbage. Single-stream’s effectiveness at increasing recycling rates is based on convenience: it tends to make recycling easier and less

consuming of both time and space (especially for small apartment or condominium units). By reducing the personal costs of recycling, the theory is that more people will do more of it.

4.) Expand Product Deposit Programs

Under deposit systems, most common for beverage containers, consumers pay a small deposit on each package purchased, which can be redeemed upon return to the retailer or a depot. The added financial incentive, however small, tends to translate into high recovery rates for applicable materials relative to those not covered by deposits. Deposit programs apply to virtually all beverage containers sold in British Columbia. Expanding them to cover more materials (i.e. glass jars and tin cans) is therefore a promising avenue for policy development.

Criteria

Policy analysis and subsequent recommendations are based on the following criteria:

- **Effectiveness:** Refers to the primary goal of the policies being assessed: increasing the recovery rates for residentially generated recyclable materials in Vancouver; working from 2009 baseline volume data and estimates of current recovery rates, increases in recovery predicted to result from the implementation of each policy are compared
- **Administrative Complexity:** Refers to the administrative demands of the policy relative to the status quo; it is based on a composite measure taking into account changes in day-to-day administrative capacity (including additional staff, offices, processes, and departments required) and the parties and levels of government necessarily involved in approving and administering the new policy
- **Transitional / Implementation Issues:** Refers to issues with transitioning to and implementing the policy, as well as getting the public accustomed to and complying with it; it is based on a composite measure accounting for difficulty in transition (i.e. resistance from the public and other relevant affected actors), time required for transition (i.e. to reach high participation / compliance rates), and other implementation issues
- **Yield:** Refers to the share of recyclable material recovered that actually ends up being recycled, which may vary depending on the system and policies in place; policies are compared according to how they are predicted to affect the status quo
- **Cost Considerations:** The policy options vary greatly with respect to their overall costs and the parties that bear those costs; this criterion involves a qualitative evaluation of each policy's cost implications specifically in terms of magnitude and distribution, including fairness and equity considerations

Analysis

Analysis of each option in terms of the criteria is summarized in the table below.

Summary of Analysis

<i>Criteria</i> <i>Policy</i>	Effectiveness	Administrative Complexity	Transitional / Implementation Issues	Yield
Bylaw Oriented Compliance	Marginal-Substantial	Medium-High	Inconsequential-Significant	No Change
Strengthen Pay-As-You-Throw Garbage Pricing	Substantial	Low	Inconsequential-Significant	No Change- Decrease
Single-Stream Recycling	Marginal	Low	Inconsequential	Decrease
Expand Product Deposit Programs	Marginal	Medium	Significant	Increase

Those interested in detailed explanations and justifications for each rating should refer to the full report. In the interests of brevity, just the highlights are summarized here.

Bylaw- Oriented Compliance

- Each element of the bylaw-oriented approach (improved container labelling, broad-based communication, and curb-side enforcement) is expected to result in at least a marginal increase in recovery; cumulatively, the overall effectiveness of this option could be substantial, although given certain issues, this is likely an optimistic assessment

- The enforcement component would require hiring and training bylaw officers, designing new processes and protocols, and administering a penalty system, just to name a few; this would significantly increase administrative complexity relative to the status quo
- Each component of the bylaw-oriented approach would require a significant investment of public funds, the enforcement component considerably more so than the others

Strengthen PAYT Garbage Pricing

- Based on academic and industry literature as well as a striking consensus among experts in the field, the proposed PAYT structure can confidently be predicted to substantially increase recovery rates for single-family residences
- Although some PAYT structures can be very complex in terms of administration, the specific model proposed would require relatively limited administrative change
- The policy introduces a number of somewhat worrying transitional / implementation issues, although many are based on perception more than reality
- The “user-pay” nature of the policy makes it highly equitable; it could be implemented at minimal public expense, if not at an overall savings (i.e. if the bi-weekly garbage collection suggestion is adopted)

Single-Stream Recycling

- Based on the literature and Surrey case study, increases in recovery rates directly attributable to single-stream recycling would likely be marginal at best
- The simplicity inherent in the policy means it introduces no significant administrative, transitional, or implementation issues
- For a number of reasons related to the comingled nature of the collected material, single-stream is likely to result in at least a small decrease in overall yield
- The system may save the City money as a result of reduced collection costs; at the same time, single-stream is argued to unfairly shift costs to manufacturers using recycled inputs, who are forced to invest more to deal with contaminated material

Expand Product Deposit Programs

- Deposits are highly effective at increasing recovery rates for specific materials, but their overall effectiveness is limited because they are only suitable for rigid containers (not fibre), which make up a relatively small overall portion of Blue Box recyclables
- Managing recyclable material through deposit programs is administratively complex, but because a system is already well-established, adding additional products would only marginally increase this complexity
- In terms of transition, it takes a significant amount of time for newly added products to reach high recovery rates
- Complete source-separation at depots / retail outlets results in 100% yield
- Deposits are a highly equitable user-pay approach, however some argue that the systems are unjustifiably expensive to run

Conclusions and Recommendations

Based on the preceding analysis I offer the following conclusions and recommendations:

- In terms of bylaw-oriented compliance, suggestions with respect to improved container labelling should be adopted, particularly updating incorrect labels; curb-side enforcement is likely too costly and legally uncertain to be feasible at this time
- Due to the strong performance of the PAYT option, particularly in terms of its effectiveness, I strongly recommend the City of Vancouver consider the structural adjustments outlined and the suggested transition to bi-weekly garbage collection
- Single-stream is an intriguing option if municipal costs are a major concern, but the evidence is less than convincing when it comes to effectiveness; given a number of significant concerns, the potential for a marginal increase in recovery is not enough to justify such a change, which is very difficult to reverse after implementation
- Given the product scope limitations of deposit programs, they are probably not the most effective policy overall; however, the additional recovery they guarantee, even if small and gradual, would still be beneficial

Dedication

This study is dedicated to its many contributors. The input of individuals who agreed to provide information, insights, and opinions was invaluable. Without it, this study would have been a mere skeleton of what it turned out to be. Contributors took a great deal of time out of their very busy schedules to help with the project, requesting no compensation in return. Your willingness to participate and enthusiasm in doing so were genuinely appreciated.

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1: Introduction

In spite of recycling services being available to them, residents of Vancouver, British Columbia, still put much of their recyclable waste in the garbage. This study aims to determine what public policy can do to increase the recovery of residentially generated recyclable materials collected in the City. Getting individuals to change their behaviour and shift their recyclables from the garbage to the recycling stream is the key to solving the stated policy problem.

Although waste extends far beyond recycling, this study does not. I focus on residentially generated recyclable material currently accepted in Vancouver's "Blue Box" program. This material includes fibre (newspaper and mixed paper) and containers (metal, glass, and plastic). The policy goal is also restricted to recycling. Waste reduction and material reuse, the other two of the well-known "three Rs," are largely left out. Although often associated with recycling, they are different activities, encouraged by different policies. Whereas increasing recycling involves relatively limited behavioural modification, getting people to reduce consumption implies much more significant lifestyle and value changes. One reason to target recycling is that it can produce significant environmental benefits but does not require people to alter their consumption behaviour like the other two more ascetic Rs. This is not to discount the value of reduction and reuse, which are likely much more significant in the grand scheme of things, but to restrict the scope to one area where public policy can clearly have a significant impact in the short term.

Short-term impact is especially pertinent given this study's context. On July 30, 2010, the Metro Vancouver Waste Committee approved an aggressive and controversial draft *Integrated Solid Waste and Resource Management* plan. In it, they set the lofty goal of increasing the

region's landfill "diversion rate"¹ from its current average of 55% to 70% by the year 2015 (Metro Vancouver 2010). One part of how the Waste Committee plans to meet their increased diversion goal has been the cause of much disagreement, namely the construction of new incineration or "Waste to Energy" capacity. Not controversial, however, is their official prioritization of recycling above both incineration and land filling. Their plan clearly states the goal of maximizing recycling and disposing of only the waste remaining after recyclables have been diverted. Getting recyclables out of the garbage stream will be a crucial part of meeting this goal. The context therefore, makes this study particularly timely.

The remainder of this section provides a brief explanation as to why this issue constitutes a public policy problem. Vancouver residents who put recyclable waste in the garbage generate a number of costs. The simplest to grasp are economic. Under all recycling programs, collected materials are eventually sold to firms that use them as inputs in new products. These materials have value, and selling them generates revenue that offsets the cost of running the programs. The degree to which revenues offset costs depends on the prices of the materials on their often-volatile markets. Strong markets could mean material revenues pay for the entire system and perhaps generate a profit; typically though, they offset considerably less than the costs involved.

From a purely market perspective, material revenue alone is typically not enough to justify residential recycling. Vancouver, however, has an established (and likely permanent) curb-side recycling program in effect that makes it economical to maximize the amount of material collected. Each piece of recyclable material that sits in the garbage as the recycling truck rolls by represents forgone revenue and an opportunity cost in the form of unutilized recycling capacity. The reason relates to where the greatest costs of recycling are incurred: collection. Curb-side collection requires trucks to stop at every home and pick up small quantities of material at each;

¹ This term refers to the percentage of total solid waste collected (garbage, recyclables, and organics from all sectors) that does not go to landfill, but is dealt with via recycling, composting, or incineration (Metro Vancouver's definition of incinerated material as "diverted" is not standard and has been controversial).

this is expensive. Costs, however, depend much more on geographical location and the number of households served than the volumes produced by each (Ackerman 1997; Pickin 2008). Most of the costs involved in collection vary little with the volume collected—driving to the start of the route, getting off at each stop, picking up, dumping and returning the containers, all cost close to the same amount whether bins are full or near empty. Simply put, recycling collection is a high fixed cost, low marginal cost operation where incremental recycling is almost always economical if a system is in place to do so, as it is for all Vancouver residents.

The final economic consideration is the cost of disposal alternatives. In North America, disposal is still relatively cheap and recycling may be more expensive than simply throwing everything in the garbage. This is not the case where the cost of traditional disposal is high. Vancouver faces such a situation given that its primary landfill in Cache Creek is nearing capacity and, after it fills, alternative options become much more expensive. The so-called “Metro Vancouver landfill crisis” therefore makes recycling more economically attractive.

Despite the aforementioned factors, recycling may not be supportable based purely on economics. The fact that so many public recycling systems operate despite being “uneconomical” is evidence that the environmental costs avoided are also significant. Indeed, the original impetus behind residential recycling was not the anticipated material revenue, but rather a variety of environmental benefits deemed important enough to justify its costs. Ackerman offers a good summary of these benefits:

- Lowered emissions from landfills and incinerators
- Reduction in litter and improper disposal
- Reduction in energy use and related emissions
- Reduction in extraction and manufacturing process impacts and emissions

(Ackerman 1997, p.21).

A myriad of indicators show the positive environmental effects of recycling. Here I offer two of the clearest ones. When it comes to environmental costs and recycling, much more

significant than the avoided “downstream” disposal costs are the avoided “upstream” energy costs of extraction, manufacturing, and processing incurred when virgin materials are used (Scott 1999). For example, relative to using virgin inputs, the energy savings from recycling aluminium are around 93%, and for steel (tin) cans, beverage container plastic, and paper, they are around 60-74%, 86% and 40%, respectively (Encorp Pacific 2009; EPA 2009). These are substantial energy savings that equate to significant avoided emissions and other environmental damage.³

A second example relates to landfilling. Paper in particular is problematic. When biodegradables like paper are landfilled, they break down in an anaerobic (oxygen-deprived) environment and in doing so produce methane gas (Ackerman 1997).⁴ Methane is a greenhouse gas over 20 times more potent than carbon dioxide, and landfills are the largest human-controlled source of it in North America (Spiegelman and Sheehan 2005). Methane prevented from entering the atmosphere through recycling therefore represents a significant avoided environmental cost.

Consideration of all these costs severely weakens, the argument that recycling is “uneconomic.” Pro-recycling public policy is needed to account for environmental externalities and “drive recycling rates beyond their economic equilibrium” (Loughlin and Barlaz 2006, p.291). These and other environmental implications, as well as the economic issues mentioned earlier, justify policy intervention.

³ Many manufacturing processes for recycled inputs also use relatively cleaner technologies, i.e. recycled paper mills can avoid using chlorine bleaches necessary in processing raw wood pulp (Schienberg 2003).

⁴ Standard composting, especially when material is periodically mixed or aerated, is aerobic, and produces carbon dioxide rather than methane (Ackerman 1997).

2: Methodology

This study involves several methodological components. I first provide technical and institutional background through a review of literature on both the general topic area and the specific policy options. This material incorporates a range of work on recycling-related topics important to understand at the outset; it also provides initial insights into the strengths and weaknesses of the various policy options. Detailed descriptions of each policy are provided in later sections of the study.

The study also includes a primary research component in the form of direct consultations with experts in the field. Parts of the background section and much of the policy and analysis sections are based on information gathered via interviews and other consultations with individuals involved in the recycling and solid waste field in some capacity. The contributors include local environmentalists, public servants working in waste and recycling, recycling program administrators, representatives from recyclable material collection, processing, and brokerage companies, and individuals with experience in manufacturing recycled products.⁵

I also reference several case studies throughout the study, including cases where the policies under consideration have been or are currently being used. Case study material largely pertains to specific policy options and is included in the analysis sections of each. Many of the cases are informed by consultations with people near to them. Consultations and case studies, complemented by the literature, serve as the foundation for the analysis, comparison, and recommendation of policy options.

⁵ Their direct contributions are indicated by in-text citations with the letter “C” following the year of the consultation. A complete list of participants is also included at the end of the report.

I did not encounter any prohibitive methodological obstacles over the course of the research, although a few issues did arise. At the outset of the project, I intended to use Vancouver-specific recovery rates for Blue Box accepted recyclable material as my baseline data, to gauge the status quo and potential for improvement. It soon became apparent that high quality data specific to Vancouver and the materials of interest did not exist. The figures I ended up using were derived from a number of waste composition studies and waste volume surveys (see Section 3.5.2 and Appendix A). The numbers were not as reliable and specific as I would have liked, but I believe the methodology to calculate them was sound and that they are useful for general illustrative purposes. In addition, I was unable to consult a few parties of interest. The non-participation of this relatively small number of potential contributors was not overly significant though, as all those whose input was imperative were willing to take part in the study.

3: Background

This section provides information on the history of modern recycling, various policy paradigms and approaches, the industry and materials markets, and the current state of recycling and solid waste in Vancouver. This background knowledge is necessary in order to fully understand the policy options and appreciate them in context.

3.1 A Brief History of Recycling in North America

Recycling has occurred throughout human history. The form we know in North America today is actually quite young and differs from previous practices in a number of ways. Prior to World War II, recycling was driven exclusively by economic concerns. In pre-industrial England, for example, recycling and reprocessing of used clothing, building materials, metals, and rags (the sole input for paper at the time), flourished as a business. The livelihoods of many were based on various forms of scavenging, peddling, and junk dealing during this period and right up to the early 20th century when public waste management began to wrest control from the informal economy. Household recycling was also economically driven, as families looked to maximize the value of material objects through remaking and reuse (Ackerman 1997).

Although diverse in many respects, these early forms of recycling were motivated entirely by economic concerns. At this point, the environmental and social impetuses that characterize modern recycling were absent. World War II and the movements to follow saw a fundamental change in peoples' reasons for recycling. During the War, patriotism in addition to financial reward encouraged households to save paper, metal, rubber, and other such materials for collection and sale to the war industries (Ackerman 1997). In the 1960s, recycling reappeared as part of the environmental movement, the motivations of which continue to be felt today.

Contamination issues with unregulated landfills, fears of chemical pollution, increasingly visible litter in the form of disposable beverage containers (a new phenomenon of the time) and a “general urge to take action against wastefulness” drove the growth of the grassroots, community recycling effort (Ackerman 1997, p.16). This new group of civic volunteer and activist recyclers had a distinctly different motivation and agenda relative to their scrap dealing and other capitalist counterparts; they were pivotal in the modernization of recycling (Schienberg 2003).

At the same time, politicians began to take notice of the issues. Waste and resource recycling policies emerged in the United States alongside and fed by the grassroots environmental movement, most notably with the creation of the Environmental Protection Agency in 1970. This activity faded at the federal level during the Reagan administration (at least in the US) but lived on at the grassroots and state and local government levels (Ackerman 1997). This modernization period also saw the legitimization of the activist recycling discourse as this group participated vigorously in the policy-making process (Schienberg 2003).

The 1980s saw new issues pull recycling into the mainstream in North America, particularly concerns over controversial garbage incineration policy and a “landfill crisis” perceived as imminent. Concern over shrinking landfill capacity grew as the limited data at the time showed large numbers of landfills closing and few new ones opening. Local landfill closures and looming financial and environmental costs for new landfill construction drove municipalities in the US and Canada toward alternatives like large-scale residential recycling programs, which became widely accessible to the masses in the late 1980s and early 1990s⁶ (Schienberg 2003). With these new programs came unprecedented innovations in recycling, waste planning policy, and technology, and saw the professionalization, integration, and institutionalization of the new urban waste management sector (Schienberg 2003).

⁶ Note that this was and continues to be the case in some areas and not others. While residential recycling grew in densely populated areas with limited landfill capacity, it failed to take off elsewhere (Loughlin and Barlaz 2006). To this day, many American and to a lesser extent Canadian cities still do not have access to recycling services.

In the end, the landfill crisis failed to materialize. This was largely because the new landfills being constructed were far larger than the smaller ones closing in order to be economical while adhering to costly new environmental safety requirements (Ackerman 1997). Ironically, some of the most rapid growth in recycling was driven by this purely perceived crisis. This growth was accompanied by broad attitudinal changes, as despite the fact that household recycling was often more expensive than outright disposal, more and more people started and continued doing it for other reasons. Under the new recycling regime, participation offered little if any personal economic benefit, representing a fundamental shift from its pre-WWII roots. Also significant was the transition of recycling from an isolated market activity to one fully integrated into the public waste management system (Schienberg 2003). These two key shifts represent the modernization of recycling in North America.

3.2 Policy Approaches and Paradigms

Recycling can be viewed from a number of perspectives, evidenced by the distinct approaches taken across national jurisdictions. These approaches differ at both the macro level with respect to responsibilities, and the micro level in terms of the combinations of specific policies employed. This subsection addresses each of these topics in turn.

3.2.1 “Green Dot” vs. “Blue Box”

Perhaps the starkest divergence in macro-level approaches to recycling lies in the assignment of responsibility. Who should be responsible for financing and operating recycling systems? A comparison of residential recycling development in Europe and North America reveals two fundamentally different paradigms: producer responsibility in Europe and government responsibility in North America.

Europe has long been the global frontrunner in recycling, at both the level of nations and the European Union. One policy with particularly far-reaching effect was the *Packaging*

Directive, adopted by the EU Parliament in 1994. It requires members to develop recycling policies to meet specific targets for the recovery / recycling of packaging. Targets were relatively aggressive when first implemented and have since been increased (Loughlin and Barlaz 2006).

The EU sets the overall standards but allows member states flexibility in meeting them. The “Green Dot” system, first adopted in Germany in 1990, has become a widely emulated approach. The Germans, long dedicated to the “producer pays” principle, are widely regarded as the pioneers of Extended Producer Responsibility, or EPR. Germany introduced legislation in the early 1990s making producers responsible for meeting government-set recycling targets for household packaging. As with the EU policy to come later, firms could choose their own approach to meeting the targets. Self-administered “take-back” is one option wherein retailers and packaging companies collect used packaging for recycling at their own outlets. This, however, can be expensive and difficult to manage in terms of logistics, storage, and materials marketing, and it cannot assure meeting recovery targets as it relies on consumers to bring their recyclables to drop-off points (Loughlin and Barlaz 2006). Most businesses, therefore, have chosen the alternative approach of contracting a third party, the Duales System Deutschland (DSD), and joining the Green Dot system.

The Green Dot system is relatively simple. The DSD, an industry-sponsored, non-profit association, operates a “dual system” of waste collection alongside existing municipal garbage-collection. Member companies place the Green Dot symbol (see Figure 1) on their products indicating to consumers that they should be put in special containers for collection by the DSD. The DSD manages material collection, processing, marketing, and sales. The system is 100% industry-funded through unit-based, material-specific fees paid by members.⁷ Material-specific fees are adjusted according to the sales revenue the materials generate. The fees on high value materials (i.e. aluminium) are substantially offset by their sales revenue. Conversely, in order for

⁷ These fees work their way back into the system in the form of higher prices on applicable products, thus making consumers indirectly responsible for the system’s financing as well.

the DSD to ensure that other low-value materials (i.e. some plastics) are recycled and their recycling obligations met, they may have to sell them at a negative prices (paying rather than being paid), which drives the fees on those materials up (Ackerman 1997; Loughlin and Barlaz 2006). In spite of some initial issues, the program has achieved significant success in terms of material recovery in Germany (Ackerman 1997).

Figure 1 – The Green Dot



Following the 1994 EU Directive, many other members adopted similar programs using the same symbol but with some variations in structure and targets. Belgium, Luxembourg, Spain, and Italy all have Green Dot programs, many designed on the German experience but adjusted to deal with issues such as high initial costs and free-riding by program non-contributors (Loughlin and Barlaz 2006).

Household recycling has followed an entirely different developmental course in North America. Canada and the US were largely isolated from the major policy shifts in Europe in the 1990s. As documented in the previous section, little national, let alone supranational recycling directive arose in North America, with programs developing sub-nationally, typically at the municipal level. And whereas industry (and specific product consumers) has picked up the tab in Europe from the start, the general public has funded the vast majority of residential recycling in North America, largely in the form of curb-side, “Blue Box” programs.

Well known to Vancouverites, the Blue Box was a Canadian invention out of Ontario, whose curb-side program now stands as one of the oldest and most comprehensive in North America (PPI 2010). It is a good example of how industry in North America has worked to prevent full responsibility for recycling being assigned to them as was done in Europe. Industry has been a key player in the development of North American recycling, promoting the role of government and shouldering at most part of the cost and responsibility themselves. The story of the Blue Box is a case in point.

The concept originally came out of the debate over disposable beverage containers, which were taking over from refillables in Ontario during the 1980s. The Blue Box was proposed by the beverage industry as an alternative to a possible provincial mandate requiring the continued use of refillables (something the industry opposed) (PPI 2010). The industry formed an organization which provided funding (\$20 million over four years from 1987), matched by the provincial government and municipalities, to set up the curb-side collection system known as the Blue Box program, named after its receptacles (see Figure 2) (CIELP 2008). Here, it can be argued that industry made an initial financial contribution in order to have a say in the outcome, rather than simply fight any initiative outright and risk ending up with full responsibility, a much more costly result in the long term.

Figure 2 – The Blue Box



Blue Box programs have become popular, expanding across the province of Ontario⁸ and into other cities like Vancouver in 1990 (City of Vancouver Website 2010). With the exception of some ad hoc contributions, however, the programs are publicly funded and managed. Vancouver's system is financed by obligatory flat-rate fees on residents, with any additional costs covered using municipal funds. This is the case throughout most of North America. Indeed, this public-financing paradigm has proven quite path-dependent, with many unfortunate consequences. For example, resistance to alternative funding mechanisms like those in Europe has discouraged and delayed⁹ the start-up of new recycling programs and limited the types of materials programs accept,¹⁰ because of the public cost implications. Political will to try new things, including shifting the cost burden to the industries that produce waste and the consumers of their products, is needed to break down many of the economic barriers currently hindering recycling in North America.¹¹

3.2.2 Supply vs. Demand Side Policy

Governments can use various micro-level policies alongside residential recycling programs to achieve different goals, including increasing material recovery. They are broadly divided in the literature into supply and demand side policies. Supply side policies influence the generation of post-consumption recyclable waste, that is, its "supply" to manufacturers using it as an input. Demand side policies, in contrast, influence the amount of inputs (recycled or otherwise) that manufactures / producers require or "demand" for use in their products (i.e.

⁸ In 1994 the Ontario Ministry of Environment introduced regulation requiring municipalities above a minimum size (5000) to operate a Blue Box program (CIELP 2008).

⁹ A great example is St. John's, Nfld., which began a curb-side program in October, 2010 after years of cost-induced delays (CBC News 2010).

¹⁰ Under the new program in St John's, for example, glass is unacceptable because of weak markets and low economic returns; #6 polystyrene plastic is also widely rejected under publicly funded programs, as it is not cost-effective to recycle.

¹¹ Ontario has been relatively aggressive here, recently mandating that producers "share in the funding of 50% of Ontario's municipal Blue Box waste diversion programs" (Stewardship Ontario Website 2010). In spite of this, North American residential recycling remains very much a public undertaking.

policies forcing producers to reduce the amount of packaging they use overall). Some of the more popular policy approaches are listed in Table 1.

Table 1 – Supply and Demand Side Policy Approaches

Policies Targeting Supply	Policies Targeting Demand
Mandatory Public Participation	Producer Responsibility
Landfill Bans on Recyclables	Recycled Content Requirements
Pay-As-You-Throw Garbage Pricing	Procurement Guidelines
Disposal Taxes	Product Stewardship & Voluntary Agreements
Policies Affecting Convenience	
Product Deposit Systems	

This study looks at increasing the volume of recyclable materials recovered, by nature a supply-side issue, making policies in the left-hand column the most relevant. Policies in the right-hand column affect industry demand for inputs in various ways. Recycled content requirements, for example, are meant to increase the ratio of recycled to virgin inputs in production, and hence demand for the former. Producer responsibility, on the other hand, may be used to encourage producers to reduce the size or weight of their packaging (and hence their demand for inputs) to in turn reduce their volume-based financial obligations to the system. Stewardship and voluntary agreements may encourage firms to change their operations in order to appease government and avoid less flexible requirements.¹² Although these may be important policies, they are less

¹² Such agreements have been used extensively in Italy, for example. Here, in return for adopting Environmental Management Systems (EMSs) and other environmentally friendly actions, firms are given special status with respect to monitoring, taxation and enforcement—“Being exempt from many of Italy’s complicated environmental regulations is a strong incentive for companies to enter into these voluntary agreements” (Loughlin and Barlaz 2006, p.299).

relevant to the task at hand. Moreover, policies targeted at demand are much more suitable to the provincial than municipal level, owing to their much broader applicability.

The policy goal of increasing material recovery rates in Vancouver relates to increasing supply, so this set of policies is the focus. This toolkit includes an assortment of incentives and sanctions that have been used in varied combinations and with varying success in other jurisdictions. The specific options addressed later are taken from this list.

3.3 The Recycling Industry and Material Markets

Most people's knowledge of recycling ends at the curb where they place their Blue Box each week. In fact, this is just the first stage in what can be a complex supply chain for recyclable materials as they transition from post-consumer waste to new products. An understanding of the full chain and the industry more generally is imperative to appreciate the pros, cons, and finer details of policy options considered.

3.3.1 The Supply Chain and Major Actors

The first stage in the recyclable material supply chain is generation, which refers to the generation of waste following consumption. Generators are typically divided into three distinct categories: residential, industrial-commercial-institutional (ICI), and demolition, land-clearing, and construction (DLC). Residential generators are households of individuals who create recyclable waste in their day-to-day activities. Such waste includes traditional recyclables like paper, plastic, metal, and glass collected by either organized curb-side pick-up or drop-off (i.e. at a depot or recycling centre). Quantities generated per household are relatively small. This category of producers and materials is the focus of the present study. ICI generators include entities like factories, shops, and universities that produce large quantities of specific materials. DLC generators account for a huge share of overall waste volume that includes material like wood, drywall, and old asphalt. The latter two categories are outside the scope of this study.

With curb-side recycling, which accounts for the vast majority of residentially generated recyclable material recovered in Vancouver, the second step in the supply chain is collection. Once collected, materials are transported to a Material Recovery Facility (MRF) where initial processing takes place. Curb-side material is collected loose, mixed (to varying degrees depending on the system), and often partially contaminated, so it must be sorted, cleaned, and aggregated for ease in transport (almost always in baled form) prior to being sold on the material markets. This is done at MRFs.

MRFs are warehouse or factory-style industrial operations. Typical infrastructure includes a weigh scale, a series of concrete-block “bunkers” for different types of material, some type of sorting line (automated or manual), an industrial-sized baler(s), and bale storage space (see Figures 3-6—all photos taken by the author and published with the permission of site operators). The major differences depend on the type of material being processed at the site. MRFs processing homogeneous ICI material may be simpler than those processing more heterogeneous residential material (i.e. mixed containers including multiple types of plastic, metal, and glass) using complex sorting equipment, for example.

Figure 3 – Materials Being Tipped



Figure 4 – Manual Sort Line



Figure 5 – Elevated Sort Line With Partitions



Figure 6 – Market-Ready Baled Materials



After initial processing, curb-side materials may go through any number of parties before ending up at a facility that manufactures them into new products. In the simplest cases, materials are marketed by the MRF operating company itself and sold directly to manufacturers. This will be the case for only some MRFs and some materials, however. More often they will go through some type of intermediary broker, marketer, or exporter (or a combination) before being sold to a manufacturer. These intermediaries come in many shapes and sizes and deal with American and overseas mills in addition to local ones. Where the material goes depends very much on what it is. British Columbia has some local plastic and cardboard manufacturing capacity, but the province's (and Western Canada's) only newsprint and magazine recycling mill closed in 2009, diverting much of that material to the Northwestern U.S. Mixed paper and some plastics have weak or non-existent local markets and are largely sold abroad, primarily to China. Overall, most material leaves the region for manufacturing.

Figures 7-9 illustrate a few of the possible supply chains for different types of recovered material. They are offered for illustrative purposes and are not the only paths these materials might take or number of links they might pass through. Companies and firms cited are specific to the Vancouver area, but the basic flows between different types of actors are broadly applicable across North America. Different colours and shades indicate different categories of actors and slight differences within categories, respectively.

Figure 7 – PET (#1) Plastic

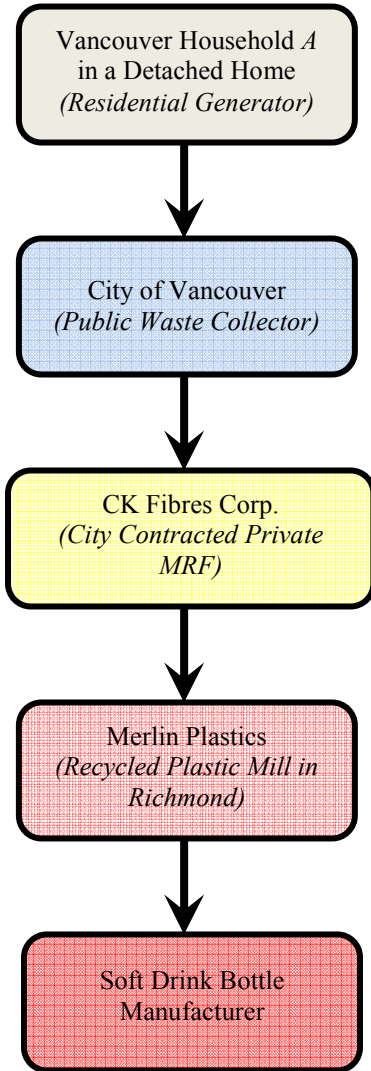


Figure 8 – Newspaper

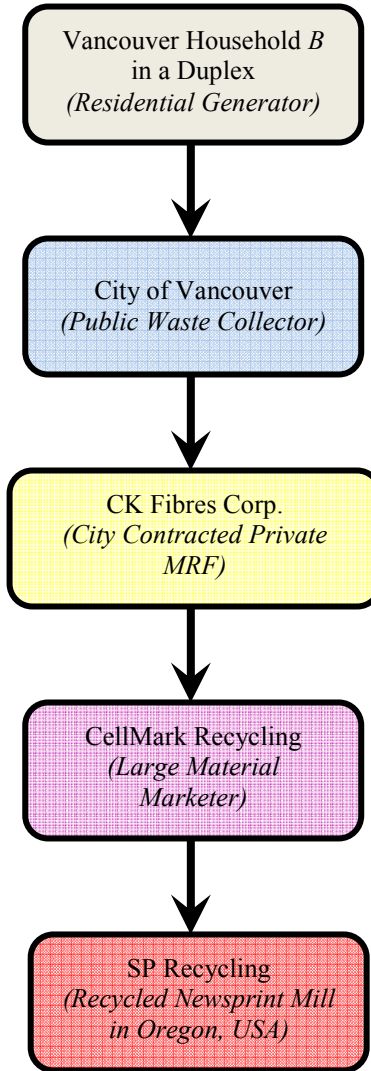
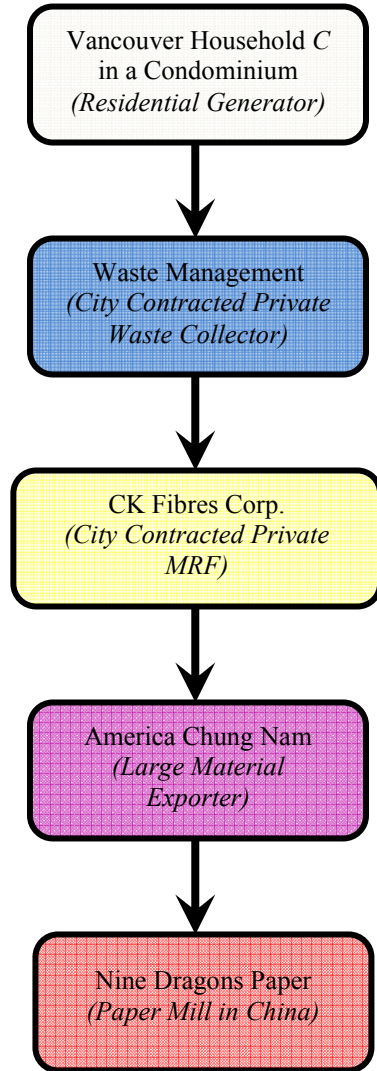


Figure 9 – Mixed Paper



3.3.2 Material Grading & Pricing

Material markets are structured around specific grading systems. A number of systems are used throughout the world; the standard in North America is the Institute of Scrap Recycling Industries' (ISRI) Scrap Specifications Circular (SSC). ISRI is an industry association that periodically publishes updated versions of the SSC. The document defines hundreds of different grades of materials including all standard residentially generated recyclables and a wide range of materials from other sources. Each grade has a code and definition including standards on composition, acceptable contamination levels, and processing specifications (i.e. bale density and dimensions); the document also includes trade and dispute resolution guidelines (ISRI 2009).

Specifications in the document are detailed and appear quite strict but are treated in industry transactions as flexible, rather than binding. This is important because of recent trends in the industry towards greater heterogeneity and contamination, in residentially sourced material in particular. As a result of current at-source sorting and collection systems, much curb-side material is a mixture of grades, often improperly sorted at the source and containing contaminants in the form of non-recyclables (garbage). It is therefore often impossible (or at least very expensive) to sort to a high level of purity and quality.¹⁴ Much of the material coming out of municipal recycling programs thus requires flexible grading because it does not meet the exact specifications of the SSC.

This flexibility also extends to pricing, which is explicitly tied to grading. Materials are priced by grade, much like other commodities. For each category of material (i.e. glass, metal, fibre, plastic), periodical pricing indicators are published with specific prices for each grade

¹⁴ Increased exporting to Asia has also been a significant factor in quality deterioration. As labour costs are relatively cheap there, they are more able to sort material economically (often manually) and do not require high purity levels from the start (Asia is one of the only places that buys, sorts, and processes large quantities of mixed paper grades because it is not economical to do so elsewhere). This has pulled down purity standards across the industry.

within that category.¹⁵ Transaction prices may be tied to one of these indicators (this is the standard for long-term contracts) or based on more variable spot prices determined by supply and demand. In both situations, some flexibility exists so that prices can be adjusted according to the specific characteristics of the material. In the case of residentially sourced recyclables, this may mean price reductions or downgrading due to poor quality.¹⁶

3.3.3 Municipal Recycling Programs

Designing a municipal recycling program requires dealing with each link in the supply chain and carefully considering the characteristics of the industry and material markets. The first link deals with collection. With residential, curb-side collection systems, municipalities may opt to invest in their own infrastructure and publicly run collections (as the City of Vancouver has done), or they may contract with a private hauler (like Surrey and many others in Metro Vancouver have done). With respect to the second link, material processing, contracting is the norm; MRF's are generally private operations, with no public involvement at this stage in the supply chain in British Columbia. The same is true for materials marketing, a responsibility generally assumed by the processor themselves or another contracted marketer / broker.

Arrangements vary with respect to the revenue generated from the sale of materials. Municipalities have two things to consider, namely, the end revenue generated from their materials and the cost of processing those materials to make them marketable, potentially at a range of prices. Contracts can be structured in a few basic ways, with a great deal of room for variation in the smaller details. One is for a municipality to take 100% of the material revenue generated (usually minus a marketing premium) and pay the processor a tonne-based fee for processing it. Such arrangements shoulder municipalities with significant risk because of the

¹⁵ *Pulp and Paper Week* and the *Official Board Markets* are two popular indicators in the fibre industry that publish monthly prices for a variety of paper grades.

¹⁶ Where tied to a published indicator price, buyers often work premiums or deductions into their contracts based on the typical quality of the material they are purchasing.

volatility of the material markets. The opposite approach is for a municipality to pay nothing and allow the processor to keep all material sales revenue to pay for the processing (and potentially provide them a profit—at greater risk, however). A final, more common approach is a hybrid of the first two, namely, some type of revenue sharing (and risk sharing) arrangement between the municipality and processor. Under such arrangements, processors transfer a contracted share of material revenue to municipalities, taking into consideration their processing costs.¹⁷ Such agreements can be structured in various ways with respect to things like percentage shares, floor pricing / minimum revenue transferred, and materials covered.

3.4 Potential for Impact

The problem of sub-optimal residential recycling rates has two key dimensions: participants and materials. Maximizing recovery means maximizing both the number of participant recyclers in the system and the amount of material each recycles. This section suggests where room for improvement lies.

3.4.1 Participation

Recycling in North America has grown significantly over the past three decades in terms of the key dimensions of access, participation rates, and materials accepted. In Canada, access to recycling services has grown from the highly limited, activist-run community centre recycling of the pre-1980s, to a standard household practice. According to Statistics Canada Survey data, services of some kind were available to around 74% of Canadians in 1994, a number that grew to 95% by 2007 (from 78% to 97% for British Columbia). In addition, more of this access is to quality, convenient services like curbside pick-up, as opposed to drop-off recycling. Participation

¹⁷ Vancouver's current processing contract with CK Fibres Corp of Richmond is of this variety. The contractor bids a fixed fee per tonne of each type of material processed. The contractor then pays the City the difference between the market value and the fee for mixed paper and newspaper; the same is true for containers if prices are strong, but if they are not, the City pays the shortfall between the bid price and market price (McLennan 2011-C).

rates have seen similar increases, again, growing from negligible prior to 1980, to 98% of Canadian households with access to services recycling at least some of their waste in 2007 (98% in BC as well) (Munro 2010). Finally, the variety of materials accepted for recycling has grown from a limited number in the late 1980s (newsprint, aluminium, glass bottles) to a much wider variety of metals, plastics, and fibrous materials¹⁸ (Schienberg 2003; Munro 2010).

Hidden within these seemingly high participation rates, however, is the problem of the partial recycler. While 95% of Canadians with access to recycling take advantage of it, only about half report that they recycle *all* of their recyclable waste. In 2006, 52% of Canadian recyclers reported recycling all material they could, while 34% reported recycling between most and all, and 15% reported recycling less than the majority (the numbers were virtually identical in BC). Certain variables appear to have a significant effect on “partial recycling.” Access to curbside recycling is one, as 55% of Canadians with it reporting that they recycle everything, compared to 34% of those without (56% and 38% in BC). Dwelling type is another, with Canadians residing in apartments just as likely as those in detached homes to recycle, but significantly less likely to recycle everything (46% compared to 54%). Finally, certain materials are often recycled at different levels; glass and metal, for example, tend to be fully recycled much more often than paper (Munro 2010).

This is an indication of where work needs to be done. On the positive side, converting non-recyclers outright does not appear to be necessary as most with access do some recycling already. The task is really about getting the large share of people not meeting their full recycling potential to increase their efforts. The factors discussed above point to some of the targets towards which policy might aim.

¹⁸ However, as noted previously, there are still some broadly rejected materials and some that remain less acceptable overall than others (glass and #4 and #5 plastics, for example).

3.5 Residential Solid Waste and Recycling in the City of Vancouver

The nature of the current solid waste and recycling management system in Vancouver has significant implications for feasible policy options. This section covers background information specific to Vancouver, including the current structure of the residential solid waste management system, volumes collected, and recovery rates.

Solid waste occupies a unique policy position due to overlapping jurisdiction between Metro Vancouver and its individual members, of which the City of Vancouver is one. Metro Vancouver deals with macro-level level policy, including landfill, Waste to Energy (incineration), and transfer station infrastructure (excluding the Vancouver landfill and transfer station), and general solid waste policy guidelines. Individual members deal with the more micro-level, day-to-day solid waste operations including collections management, contracting, and policy related to system structure (i.e. the number of streams), acceptable materials, scheduling, and bylaws. The following sections detail Vancouver's current approach to their areas of jurisdiction, with reference to Metro Vancouver where appropriate.

3.5.1 System Structure

The City of Vancouver provides weekly curbside collection of recyclable materials to all residents. Currently, acceptable materials include all types of paper products, as well as all glass containers (bottles and jars), metal containers (including aluminium foil and foil containers), and rigid plastic containers marked with the #1, 2, 4 or 5 recycling emblems.¹⁹ All beverage containers (including those with deposits) with the exception of paper milk cartons are also accepted. Non-rigid plastics like bags, even though they are often marked with the #2 recycling emblem, are not acceptable (City of Vancouver Website 2010).

¹⁹ The different numbered emblems on plastics indicate resin type. Types 1, 2, 4, 5 and 6 are commonly used for household products. Prior to 2002, the City of Vancouver only accepted plastics numbered 1 or 2, as the others are low in value and have weaker markets. In 2002, plastics 4 and 5 became acceptable (City of Vancouver 2002). Number 6, polystyrene (aka "Styrofoam"), although abundant, remains unacceptable because it is uneconomical and problematic to recycle.

These materials are collected in three separate “streams”:

- 1) newspaper (including inserts)
- 2.) mixed paper (all paper types)
- 3.) mixed containers (glass, metal, and plastic).

Single-family homes and most duplex and townhouse units have a “Blue Box,” a “Blue Bag,” and a “Yellow Bag” (see Figure 10). Newspaper goes in the Blue Bag, mixed paper in the Yellow Bag, and loose containers in the Blue Box. Multi-family residences such as apartments and condominiums deal with recycling in the same three streams, but use large communal “toter bins” (see Figure 11).

Figure 10 – Blue Box, Blue Bag, and Yellow Bag



Figure 11 – Multi-Family Residence Communal Toter Bins



A number of other significant differences exist between single and multi-family residences.²⁰ In Vancouver, multi-family units in the areas of Downtown, Kitsilano, Fairview, and Mount Pleasant—all areas with relatively high concentrations of such buildings—receive recycling collection service from a city-contracted hauler (Waste Management at the time of writing). The rest of the multi-family units in Vancouver, along with all single-family residences citywide, have their recyclables collected by city staff using city-owned trucks.²¹ Fees for these services are charged annually to the building owner on their property tax bill, or, in the case of condominiums / co-ops, to the strata corporation (City of Vancouver Website 2010).

Perhaps the most consequential structural difference between the two building types has to do with management of garbage. Multi-family units in Vancouver use large, communal

²⁰ To give an idea of the scale of each dwelling type in the City, as of 2009 there were 95,000 single-family homes, each with their own Blue Box and bags, and 150,000 multi-family units across approximately 4,800 buildings, each using communal toter bins for recycling (City of Vancouver, 2010a).

²¹ Vancouver is one of the relatively few Metro Vancouver members that uses city-owned trucks and city-employed staff to conduct solid waste collection; most others have contracted these services out to private waste haulers. The City currently owns and operates 16 fully-automated and 3 semi-automated garbage collection vehicles, along with 24 for recycling and 4-14 for yard waste, depending on the season (McLennan 2011-C).

garbage receptacles (dumpsters) in addition to communal recycling bins (see Figure 12). With such residences, the strata council or building management independently contracts garbage collection to private waste haulers and pays for the service.²²

Garbage collection for single-family residences is very different. It is done using a fully-automated²³ cart-based system, where each individual household has a standardized, wheeled garbage cart for their personal use (see Figure 13). The fee for this service (along with other services like recycling and yard waste collection) is charged annually as a line item on each owner's property tax bill.²⁴

Figure 12 – Typical Multi-Family Communal Dumpster



²² An unfortunate implication of this is that garbage volumes from multi-family units are not measured as they are for publicly collected garbage. This results in some data uncertainties, discussed later.

²³ Fully-automated pick up uses collection vehicles with robotic arms and clamps which pick up and dump waste containers with no human assistance required (aside from joystick operation within the vehicle). This is distinct from manual collection where staff both pick up and dump containers, and semi-automated collection where staff pick up containers and position them on a truck-attached apparatus that lifts and dumps them.

²⁴ If such a household generates more garbage in a week than they can fit in their cart, they can also purchase stickers at \$2 each from various City outlets and local grocers; each additional bag is picked up only if it is tagged with such a sticker (City of Vancouver Website 2010). The City sells roughly 10,000 of these stickers annually (McLennan 2011-C).

Figure 13 – Single-Family Garbage on Collection Day



In addition to its fleet of collection vehicles and staff, the City of Vancouver owns and operates important solid waste infrastructure in the form of the South Vancouver Transfer Station and Vancouver Landfill (physically located in Delta). Metro Vancouver transfer stations (of which there are 6 others throughout the region) are sites where garbage collected by short-range trucks is taken to be weighed, inspected for banned materials (including recyclables), dumped, compacted, and loaded onto long-range trucks for transport to the Cache Creek Landfill. The City controls the Vancouver Landfill, where public and private waste haulers servicing all types of waste generators may dump solid waste. As of January 2011, the “tipping fee”²⁵ at the Vancouver landfill and all transfer stations in Metro Vancouver was \$97 per tonne for garbage, up from \$82 in 2010 (City of Vancouver Website 2010). Recycling services are also provided at transfer

²⁵ A “tipping fee” is the money charged to a waste hauler at a disposal site—literally, a charge to “tip” their truck contents.

stations: residents may drop off large volumes of recyclables there (i.e. if they have more than will fit in their Blue Box) free of charge.

3.5.2 Volumes and Recovery Rates

Table 2 summarizes key Vancouver-specific baseline recycling data. The units are metric tonnes. These numbers include only material collected at the curb. They do not include residential material dropped off at transfer stations, which makes up a very small portion of the total and is not tracked according to its source. Neither do they include beverage containers returned to Encorp depots (see Section 6.4.1 for details). Recovery rates in columns 5-6 refer to the percentages of Blue Box-accepted, residentially generated recyclable material that actually end up recovered for recycling (excluding returned deposit material).²⁶

Table 2 – Key Baseline Recycling Data, City of Vancouver

Material	Volume Recovered - Low Density*	Volume Recovered - High Density**	Volume Recovered - Total	Recovery Rate - Single-family	Recovery Rate - Multi-family
Fibre:					
<i>Newsprint</i>	5,667	1,921	7,588		
<i>Mixed Paper</i>	11,893	3,743	15,636		
Total	17,560	5,664	23,224	66%	49%***
Mixed Containers	6,862	1,926	8,788	66%	30%

(Source: 2009 Solid Waste and Recycling Data Survey, among others – see Appendix A)

*Includes all single-family homes (Low Density) and the small share of multi-family units serviced by city crews

**Includes the majority share of multi-family homes (High Density) serviced by city contracted private collectors

***This figure is somewhat underestimated – see Appendix A

²⁶ It is estimated using a rather complex methodology, described in Appendix A.

The key observation from Table 2 is the significant room for growth in recovery rates. Columns 5 and 6 show that Vancouver residents are currently recycling at significant rates, but could easily do more, particularly in the case of multi-family residences. As the highest recovery rate observed is only two thirds of material produced, substantial increases should be attainable with limited effort. The policies described in the next section are analyzed with this in mind.

4: Policy Options

In this section, I introduce the major policy options considered in the remainder of this study. All are supply-side oriented and taken directly or adapted from those listed in Table 1. I describe their basic mechanics and explain the theory behind why each may be effective in achieving the key policy goal. Vancouver-specific details are also provided, including how each policy currently manifests in the City. In the case of the first two options, which may manifest in various forms, Vancouver-specific approaches are also suggested.

4.1 Bylaw Oriented Compliance

The first option is to increase material recovery through a bylaw-focused approach. Many jurisdictions in charge of managing solid waste have the authority to enact bylaws related to recycling. Common among such bylaws are those that regulate which materials are acceptable and not acceptable in the garbage and recycling streams. For example, in the interests of encouraging participation in recycling programs and avoiding the costs discussed in Section 1, recyclable materials accepted in curb-side programs are often banned or restricted from the garbage. Achieving high rates of compliance with these bylaws, therefore, would help solve our policy problem.

Although any policy to increase recovery in this context could be framed as one encouraging compliance with bylaws, here the approach is more narrowly defined as one that focuses specifically on communicating and enforcing the written bylaws. This is the pyramid approach: begin with widespread education and communication to ensure bylaws are known and understood (the broad base of the pyramid), and gradually escalate targeted enforcement and sanctions on the smaller number of remaining non-compliers (the narrow peak of the pyramid).

The communication approach can be effective at encouraging compliance among those who are otherwise unaware of the bylaws and their expectations. The vast majority of society (representing the broad base of the pyramid) is assumed willing to comply if informed. There will always be a narrower segment who continue to defy the rules, however. Escalating bylaw enforcement and penalties are required to get each group of increasingly resistant (but smaller in number) individuals into compliance (Morgan and Yeung 2007). Both broad-based communication and targeted enforcement can be implemented in a variety of ways.

4.1.1 Vancouver Status-Quo

Currently, Vancouver has regulations on recyclable material in the garbage stream codified in the Solid Waste Bylaw No. 8417 (City of Vancouver 2010). This document distinguishes between materials that are “prohibited” and “restricted” from both “Garbage Containers” and “the Vancouver Landfill and Transfer Station.” Prohibited materials include mostly dangerous items like chemicals, flammables, and other hazardous waste, but also beverage containers with deposits. These materials are all strictly prohibited from “garbage containers from which the City Engineer collects solid waste” (this includes residential garbage carts) and Vancouver’s landfill and transfer station (City of Vancouver 2010, p.17). All other Blue Box recyclables listed in Section 3.5.1 are listed as “restricted” materials. With respect to these recyclables in garbage containers, article 7.6 reads:

No garbage container from which the City Engineer collects garbage may contain 5% or more by volume one or more of the materials described in Schedule F to this By-law. [Schedule F includes all Blue Box accepted recyclables] (City of Vancouver 2010, p.17).

With respect to material disposed at the Vancouver landfill and transfer station, article 8.8 reads:

A surcharge of 50% on the tipping fee may be assessed on garbage loads disposed at the Vancouver Landfill or Vancouver South Transfer Station that contain 5% or more by volume of one or more of the materials described in Schedule F to this By-law. [Schedule F includes all Blue Box accepted recyclables] (City of Vancouver 2010, p.19).

The 5% volume caveat is meant to allow reasonable discretion on the part of bylaw officers, but it also makes restrictions on recyclable material somewhat more ambiguous and difficult to enforce than if they were prohibited outright (Stringer, 2011-C).

Currently, enforcement is concentrated at the Vancouver landfill and transfer station, directed towards anyone tipping waste there. Enforcement is severely limited when it comes to individual household containers. In theory, they can be prosecuted and fined for infractions but the act of infraction must be physically witnessed and sworn to in order for this to be done. This means that if recyclables are found in a garbage cart after the fact, the household could shirk the bylaw by simply claiming someone else put them there, for example. Effective curb-side enforcement is therefore unworkable under current bylaws (Moffitt 2011-C). The current “enforcement” scheme is limited to collection staff identifying non-compliant material and tagging carts with an explanation of the problem and indication that the property will be contacted about it.²⁷ Cart tagging may take place after material has been collected, or before, in which case contents may be left behind. Under Vancouver’s fully-automated, closed-lid, cart-based garbage system, however, even tagging non-compliant carts is unlikely as robotic arms make it such that operators rarely see container contents (Moffitt 2011-C). And when it comes to communal dumpsters, there is typically no curb-side enforcement or feedback of any type.

The vast majority of Vancouverites are likely unaware of what these bylaws say, or that they even exist. Vancouver waste activist Helen Spiegelman suggests that no more than a select group who are either keenly interested in the topic or directly involved in the industry are aware of and understand the regulations (Spiegelman 2010-C).

A strong bylaw-oriented approach would therefore involve significant investment in both communication and enforcement of penalties. This could include a combination of the following:

²⁷ Officials consulted were not certain how much follow-up actually occurs.

1.) Clear, powerful, and consistent garbage / recycling container labelling

An easy way to educate the public about which materials bylaws permit in each container is by specifying the information on the containers themselves. Some such labelling exists in Vancouver, for both single-family and communal containers (see Figures 14-20—all taken by the author). Even so, the status-quo is problematic for several reasons:

- Many of the current labels are out of date and incorrect: Figure 14, for example, shows the label from a multi-family mixed container recycling toter; it indicates that only plastics #1 and #2 are acceptable, when in fact #4 and #5 were introduced to the system in 2002²⁸
- Labelling is highly inconsistent: For communal waste containers, a wide variety of different labels from different time periods can be found on both garbage and recycling bins; some have no labels at all²⁹
- Labels are focused on hazardous items: Both single-family and communal garbage containers display clear labels showing banned hazardous materials, which although important, overshadow information on banned recyclables
- Labels do not always implicate all recyclable materials: Depending on the label, it may indicate that paper / cardboard is banned, or that deposit containers are banned, or that all recyclables are banned (see Figures); this is the most significant issue for single-family garbage containers

²⁸ The City does not have exact numbers on the share of toters that are up-to-date vs. out-of-date; they suggest the number out-of-date is “significant” (Thomas 2011-C).

²⁹ All single-family garbage carts feature the same label, shown in Figure 20. Large dumpster labels indicating banned recyclables (Figure 17) are designed and distributed by Metro Vancouver. Dumpsters are owned by private companies and attaching labels is not currently mandatory—companies that wish to can request labels from Metro Vancouver and install them. There are many different waste haulers in Vancouver, but only some have opted to label their containers; this is the source of the inconsistency (Doi 2011-C).

- Labels are not aggressive / powerful enough: They ought to clearly inform people that putting recyclables in the garbage is **illegal**

Figure 14 – Out-Dated and Incorrect Toter Label



Figure 15 – Recent and Correct Toter Label

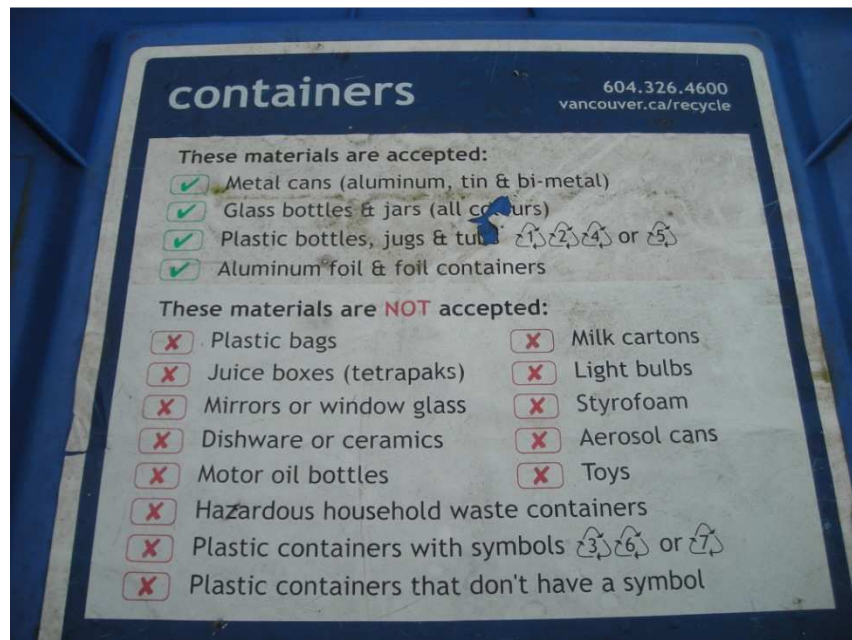


Figure 16 – Hazardous Material Label



Figure 17 – Metro Vancouver Comprehensive Label



Figure 18 – Residential Dumpster with Multiple, Current Labels



Figure 19 – Residential Dumpster with No Labels



Figure 20 – Single-Family Garbage Cart Label



2.) *Enforce bylaws at the curb*

In addition to bylaw enforcement directed toward those tipping at disposal sites, bylaws could be amended to facilitate enforcement (inspection) on household containers at the curb, including monetary penalties for noncompliance. Like enforcement at the landfill and transfer station, it would be random, for deterrent effect. Maximum effectiveness would require that the public be properly informed of new measures being taken (i.e. through advertising) so they could heed warnings and adjust behaviour accordingly.

A bylaw-oriented approach initially emphasizing communication, and later effective enforcement as detailed above, holds significant potential to increase recovery rates.

4.2 Strengthen Pay-As-You-Throw Garbage Pricing

Pay-As-You-Throw (PAYT) pricing (aka unit-pricing / use-based pricing / variable rate pricing) is a user-pay approach to waste where garbage service charges vary according to volume generated. Fixed rate garbage fees provide little direct monetary incentive for people to keep their recyclables out of the garbage because they pay the same amount regardless of whether the material ends up in the garbage can or the recycling bin. The theory is that if required to “pay as you throw” per unit of garbage, people will dispose of as much as they can through lower-cost methods. As recycling remains free or charged at flat rates, people are encouraged to recycle as much as possible to avoid added disposal costs. PAYT programs are common in North America and come in a number of distinct forms, providing monetary incentives of varying strengths.

One of the clearest to understand is simply charging by weight: for each additional kilogram (or some other weight increment), a household pays a marginal fee, thus encouraging them to limit waste generated to avoid paying more. On-board scale and computer technology exists that can weigh garbage containers as they are tipped, and charge households accordingly. Weight-based programs exist in a number of European jurisdictions, but curiously, Canadian federal regulations, specifically those under the *Weights and Measures Act*, make this option unfeasible in Canada. The regulations apply to “the use of onboard weigh scales for commercial trade purposes” and require that measuring devices meet strict accuracy specifications and be government certified (Kalogerakos 2009, p.9). The technology used to weigh garbage has trouble meeting accuracy specifications, in part because scale sensors are located in the robotic arm of the truck, and weights may vary at different points as the container is physically lifted and dumped³⁰ (Lynch 2010-C).

³⁰ In theory, improved technology could make weight-based PAYT workable. For now, however, it remains problematic (Lynch 2010-C; Rotheisler 2010-C).

PAYT can also be bag or tag based. Under bag-based systems, garbage is only collected if it is set out in approved bags, purchased from recognized outlets and priced to cover program costs and possibly incentivize recycling and waste reduction. Tag or sticker based systems are similar: households can use their own bags (or cans) as long as they meet certain specifications, but they are picked up only if properly tagged / stickered. Stickers / tags are priced and sold as in bag-based systems.

Another popular PAYT approach is the “variable or subscribed can.” Under these programs households pay “based on the number (or size) of cans of garbage they sign up for as their “normal” setout” (Skumatz, Truitt, and Green 1997, p.31). Containers are offered in a number of standard sizes, which correspond to a pricing schedule. For example, a household may look at the fee schedule and choose a 90-litre container rather than a 120-litre container in order to save the difference in price. Such systems are relatively less “variable” because container sizes cannot be adjusted over each collection cycle—a household can change their container size by ordering a new can, but this takes time.³²

Each of the PAYT systems discussed can vary with respect to a number of highly consequential details. One is the rate structure design (RSD). Depending on the type of program, rates can vary in terms of how high they are set and how rapidly they change when more garbage is generated—the higher the fees and increments of increase, the stronger the incentive. Billing can also vary between monthly and yearly, as can its method and visibility—the more frequent and visible the payments, the stronger the incentive. Finally, collection schedules can vary, usually between weekly and bi-weekly—the less frequent the collections, the stronger the incentive.

³² The City of Vancouver currently has such a system. Residents simply call the City if they want to change their cart size, with the difference in fee prorated on their account. More than one container change within a year may require an additional fee (City of Vancouver Website 2010).

4.2.1 Vancouver Status Quo

The City of Vancouver currently uses a variable can PAYT program, but one that fails to effectively harness the full potential of PAYT incentives to encourage recycling. Table 3 shows the different container sizes and corresponding annual fees (2010).³³ These rates apply to households using city-issued garbage carts, and not those using communal dumpsters (i.e. apartments / condominium buildings).

Table 3 – Vancouver’s PAYT Pricing Structure - 2010

Container Size	Annual Fee	Average Cost Per Litre of Capacity	Marginal Cost Per Litre of Capacity
75 litres	\$89 (\$7.42 monthly)	\$1.19	-
120 litres	\$105 (\$8.75 monthly)	\$0.88	\$0.36
180 litres	\$128 (\$10.67 monthly)	\$0.71	\$0.38
240 litres	\$150 (\$12.50 monthly)	\$0.63	\$0.37
360 litres	\$194 (\$16.17 monthly)	\$0.54	\$0.37

(Source: City of Vancouver Website 2010)

The incentives created by this system are sub-optimal in a number of respects. For one, there are only five container sizes to choose from. Considering that Vancouver currently has weekly garbage pick-up, the smallest container is simply too large to provide an effective

³³ This was the pricing structure at the time of writing. The fees have since been adjusted for 2011, increasing overall by an average of 2% – see Appendix B for complete details.

monetary incentive for many households to shift all recyclables from the garbage. Even the smallest allows significant waste capacity—more than many households could fill in a week, even without aggressively diverting.³⁴ Second, the overall fees are quite low, which is especially clear when considered on a monthly basis (see column 2). Even with the larger containers, fees are low enough for most Vancouver households to consider them relatively insignificant. In addition, as container sizes increase, concurrent fee increases are minimal and do not provide a strong incentive to downgrade. For example, between the smallest two containers, having an extra 45 litres of weekly disposal capacity costs only \$16 a year.

The fee design is also the source of perhaps the most glaring problem with the incentive structure. Column 3 in Table 2 shows the current fees on an average cost per litre basis, where the dollar figures indicate the annual fee paid for each litre of weekly disposal capacity. Rather than costing the same amount (or more) per litre, this cost decreases with every single upgrade. For example, moving from the smallest to largest container reduces cost per litre by more than half! This situation can be compared to a bulk supermarket sale where each unit of a product is discounted as more are purchased—it essentially offers residents bulk-buying discounts for generating more waste!

This current structure is a result of the City’s “cost of service” (CAS) approach to setting solid waste fees. CAS dictates that fees be set to recover the direct financial costs of delivering the service, with no cross-subsidization between different services. As discussed in Section 1, collection is the most significant solid waste service cost, and one that depends more on the number of stops than the volume of waste collected at each. The current container fees are a reflection of this: each is a combination of a “fixed fee” (the same regardless of container size³⁵) to cover the fixed costs of the operation (i.e. trucks, labour), and a “volume fee” (which increases

³⁴ Consider, for example, that you could fit just under 19 four-litre milk jugs’ worth of garbage in the *smallest* container in a week.

³⁵ The current fixed fee is \$63 (City of Vancouver 2011c).

roughly in proportion with capacity³⁶) to cover variable costs (i.e. disposal tipping fees) (City of Vancouver 2011c). Fees recover only the direct financial costs of providing the service; they ignore both the long-term economic costs of disposal infrastructure (i.e. expanding landfill / incineration capacity) and environmental externalities. Incentivizing recycling and waste reduction is very much secondary to cost recovery.

Figure 21 – Vancouver PAYT in 2010: Graph

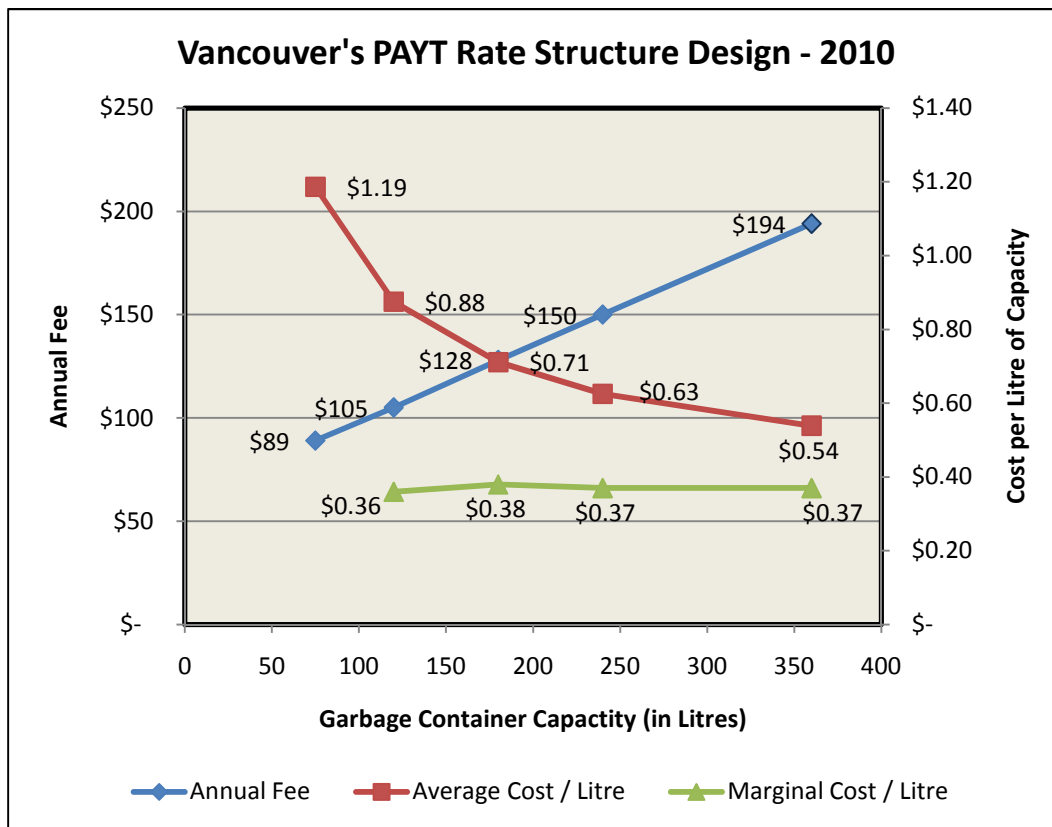


Figure 21 illustrates this problem graphically. Points plotted correspond to the different garbage container sizes indicated on the horizontal axis. The primary vertical axis shows annual fees (Table 3, column 2), the secondary axis cost per litre of capacity (Table 3, columns 3-

³⁶ Additional capacity currently costs approximately 38 cents per litre (City of Vancouver 2011c).

average, and 4-marginal). The blue curve (diamond markers) representing overall annual fees is logically upward sloping—as container sizes increase, so do annual fees. The red curve (square markers) showing the average cost per litre of capacity for each container, however, is downward sloping—and steeply downward sloping at that, particularly at the initial stages. This curve shows how overall, cost paid per litre decreases as container size increases—the bulk discounts referred to earlier. Finally, the green curve (triangle markers) represents the marginal cost per litre of capacity with each container upgrade. It is related to the volume-based portion of the container fees. Because volume-based fees increase roughly in proportion with capacity, this curve is close to a flat line.

To provide a real incentive to recycle and reduce, this rate structure design needs to be adjusted. Most importantly, overall annual fees, rather than just the “volume fee” portion of them, need to increase more proportionally with increases in capacity; this would mean a much steeper annual fee curve (meaning larger fee increments between container sizes) and a much flatter average cost curve—the flatter, or even more upward sloping this curve, the stronger the incentive.³⁷ Although volume-based fees currently increase in proportion with additional capacity (meaning marginal costs are constant), the fixed portion of the overall fee is large enough that it hides this fact to all but those who are most familiar with the system. For the vast majority of households who only ever see and understand the overall fee, the rate structure makes it appear as though upgrading container size means enjoying significant bulk discounts. When it comes to incentives, perceptions are all important. The incentives need to be clearly communicated via the overall, rather than marginal costs: if larger containers cost significantly more overall, households will see a strong incentive to recycle in order to downgrade.

³⁷ Skumatz’s 2002 study found that fee increases that are less than proportional to size increases provide the same recycling incentive once the increase reaches around 80% (i.e. doubling capacity at an 80% fee increase has the same effect as doubling capacity for double the fee) (Skumatz 2002). Making the curve perfectly flat or even upward sloping would therefore be quite aggressive and likely unnecessary.

Fees are assessed annually via property tax notices. Figure 22 shows a mock City of Vancouver property tax bill (for a non-strata property owner), with the line item for garbage collection highlighted in yellow. The size of the garbage cart and associated fee are both explicit. Although the visibility helps strengthen the incentive, the relative infrequency of billing (annual) does not. Unfortunately, City officials consulted believe the administrative costs of (i.e.) monthly billing would probably be prohibitive, and difficult to justify without confidently knowing how effective the added incentive would be (Moffitt, 2011-C). As for multi-family dwellings, most residents will never see any garbage fees, as the service is provided by private haulers paid directly by the strata council / building management, and charged indirectly to residents (via rent for renters and strata fees for condo owners, for example).

Vancouver could strengthen its PAYT incentives in a variety of ways. The status-quo, particularly in terms of infrastructure, largely dictates what is feasible. As the City recently invested substantial capital in a fully automated collection system, complete with new trucks and standardized carts, a bag, tag, or sticker approach does not make sense. Neither does a weight-based program for the issues mentioned. This leaves a modified version of the current variable can program as the only feasible alternative. Recycling could be encouraged via this method by:

- increasing *overall* fees and adjusting them so that the price increments between container sizes are significantly larger and designed so that fee increases are more proportional to capacity increases, and
- creating either a smaller minimum container size (offered at a reduced rate if not free of charge) or, even better, switching to bi-weekly garbage collection³⁸ (which also incentivizes based on available capacity and likely has a stronger effect)³⁹

³⁸ Trying different combinations of collection schedules, i.e. switching from weekly to bi-weekly garbage collection, is a current trend in municipal solid waste management throughout North America. With Vancouver's recent addition of food scraps to the yard waste system, it is entirely feasible that a bi-weekly garbage with weekly recycling / organics collection program be implemented.

In terms of billing, research suggests that it might also be beneficial to merge all solid waste fees together, rather than including garbage, recycling, and yard waste as separate line items (note these two additional items below the highlighted garbage line in Figure 22). Jurisdictions that have done so have experienced increased waste reduction and recycling (Skumatz 2001; Kelleher Environmental 2009). This is likely because embedding recycling / yard waste charges within the garbage (or “solid waste”) fee creates the perception that these services are “free,” and encourages their use as an alternative to garbage disposal, which is perceived as “not free” and in fact more expensive after the merger of fees.⁴⁰ Other changes to the payment system such as monthly billing would also strengthen the incentives, but are less feasible because of the significant administrative and transitional issues they imply. Alone, however, the other suggestions are entirely feasible and worthy of consideration.

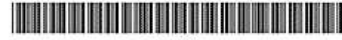
³⁹ Bi-weekly garbage collection may be the only option if a smaller can cannot be designed to fit the robotic clamps that Vancouver garbage trucks currently use to grip and lift containers.

⁴⁰ This is an idea from “behavioral economics.” Evidence suggests people tend to treat “free” goods much differently from those with a cost, even if that cost is very low.

Figure 22 – Mock Property Tax Notice



20XX PROPERTY TAX NOTICE
DUE DATE: Monday, July 5, 20XX



Statement Date: Jun 13, 20XX

5% PENALTY IF NOT PAID OR GRANT NOT CLAIMED BY JULY 5, 20XX

PROPERTYOWNER, IMA
 123 ANYWHERE ST
 VANCOUVER BC V0X 0X0

FOLIO NUMBER	999-999-00-0000	ACCESS	074490
LEGAL DESCRIPTION			
LOT 123 BLOCK 123 PLAN 123 DISTRICT LOT 123 NEW WESTMINSTER LAND DISTRICT			

Property Value		Assessed			Averaged	Taxable		
CLASS		2010	2009	2008	2010 Land	GENERAL	SCHOOL	GVTA
Residential	Land	700,000	600,000	500,000	600,000	600,000	600,000	600,000
	Buildings	150,000	150,000	150,000		150,000	150,000	150,000
	Total	850,000	750,000	650,000		750,000	750,000	750,000
PROPERTY ADDRESS		123 ANYWHERE ST			COLUMN A	COLUMN B	COLUMN C	
PID		123-123-123	CLASS	RATE	NO GRANT	BASIC GRANT	ADDITIONAL GRANT	
School - Residential				1.55095	1,163.21	1,163.21	1,163.21	1,163.21
Less: Home Owner Grant							-570.00	-845.00
NET SCHOOL TAXES					1,163.21	593.21	318.21	
BC Assessment				0.06624	49.68	49.68	49.68	49.68
Municipal Finance Authority				0.00020	0.15	0.15	0.15	0.15
Regional District				0.06849	51.37	51.37	51.37	51.37
TransLink				0.37928	284.46	284.46	284.46	284.46
NET OTHER TAXING AUTHORITIES					385.66	385.66	385.66	
City of Vancouver General Levy				2.14861	1,611.46	1,611.46	1,611.46	1,611.46
Garbage Cart 120L				105.00000	105.00	105.00	105.00	105.00
Recycling				29.00000	29.00	29.00	29.00	29.00
Sewer - 1 Dwelling				227.00000	227.00	227.00	227.00	227.00
Water - 1 Dwelling				417.00000	417.00	417.00	417.00	417.00
Yard Trimmings Cart 360L				75.00000	75.00	75.00	75.00	75.00
NET CITY TAXES					2,464.46	2,464.46	2,464.46	
TOTAL 2010 TAXES					4,013.33	3,443.33	3,168.33	
Payments/Adjustments					-2,100.00	-2,100.00	-2,100.00	
TOTAL OUTSTANDING TAXES					1,913.33	1,343.33	1,068.33	

You are not currently enrolled in the Tax Instalment Payments Plan. If you were to enroll your estimated monthly payment amount for next year's taxes would be \$317.00 if you claim the additional grant, \$345.00 if you claim the regular grant, \$402.00 if you do not claim a grant.

To claim your Home Owner Grant, complete the form below in full, sign, and remit it by July 5, 2010 to avoid 5% penalty. Or visit vancouver.ca/ehog.

Customer Copy

AMOUNT DUE JULY 5, 20XX

A - NO GRANT	B - BASIC GRANT	C - ADD'L GRANT
\$1,913.33	\$1,343.33	\$1,068.33

KEEP THIS PORTION

APPLICATION FOR HOME OWNER GRANT/REMITTANCE ADVICE

2010 CITY OF VANCOUVER TAX NOTICE
 PO Box 7747 VANCOUVER BC V6B 8R1
 Due Date: July 5, 20XX

I, _____ PRINT NAME IN FULL

have read and understand the Home Owner Grant Eligibility requirements on the reverse and certify that I qualify for: Please check only one:

- BASIC GRANT
- SENIOR GRANT (age 65 or over during this calendar year)
 My birth date being:
- OTHER ADDITIONAL GRANT (see reverse for criteria)
 I understand that I may be required to provide additional information to be eligible for a grant. I also understand that the Home Owner Grant Admissions Branch may confirm my age and address with ICBC.

*(or signature of spouse/relative of deceased owner)

OWNER SIGNATURE*
 GRANT NOT VALID UNLESS SIGNED AND COMPLETED IN FULL

DATE SIGNED _____ / ____ / ____

TELEPHONE (____) _____

ADDRESS OF RESIDENCE _____

A	B	C
No Grant	Grant: 570.00	Grant: 845.00
\$1,913.33	\$1,343.33	\$1,068.33

Amount Paid

FOLIO 999-999-00-0000
 PID 123-123-123
 CIVIC 123 ANYWHERE ST
 OWNERS PROPERTYOWNER, IMA
 123 ANYWHERE ST

VANTAX



999-999-00-00006 00001913335 00001343335 00001068338

(Source: City of Vancouver Website 2010)

4.3 Single-Stream Recycling

The mechanics of single-stream recycling (aka “comingled recycling”) are very simple, which is the whole point. As the name implies, it is a system where all recyclables are collected together, with no source-separation beyond keeping them apart from general garbage. They are later sorted at MRFs, generally those with equipment specially designed for single-stream.

The theory behind single-stream’s effectiveness at increasing recycling rates is based on various convenience factors. Eliminating at-source (in-house) sorting requirements and allowing households to put all recyclables in the same container makes recycling easier and less consuming of both time and space. The time savings in reality might not be large, but those that do manifest may encourage recycling; mere perception of time / effort saved is perhaps a more significant influence overall. Single-stream may also save space in homes that currently use multiple containers for recyclables before putting them in the Blue Box (i.e. if the initial sort takes place indoors and the Blue Box is kept in the garage). Space savings are especially acute in apartments / condos using communal bins outside units, because occupants need only have one container for recyclables inside their unit, rather than the current three. This *may* mean emptying this container more often, but it also means that a fraction of the space is necessary.⁴¹ The idea behind single-stream is that by reducing these personal costs of recycling, more people will do more of it.

Survey data provide some empirical backing for this theory. Munro’s 2007 Statistics Canada report found that nationally, approximately half of respondents with access to recycling were recycling either nothing, or “not recycling all that was possible for them “(Munro 2010, p.13). When asked what was preventing them from recycling / recycling more, respondents most often cited that recycling was “not convenient,” “too time consuming or takes too much effort,”

⁴¹ Multi-family unit space concerns are strong in Vancouver, as many such units are relatively small (i.e. under 650 square feet), a trend that is increasing as the City densifies. Space is without a doubt a large part of the reason these units currently recycle at such low rates.

and/or “takes up too much space” (Munro 2010, p.24). Single-stream may be an effective way to eliminate these barriers to recycling for the reasons just discussed.

4.3.1 Vancouver Status Quo

As described in Section 3.5.1, Vancouver currently collects recyclables in three streams. Most other Metro Vancouver members do the same. This system imposes relatively greater personal costs than single-stream recycling, without any direct economic reward or compensation. Moving to single-stream would reduce these costs and potentially encourage more recycling. A few Metro Vancouver members, including the City of Surrey, have switched to single-stream recycling, which is an increasingly popular approach that many more jurisdictions in the region are no doubt considering. It is also an option for consideration in the City of Vancouver.

4.4 Expand Product Deposit Programs

Deposit systems may be applied to a range of recyclable packaging products, the most common of which are beverage containers.⁴³ Under these systems, consumers pay a small deposit on each package, usually between 5 and 20 cents, which can be redeemed upon return to the retailer or a depot. Depending on the structure of the program, producers, retailers, and external program administrators (i.e. stewardship associations) may be involved.

The effectiveness of such programs comes from the added financial incentive. Increasing recovery rates comes down to influencing individual behaviour, often an exceedingly difficult task. Money exerts a unique and powerful influence in this respect and even seemingly small deposits can have a significant effect. Indeed, the recovery rates for products included in deposit

⁴³ The term “bottle bill” is often used in the literature to refer to legislated beverage container deposit systems. Such systems have a long history in North America, first applied to beer bottles in the early 20th century. At this time, the bottles were quite valuable, and bottlers charged deposits to ensure they got them back (Ackerman 1997).

systems are extremely high—far in excess of those not included. Therefore, expanding deposit systems to cover more materials is a promising avenue for policy development.

4.4.1 Vancouver Status Quo

Producer responsibility programs are a provincial jurisdiction in Canada, so the systems that apply in Vancouver also apply throughout the province. In BC, certain products are included in the *Recycling Regulation* to ensure they are recovered at high rates and properly / safely recycled. Currently such products include, but are not limited to tires, cell phones, paints, thermostats, and beverage containers (Encorp Pacific Website 2010). If a company wants to sell one of these products in BC, they are legally required to comply with the regulation, something that is generally done via a recognized product steward.

A product steward is a non-profit organization that handles material recovery and recycling on behalf of private companies in a given industry. With beverage containers, the only Blue Box-acceptable material currently covered by the *Recycling Regulation*, BC's steward is Encorp and the approach to meeting recovery targets is product deposits. Virtually all beverage companies in BC have designated Encorp as their steward.⁴⁴ For each unit sold on the market, companies remit a deposit and, if applicable, a container recycling fee (CRF) to Encorp, while simultaneously charging retailers the same fees. The retailer then passes the fees on to consumers. The consumer may return the empty product to either the retailer or an independent Encorp-registered depot, where they can retrieve their deposit refund, but not applicable recycling fees. These fees, along with the revenues generated from the sale of materials and any un-refunded deposits, fund the administration of the system (Sigmund 2010-C).

⁴⁴ The only major exceptions are milk and domestic beer containers. Domestic beer brewers have joined together and opted to administer a separate program. Their products can be put in the Blue Box or returned to the same depots as all other beverage containers, however, so the distinction is not readily visible to the everyday consumer. Milk containers are currently exempt from the *Recycling Regulation*. However, in 2007 Encorp partnered with the BC Dairy Council to start a voluntary, non-deposit program for milk containers (paper milk cartons are currently not accepted in the Vancouver Blue Boxes, whereas plastic jugs are) (Sigmund, 2010-C).

As the only steward in the province that runs deposit programs, and one with over 15 years of experience, Encorp is the logical choice to handle any new materials added to the deposit system. At its inception in 1994, Encorp handled only soft-drink containers; it has since gone through multiple rounds of new product additions, including all non-alcohol beverage containers in 1998, polycoat containers in 1999, and even milk containers and electronics (both non-deposit) in 2006 (Encorp Pacific Website 2010). As Encorp is in a position to add more materials, this policy approach is feasible and will be considered.

5: Criteria

The policy options will be assessed based on the following set of criteria. Criteria, definitions, and measures are summarized in Table 4 to follow.

5.1 Effectiveness

Effectiveness here refers to the primary goal of the policies being assessed: increasing the recovery rates for residentially generated recyclable materials in Vancouver. Working from 2009 baseline volume data and estimates of current recovery rates, increases in recovery predicted to result from the implementation of each policy are compared. A degree of uncertainty is unavoidable in predicting such increases. Therefore, a qualitative interval scale is used to rate each policy, rather than a precise estimate in quantitative terms, which would inevitably be somewhat arbitrary. The terms used to describe increases in recovery expected to result from the policies are:

- negligible: the policy cannot confidently be linked to any increase in material recovery
- marginal: the policy will likely lead to a small, marginal increase in overall recovery of not more than a few percentage points
- substantial: the policy is predicted to lead directly to a significant increase in recovery rates, in the order of 5 percentage points or more

Wherever possible, more precise details are provided on the magnitude of potential increases and the conditions necessary to produce them. This includes the highly consequential influence of residence type: single vs. multi-family.

5.2 Administrative Complexity

This criterion refers to the administrative demands of the new policies relative to the status quo. Measuring it takes into account changes in day-to-day administrative capacity (including additional staff, offices, processes, and departments required) and the parties and levels of government necessarily involved in approving and administering the new policy. As a composite measure, the scale is a qualitative interval ranking of “high / medium / low,” taking each of these factors into account.

5.3 Transitional / Implementation Issues

This criterion refers to issues with transitioning to and successfully implementing the new policy, as well as getting the public accustomed to and complying with it. It is based on a composite measure accounting for difficulty in transition (i.e. resistance from the public and other relevant affected actors), time required for transition (i.e. to reach high participation / compliance rates), and implementation issues. Policies are judged as to whether the transitional / implementation issues they present are “prohibitive, significant, or inconsequential.”

5.4 Yield

The “yield” (aka “capture”) concept refers to the share of recyclable material recovered that actually ends up being recycled.⁴⁵ As recyclables pass through the supply chain, some of what gets collected with the intention of being recycled ends up being disposed of as garbage (making the yield less than 100%); the amount disposed of may vary depending on the system structure and policy framework in place. The primary goal of the policy options is increasing the recovery rates for recyclable materials; implicit in this is the expectation that the material collected actually gets recycled. As environmental benefits are the justification for recycling, this

⁴⁵ This is a fundamentally different concept from “effectiveness,” which refers to the share of recyclable material produced that actually ends up being recovered.

expectation must be considered. The options are compared according to how they are predicted to affect the status quo with respect to yield. The interval scale “increase / no change / decrease” is used to rate each policy. Wherever possible, more precise details are provided on the sources and magnitude of changes to yield brought about by the policies.

5.5 Cost Considerations

The alternative policy options vary greatly with respect to their overall costs and the parties that bear those costs. Financial impacts can affect the public at large, specific groups of consumers, government departments, and/or various private actors within the recovered materials supply chain. This criterion involves a qualitative evaluation of each policy’s cost implications specifically in terms of magnitude and distribution, including fairness and equity considerations. Evaluations focus on significant cost-related issues with broader ramifications for the feasibility and/or attractiveness of each policy.

5.6 Summary

Table 4 – Summary of Criteria

Criterion	Definition	Measure	Scale
Effectiveness	The degree to which the policy is estimated to increase overall material recovery rates	Qualitative, interval rating based on predicted change in recovery	Substantial Marginal Negligible
Administrative Complexity	The administrative demands of the new policy relative to the status quo	Composite measure of factors related to policy approval and administration	High Medium Low
Transitional / Implementation Issues	Issues with switching to the new policy and getting the public accustomed to and complying with it	Composite measure of factors related to transition, implementation and achieving compliance	Prohibitive Significant Inconsequential
Yield	Change in the share of recovered recyclable material that ends up being recycled, relative to the status quo	Qualitative, interval rating based on predicted change in yield	Increase No change Decrease
Cost Considerations	Monetary cost implications of the policy on relevant effected parties	Description of significant policy implications in terms of the magnitude and distribution of costs	No set scale – A qualitative evaluation of significant cost-related issues

The greatest weight in subsequent analysis and recommendations is given to the effectiveness criterion. It directly addresses the key policy problem around which this study is centred. Regardless of how well a policy rates with respect to the latter four criteria, if it is ineffective, there is no point in pursuing it as a means of addressing the policy problem. For policies deemed effective, the remaining four criteria are all important. More weight, however, is focused where particularly extreme ratings are warranted, as such situations may expose critical weaknesses that necessitate rejecting certain policies outright.

6: Analysis of Options

6.1 Bylaw-Oriented Compliance

6.1.1 Effectiveness: Marginal-Substantial

The huge potential for variation in form and intensity of bylaw-compliance measures, and the lack of previous research on this policy, make it difficult to judge effectiveness. However, there are reasons, including some backed by empirical evidence, that suggest it would have at least a marginal effect, if not a substantial one. For one, multi-family recycling containers that currently display incorrect labels are no doubt causing some to unknowingly put recyclable material in the garbage. Updating container labels is an effective way to alert those who want to comply but are not doing so because of misinformation or a lack of information. Correct labels are especially important for multi-family residences because of their relatively poor recovery rates and large potential for improvement.

Clear, blunt garbage container labelling, identifying all banned recyclable materials and explaining that putting them in the garbage is illegal also has potential. It would encourage recycling among the misinformed non-compliers mentioned, and the additional segment of the population who would not normally comply unless cajoled by “aggressive” labelling. Targeted use of multi-lingual labels could also encourage recycling among new immigrants; specific translations could be used in areas of the City where Census data show concentrations of particular language minorities, for example.

The enforcement option being considered is for random inspection of individual garbage containers at the curb—where the problem of recyclables in the garbage originates—in addition to current random inspection of loads dumped at disposal sites. The use of random container

inspections backed by monetary fines for noncompliance would deter people from putting recyclables in the garbage. The effectiveness of deterrence is very difficult to judge, as it depends on a number of factors like the intensity of enforcement (including how well efforts are publicized) and severity of penalties. A good job of the former could be done with ample investment. The latter is somewhat problematic in that the only penalty enforceable under current bylaws would be for non-compliant material to be tagged with an indication of the violation and not picked up on garbage day—hardly a severe penalty. Even with bylaw change, the legality of sanctions beyond this (i.e. fines) is uncertain due to the aforementioned difficulties in clearly linking individuals to infractions.⁴⁸ Additionally problematic are multi-family residences, which encounter issues with both a) legality in terms of public inspections of privately owned dumpsters, and b) tracing non-compliant material back to individual units.⁴⁹ If made to work, however, curb-side enforcement would likely lead to at least a marginal increase in compliance, even if the intensity was quite limited.

The publicity necessarily included in this policy approach would also encourage increased material recovery. Container labels are a form of publicity / communication by their very nature. Communication with the public would also naturally go with enforcement to maximize the deterrent effect.⁵⁰ Lantz argues that providing information and publicly promoting recycling will result in more of it, at least initially. He writes:

Anytime a program changes, whether it be to add a bin, add new materials, change the collection system or move to single-stream, a requisite increase in the quantity of material collected at the curb occurs, because the change reminded people about the program (Lantz 2008, p.3).

⁴⁸ This remains a legal grey area. At the time of writing, the Central Okanagan Regional District was implementing a new program using camera-equipped trucks to monitor garbage container contents and penalize bylaw infractions. City of Vancouver officials, however, are skeptical that the practice is legal and would want to see how it plays out in court before considering it (Moffitt 2011-C).

⁴⁹ Theoretically, penalties could simply be levied on strata corporations / building managers who would be responsible for weeding out problem individuals and making their buildings compliant.

⁵⁰ See Appendix C for some examples of advertisements used by the City of Vancouver to publicize the addition of household food scraps to the yard waste program.

He suggests that the publicity and communication that come with program changes should really get the credit for recovery rate increases, rather than the changes in and of themselves. He observes that initial increases often trail off post-implementation, as people relapse because they are no longer receiving reminders and “feedback” on their recycling behaviour (Lantz 2010-C; Skumatz 1996). On-going communication and enforcement efforts are one way to provide continuous feedback and sustain highly compliant behaviour.

Each of these communication and enforcement measures can be expected to produce a marginal increase in recovery in spite of the issues mentioned; in aggregate, the effect could be substantial. This, however, depends on many variables, most notably the intensity of enforcement efforts and communication, and a “substantial” rating is probably optimistic.

6.1.2 Administrative Complexity: Medium-High

The administrative complexity of this policy depends heavily on the specific form and intensity it takes. Updating container labels would involve only temporary increases in administrative complexity over the course of label design and installation. Hiring staff to attach new labels would likely be the only significant issue, and even then, a short-lived one.

Enforcement on the other hand, would involve substantial increases in administrative complexity relative to the status quo. Vancouver currently has no bylaw officers working at the curb, as the only feedback used is cart tagging done by collection vehicle operators. Enhanced curb-side enforcement and prosecution would first require amending the current bylaws to allow it. It would then involve setting up a new enforcement subdivision in the City solid waste department, establishing new processes and protocols, hiring and training enforcement officers, and potentially setting up a fine and payment system. There would be additional administrative demands on the advertising / communication side of things as well. By our definition of administrative complexity, these additions justify a minimum rating of medium, if not high.

6.1.3 Transitional / Implementation Issues: Inconsequential-Significant

All this policy requires of residents is closer attention to pre-existing bylaws. As such, it involves a fundamentally different type of “transition” than the other three options considered, each of which includes changes to the solid waste system itself. The enforcement pyramid approach described in Section 4.1 is gradual by definition, starting with broad communication efforts intended to inform / educate about the bylaws, and moving from there to enforcement upon remaining non-compliers. Effectiveness would therefore likely increase in steps, taking some time to peak. Publicity would immediately create a bump for those who understand the system but need an extra reminder to participate fully, and perhaps rise more slowly after that for the less informed to learn all the details of what goes where.⁵¹ Depending on the intensity of communication and enforcement, this process could take anywhere from a few months to over a year and likely require on-going efforts to maintain (as is currently the case at disposal sites).

On public resistance, the curb-side inspection element raises privacy concerns. Even though waste becomes public property once discarded at the curb, some individuals may protest that having it inspected thereafter is an invasion of privacy. Allen Lynch of the North Shore Recycling Program suggests that introducing “garbage police” would incite massive public outcry (likely of varying intensity depending on the community in question) (Lynch 2010-C). Peter Rotheisler of the Central Okanagan Regional District (who are currently implementing a camera-based inspection system), however, downplays its significance, arguing that after some initial grumbling it will quickly become a non-issue, and that most will be compliant and thus unaffected (Rotheisler 2010-C). Exactly how this issue would play out in Vancouver is uncertain.

⁵¹ Learning exactly what materials are acceptable in each bin, bag, and cart can take some time and may not be a simple process, especially for those inexperienced or unfamiliar with recycling (i.e. those from places that do not recycle).

6.1.4 Yield: No Change

This policy has no effect on yield as it changes neither the way individuals recycle, nor the way processors deal with the material. An approach that focused on education / enforcement around recycling containers (rather than garbage containers, as is our main focus with this option), could be expected to increase yield by encouraging fully compliant recycling behaviour (i.e. not putting garbage / unacceptable materials in recycling bins and sorting material properly). This would have no impact in recovery rates, however, so is not considered here.

6.1.5 Cost Considerations

The costs involved with this approach are substantial and would be paid exclusively out of City of Vancouver (and potentially Metro Vancouver) funds. The suggested container label improvements would mean one-time costs to design, translate, produce, and attach new labels.⁵² With 95,000 single-family homes (some with more than one garbage cart), and dumpsters and recycling totes (3+ per building) used in approximately 4,800 multi-family buildings across the City, this would be a reasonable investment (City of Vancouver Website 2011).

Much larger, however, would be the investment necessary to effectively and continuously publicize and enforce bylaws at the curb. As an indicator of communications costs, the City of Vancouver has spent roughly \$400,000 on communications for “Phase 1”⁵³ of the expanded organics program, with an additional \$400,000 expected for “Phase 2” (Moffitt 2011-C). Investments of at least this much—much more if campaigns were to be on-going—would be

⁵² For example, a set of labels for a single recycling tote is in the “\$3.00 to \$3.50 range depending on the material and the number of decals used.” As it is labour intensive to remove old decals, the current City policy is to attach new ones over old ones thus limiting the labour involved (they also plan to make labels available to building managers / strata corporations for them to install). The City hopes to have all recycling tote labels up to date by the end of 2011, but the full cost of installation is not yet known, and will depend on whether they can complete the work with current staffing levels (Thomas 2011-C).

⁵³ Paid communications included direct mail postcards to all households included in the program (single-family homes), brochures in four languages distributed at grocery stores and community events, ad bars in grocery stores, posters at bus stops around the city, and corrective cart stickers (all implemented between May and October of 2010), as well as an on-going website / internet campaign (City of Vancouver 2010b). See Appendix C for examples of the media / communications used.

required to publicize enhanced enforcement efforts. Actual enforcement costs, in terms of employing officers and administering sanctions, would be an additional cost. As another cost indicator, when asked how much it would cost to significantly strengthen enforcement efforts at transfer stations, a Metro Vancouver official consulted claimed the investment would be “very considerable” (Stringer, 2011-C). This suggests that efforts do to so at curb-side could be prohibitive, likely far in excess of what could be reasonably justified by the increase in recovery produced, the magnitude of which is uncertain.⁵⁴

6.2 Strengthen Pay-As-You-Throw Garbage Pricing

6.2.1 Effectiveness: Substantial

User-pay approaches are highly effective at influencing behaviour in all sorts of policy areas, of which solid waste is no exception. Empirical evidence strongly supports the suggestion that a strengthened PAYT system in Vancouver of the type suggested would result in a substantial increase in material recovery.

The degree of consensus across the industry about PAYT’s effectiveness is telling. Individuals consulted for this project came from all corners of the solid waste industry and disagreed vehemently on many matters, often providing opinions / facts that were contradictory. One thing all agreed on however, was that PAYT is highly effective at getting recyclables out of the garbage and reducing waste generation more generally. Considering their starkly different perspectives and motivations, this consensus was quite striking.

Academic research comes to the same conclusion. Skumatz (2008) conducted a cross-sectional regression analysis on solid waste and recycling data collected from over 1,000 communities in the United States. She found that after controlling for demographic factors (i.e.

⁵⁴ Moffitt of the City of Vancouver, expressed scepticism about the cost-effectiveness of this option vs. the alternatives in the absence of research on the differences in effectiveness between education / publicity / warnings and the type of enforcement described here (Moffitt 2011-C).

income, community size, urban / rural classification) and a variety of solid waste program characteristics, the presence of a PAYT program had the largest impact on recycling diversion of all variables considered, including other system modifications (i.e. moving to single-stream). In her model, having a PAYT program in place led to a decrease in residential waste disposal of approximately 17% by weight, with 6% attributable to waste reduction, 5-6% to increased recycling and 4-5% to increased diversion to yard waste programs (Skumatz 2008, p.2782). In her sample, the PAYT induced-increases in overall recyclables collected were between 33% and 50%; she cites other research done in Iowa that measured increases of this type in the 50% to 100% range (Skumatz 2008).⁵⁵ These findings, she writes,

indicate strong evidence for implementing incentive pricing in communities with underperforming programs or in communities that aren't reaching their goals (Skumatz 1996, p.2).

These observed increases come from comparisons of PAYT vs. non-PAYT programs and before and after cases of PAYT implementation; they are therefore not directly transferable to Vancouver as the City already has a variant of PAYT in place. There is evidence, however, that strengthening the incentives through the suggested rate structure design changes would have a significant effect. In a quantitative analysis of PAYT programs throughout the United States, Skumatz found a wide variety of rate structures using anywhere from minimal rate increases for significantly more capacity (“bulk discounts”), to proportional increases, to increasing schedules (i.e. an upward sloping average cost curve in Figure 21). She found that within limits, more proportional increases tended to provide greater incentives to reduce waste and increase recycling. When rates increased by just a few dollars between container sizes (i.e. not in proportion to capacity) the impact was positive, but small (i.e. 0.2-0.3 percentage point increases in total volume of recyclables collected). More proportional increases however, produced

⁵⁵ The communities considered here would have been starting from rather low recycling rates, which is why overall volume could increase by up to 100%; in Vancouver, which would be starting from a much higher baseline, predicted increases of this type would be lower, but still significant as recovery rates are currently nowhere near 100% (See Section 3.5.2).

substantial jumps in recycling; she found that a 30 gallon (113.5 L) increase in capacity with a rate differential of 80% or higher (slightly less than perfectly proportional), was associated with a 4.4 percentage point increase in overall recycling. She argues that differentials around this magnitude are enough to provide strong incentives, equal to those with perfectly proportional fees (Skumatz, 2001; 2002).

This suggests that partial flattening of the average cost curve in Figure 21 could have a significant effect on recovery rates in Vancouver. Table 5 shows where Vancouver currently stands in terms of differentials and proportionality. It shows that when looked at as overall percent changes, capacity and fee increases do not increase anywhere near proportionally, as the differentials (% fee increase divided by % capacity increase) range between 30% and 58% — certainly nowhere near the 80%+ cited by Skumatz. A Kelleher Environmental report commissioned by the City of Vancouver suggested that making Vancouver’s rate design structure perfectly proportional based on volume (i.e. based entirely on volume with no fixed cost portion) would result in an 11% decrease in overall waste produced.⁵⁶ Combining a proportional structure with embedded recycling and basic yard trimmings fees (i.e. one “solid waste fee”) was projected to result in a 16% decrease (Kelleher Environmental 2009). This is strong evidence that rate structure design adjustments of the type suggested could have a substantial effect.

⁵⁶ This is an somewhat “optimistic” projection based on a minimum price of \$42 for the 75 litre container and maximum price of \$200 for the 360 litre container, and an expected price elasticity of -0.09 (Kelleher Environmental 2009).

Table 5 – Vancouver’s Current Container Rate Differentials

Container Upgrade	Capacity Increase	Fee Increase	Differential
75 L → 120 L	60%	18%	30%
120 L → 180 L	50%	22%	44%
180 L → 240 L	33%	17%	52%
240 L → 360 L	50%	29%	58%

Research also supports the notion that the type of garbage bin capacity decreases suggested here would make Vancouver’s PAYT system even more effective. For example, Pickin conducted regression analysis using longitudinal solid waste data from 30 municipalities around Melbourne, Australia. In addition to corroborating Skumatz’s conclusions on PAYT and reduced garbage generation, his study found that mandatory reductions in garbage bin size (from 240 to 140 litres) lead to a 12% average per capita increase in recyclables quantity collected on top of reductions in garbage generation (Pickin 2008).

In the case of Vancouver, moving to bi-weekly garbage collection would be a way to take advantage of effective capacity-related incentives observed in Melbourne. Introducing a smaller minimum can size would have less of an effect because using it would remain optional; bi-weekly garbage collection, like can size reduction in Melbourne, would be much more effective as it would apply to all. Lantz also argues that bi-weekly garbage collection (and other measures that restrict capacity / service) is one of the most effective ways of increasing recycling, and diversion more generally. He cites recycling increases (total volumes collected) of 30% to 40% in one Ontario municipality upon switching to garbage bag limits and bi-weekly collection as evidence of this (Lantz 2008, p.3).

One serious limitation arises as to the effectiveness of this policy, however. It does not work for multi-family units because they use communal dumpsters and do not deal with the City.

This is unfortunate as they tend to be particularly poor recyclers. In reality, multi-family dwellings have PAYT because their contractors charge them based on volume / pick-up frequency. But because fees are relatively small when divided among all units, and because they are hidden in rent / strata fees, each individual household's incentives to recycle (and reduce) are not strong.⁵⁸ If the private companies serving multi-family units were contracted by the City (as some recycling is), then PAYT could be worked into these contracts.⁵⁹ This, however, is not the case, and cities have limited if any authority in their charters to regulate private companies in this way using other means (Moffitt, 2011-C). Even so, the lion's share of recyclable waste generated in Vancouver comes from single-family homes (around 70% of fibre and 62% of containers), so the effect of this policy would still be substantial.

6.2.2 Administrative Complexity: Low

As is evident in the description of PAYT system mechanics in Section 4.2, administrative complexity can vary widely depending on the specific structure chosen. Weight-based programs, for example, are very complex. They require that garbage be weighed and this measurement recorded for every household over every collection cycle; they also employ monthly billing cycles. This translates into a complex and demanding accounts and billing system that would require large expansions in day-to-day administrative capacity (staff, offices, processing systems) were it to be implemented in Vancouver. Bag / tag / sticker programs are less complex, but still require on-going administration of their purchase and distribution.

⁵⁸ Overall, multi-family residence garbage fees are quite substantial, and whoever manages them regularly sees the costs directly and has an incentive to reduce them. Moffitt suggests that in spite of this, management may still not act because of things like a lack of tools to increase recycling (enough bins, educational or promotional material), being overwhelmed by other priorities (i.e. getting the roof fixed for a decent price), or a desire to ensure an abundance of disposal capacity to avoid garbage overflows (Moffitt 2011-C).

⁵⁹ This would have to be done in creative ways like charging buildings based on the number of units / residents and the amount of waste collected. City officials consulted suggested that crafting workable regulation of this type would be very challenging (Moffitt 2011-C).

The PAYT model suggested here, however, was chosen in part because it involves limited administrative change. The proposed adjustments to the current variable can payment structure, the addition of a smaller minimum can size or biweekly garbage collection, and the merging of all solid waste fees, would each involve amendments to current solid waste bylaws. The administrative demands of such amendments would be minimal, however; Vancouver's solid waste bylaw is routinely amended, often in more serious fashion.⁶⁰ Making smaller cans available would also involve some administrative demands, but nothing substantial. The other suggestion, namely that Vancouver move to bi-weekly garbage collection, would be a slightly more serious administrative change, especially if it occurred alongside a change in yard trimmings / organics collection from bi-weekly to weekly.⁶¹ The increased complexity and demands on administrative capacity of such a change would be significant only during the transitional phase, however. None of the proposed changes would require expanded capacity in the form of extra staff, offices, etc.

6.2.3 Transitional / Implementation Issues: Inconsequential-Significant

Perceived issues with implementation are a huge source of hesitance / resistance on the part of policymakers considering PAYT. Because of the monetary nature of PAYT, it may encourage certain adverse and unintended reactions that confound the policy's intentions. One widespread and understandable effect of volume-based PAYT is "stomping" (Skumatz 2008). When additional volume costs more, there is an incentive to fit as much material as possible into the space available, which means people stomp, squash, and otherwise compact their garbage. Garbage trucks are equipped with high-power compactors so this activity is not at all helpful (it may even make containers more difficult to lift and or empty).

A much more worrying side effect, however, is non-compliance in the form of improper disposal. This can mean outright illegal dumping (i.e. putting garbage in a ditch or abandoned

⁶⁰ It has been amended in various ways 16 times since 2001.

⁶¹ This is the standard practice when garbage collection is bi-weekly.

lot), depositing garbage in other peoples' garbage cans, or hiding it in your (or someone else's) recycling / yard waste container. PAYT often faces serious political barriers, many of them a result of these feared side effects. Surrey, for example, has ruled out the PAYT option for the time being, citing concerns about unintended consequences (Costanzo 2010-C).⁶²

Research shows that illegal dumping may be more of a fear than a reality (Skumatz 1997; 2008; Pickin 2008). Skumatz surveyed more than 1,000 North American communities and found that illegal dumping was a problem in about 20% of those with PAYT, and a "significant" issue in only 3%, "a problem that on average, lasts about three months or less" (Skumatz 2008, p.2783).⁶³ She also found that only about 15% of illegally dumped material originated from households (most coming from the commercial / industrial sector), and that of this share, the largest component was bulky items like appliances, which are generally not dealt with in the curb-side system. Illegal dumping may also vary depending on the type of community in which PAYT is implemented. It is probably a much more reasonable concern in Surrey than Vancouver, for example, because Surrey has much more open space, including empty lots, large parks, industrial areas, and ditches, which are all easy targets for dumping.

Shifting excess garbage to recycling containers may be a valid concern, especially if PAYT exists alongside single-stream recycling, and especially if the single-stream program uses closed top carts (which hide contents) and automated collection (see Section 6.3, esp. 6.3.4). For example, Lantz partly blames PAYT for high residue (garbage) rates (20%+) found in Toronto's closed-top cart, single-stream recycling system (Lantz 2010-C).⁶⁴ For this reason, PAYT and

⁶² According to Surrey's deputy manager of operations Robert Costanzo, "the concern is that not only will it [garbage] end up in the wrong cart, but it will end up in a ditch, the neighbour's cart etc." (Costanzo 2010-C).

⁶³ Some jurisdictions have reported that introducing PAYT actually lead to a decrease in illegal dumping because of all the increased attention the issue received as a result (Skumatz et al. 1997).

⁶⁴ Lantz suggests that many Torontonians order the smallest garbage can available with the intention of simply throwing excess garbage in their recycling cart, where it is hidden and generally unmonitored (Lantz 2010-C).

single-stream can be somewhat incompatible policies, especially if the monetary incentives of the PAYT system are strong.

Significant public resistance is unlikely to be an issue. Skumatz has found that following implementation, communities tend to approve of PAYT programs at very high rates (90%+), “and they don’t want to return to the old system because PAYT is fairer” (Skumatz 2008, p.5). If attempts were made to strengthen PAYT incentives for multi-family units using private garbage services, resistance from these private service providers could be expected, as PAYT decreases their volumes and hence their profits. Certain measures such as increasing tipping fees, however, can and have been taken, and there is little private companies can do to resist them. Public policies that intrude more on the practices of private companies are more problematic.

Time required for the public to adjust to our recommended PAYT model would be limited. The fact that a PAYT system already exists in Vancouver means that residents would only have to learn about and get accustomed to the new fee structure and availability of a smaller minimum can size. The change would have to be well communicated, however, to ensure that everybody understands and internalizes the stronger incentives as quickly as possible. If also used, bi-weekly garbage collection would be a major change requiring a more significant initial learning process, but one that would be unlikely to require more than a few months.

6.2.4 Yield: No Change-Decrease

In theory, this policy should have no effect on yield as it changes neither the way individuals recycle, nor the way processors deal with the material. In practice, however, PAYT with strong monetary incentives has been blamed for encouraging people to put garbage in their recycling containers when they have unused capacity, rather than paying for its proper disposal. Increased residue levels in recyclables sent to the MRF have implications for cross-contamination and process loss (see Section 6.3.4), which may lead to some yield reductions.

6.2.5 Cost Considerations

As with administration and transition / implementation, the magnitude of PAYT-related costs depends very much on the model used. For instance, a weight-based program would require high-tech trucks and standardized carts equipped with RFID (Radio Frequency Identification) tags, which represent a significant investment. The model suggested here does not imply costs anywhere close to this magnitude, in part because it involves relatively inexpensive adjustments to the current system. The only factor with significant cost implications would be switching to bi-weekly garbage collection, something that would actually save money (albeit not as much if freed-up garbage capacity were redirected to yard waste / organics collection). Reductions in waste generated may also result in reduced disposal costs. If a smaller cart size were offered, its purchase and distribution would impose some additional costs, but nothing substantial.

PAYT is equally attractive in terms of cost distribution. PAYT is based on the user-pay principle and as such is difficult to argue against. As Skumatz writes:

PAYT programs are perceived as fair: unlike fixed-fee tax options, customers who use more service pay more. Customers who put out more garbage for collection pay more; those who put out roughly the same amount pay roughly the same fees...Without PAYT, low disposers pay the same as large disposers. PAYT provides a recurring economic signal to modify behaviour, and allows small disposers to save money compared to those who use more service (and cost the system more) (Skumatz 2008, p.2782-2783).

Additionally, our PAYT model could be designed so as not to appear a government “cash grab.” It could be structured to be revenue neutral by, for example, reducing or eliminating the fees on the smallest containers and increasing the size of the fee increments for larger containers.⁶⁷ If the bi-weekly garbage collection option were adopted, potential citizen dissatisfaction with service

⁶⁷ This is exactly what the Kelleher Environmental report commission by the City suggested: price decreases on the smallest two containers, no change on the third, and increases on the largest two (Kelleher Environmental 2009).

reductions could be appeased by decreasing the fees charged for recycling and yard / food waste services, which would be an additional incentive to take more advantage of them.⁶⁸

One monetary concern that comes up in the PAYT literature relates to equity and family size. The critique is that PAYT does not discriminate between households based on their size, and that it is inequitable (in the vertical sense) as larger families inevitably produce more waste and end up paying more (even if they are doing relatively well in terms of per-capita waste generation). This critique is understandable but I do not believe it is valid. Skumatz succinctly summarizes my feelings on the family size (and income) critique:

Elected officials often express concerns about the impacts of PAYT on large families and the poor. It is important to separate the two effects. Large families pay more for groceries, water, and other services they use more often than other households, and PAYT basically extends this to trash service. Note that large families have opportunities to reduce trash through recycling – opportunities that are not as readily provided in the use of food. Consider the converse of the argument – is it fair for small families on fixed incomes (retirees) to subsidize large disposers (whether or not they are large families)? (Skumatz 2008, p.2783).

The simple fact is that larger households produce more waste and impose greater costs on the system, both financially and environmentally. As Skumatz reminds us, having a larger family means paying more for all sorts of goods and services, and there is no reason garbage service ought to be made an exception, especially given that families have much more control over it than most of their other expenditures. It is also important to note that the type of fee structure suggested is by no means unprecedented. Vancouver's current PAYT structure could be labelled inequitable in the sense described, as could BC Hydro's block pricing structure, which is specifically designed to incentivize reduced consumption, rather than perfectly recover costs.⁶⁹

⁶⁸ Garbage fees themselves could also be reduced along with service, although this would go against the principles recommended here, namely that they should be high to act as a strong incentive to recycle.

⁶⁹ If vertical equity concerns are deemed to require it, there are various ways to discount or subsidize service fees based on household size. Special arrangements like this are currently used in some PAYT systems (Skumatz 2008). The additional administrative complexity and costs are significant, however, and for this and the other reasons mentioned are not recommended.

Our PAYT model would involve a significant change in the way service fees are conceptualized at City Hall. The “cost of service” mentality currently dictates that they be structured to cover the financial costs of providing the service, with overall fees including both a fixed and volume-based portion. As discussed in Section 1.1, garbage collection is a high fixed cost, low marginal cost operation where the act of stopping for a pick-up is more important than the amount collected; the current fee structure reflects this. What it does not properly reflect are the environmental costs imposed by marginal waste generation and important equity considerations. Furthermore, it fails to take advantage of PAYT’s full potential to incentivize recycling. These factors justify a BC Hydro-style pricing structure for garbage like the one proposed here.

6.3 Single-Stream Recycling

6.3.1 Effectiveness: Marginal

In spite of the entirely logical theory behind single-stream’s effectiveness (see Section 4.3), the evidence suggests that in practice, increases in recovery brought about by it are marginal at best. The Surrey case study is indicative. Following the transition from three-stream to single-stream in 2009, Surrey saw total recyclables recovered annually increase “marginally,” from around 20,000 tonnes to around 25-26,000 tonnes (Costanzo 2010-C). Looking at just these numbers, it would seem single-stream had a positive impact,⁷⁰ but a number of other factors need to be considered:

- Numbers include residuals, which increased slightly with the onset of single-stream (see Section 6.2.4);

⁷⁰ The fact that this increase was observed over the economic downturn—during which overall consumption decreased— may add more support for this conclusion.

- Increases are absolute and do not account for population growth, which in Surrey is currently 2,000 to 3,000 households annually (Costanzo 2010-C);
- Some new materials became acceptable under the single-stream program (albeit they compose a small portion of overall volume)

In addition, Lantz argues that *any* change to a recycling program, which will necessarily include a degree of public education / communication, will inevitably lead to at least an initial bump in recovery (Lantz 2010-C). The fact that the Surrey transition involved communication suggests that some of the observed increase in recovery may be attributable to the publicity. Even so, single-stream in and of itself likely did have a marginal impact; studies done elsewhere suggest the same result (see Pickin 2008 and Skumatz 1996).

Ontario offers another case study. Lantz (2008) analyzed a number of Ontario municipalities that changed from dual to single-stream systems in 2005. He found that recovery went up significantly in one, whereas it actually decreased in the other two. Again, he notes that increases in material volumes coming to the MRF at the start of new single-stream programs are typical, but not necessarily attributable to single-stream itself. Rather, they may be due to “increased promotion, bag limits or a user pay system,” just to name a few (Lantz 2008, p.3). Indeed, “no clear evidence indicates that the implementation of single-stream recycling itself is the main basis for increased diversion rates” (Lantz 2008, p.3).

Overall, then, little conclusive evidence exists to suggest single-stream alone is any more than marginally effective. Increases seen with the transition to single-stream depend very much on intervening factors like raised awareness through publicity, garbage disposal restrictions and PAYT (see Section 6.2), as well as the composition of the community in terms of demographic

characteristics and the split between single-family and multi-family residences.⁷² In Vancouver, single-stream alone would not likely be more than marginally effective, if at all.

6.3.2 Administrative Complexity: Low

Moving to a single-stream program would require no significant administrative changes. The Surrey experience showed no notable change in day-to-day solid waste administration or the periodic contracting process, including staffing levels (Costanzo 2010-C). It would be a purely operational change, decided by the city solid waste department and requiring no changes to current bylaws. If the city decided to do it using an automated, cart-based system (as is common practice with single-stream, although not currently done in Surrey), there would be a temporary additional administrative burden, much like that experienced when Vancouver transitioned to an automated system for garbage.

6.3.3 Transitional / Implementation Issues: Inconsequential

As opposed to other policies that tend to increase the complexity of recycling for individuals to varying degrees, single-stream does the opposite—it makes recycling significantly easier. This, as discussed, is one of its key justifications in the first place and makes implementation and transition relatively simple.

Looking at Surrey as a case study, the transition and implementation process was very smooth. Prior to implementation, the city engaged and informed the public through open meetings, and information distributed in the city's annual calendar (sent to all residents) and via the city website, as well as advertising in local newspapers and supermarkets.⁷³ They found very

⁷² In theory, single-stream should be relatively more effective for multi-family units, because it helps ameliorate some of the space / storage issues involved in household recycling, which are particularly pronounced in smaller, multi-family units. The need to transport material from one's unit to communal receptacles also makes single-stream more attractive (easier) in this type of building.

⁷³ The city spent approximately \$100,000 on communication, a figure that would have been \$50,000 - \$100,000 higher if not for paid advertising in the city calendars (Costanzo 2010-C).

limited public opposition to the change (Costanzo 2010-C). An independent survey commissioned a few months after implementation showed 73% preferring single-stream, 9% preferring the previous three-stream system, and 18% indifferent (Dillon Consulting 2010).

A common problem experienced with the transition from three-stream / dual-stream to single-stream is increased residue in recycling containers. This tends to be exacerbated when programs use closed-top recycling carts (rather than open bins), which effectively hide their contents, and/or strong (i.e. high fee) PAYT. For example, the MRF currently processing Toronto's single-stream recyclables—from a program with both closed-top carts and PAYT—deals with residue rates in the order of 21% (Lantz 2010-C). Surrey's program, that uses neither of these things, saw residue rates increase marginally from 3% to 4.5%, over the transition from three-stream to single-stream (Costanzo 2010-C). Ultimately, single-stream induced residue increases can be kept under control by carefully structuring programs with these issues in mind.

Surrey experienced some other initial growing pains in terms of people recycling (in)correctly under the new system, but nothing overwhelming. For example, there were some issues with people tying their milk jugs or newspapers together thinking they were helping in doing so, when in fact these things cause problems with single-stream sorting equipment. With time, as familiarity with the single-stream program (and any other new system for that matter) grows, both non-compliance with guidelines (i.e. people recycling improperly) and opposition subside—this has been the case in Surrey (Costanzo 2010-C).

6.3.4 Yield: Decrease

Yield is a relatively significant concern with single-stream. A changeover to single-stream in Vancouver would likely mean a decrease in yield from the status-quo, resulting from a number of cumulative factors. The first, and likely most minor, is loss from cross-contamination. When all different types of materials are mixed, there is the potential for some to contaminate

others to the point they are no longer recyclable (i.e. improperly cleaned containers spilling onto paper, or broken glass being embedded in plastic / paper). Such contamination can occur between different types of recyclables and between recyclables and garbage, which, as explained in the previous section, tends to become more abundant in single-stream programs. Processors consulted, however, downplayed this type of loss as minor, citing that cross-contamination is rarely so serious that material becomes unrecyclable outright (in part because processing and manufacturing technology is able to deal with it) (Rogers; Lantz; Stefenelli; Costanzo 2010-C).

Certain issues at the MRF can potentially have a much greater negative impact on yield. One such issue is “process loss.” No MRF process is perfect, even the most technologically advanced, and some material will inevitably be lost due to imperfections and inaccuracies (Lantz 2010-C). This includes recyclables that are missed or accidentally filtered off as garbage. Because single-stream requires much more intensive processing, including the use of more (and more complex) machines, it may involve more process loss.

An even more significant issue is the accuracy of processing in terms of the purity of the end product. If for example, a system is poor at separating containers from fibre, a significant portion of each “newspaper” bale sold to a mill may be plastic, glass, metal, or garbage. When it arrives at the paper recycling mill, most if not all of this contamination, much of which is recyclable, will be filtered off and landfilled.⁷⁵ As single-stream has become more popular and its products more abundant, paper mills have seen concurrent increases in contamination due to sorting inaccuracies. Blue Heron Paper in Oregon, for example, has seen contamination in incoming paper grow from around 0.25% to 5% over the last 10-20 years, and subsequent volumes of contaminants going to landfill increase dramatically (Malloch 2010-C).⁷⁶ Other mills

⁷⁵ Ways of re-diverting this material back to the recycling stream are currently being considered / developed, but at this point the vast majority is disposed of as this is cheaper, especially given that many recycling mills have their own private landfills (Lantz 2010-C; Malloch 2011-C).

⁷⁶ Of these contaminants, around 50% is plastic (half film [bags] and half containers), and the rest is things like glass, metal, and a wide variety of other materials and objects (Malloch 2011-C).

have reported residue rates from single-stream products averaging 10-15%, with some of the worst exceeding 25% (Lantz 2008). Contamination is less an issue for containers because they tend to be positively sorted,⁷⁷ although their overall volumes are much less than for fibre.

The seriousness of these issues and magnitude of reductions in yield are highly variable. Experts note that at this time, given the state of MRF technology, single-stream processing may be done very poorly, or very well. It all depends on investment and willingness to pay on the part of the municipality and processor. If a municipality is willing to pay a premium in order to ensure a certain standard of processing, it is well within their ability to incorporate these requirements in their contracts in order to guarantee minimal reductions in yield.

6.3.5 Cost Considerations

The most significant factor driving the current trend towards municipal single-stream recycling likely has little to do with recycling rates, although that may be used as part of the justification. Instead, single-stream is attractive to many cities because it can be cheaper than other recycling systems. As explained in the introductory section, by far the greatest cost involved in solid waste management is collection, and when it comes to collection, single-stream is markedly cheaper than the alternatives. Whereas three stream programs require the use of compartmentalized trucks to keep the streams separate during collection, single-stream programs can collect everything in one large compartment. Single compartment trucks are also able to compact material, meaning more can be collected before the vehicle must return to the MRF, resulting in fewer trips back and forth. The end result is that collection is faster and more

⁷⁷ This means that desired material is targeted and removed from the mixed stream, ensuring high purity. Negative sorting (typical for fibre) is where contaminants are targeted for removal, and at least some are inevitably missed.

efficient, requiring far less fuel, manpower, and trucks (and the trucks that are needed are simpler, cheaper and can also be used for garbage / yard waste collection).⁷⁸

Again, the Surrey case study is telling. By switching to single-stream they reduced the number of collection vehicles needed by half, from 28 to 14. They were also able to switch the type of trucks from compartmentalized to cheaper and more efficient rear load compactors (much like standard garbage trucks). These trucks now might make one mid-shift return to the MRF to empty their contents, whereas before such trips were constant. The collections-based savings are estimated at \$2 million annually (Costanzo 2010-C).

The story on the processing cost side is different. The nature of single-stream material is such that when it arrives at the MRF, it requires intensive sorting before it can be sold. Increasingly, this is being done with complex technology, including moving separation screens, tumblers, centrifuges, optical sorters, magnets, and eddy-currents. This equipment can be very costly to purchase and maintain (as there are many moving parts).⁷⁹ The processing costs with single-stream, therefore, are higher, a reality reflected in municipal contracts.

Material quality also has cost implications. As mentioned, depending on the investment made in processing, the materials produced may vary in terms of quality and the prices they command. In general, even the best single-stream material will likely be slightly more contaminated and lower in quality than that coming from a good, multi-stream program. Municipalities and processors can therefore expect at least somewhat lower material revenues under single-stream—potentially far lower if they do not invest properly in processing.

Conclusions about overall costs when each of these factors is considered are variable. According to Surrey officials the savings overall are clear and significant (Costanzo 2010-C).

⁷⁸ Fully-automated, cart-based single-stream collection is the most efficient method, but increased efficiencies are experienced with manual and semi-automated collection as well.

⁷⁹ Equipment costs depend very much on the total amount of material over which they can be amortized—the more material that can be pooled together (i.e. among neighbouring municipalities), the cheaper overall.

Others are not convinced. The 2008 Lantz study cited earlier, for example, also compared Ontario program costs before and after single-stream implementation.⁸⁰ He found that after adjusting for all the factors discussed here (as well as a few more), the average costs for the single-stream programs were actually slightly higher than those for the dual-stream programs. His final conclusion is that “with increased processing costs and the lost revenues in total far exceeding collection savings in most instances...overall, single-stream recycling does not show the cost advantage that was originally anticipated” (Lantz 2008, p.5).

Overall costs, therefore, may or may not change significantly with single-stream. Their distribution, on the other hand, will shift considerably. Single-stream relieves municipalities of significant collection costs, which then translate into higher processing costs for the mixed material. Processors, however, can demand compensation for these extra costs in the form of higher fees (Stefenelli 2010-C). In the end, it is manufacturers that likely end up shouldering the brunt of the cost burden. Increased contamination in much single-stream material has serious cost implications for manufacturers using recycled inputs (especially paper), who have to invest in equipment to filter it out. With intense competition for supply from Asian mills leading to scarcity, local buyers face a seller’s market where they are weakly positioned to price discriminate based on quality; for many the choice is either invest in the technology and pay the disposal cost to deal with the contaminants, or go out of business (Malloch 2011-C). This situation gives processors a great deal of power, as manufacturers may have to grudgingly purchase their material, even if the investment in processing it has been minimal.

There are questions as to whether this distribution of costs is reasonable. Kinsella and Gertman (2007) argue that municipal decision makers are advancing the single-stream movement independently, blinded by collection savings and under-investing in processing without consideration of the broader effects on other parts of the interdependent recycling system. They

⁸⁰ Each program had a dual stream (fibre and containers) program in place prior, not a three stream program like Vancouver.

point specifically to manufacturers of recycled products (particularly domestic ones), who are being forced to pay much of the price for this short-sightedness.⁸¹ They write:

Only when collectors and municipal programs ensure the optimal functioning of the other sectors can the potential of increased volume [from single-stream] make the added costs throughout the system worthwhile (Kinsella and Gertman 2007, p.3).

Single-stream therefore, involves an unreasonable and damaging shift in costs if proper investment is not made at the initial stages. This however, need not be inevitable.

6.4 Expand Product Deposit Programs

6.4.1 Effectiveness: Marginal

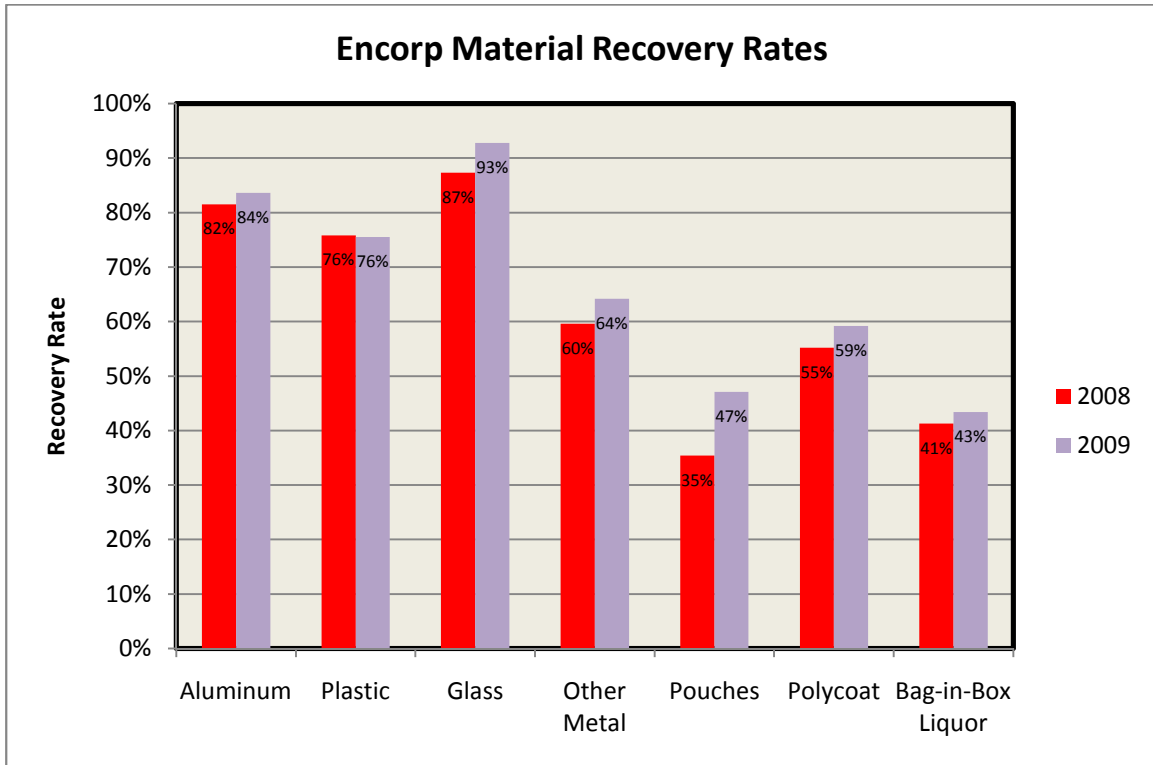
For narrowly defined product categories, deposit programs are highly effective. Their monetary incentives are clear and strong. They encourage individuals and households to recycle deposit-material by appealing to their wallets in addition to their environmental proclivities. In addition, in many cases where the incentives are not enough for some consumers, others effectively end up recycling on their behalf.⁸² They are by far the most effective method considered in this study when it comes to increasing recovery rates for specific materials. And, contrary to the other policies considered, the single-family / multi-family divide has no discernable effect on either the ability to implement the policy or its effectiveness with respect to each group; the materials are returned to commercial sites and the monetary incentives are the same regardless of where one lives.

⁸¹ Many North American recycled paper mills, for example, have either shut down (i.e. Catalyst Paper-Coquitlam), or filed for bankruptcy restructuring (i.e. Blue Heron Paper, AbitibiBowater, and White Birch Paper).

⁸² I am referring here to the phenomenon of “scavenging” or “binning.” This is a practice employed by individuals who gather deposit-material from streets, parks, recycling, and garbage containers, and then return them for the deposits as a way of earning income. This activity exists across the province from highly affluent areas like Vancouver’s North Shore (Lynch 2010-C), to rural areas in the Okanagan (Rotheisler 2010-C). It is particularly intense in the City of Vancouver, with hundreds of people participating and massive volumes of material being collected, much of which would not otherwise have reached the recycling stream.

Effectiveness is clearly illustrated in Figure 23 below, which shows the province-wide recovery rates on all Encorp deposit material for the years 2008 and 2009.⁸³

Figure 23 – Encorp Effectiveness: Graph



(Source: Encorp Pacific 2009)

The figure shows high recovery rates on deposit-material. The first three categories in particular, show rates significantly higher than those estimated for non-deposit Blue Box recyclables in Section 3.5.3. These three categories, aluminium, plastic, and glass, also account for the vast majority of Encorp deposit material: 88% of such material sold in 2009 (Encorp Pacific 2009). Part of the reason their recovery is higher than the other product categories also has to do with

⁸³ Note that this data does not distinguish between residentially generated material and that coming from other sources like schools, offices, restaurants, etc. For this reason, these aggregated rates are an approximation of the likely residential-specific rates.

how long they have been under deposit systems. Aluminum, for example, has been dealt with this way in BC since 1972 (Sigmund 2010-C). Encorp notes that as new materials are added to the system, it takes time for their recovery rates to increase; with time and education rates tend to go up. Figure 23 corroborates this, as recovery rates increased on all materials (except plastic, which did not change) between 2008 and 2009.⁸⁴

In spite of their being highly effective for increasing recovery of specific products, the overall effectiveness of deposit programs is limited. The main reason is that they are only suitable for certain types of recyclables, namely rigid containers, which account for a small overall share of the residential total. The recovery data for Vancouver in Section 3.5.3 shows that the container stream is far smaller than the fibre streams, which together account for over 62% of total residential recyclables collected. Because deposit systems require people to return materials fully intact, they are not suitable for paper products, which tear easily and are highly susceptible to water damage. Paper products are also far too abundant to make deposits a feasible option and their origins are impossible to track (unlike beverage containers), which makes administration problematic. In order for deposits to have a substantial impact, they would have to cover virtually all recyclable containers, which includes a massive range of products that would likely have to be phased in over a lengthy period of time. For these reasons, the only feasible way to implement this policy would involve the gradual addition of only new container products, which is unlikely to have more than marginal overall effectiveness in the short to medium term.

6.4.2 Administrative Complexity: Medium

Compared to the Blue Box method of dealing with recyclables, the Encorp system is administratively complex. It involves tracking product sales, collecting fees, paying handlers, transporters, and processors, advertising, and extensive data collection, just to name a few

⁸⁴ Note that part of these increases may also have to do with the economic downturn, which may have encouraged people to return their beverage containers for the deposits more than they would have in better economic times. Even so, this increasing recovery trend is consistent over time.

operations. Most of this administrative complexity, however, can be fairly thought of as “fixed,” where the marginal complexity of adding new products to the system is relatively low. Adding new products does require Encorp to do preliminary research in order to design effective programs for each of them (i.e. education / communications strategies) (Sigmund 2010-C). Other additional administrative demands, however, can be easily absorbed into the pre-existing system. Indeed, Encorp has the willingness and administrative capacity to incorporate any new products added to the *Recycling Regulation* into the existing system, as it has done multiple times in the past (Sigmund 2010-C).

Expanding the products included would require incremental increases in capacity, varying in degree depending on the number and specific characteristics of the additional products added (i.e. how developed their markets are, and how easy their origins are to track). Capacity in this sense refers primarily to hiring additional staff to deal with increasing demands on the existing system. In addition, an acute capacity-related issue specific to Vancouver is the current shortage of depots (where 85-90% of returned materials are taken) (Sigmund 2010-C). Even with only the current material covered, both Encorp and the City of Vancouver recognize the need for more locations. The scarcity and high cost of land and well-located commercial space in the city makes siting depots a problem.⁸⁶ Whereas the recent addition of milk containers did not overly stress existing infrastructure, adding a significant number of new products to the deposit system would necessitate more, larger depots, and exacerbate this issue. More frequent material pick-ups from depots to relieve demands on their space, as well as expanding the use of mobile depots, are ways to mitigate these issues. However, they involve increased administrative complexity and do not entirely alleviate the need for newer, larger physical depots.

Finally, whereas the other policies analyzed fall exclusively within municipal jurisdiction, expanding product deposits requires changes to provincial legislation (specifically

⁸⁶ Encorp cites acquiring the necessary businesses licences as an additional issue (Sigmund 2010-C).

the *Recycling Regulation*, which forces producers to use these programs—something they would not otherwise do as it is an added cost), a relatively more complex administrative process. Substantial expansion of deposit programs, therefore, would involve a significant, but not intractable marginal increase in administrative complexity.

6.4.3 Transitional / Implementation Issues: Significant

Expanding product deposits involves a number of significant issues with respect to this criterion. First, if a large number of new products were to be added in the interests of significantly increasing recovery, adding them all at once would not be feasible. Instead, products would have to be added incrementally and over a significant period of time to be smoothly absorbed into the existing system. Even then, it takes time for recovery on each individual product stream to increase as people need to be educated (i.e. to even realize they can get money back on specific items) about the program and modify their behaviour, which is a gradual process, potentially requiring a long period of time before high recovery is achieved. Encorp notes that depending on certain characteristics including their abundance and cleanliness, different products vary in initial recovery and the speed at which it increases (Sigmund 2010-C).

This policy option may also face some public resistance. As mentioned in the previous section, it may require siting additional depots. In Vancouver, given the intensity of scavenging and the social issues that come with it (both actual and perceived), there is some public resistance to opening more depots. Retailers may also resist this policy because of the added cost to them—under the legislation, retailers are legally obligated to take back all the deposit-covered products they sell, at their own cost.⁸⁷ Most would prefer not to have this responsibility. As with administrative complexity, therefore, this policy introduces significant, but not insurmountable transition / implementation issues.

⁸⁷ They are allowed to impose per-customer, per-day container return limits (24 units), however, and also receive handling fees from Encorp as compensation for costs incurred (Sigmund 2010-C).

6.4.4 Yield: Increase

This option is superior to all others with respect to yield. The nature of product take-back is such that separation by material type is extensive and sorting is virtually 100% accurate. Once processed (baled), Encorp material is 100% pure and uncontaminated—none is lost to cross-contamination, process loss, or sorting inaccuracies, as it is with other types of recycling systems. Encorp is in fact obliged under provincial legislation to recycle 100% of the material they collect (Sigmund 2010-C). Expanding the Encorp System to include more materials, therefore, would result in an increase in overall yield.

6.4.5 Cost Considerations

The Encorp deposit program costs a significant amount of money to run. Some in the recycling industry argue that it and other stewardship systems are inefficient and deal with material at an exorbitant cost. They argue that the private sector could deal with the same material through the Blue Box system for a fraction of the price (Stefenelli 2010-C). Done this way, reductions in handling and administration costs would allow the outright elimination of Container Recycling Fees, meaning lower costs for consumers.⁸⁸ The deposit incentives would have to be removed, however, which would result in a decrease in recovery rates—likely a significant one.

Encorp argues that their longstanding system is run effectively and efficiently and that they are intensely pressured to minimize costs, particularly by their brand owner partners. They believe that the additional costs of dealing with material through stewardship deposit programs are fully justified by the superior recovery rates that result (Sigmund 2010-C).

The Encorp model is highly defensible in its cost distribution. As those who choose to buy the containers finance it, the program adheres to the user-pay principle and receives no public

⁸⁸ The existence and amount of these fees depends on the state of materials markets—when prices for a given type of material are high enough that sales revenue alone covers all costs, recycling fees on that material stream are reduced / eliminated (recycling fee reviews / adjustments take place annually) (Sigmund 2010-C). If done through the Blue Box, the fees would be removed and beverage containers dealt with the same way as all other material.

funding from taxpayers. In addition, Encorp CRFs are designed to avoid product cross-subsidization: those products that cost more to deal with have higher fees. This system is both fair and equitable as consumers are free to make the choice to consume the products and pay the recycling costs, while non-users are not forced to subsidize them. Brand owners and retailers also have the option to pay the CRFs to Encorp and not pass them on to consumers—a producer-pay approach, and also a fair way to go about financing⁸⁹ (Sigmund 2010-C).

Because deposit programs shift materials out of the Blue Box, they also have cost implications for processors and/or municipalities that earn money from their sale. For example, deposits currently chase high value aluminum cans out of the Blue Box, which means program revenues are lower and costs effectively higher (Rogers 2010-C). If deposits were added to other high value products (i.e. those made of metal or #2 HDPE plastic), this effect would be exacerbated.

⁸⁹ It is much more common for producers to pass these costs on, however.

7: Policy Evaluation and Recommendations

Table 6 – Policy-Criteria Matrix

<i>Criteria</i> <i>Policy</i>	Effectiveness	Administrative Complexity	Transitional / Implementation Issues	Yield
Bylaw Oriented Compliance	Marginal-Substantial	Medium-High	Inconsequential-Significant	No Change
Strengthen Pay-As-You-Throw Garbage Pricing	Substantial	Low	Inconsequential-Significant	No Change-Decrease
Single-Stream Recycling	Marginal	Low	Inconsequential	Decrease
Expand Product Deposit Programs	Marginal	Medium	Significant	Increase

Based on the preceding analysis summarized in Table 6 above, I am led to a number of conclusions on the solid waste policies that Vancouver ought to pursue in the interests of increasing residential recycling. I will address each option in turn.

Some elements from the bylaw-oriented approach would be advisable, and others less so. On container labelling, at the very least those multi-family recycling totes that are now incorrectly labelled should be updated. The status-quo in this respect amounts to misinformation and is a serious problem that must be fixed. It is also a very simple way to attack the poor performance of multi-family residences when it comes to recycling.

Consistent labelling of residential dumpsters is a similarly simple and effective approach. The current Metro Vancouver policy of distributing labels to only those companies requesting them should be reviewed. Regulation via City bylaws requiring all waste companies using dumpsters to ensure they are properly labelled is not an unreasonable intrusion into private enterprise. In fact, it is in the interests of these companies to have their containers labelled in order to reduce their risk of being penalized at disposal sites for dumping banned material. The other labelling-related suggestions are also strongly recommended. Clear information is important in its own right and these simple measures are likely to have some positive effect, with limited administrative complexity, transitional / implementation issues, and financial investment. Overall, I believe this part of the bylaw-oriented option passes the cost-benefit test

The enforcement scheme described earlier, however, does not pass this test. It is entirely logical (not to mention fair) that garbage be monitored where it originates and its generators held accountable. However, the administrative complexity and costs associated with this type of enforcement are too great to justify the increases in recycling, especially given that they are far from certain. This is part of the reason that enforcement is concentrated where it is now, at disposal sites, where it is economically feasible. In addition, the legal uncertainty surrounding this option is good reason to rule it out, at least until other cases are tested in court. Even without this type of enforcement, however, the education and feedback components of the bylaw oriented approach have significant potential to increase compliance.

The performance of our PAYT model in this analysis is uniformly positive. It is the only option that can confidently be rated “substantial” in terms of effectiveness, and at the same time raises no serious irremediable concerns on any other criteria. On this basis, I strongly recommend the City of Vancouver consider the structural adjustments outlined and the suggested transition to bi-weekly garbage collection. The latter would be a much more effective method of restricting capacity than offering a smaller minimum can size, although this is an option as well. A switch to

bi-weekly garbage collection without any other changes would no doubt have a substantial effect; indeed, Lantz suggests that this policy alone would “have the greatest single impact on increasing recycling rates” (Lantz 2010-C). With increased monetary incentives, however, such a PAYT system would be all the more effective. Given that Vancouver is currently implementing an expanded household organics program, a switch to bi-weekly garbage collection alongside weekly organics and recycling is feasible, and a natural progression from current City policies.

If cost were the primary criterion, single-stream might be something to consider. When effectiveness is paramount, however, the evidence is less than convincing. Given serious questions about yield, residue, and its far-reaching effects on the recycling industry, the potential for a marginal increase in recovery is not enough to justify such a fundamental change, which is very difficult to reverse after implementation. In addition, single-stream would be somewhat incompatible with the recommended PAYT system, given the strength of the monetary incentives and increases in residues likely to result. Not surprisingly, a recent report on single-stream by the Vancouver Solid Waste Department expressed concern about the same issues discussed in this analysis and came to the same conclusions (Chauo, McLennan, and Underwood 2010).

The product scope limitations of deposit programs are unfortunate given how highly effective they are at encouraging recovery. As the analysis shows, they are probably not the way to achieve substantial overall effectiveness, largely because they do not work for paper products. This is not to say additional products should not be added, however. Indeed, Encorp has added new products throughout its existence and will no doubt continue to do so. The additional recovery, even if small and gradual, would still be beneficial, particularly as product deposits target multi-family recycling in addition to single-family, which is an constant issue with other approaches.

8: Conclusion

At the time of writing, it appeared quite possible that a number of the recommended policies might be implemented in the City of Vancouver. Officials consulted recognized the issue with incorrect totter labelling and planned to have all incorrect labels replaced by the end of 2011 (Thomas 2011-C). Bi-weekly garbage collection was also being seriously considered for Phase 2 of the household organics program. As well, the British Columbia government had committed to adding new products to the *Recycling Regulation* annually—many that could be Encorp / deposit friendly. The City, however, remains sceptical about major changes to the garbage rate structure design. Increasingly urgent environmental concerns, high oil prices, and a landfill nearing capacity necessitate that Vancouver and other Metro Vancouver members seriously consider abandoning the traditional cost recovery mentality. Strong PAYT offers powerful economic incentives that ought to be exploited in the greater interests of recycling and waste reduction.

The topic of multi-family residences is an appropriate one on which to conclude. The distinct way these buildings currently deal with garbage makes it very difficult to target them with effective solid waste policies, which is all the more problematic given their poor recycling performance. Although improved container labelling and product deposits are ways to marginally improve this performance, they are nowhere near as effective as PAYT is for single-family residences. Metro Vancouver has recently tested some promising new policies for multi-family residence recycling. They include providing more recycling totters and setting aside more space for recycling / composting, and using heavily graphic-based communications to overcome language barriers, which are often quite pronounced in multi-family residences (Metro Vancouver 2010a). Analysts looking at this problem in the future would therefore be advised to pursue these and other innovative policies focused on multi-family residences.

Appendices

Appendix A – Methodology For Calculating Recovery Rates

Single-Family:

Single-family residence recovery rates were calculated using data from Metro Vancouver's *Solid Waste Composition Study, 2008*, prepared by *Technology Resource Inc.*, and data from Vancouver's *2009 Solid Waste & Recovery Data Survey*.

The 2008 study (which analyzes data collected in October 2007) was the most recent, detailed waste composition study available at the time of writing. It includes a detailed breakdown of the single-family residential waste stream for the entire Metro Vancouver region (Vancouver specific waste composition data does not exist). The percentages of the waste stream made up of each material category and its subcategories were analyzed to determine the total share of Metro Vancouver garbage that could theoretically be recycled through curb-side, Blue Box programs (judging by materials accepted in Vancouver's program). These percentages were then applied to the total volume of single-family garbage collected in Vancouver for 2009, to determine the volume of recyclables ending up in the garbage, split between the fibre and container categories. These volumes were then added to the volumes collected as recyclables from single-family units through the City curb-side program (the numerator) to get the total amounts generated (the denominator). Dividing this term by volumes collected produced estimated single-family recovery rates for fibre and containers in Vancouver.

Multi-Family:

Multi-family unit recovery rates were calculated using data from the *Multi-Family Buildings Waste Audit, 2006*, prepared by *Gartner Lee Limited* for the Greater Vancouver Regional District (as Metro Vancouver was known at the time).

This 2006 waste audit (which analyzes data collected in 2005) was the best multi-family data available at the time of writing. Using the same categories and sub-categories as the single-family study, it provides a breakdown of the multi-family waste stream. Again, the data were analyzed to determine the share of multi-family garbage that could theoretically be recycled. The study also provided an estimate of the total volume of garbage generated by multi-family units across Metro Vancouver. This number was determined by sampling and subsequent extrapolation across the population, as this data is not directly measured (because this waste stream is serviced by many participants in the private sector who do not report volume data). The volume of recyclables in multi-family garbage was again determined by multiplying their estimated share within the garbage by the estimated total volume of garbage produced. The study also provided an estimate of the total recyclables collected as such from multi-family buildings. Recyclables in the garbage and recyclables in recycling bins were added to produce the total generated, and the latter divided by this total to produce recovery rates for each stream. As noted in Table 2, the rate for fibre is assumed underestimated; this is because some multi-family buildings assessed in the study contracted cardboard to private collectors, meaning it was recycled outside the municipal system.

Lindsay Moffit of the City of Vancouver is credited with devising the basic methodology used for both types of dwellings.

Issues:

For this project, it was important to determine recycling rates as I have defined them in order to get an idea of the status quo and potential room for increase. The initial hope was to obtain recycling rate data for all Blue Box accepted material, for the residential sector exclusively

(split between single and multi-family) and specific to the City of Vancouver. It quickly became obvious that such narrowly defined data does not exist. The data available includes a wide variety of recycling / recovery / diversion rates, defined and measured very inconsistently (the most commonly cited figure in Metro Vancouver is the “diversion rate” which is simply the volume of solid waste collected that does not go to landfill, divided by the total collected overall—an inherently problematic number of limited use for this study’s purposes). The only recycling rate data available that is of truly high quality is that on beverage containers dealt with through the Encorp program. Even this data, however, is not segregated by sector (i.e. residential) or region/city.

The only option for producing the desired recycling rates turned out to be through collection figures and waste composition data. The figures produced should be considered indicative of the approximate status quo, but far from precise. They are weakened by the following issues:

- A lot of general data for the Metro Vancouver region had to be applied to Vancouver, as specific data for the City is not available (the Gartner Lee study suggests there is relatively little variation in waste composition throughout the region, however)
- Rates were calculated using data from various points in time, some as much as five years old – this is unavoidable as waste composition studies are not done regularly, especially for multi-family units
- The composition data used to calculate rates for single-family units inevitably incorporates some waste from multi-family and other waste sources (because of mixing in collection vehicles)

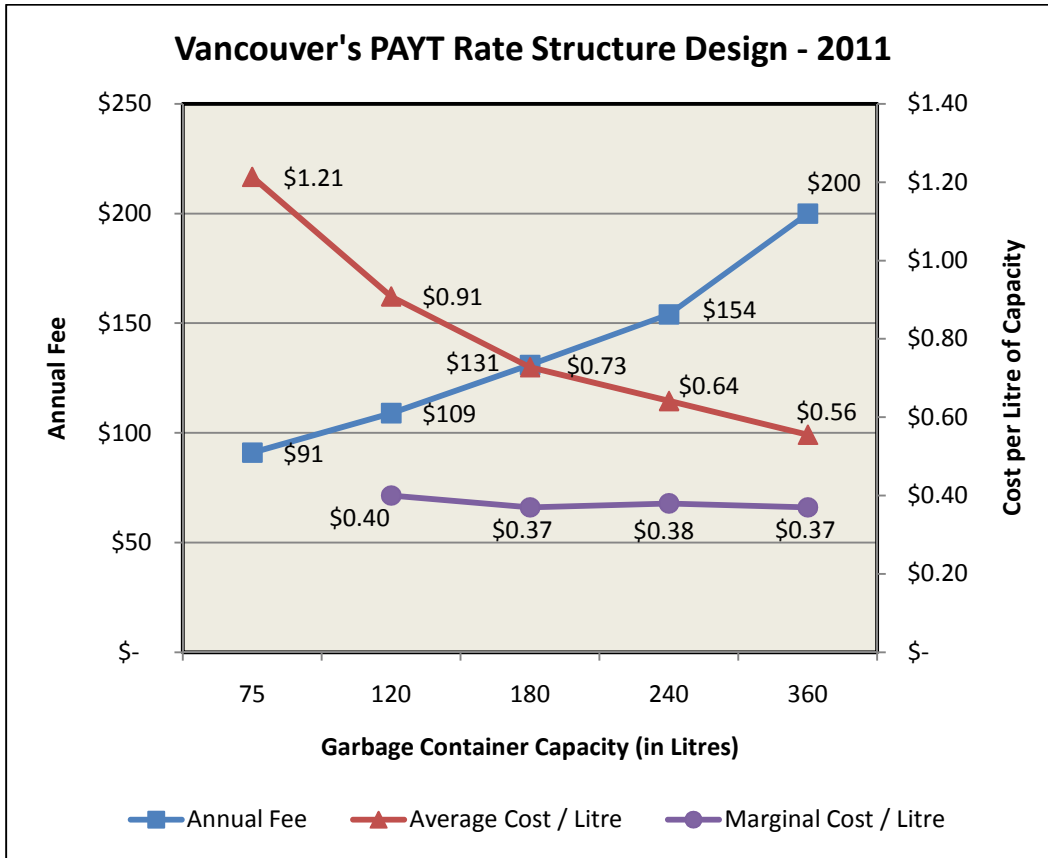
Appendix B – Vancouver’s PAYT System in 2011

Table 7 – Rate Structure Design Changes 2010 → 2011

Container Size	Annual Fee	Average Cost Per Litre of Capacity	Marginal Cost Per Litre of Capacity
75 litres	\$89 → \$91 (\$7.42 → \$7.58 monthly)	\$1.19 → \$1.21	-
120 litres	\$105 → \$109 (\$8.75 → \$9.08 monthly)	\$0.88 → \$0.91	\$0.36 → \$0.40
180 litres	\$128 → \$131 (\$10.67 → \$10.92 monthly)	\$0.71 → \$0.73	\$0.38 → \$0.37
240 litres	\$150 → \$154 (\$12.50 → \$12.83 monthly)	\$0.63 → \$0.64	\$0.37 → \$0.38
360 litres	\$194 → \$200 (\$16.17 → \$16.67 monthly)	\$0.54 → \$0.56	\$0.37 → \$0.37

(Source: City of Vancouver Website 2010 and 2011)

Figure 24 – Vancouver PAYT in 2011: Graph



The changes in rate structure design between 2010 and 2011 were not significant. They involved a very modest overall increase in price of 2% (weighted average) across all container sizes. The key features in Figure 24 (for 2011), are virtually identical to those in Figure 21 (for 2010), indicating that the rates have changed little in terms of differentials and proportionality. This indicates the persistence of the cost of service mentality in designing the garbage fee structure, and a resistance to incorporating less direct economic costs, environmental externalities, and strong recycling / reduction incentives.

Appendix C – Household Organics Program: Communications

Figure 25 – Multilingual “Grocery Ad Bar”



(Source: City of Vancouver, via L. Moffit)

Figure 26 – Warning Sticker for Non-Compliance

What types of food scraps can you recycle in your yard trimmings cart?

YES!

- YES Uncooked fruit**
- YES Uncooked vegetables**
- YES Coffee grounds and filters**
- YES Teabags**
- YES Eggshells**

NO!

- NO Plastic bags including grocery, sandwich and compostable**
- NO Cartons or plastic and styrofoam containers**
- NO Oil, grease or chemicals**
- NO Coffee cups**
- NO Diapers or wipes**
- NO Animal waste or cat litter**

FOOD SCRAPS RECYCLING PROGRAM

資料查詢 सहायकी कडे Hoi chi tiet Obtenga Información Call 604.273.8888

vancouver.ca/foodscraps

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CITY OF VANCOUVER

VANCOUVER GREENER CAPITAL

(Source: City of Vancouver, via L. Moffit)

Figure 27 – Stickered Containers



Figure 28 – Actual Sticker Indicating Specific Infraction



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