

Closing the Loop

Reducing Greenhouse Gas Emissions and Creating Green Jobs Through Zero Waste in BC

By Marc Lee, Ruth Legg, Sue Maxwell and William Rees

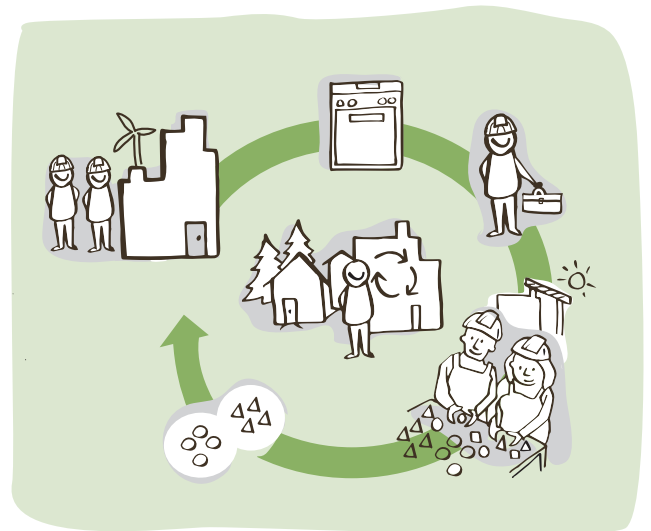
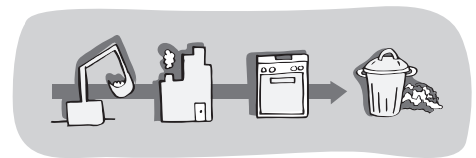
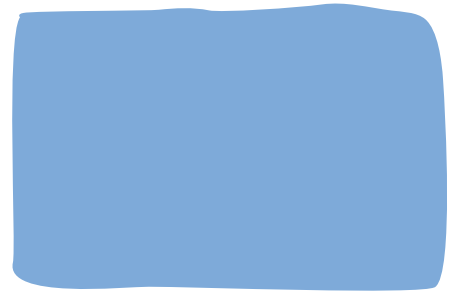
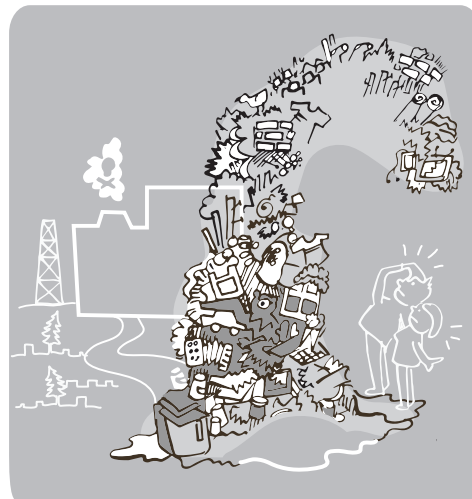
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CLOSING THE LOOP: REDUCING GREENHOUSE GAS EMISSIONS AND CREATING GREEN JOBS THROUGH ZERO WASTE IN BC

By Marc Lee, Ruth Legg, Sue Maxwell and William Rees

March 2013

Canadian Centre for Policy Alternatives – BC Office and the Wilderness Committee

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Closing the Loop

Reducing Greenhouse Gas Emissions and Creating Green Jobs Through Zero Waste in BC

MOST PEOPLE ARE FAMILIAR with the idea that we need to “reduce, reuse, and recycle” to protect our environment. Over the last few decades, waste management programs have made good progress in diverting solid waste from landfills through recycling and composting. But success has been lacking in reducing the amount of waste that is created in the first place, and in re-using materials (like bottles and packaging) before recycling.

This study aims to address the core problem: a culture of consumption and an economic system that is wasteful and that contributes to climate change. It looks at the possibilities for reducing both solid waste and greenhouse gas emissions while maintaining a high quality of life from the products and services we use.

Zero waste policies emphasize upstream, proactive solutions—aggressive materials reduction, re-design, and re-use before recycling and composting. The object is dramatic reductions in the volume of materials that flow through the economy, and therefore reduced energy consumption and greenhouse gas emissions. *Closing the loop* refers to the shift away from a linear economic model—where materials are extracted, made into consumer goods, then trashed—and towards a resource recovery model where materials cycle through the economy.

Well-designed policies can also support local economic development and the creation of new green jobs by increasing domestic capacity to manage and add value to the materials that are recovered.

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LANDFILLS, INCINERATION AND GREENHOUSE GAS EMISSIONS

Carbon dioxide is BC's single largest waste by weight—more than 49 million tonnes in 2010, compared to 5 million tonnes of solid waste generated—even though carbon pollution goes into the atmosphere, not a landfill. From a solid waste management perspective, both landfills and incineration pose challenges due to greenhouse gases.

In the case of landfills, methane, a more potent greenhouse gas than carbon dioxide, is released when organic material does not decompose properly:

- Official estimates of BC landfill emissions are about 4 million tonnes of carbon dioxide equivalent (Mt CO₂e) per year—however, our analysis suggests they are likely to be much higher, around 13 to 19 Mt per year.
- More than one quarter of waste going to landfill is compostable organic material. Composting programs, and initiatives like Metro Vancouver's plan to ban organics from disposal by 2015, are recognizing and starting to address this problem.
- Landfill gas can be captured in some cases, and used for energy, but this should be viewed as a short-term measure.

A planned new incineration facility for Metro Vancouver would handle up to 370,000 tonnes of waste per year. This growing reliance on incineration needs to be rethought.

Incineration gives the impression of making waste disappear, but it merely transforms solid waste into ash, gases, heavy metals and toxic compounds. While billed as “waste-to-energy” (WTE), incineration, in fact, wastes the embodied energy that was used in making a product—the energy required for resource extraction and processing, product manufacture and transportation.

BC has one major incinerator in Burnaby, a waste-to-energy facility that processes about 280,000 tonnes of waste per year (about 28% of waste disposed in Metro Vancouver). A planned new incineration facility for Metro Vancouver would handle up to 370,000 tonnes of waste per year. This growing reliance on incineration needs to be rethought:

- Incineration produces the greenhouse gases carbon dioxide and nitrous oxide.
- Official estimates of GHG emissions from incineration in BC (84,000 tonnes CO₂e) are dramatically understated because they do not include emissions from combusting organic materials.
- In terms of GHG emissions per unit of energy produced, incineration is worse than any fossil fuel generation, including coal.
- Incineration often competes with or hinders more progressive solutions like recycling.

REDUCING EMISSIONS BY REDUCING WASTE

Clearly, there are major opportunities for diverting waste from landfill and incineration. Recycling and composting far exceed other forms of waste disposal in terms of mitigating the environmental impacts of solid waste. But there are physical limits to recycling, and plastics, in particular, can be challenging. Only 10% of plastic in BC is recycled, and most of it is “down-cycled” into lesser-grade materials. But far more attention needs to be paid to reducing the amount of waste produced in the first place. Reduction and re-use strategies go beyond recycling by displacing the need for new emissions-intensive manufacturing and transportation.

- Large parts of consumer waste could be transformed by re-use and better product design, from soft drinks to product packaging to food containers to electronic components. Banning single-use containers would also help.
- Requiring extended warranties on durable products and consumer electronics would push manufacturers to provide repair and maintenance, and re-use components.
- Collaborative consumption or sharing has been around for a long time, with public libraries being a good example—some communities are building on this idea with toy or tool “libraries” that decrease resource consumption while building community
- Growth of the Internet has also enabled dematerialization—digital music, video, books and magazines are the most obvious examples—a pure reduction in materials while allowing essentially the same consumption.

Clearly, there are major opportunities for diverting waste from landfill and incineration. But far more attention needs to be paid to reducing the amount of waste produced in the first place.

BUILDING A RESOURCE RECOVERY ECONOMY

For economies like BC, closing the loop is no small task. BC’s resource-based economic model has been subsidized through tax credits, low royalty rates, cheap electricity and publicly-funded infrastructure. In addition, some costs of production have been externalized: for example, costs like pollution and climate change are borne by people in general and by the environment, not by the specific producer or consumer.

Many of the materials collected from BC recycling programs are not processed locally, but are treated like just another commodity that BC exports to the US or Asia.

Changes in economic incentives to capture externalized costs like pollution can develop robust local markets and support a resource recovery economy:

- Shift away from encouraging the extraction of raw resources and toward supporting the use of recycled materials and fostering local manufacturing.
- Drive market demand for recycling by addressing key barriers such as a lack of domestic capacity in areas such as carpet, non-refundable glass, and paper.
- Disposal bans or increasing tipping fees for disposal in landfills or incinerators would help drive incentives for recycling.
- Ensure demand for recycled materials through public procurement policies and requirements for minimum amounts of recycled content.

- Encourage the diffusion of business models based on renting and leasing, rather than owning.
- Support cooperative economies and collaborative consumption approaches.

The overall framework for managing how materials flow through the economy may eventually resemble supply management systems like those that currently exist in agriculture, and could be supported by public investments or a Crown corporation if necessary.

Making collection easy for households and businesses should be a priority. Extended producer responsibility (EPR, also known as “stewardship” or “take back”) programs put the onus on producers for post-consumer recycling, but can be confusing for consumers. New requirements for EPR programs can encourage reductions in waste generated by:

- Including higher targets for recovery, consumer awareness and access, and goals for reducing, re-using and repair.
- Requiring better labelling for products.
- Establishing deposit and return systems for containers, packaging and other products.
- Guarding against contamination that makes materials less valuable (most waste experts caution against cheaper “single stream” collection efforts for this reason).
- Tailoring collection systems (curbside pickup, on-street bins, retail return points, or designated depots) to meet the particular circumstances of the product and the regional district or municipality.

Managing waste for resource recovery has the potential to create green jobs in BC. 100% recycling of BC’s waste, with all sourcing and processing done locally, would mean about 7,000 new direct jobs.

DEVELOPING A GREEN JOBS AGENDA

Managing waste for resource recovery has the potential to create green jobs in BC. Repair, servicing and maintenance, and re-using bottles and containers, all create decent work. Sophisticated collection and sorting systems, and redirecting recovered material from export markets toward domestic re-use, re-manufacturing and recycling activities will also support new employment in BC.

Based on research carried out in the US, UK and Europe, we estimate that 100% recycling of BC’s waste, with all sourcing and processing done locally, would support 12,300 direct jobs. With an existing provincial diversion rate of 43%, this would mean about 7,000 new direct jobs. In addition to these, there are also potential jobs gains in the more labour-intensive repair and refurbishment of products.

Because there may be job losses from reduced resource extraction and landfilling and incineration practices, “just transition” programs will be needed that facilitate new skills development. On balance, it is anticipated that job creation impacts would be larger than losses, but policy should actively seek to create those jobs by developing the sectors cited above. Promoting and supporting unionized workforces would push green jobs to ensure decent wages and working conditions.

BEYOND RECYCLING: NEXT STEPS FOR BC

We consider both reductions in generation (reducing) as well as increases in diversion rates (recycling and composting) in order to model scenarios for 2020 and 2040. We assume a commitment by governments to implement new programs, standards and regulations, most of which are in place by 2020. Changes in product design and robust substitutes for existing products will take longer to phase in, as well as new norms for society's behaviour around conserving materials.

- We estimate a 13% reduction in waste generation by 2020, and a 45% reduction by 2040—a major shift toward decreasing materials and energy throughput in the economy.
- Changes in materials, and source-separated collection systems, push the economy close to 100% recycling of materials by 2040.
- By 2020, reduced generation and more aggressive recycling and composting lead to 4.9 million tonnes CO₂e savings by displacing organics from disposal and reducing the need for energy-intensive extraction and processing activities.
- By 2040 this rises to 6.2 million tonnes.

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RECOMMENDATIONS

- **INTEGRATE GHG EMISSIONS INTO WASTE MANAGEMENT PLANNING**—BC should establish formal targets for reductions in waste generation as well as increased diversion, and these plans should fully account for GHG implications in concert with climate action. The province should require that regional districts re-draft solid waste management plans in line with zero waste objectives.
- **DO NOT EXPAND INCINERATION (WASTE-TO-ENERGY) CAPACITY**—Incineration has adverse consequences for health and GHG emissions, and requires a steady stream of waste that is inconsistent with zero waste objectives. Even if energy is produced from incineration, it is uneconomic energy as it destroys useful materials that are costly to replace from virgin sources.
- **REQUIRE PROVINCE-WIDE COMPOSTING**—Banning organics from landfills is a top priority in terms of GHG emissions, and will take effect in Metro Vancouver as of 2015. Similar requirements should be applied across BC.
- **PHASE OUT SINGLE USE PRODUCTS AND PACKAGING**—BC should implement deposit and return systems in support of re-use mandates (all beverage containers, including milk and soft drinks; food containers and cutlery) and require that stores take back containers and packaging for any product they sell. Other single-use items should be phased out, such as junk mail, telephone directories, disposable plates, cutlery and food containers, and plastic bags.

Following the directions laid out in this paper, the next generation of zero waste policy has great potential to help reduce GHG emissions and create green jobs through “closing the loop” on production in BC.

- **MOVE CAUTIOUSLY ON A NEW BC FRAMEWORK FOR PACKAGING AND PRINTED PAPER**—Potential moves toward “integrated resource management” that mix more types of waste together, instead of maintaining multiple streams of materials, are problematic. A new framework must also respect municipal government and social enterprise investments and existing labour contracts, push producers up the pollution prevention hierarchy, and be rolled out for the industrial, commercial and institutional sector, as well as residential.
- **ESTABLISH MINIMUM RECYCLED CONTENT REQUIREMENTS**—BC should implement re-use requirements and minimum recycled content requirements for a wide range of products. Public sector procurement should also strongly support keeping material flows in BC rather than exporting.
- **INVEST IN CAPACITY TO MOVE UP VALUE CHAIN**—BC will need to make public investments in support of a shift away from landfills and incinerators, and toward waste reduction, re-use, repair and maintenance, and finally, recycling and composting.
- **DEVELOP A GREEN JOBS AND JUST TRANSITION FRAMEWORK**—Policies are needed to help create well-paid, decent green jobs in the resource recovery sector, including policy to support retraining and job transitions from status quo operations. A sector-wide approach that includes collective bargaining and a commitment to decent wages and working conditions is important to this end.
- **SUPPORT RESEARCH AND INNOVATION AIMED AT REDUCING THE AMOUNT OF MATERIALS FLOWING THROUGH THE ECONOMY**—Research funding should target resource recovery with an emphasis on efficient design, product durability and service economies that dramatically reduce material throughput. In addition, funds to support pilots and start-ups, innovative business models (such as leasing), re-use centres, dematerialization, and other sharing/cooperative projects would accelerate the transition to lower waste generation.
- **BAN OR TIGHTLY REGULATE MATERIALS THAT ARE TOXIC OR NON-RECYCLABLE**—Materials flowing through the economy should be safe for human, plant and animal health. The “precautionary principle,” which puts the onus on producers to demonstrate their products are safe, should be the bedrock of materials regulation in the economy.
- **SHIFT INCENTIVES THROUGH PRICING AND REGULATION**—Ecological fiscal reform should include reforming the royalty regime for resource extraction, which would make recycling more competitive. Fees for disposal to landfill and incineration should be steadily increased.

Following the directions laid out in this paper, the next generation of zero waste policy has great potential to help reduce GHG emissions and create green jobs through “closing the loop” on production in BC. Furthermore, a provincial policy mandate for zero waste creates an important opportunity to develop a localized economy better positioned to weather global changes—climate change, market volatility and resource scarcity—that are gathering on the horizon.

Zero Waste Policies

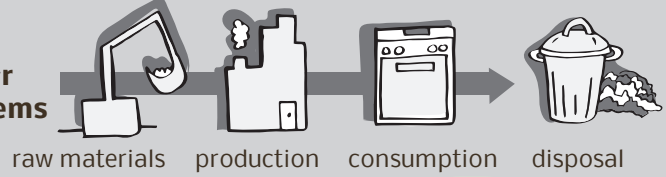
Can Reduce Greenhouse Gas Emissions and Create Green Jobs

Our culture of consumption is extremely wasteful and contributes to climate change.

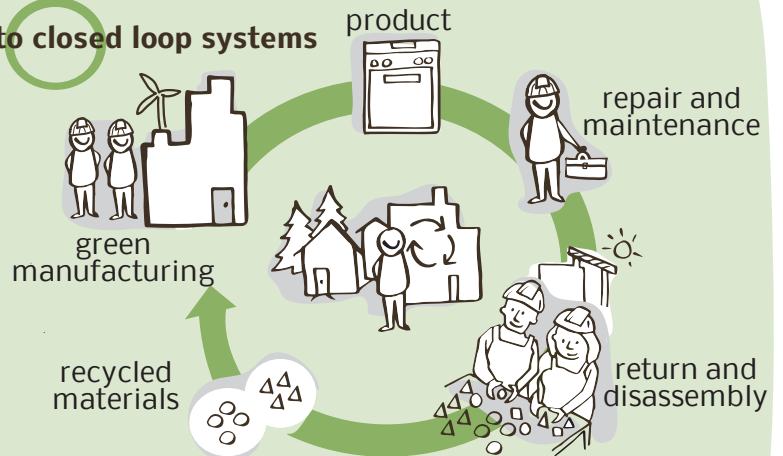


Zero Waste Policies Shift

from linear systems



to closed loop systems



Zero waste policies support **local economic development** and green jobs by increasing our capacity to manage materials.

Zero Waste emphasizes upstream, proactive **SOLUTIONS**

Eliminate	rethink	no junk mail	dematerialization	drink tap water
	repair	sharing		
	no single use products	consignment		
	make it easy	compost		
	Disposal	Hey, where did the landfills and incineration go?		

OUTCOMES

- reduced greenhouse gas emissions
- fewer raw materials needed
- less manufacturing energy used
- compost for gardens
- no pollution from incinerators

www.policyalternatives.ca/zero-waste

Sam Bradd

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CLIMATE JUSTICE PROJECT

Introduction: From Waste to Resource

A growing population consuming ever-greater quantities of stuff is pushing ecological limits—in terms of resource extraction, waste, energy use, and greenhouse gas emissions.

THE CONCEPT OF “ZERO WASTE” has emerged as a new pillar of sustainability, an ideal juxtaposed against a global economic system characterized by environmental degradation and wasteful consumption. Starting with resource extraction, processing and production, and on to supermarkets and big box stores, huge gains have been made for (affluent) consumers in the availability of goods and services. But a growing population consuming ever-greater quantities of stuff is pushing ecological limits—in terms of resource extraction, waste, energy use, and greenhouse gas emissions.

A century ago, waste in industrializing cities became a public health concern, leading to a mandate for cities to collect and manage waste by dumping it in landfills or burning it in incinerators. In turn, formalized disposal systems made it easier for manufacturers to produce disposable products, with citizens in effect subsidizing today’s thriving “throwaway culture” through their municipal taxes. Many common products have a useful lifespan of minutes (or seconds) before being trashed, including single-use items like plastic packaging and bags, styrofoam cups and plates, and junk mail. In other cases, products of global supply chains, such as consumer electronics, are complex mixes of materials and components that cannot be easily repaired when they break down (shortly after the limited warranty expires), or become victim to shifts in fashion.

In recent decades, governments have aspired to reduce the amount of waste going to landfills by diverting materials that can be recycled away from landfills. In addition to curbside “blue box” programs, diversion rates are being increased through the introduction of composting programs and extended producer responsibility (EPR) programs that put a greater onus on producers for addressing waste at the end of a product’s life. BC is ahead of most North American jurisdictions in implementing EPR programs.

The pollution prevention hierarchy is a commonly understood framework for thinking about waste, in order of environmental impact: reduce, re-use, recycle, recover energy, and disposal. While “reduce-reuse-recycle” has been a slogan (even a children’s song) for a generation, real-world waste policy today remains centred on lower-level solutions driven primarily by the goal of diverting waste from landfills. In spite of recycling successes, however, the total amount of

waste going to landfills has continued to grow. Incineration, rebranded as “waste-to-energy” (WTE), remains a controversial alternative to landfilling. Metro Vancouver has one WTE plant and is planning for another.

In contrast, *zero waste* places much greater emphasis on upstream, proactive solutions—aggressive materials reduction, re-design, and re-use *before* recycling and composting. The object is to reduce the *material and energy throughput* of the economy—the volume of materials that flow from extraction through to disposal, and the energy used along the way. According to the Zero Waste International Alliance:

Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health.¹

This paper looks at the prospects for closing the loop—a transition from managing wastes to recovering resources that feed back into production—and considers the intersection between climate action and zero waste policies.² Although “zero” is perhaps more an aspirational than an operational goal,³ zero waste thinking is consistent with efforts to dramatically shrink the ecological footprint of society, and has great potential to save energy and GHG emissions through absolute reductions in energy and material flows through the economy.

Table 1 (page 14) shows BC’s estimated waste stream of 5 million tonnes in 2010, broken down by category, and recycling rates.⁴ Later in the paper we model a zero waste approach that both reduces total waste generated and dramatically increases recycling rates. The deeper context for this analysis is a throwaway culture, spurred on by advertising, fashion and planned obsolescence: products that are outdated by a new version that performs better, that break down in a given time, and products that go out of style even while function and quality remain intact.⁵ In the early 21st century, ecological limits to our economic system have become increasingly apparent even as the globalized economy distances consumers from the environmental and social harms caused by the products they buy. Inexpensive, “disposable” products exist precisely because ecosystems are compromised and workers subjected to poor conditions and low wages are invisible half a planet away.

In addition to changes in consumption patterns, well-designed waste-to-resource policies can support local economic development and social justice goals. Zero waste policies can drive the creation of new green jobs by increasing domestic capacity to manage and add value to materials that are recovered, recycled or composted in closed-loop cycles. In contrast, existing recycling practices fit into a global production system that treats recovered materials as just another commodity for domestic or export markets. For example, aluminum cans in BC are generally exported to the US for recycling. Most of BC’s paper is exported for recycling (depending on the grade of

This paper looks at the prospects for closing the loop—a transition from managing wastes to recovering resources that feed back into production—and considers the intersection between climate action and zero waste policies.

1 Zero Waste International Alliance website, “ZW Definition” (2004, revised 2009), <http://zwia.org/standards/zw-definition/>.

2 Sewage or liquid waste policies have some overlap with our discussion, but have a different set of engineering and policy issues. We do not consider them in this paper.

3 Indeed, the term “zero waste” can be misleading if used in conjunction with targets that never actually get to zero, or in a manner that suggests incineration (waste-to-energy) is acceptable, whereas most zero waste advocates would strongly disagree with such usage.

4 These data refer mainly to post-consumer solid wastes. They do not include such categories as overburden, mining wastes, and gaseous discharges (carbon dioxide is the single largest waste by weight in industrial economies).

5 Vance Packard, *The Waste Makers* (New York: Van Rees Press, 1960).

paper, anywhere from half to all recovered material is exported), while market conditions have driven two large manufacturers of recycled paper to close BC operations.⁶

TABLE 1: ESTIMATED WASTE IN BC, 2010

Category	Indicative products	Estimated BC waste generation (tonnes)	Share of total	Recycling rate (Metro Vancouver)
Paper & paperboard	Office paper, newsprint, cardboard, phone books, books, magazines, tissue paper, paper plates, wrappers	1,067,776	21%	58%
Plastics	Shopping and garbage bags, beverage containers, other containers, toys, lawn furniture	328,376	6%	10%
Organics (compostable)	Yard waste, food scraps, untreated wood	1,411,443	28%	42%
Organics (non-compostable)	Treated wood, textiles, rubber, leather	332,108	7%	29%
Metals	Aluminum, copper, steel	208,339	4%	62%
Glass	Beverage containers, food containers, mirrors, windows, lightbulbs	252,371	5%	78%
Inorganic building materials	Drywall, masonry, ceramics, asphalt, carpet	1,265,597	25%	75%
Electronic waste	TVs, cell phones, computers and displays, small appliances	52,159	1%	16%
Household hazardous	Batteries, medical (needles, equipment), paints, solvents, pesticides, containers for hazardous products	50,375	1%	76%
Household hygiene	Diapers, animal litter, tampons, sanitary napkins	58,703	1%	0%
Bulky objects	Large appliances, furniture	33,471	1%	0%
Fines/misc.	Unidentifiable remains, combustion residuals	28,283	1%	2%
Total		5,089,000	100%	53%

Source: Estimated waste generation uses breakdown by category for Metro Vancouver from Morris (2009, see note 29), applied to total waste generation as estimated by BC Stats (2012). Recycling rate is for 2008 and also from Morris.

The deeper context for this analysis is a throwaway culture, spurred on by advertising, fashion and planned obsolescence.

A century and a half of extracting and exporting resources has shaped BC's business and political culture, and helped determine the nature and distribution of jobs and communities in the province. Economic incentives and regulatory frameworks have also been geared to facilitate the extraction of virgin materials (mining, oil and gas, forestry) through low-cost electricity, infrastructure, and preferential tax treatment. Making a shift to closed-loop for even the domestic system of production and consumption will take a concerted effort over many decades, and is ultimately consistent with a much more localized economy.

In the next section, we review waste management policies through a climate change lens, with a view to reducing GHG emissions. We then look at overcoming the pervasive externalities associated with a shift to a resource recovery economy, from extraction of raw materials to collection systems. A major benefit of a well-designed system is the creation of green jobs, and we review some of the evidence. We make some estimates for green jobs potential from zero waste policies, and model possible GHG reductions. Finally, we consider next steps for zero waste policies.

⁶ Cascadia Consulting Group and EBA, *Recycling Market Study* (prepared for Metro Vancouver, May 2012), www.metrovancouver.org/services/solidwaste/planning/Documents/RecyclingMarketStudyReport.pdf.

GHG Emissions and Waste in BC

IN ECOLOGICAL ECONOMICS, energy and materials are key inputs into production, and wastes, including air emissions, waste water and solid waste, are inevitable outputs. Sustainability demands that material and energy inputs to production be harvested in a way that does not compromise future generations, and the volume of wastes generated in economic production and consumption process must not exceed the capacity of natural “sink” functions to process them.⁷ Consistent with this approach are two closed-loop systems of production—organic and technological— in which “waste is food.”⁸ In the organic cycle, all ‘wastes’ are biodegradable or compostable and thus the basic elements are returned to the soil, air or water to be naturally recycled. In the technological cycle, the goal is to ensure that non-biodegradable, human-made items be manufactured to be completely re-used, re-manufactured or recycled.

Climate change is intimately connected to a culture of waste. In fact, carbon dioxide is BC’s single largest waste by weight—more than 49 million tonnes in 2010,⁹ compared to 5 million tonnes of solid waste generated.¹⁰ While CO₂ pollution goes into the atmosphere rather than a landfill, it remains a substantial waste product of the burning of fossil fuels that powers our industry, businesses, homes and vehicles. Waste policies should seek to simultaneously reduce both CO₂ and solid waste, and to better understand the linkages between the two.

Climate change is intimately connected to a culture of waste. In fact, carbon dioxide is BC’s single largest waste by weight—more than 49 million tonnes in 2010, compared to 5 million tonnes of solid waste generated.

7 Marc Lee and Kenneth Carlaw, *Climate Justice, Green Jobs and Sustainable Production in BC* (Vancouver: CCPA–BC, September 2010), www.policyalternatives.ca/greenjobs.

8 William McDonough and Michael Braungart, “The NEXT Industrial Revolution,” *The Atlantic Monthly* 282:4 (October 1998): 82-92.

9 BC Ministry of Environment, *British Columbia Greenhouse Gas Inventory Report 2010* (June 2012). Figure does not count other GHGs, such as methane, nor CO₂ emissions from net deforestation or other changes in land use. Total GHG inventory for 2010, including net deforestation and other GHGs, was just under 62 Mt CO₂ equivalent.

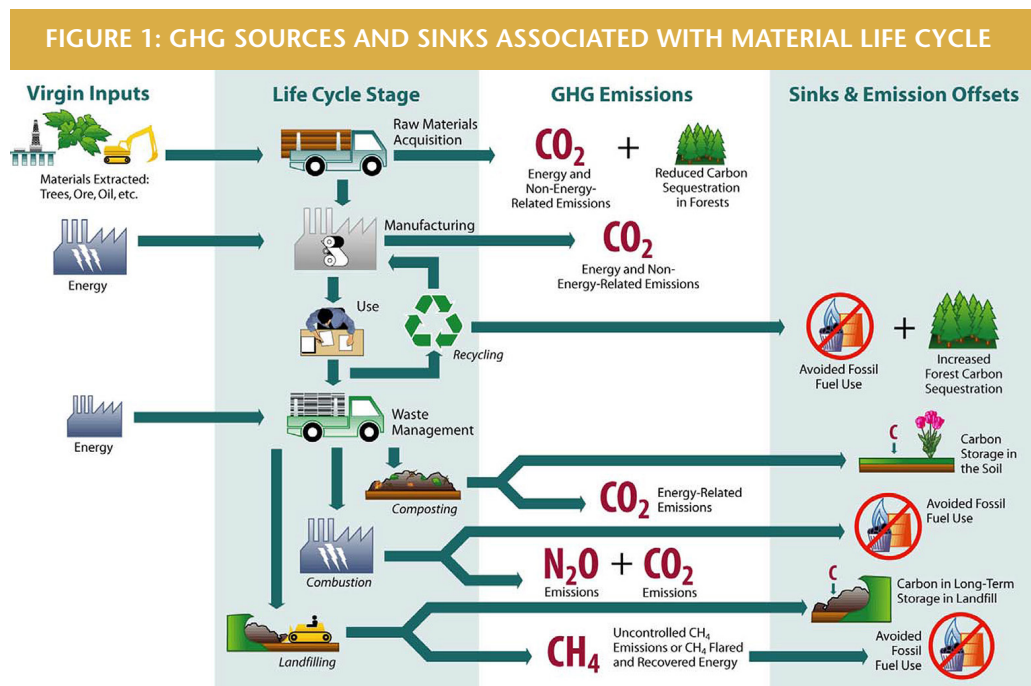
10 Jade Norton and Dan Schrier, *Solid Waste Generation in British Columbia: 2010-2025 Forecast* (prepared for BC Ministry of Environment by BC Stats, 2012), www.bcstats.gov.bc.ca/Files/74a2af86-a9b3-406f-87ed-fea55a94a9d0/SolidWasteGenerationinBritishColumbia2010-2025Forecast.pdf.

Estimates of greenhouse gas emissions from waste typically include direct emissions from waste management practices (landfill and incineration emissions). These amounted to 4 million tonnes of CO₂ in BC's GHG inventory in 2010 (almost all from landfills), or 6.4% of BC's total. In this narrowly defined view, the waste sector's contribution to GHG emissions would appear to be very small. However, there is good reason to believe that this sector's emissions profile is, in fact, much larger.

More importantly, this narrow accounting of waste fails to make the connection between post-consumer waste and much larger emissions from the extraction of raw materials, and the production and transportation of goods. Accounting for indirect emissions embodied in goods and services (whether made in BC or imported) complicates matters, but in the US it is estimated that 37% of GHG emissions are related to waste from energy used in extraction, processing, manufacturing, transportation and waste management.¹¹

Recycling of materials greatly reduces the need for emissions-intensive extraction and processing of virgin materials. Reduction, dematerialization and re-use strategies go even further by displacing the need for new emissions-intensive manufacturing and transportation. This leads to greater carbon storage in forests that are not logged, in long-lasting products and materials, and in soils derived from composted organic materials.

We discuss each of these in turn in the BC context. In all cases, reduction of GHGs through zero waste practices has important health and environmental co-benefits in the form of reduced toxins leaching from landfills or pumped into the atmosphere, as well as increased forest conservation and reduced resource extraction.



Source: US Environmental Protection Agency, *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks*, 3rd edition, September 2006

¹¹ US EPA, *Reducing Greenhouse Gas Emissions Through Recycling and Composting* (May 2011): 4, www.epa.gov/region10/pdf/climate/wccmmf/Reducing_GHG_s_through_Recycling_and_Composting.pdf.

EMISSIONS FROM LANDFILLS

Policies for managing organics are highly synergistic with reducing GHG emissions from the waste sector. More than one quarter (28% in Metro Vancouver) of waste generated is from compostable organic material. Methane is a potent greenhouse gas that arises from the incomplete decomposition of organic matter in the absence of oxygen, a common occurrence in landfills. Emissions from BC landfills amounted to 184,000 tonnes of methane, which is equivalent to almost 4 million tonnes of CO₂ in BC's greenhouse gas inventory in 2010.¹² This comprises 6% of BC's GHG inventory, and is slightly larger than the emissions from all BC homes.

There is good reason to believe that methane leakages from landfills have an even worse climate impact, due to measurement issues in the treatment of methane and how it is converted to a CO₂ equivalent. Because methane breaks down in the atmosphere into CO₂ over time, the time frame chosen when converting into CO₂ equivalents matters. Annual CO₂ equivalent emissions are based on a 100-year time frame, but a shorter time frame is arguably more relevant because of the potential for additional warming to push ecosystems—retreating glaciers, melting permafrost, dying forests, shrinking Arctic sea ice in particular—past “tipping points” that trigger feedback loops of rising temperature. Measured on a 20-year time frame, methane emissions could be as much as 72 to 105 times that of CO₂.¹³ Applied to 2010 landfill emissions, the range of CO₂ equivalent emissions would be 13 to 19 Mt.

The scale of yard waste and food scraps and their GHG potential underline the importance of diverting organic materials from landfills through composting programs. Ideally, an organics pollution prevention hierarchy would be followed. About 40% of food, worth \$27 billion, is wasted in Canada, with half at home, and the other half at various points in the supply chain.¹⁴ In the US, the same share of food waste was estimated to account for a quarter of the fresh water consumption and approximately 300 million barrels of oil.¹⁵ Compost has the added benefit of storing carbon and being a substitute for energy- and GHG-intensive fertilizers used in conventional food production.

Metro Vancouver's plan to ban organic materials from landfill by 2015 is notable. Across BC, more aggressive composting programs are likewise needed, primarily at a very local scale. Backyard composting is ideal, though for households without a backyard, composting at the neighbourhood level would reduce the need for fossil-fuel-powered transportation of organics, and could be linked back to community gardens and other urban agriculture projects. Good composting practices that ensure proper air flow to prevent methane emissions must also be employed. And while most people think of composting in the home (if at all), workplaces, food services and restaurants are key places where composting programs should be rolled out. Multi-unit buildings

The scale of yard waste and food scraps and their GHG potential underline the importance of diverting organic materials from landfills through composting programs.

12 BC Ministry of Environment, *British Columbia Greenhouse Gas Inventory Report 2010* (June 2012). These estimates do not include emissions associated with the transportation of waste. Landfills also release CO₂, but this is considered part of the natural carbon cycle and not counted as a greenhouse gas. BC's GHG inventory estimates use a conversion factor of 21—that is, one tonne of methane is equivalent to 21 tonnes of CO₂. However, the global warming potential relative to CO₂ is likely to be larger, 25 to 32 times, based on recent scientific measurement.

13 The International Panel on Climate Change reports the global warming potential of methane on a 20-year basis as 72 times that of carbon dioxide. It is believed this will be revised upwards, with recent research pointing to a figure in the range of 79 to 105 times. See D. Shindell et al., “Improved Attribution of Climate Forcing to Emissions” in *Science*, October 30, 2009, 326:5953 (716-718), DOI: 10.1126/science.1174760.

14 Martin Gooch, Abdel Fefel and Nicole Marenick, *Food Waste in Canada: Opportunities to increase the competitiveness of Canada's agri-food sector, while simultaneously improving the environment* (prepared for Value Chain Management Centre, November 2010), www.valuechains.ca/documents/Food%20Waste%20in%20Canada%20112410.pdf.

15 Kevin D. Hall, Juen Guo, Michael Dore and Carson C. Chow, “The Progressive Increase of Food Waste in America and Its Environmental Impact,” *PLoS ONE* 4(11) e7940 (2009), doi:10.1371/journal.pone.0007940.

also need coherent collection programs in place. New compost collection programs (yard waste and food scraps), are usually aimed at single-family homes, with on-site composting and/or collection from multi-unit buildings and businesses very limited.

Methane gas captured by landfills from existing waste can be flared, or combusted into CO₂ and water to create energy (methane is also the key hydrocarbon in “natural gas”). This neutralizes it as a greenhouse gas (part of the natural carbon cycle). BC’s Landfill Gas Management regulation requires gas capture technologies be applied to landfills that generate 1,000 tonnes or more of methane per year.¹⁶ While methane capture, and use for energy, is possible, the gas cannot be completely captured, so diversion of organics from landfill should be the top priority. Existing organic content of landfills will continue emitting methane for several decades, and this should be captured, but caution is advised around relying on landfill gas as a source of energy.

A final consideration is that landfills would represent a carbon sink in the absence of methane emissions because they store carbon that would otherwise be in the atmosphere. Absent organics, this still leaves the problems of potentially toxic materials that can leach into groundwater; these materials need to be phased out and/or captured at other points in a resource recovery system. But it is possible to consider landfilling of plastics and wood products as part of a carbon storage strategy, although less preferable to the zero waste objective of achieving completely closed loops.

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INCINERATION

Incineration has appeal among policymakers because it gives the perception of making waste disappear, and can produce heat and electricity for other economic uses. This view is deceptive: incineration may well destroy recognizable items, but not their material basis. Waste never “disappears”: every atom entering the system must leave the system in some form: ash, gas, heavy metals and toxic compounds created through burning (e.g., dioxins and furans). In many jurisdictions, incineration has raised important environmental justice issues, as low-income and visible minority households are disproportionately burdened by living in close proximity to the incinerators, with adverse impacts on health.¹⁷

Even in terms of solid waste, actual results of incineration are disappointing. While some people may imagine that waste burned is waste gone, the residue left to go to landfill has been estimated at 22 to 45% of the original tonnage depending on how optimally the facility is run.¹⁸ Metro Vancouver estimates post-incineration “bottom ash” at 17%; in addition, fly ash typically accounts for another few percent.¹⁹

16 The regulations require annual reporting, and all landfills with more than 100,000 tonnes in place or with an annual acceptance rate of more than 10,000 tonnes are required to assess their emissions and practices. There are about 35 landfills in BC that meet this requirement, and which comprise about 90% of methane emissions as of 2006. See Golder Associates, *Inventory of Greenhouse Gas Generation from Landfills in British Columbia* (submitted to BC Ministry of Environment, 2008), www.env.gov.bc.ca/epd/codes/landfill_gas/pdf/inventory_ggg_landfills.pdf.

17 Brenda Platt, David Ciptlet, Kate M. Bailey and Eric Lombardi, *Stop Trashing the Climate* (Washington, DC: Institute for Local Self-Reliance, 2008).

18 Jessica North, Warren Snow and Julie Dickinson, *Wasted opportunity: A closer look at landfilling and incineration* (Auckland, NZ: Zero Waste New Zealand Trust, n.d.), www.ecologycenter.org/iptf/recycling/WastedOpportunity.pdf; Organisation for Economic Co-operation and Development, *Towards sustainable household consumption? Trends and policies in OECD countries* (Paris: OECD, 2002); Earth Tech, *Alternatives to waste study—draft version* (Burnaby, BC: Earth Tech, 2005).

19 Metro Vancouver, *Waste-to-Energy Facility*, www.metrovancouver.org/about/publications/Publications/WasteEnergyFactsheet.pdf. Fact sheet does not specify percent fly ash, but a DEFRA 2007 study shows 20-30% bottom ash plus 2-6% fly ash by weight (and by volume, bottom ash is 10%), UK Department of Environment Food and Rural Affairs, *Incineration of Municipal Solid Waste (2007)*, <http://archive.defra.gov.uk/environment/waste/residual/newtech/documents/incineration.pdf>

In terms of greenhouse gases, incineration produces carbon dioxide and nitrous oxide from the combustion process. BC has one major incinerator in Burnaby, a waste-to-energy facility that processes about 280,000 tonnes of waste per year (about 28% of waste disposed in Metro Vancouver). Official GHG emissions in BC from incineration in 2010 totaled about 84,000 tonnes in CO₂ equivalent.²⁰ However, by accounting convention only fossil-fuel-derived products (e.g. plastics, certain textiles, rubber) are included; biomass-based materials are not included as CO₂ released is considered part of the natural carbon cycle.²¹ This practice has been criticized, as organic materials (wood and compost in particular) can store carbon for long periods of time. Excluding biomass emissions thus greatly understates the carbon footprint of incineration, which is likely to be three times as large as official estimates.²²

While Metro Vancouver has been actively promoting the idea of zero waste (for example, the Zero Waste Challenge, and related conferences), its recently approved Solid Waste Management Plan puts high priority on new incineration capacity on the grounds that it diverts material waste from landfills and can generate electricity. Metro's proposed waste-to-energy (WTE) facility, still in planning stages, would handle up to 370,000 tonnes of waste per year.²³ This would more than double incineration emissions. Over time this investment could undermine zero waste goals, as waste will be needed as a feedstock to power the facility for several decades. A decrease in waste flow (normally a good thing) could lead to energy shortages for customers and financial repercussions.

GHG emissions from incinerating waste are much higher per unit of electricity produced than from burning natural gas, and close to the emissions from burning coal, the dirtiest of fossil fuels. However, if all emissions (including combustion of organic materials) are counted, incineration is worse than any fossil fuel generation, including coal.²⁴ A study for Metro Vancouver found that the most energy from burning waste comes from plastics (36.8 GJ per tonne), which is not surprising as plastics are derived from fossil fuels, followed by paper (16.5 GJ/tonne) and organics (8.7 GJ per tonne).²⁵ As these materials are some of the key ones that should be diverted from waste, programs that succeed in reducing waste could, perversely, be a challenge for incinerators needing to run at high enough temperatures to reduce the formation of toxic compounds.

Waste economist Jeff Morris notes that WTE is predicated on approximately one tonne of garbage being the energy equivalent of one barrel of oil. But it takes 8 to 10 barrels of oil to make the products resulting in a tonne of garbage.²⁶ Incineration wastes the "embodied" energy that was used in making a product—the energy required for resource extraction and processing, product manufacture and transportation. Recycling the same amount of materials saves more energy than is produced in a WTE facility, by displacing the need for virgin materials. From a GHG perspective, landfilling plastics and wood products would be preferable to incineration because it would be a form of carbon storage rather than emissions—although as we note throughout the report it is

While Metro Vancouver has been actively promoting the idea of zero waste (for example, the Zero Waste Challenge, and related conferences), its recently approved Solid Waste Management Plan puts high priority on new incineration capacity.

20 BC Ministry of Environment, *British Columbia Greenhouse Gas Inventory Report 2010* (June 2012).

21 Environment Canada, *National Inventory Report 1990-2009* (submitted to the UN Framework Convention on Climate Change, 2011): 159.

22 *Stop Trashing the Climate*, supra note 17. Roughly speaking, one tonne of waste converts to one tonne of CO₂ when incinerated.

23 Previous proposals were for up to 500,000 tonnes. Latest estimate is per Metro Vancouver Zero Waste committee (see Zero Waste Committee, February 16, 2012): 18, www.metrovancouver.org/boards/Waste%20Management%20Committee/Zero_Waste_Committee-Agenda_120216.pdf.

24 *Stop Trashing the Climate*, supra note 17.

25 Technology Resource Inc., *Solid Waste Composition Study* (prepared for Metro Vancouver, 2008), www.metrovancouver.org/about/publications/Publications/SolidWasteCompositionStudyFinal-2007.pdf.

26 Jeffrey Morris, "Recycling versus incineration: an energy conservation analysis," *Journal of Hazardous Materials* 47 (1996): 277-293.

far superior to move up the pollution prevention hierarchy by reducing material throughput and creating closed-loop systems.

Finally, a key concern with new incinerators is that they divert resources (e.g. funding, staff time) from meaningful waste reduction activities to creation, defense and ongoing support for incinerators. This significant opportunity cost is often ignored.

RECYCLING

As noted, material waste represented by final product disposal is only a tiny fraction of total waste generated in the system. The extraction and processing of resources and the manufacture of intermediate materials into consumer goods all generate wastes (in addition to solid waste, liquid wastes and airborne emissions can also have adverse health impacts on humans and other life downstream or downwind).

Environment Canada reports that municipal solid waste totals about 34 million tonnes per year, a relatively small amount compared to oil sands tailings of 645 million tonnes, mining waste rock and tailings of 473 million tonnes, and livestock manure of 181 million tonnes per year.²⁷ Added together, this implies about 40 tonnes of material waste per person each year in Canada. This includes wastes associated with production for export markets, but does not include waste outside of Canada related to the production of imported goods (proper accounting for material flows is still in its infancy). Nor does it include GHG emissions and other forms of air pollution. A more thorough analysis by the World Resources Institute estimated total annual waste (including imports and less exports) ranging from about 20 tonnes per capita for Japan and Austria to 85 tonnes per capita for the US (Canada was not studied).²⁸

From a life-cycle perspective, the greatest opportunity for GHG emission reduction comes from displacing emissions produced in energy-intensive extraction and manufacturing processes. Figure 2 shows common material types and the average GHG savings from per tonne recycled. The most significant emission reductions per tonne of material are for aluminum (a non-ferrous metal) because of the very high energy- and GHG-intensity of aluminum production. Paper recycling also makes a significant contribution because it supports carbon sequestration in forests (avoiding new logging).

Recycling and composting far exceed other forms of waste disposal in terms of mitigating the environmental impacts of solid waste, with respect to climate effects, human health risks and ecosystem toxicity, according to an analysis of waste management in Metro Vancouver.²⁹ According to the analysis, increasing the percentage of waste diverted to recycling and composting to 80% would save 4.3 million tonnes of CO₂ per year. Another study on BC's EPR programs estimates that materials recycled through eight BC stewardship organizations resulted in a reduction of about 267,000 tonnes CO₂e in 2007, with aluminum cans and tires accounting for about 82% of

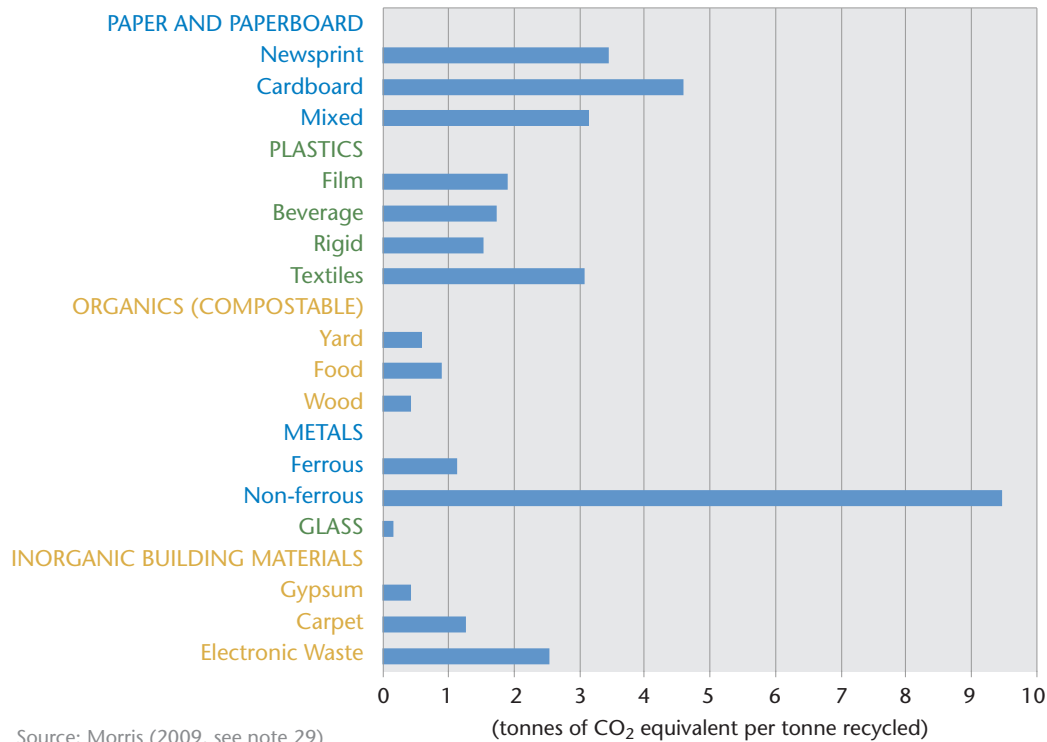
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27 Statistics Canada, *Human Activity and the Environment 2012: Waste Management in Canada*, cat no. 16-201-X, www.statcan.gc.ca/pub/16-201-x/2012000/part-partie2-eng.htm.

28 World Resources Institute, *The Weight of Nations: Material Outflows from Industrial Economies* (Washington, DC: WRI, 2000), http://pdf.wri.org/weight_of_nations.pdf.

29 Jeffrey Morris, *Environmental Life Cycle Assessment of Waste Management Strategies with a Zero Waste Objective: Study of the Solid Waste Management System in Metro Vancouver, British Columbia* (prepared by Sound Resource Management Group for Belcorp Environmental Services, 2009).

FIGURE 2: GHG EMISSION REDUCTIONS FROM RECYCLING AND COMPOSTING



these reductions.³⁰ We present some estimates of GHG reduction possibilities from a zero waste program later in the paper.

There are physical limits to recycling. Much of what we call recycling is, in fact, less desirable “down-cycling,” meaning that materials collected from one use (e.g. yogurt containers made of high grade food quality plastic) are made into a lower-grade material (e.g. plastic wood made from mixed plastics). Some low-grade materials can be used as filler in concrete or landfill cover. While down-cycling plastics is an improvement over incineration, it ultimately creates waste because after several cycles the degraded materials can no longer be recycled (see *The Plastics Predicament* on page 22). For paper products, down-cycling is the norm as fibre length and strength diminish with each use (the material ultimately can be composted).

Forestry plays a special role in BC’s economy, and forest management in relation to carbon storage is a new area of interest.³¹ Conserving more forests, increasing the age at which forests are harvested, and reducing wood waste at logging sites all contribute to increased carbon storage. In addition, wood and paper products also lock up carbon for decades, if not centuries. Recycling

30 Gardner Pinfold Consulting, *Economic Impacts of the BC Recycling Regulation* (prepared for BC Ministry of Environment, 2008). The study examines the environmental benefits of recycling by eight stewardship organizations in terms of three measures of reduced emissions using the Waste Reduction Model (WARM) created and supported by the US Environmental Protection Agency (EPA). The eight product stewardship programs in BC were: Beverage Container Stewardship Program; BC Used Oil Management Association; Post-Consumer Pharmaceutical Stewardship Association; The Product Care Association; Tree-Marking-Paint Stewardship Association; Tire Stewardship BC; Electronics Stewardship Association of BC; and Western Canada Computer Industry Association, for computers and printers.

31 Ben Parfitt, *Managing BC’s Forests for a Cooler Planet: Carbon Storage, Sustainable Jobs and Conservation* (Vancouver: CCPA-BC, 2010), www.policyalternatives.ca/coolforests.

THE PLASTICS PREDICAMENT

While reuse, repair, recycling and composting offer a coherent framework for many materials in the waste stream, plastics present a unique challenge to achieving zero waste. The problems with the prolific petroleum product are multifold. Recycling rates for plastics are typically lower than any other consumer product. While they are labeled with a resin code (a number surrounded by the three arrow recycling symbol) this falsely implies they are *accepted* in the local area for recycling.³² In reality, only about 10% of plastic in BC is recycled.³³ These problems prompt us to question whether plastic can play a role in zero waste at all.

Susan Freinkel, author of *Plastic: A Toxic Love Story*, argues that it might not make sense to completely eradicate plastic. The real problem is that half of plastics are used for single-use products, so the focus should not be on eliminating plastics *per se*, but on making “better, safer plastics, forged from renewable sources, rather than finite fossil fuels, using chemicals that inflict minimal or no harm on the planet and our health.” In other words, plastics only generate huge quantities of waste in their current form and function—which can be changed.

While Freinkel’s criticism of single-use products addresses the heart of waste culture, her support for “better” plastics is not unanimous. For example, allegedly compostable plastics have been criticized for requiring special conditions under which they will break down. Their presence may also contaminate the feedstock for recycling of regular plastics. Finally, sourcing biomass to make compostable plastics may be a challenge given pressing alternatives like growing food.

With existing plastics, the variety of resin types and grades make recycling a challenge as they do not mix well together. While some high-grade plastics are recycled in a closed loop (pop bottles, made from PET plastic, are the best example), most plastic is down-cycled into different products, and other plastic types are bundled together for export or incinerated. A successful plastics recycling system would need to focus on a narrower range of resin types, source separated after consumption.

The sheer volume of plastic in circulation today, as well as its utility in production, means that plastic will inevitably be part of BC’s near future. These products will likely be down-cycled and need to be properly managed. It is therefore important to build the right policy and program incentives that deter the current wasteful uses and toxic effects plastic cause. Dramatically reducing plastics waste will require a variety of strategies, such as reducing new plastics production as well as reusing and recycling existing plastics as much as possible. In the transition, it is hard to rule out a limited amount of long-lasting plastics for products that cannot easily be substituted with another material. The eventual goal, however, would be to substitute all plastics with non-toxic materials that can be composted or perpetually recycled.

³² This paper uses the word *recycle* to describe the physical reprocessing of a material, and not the behaviour of dropping a product off somewhere. For example, it is often assumed that materials are recycled once dropped off at depots, but this is not always the case.

³³ Based on Morris (2009, supra note 29) estimates.

thus promotes conservation and carbon storage objectives. Wood products could be harvested in a manner reflecting a circular economy, with harvested wood moving along a path of re-use, from use in buildings to furniture to wood pallets to paper and then finally composted.³⁴

High rates of diverting waste from landfill are a necessary but not sufficient condition for reducing material throughput in the economy. Even as diversion rates have increased, the total quantity of waste disposed of in landfills and incinerators has continued to rise. Moreover, beyond diverting materials from landfill, there is little data on the extent to which products are recycled, incinerated or exported to other jurisdictions. This is particularly of concern for plastics, which may have greater economic value (not counting external costs of GHG emissions) as feedstock for incineration than in recycling.

RE-USE AND REDUCTION

While recycling has received most of the attention as a green waste management priority, it is reduction of waste that should be the most important objective. Moving up the pollution prevention hierarchy—redesign, source reduction, repair and maintenance, and total re-use of products *before* they are considered for recycling or deconstruction—is an improvement over recycling in terms of avoided GHG emissions by precluding the energy needed to re-process materials. In BC, with its abundant renewable electricity, this has less impact on GHG emissions. Still, new clean energy supplies are not cheap, and reductions in industrial demand could make a major contribution to an overall societal improvement in energy efficiency.

To date, companies have not had to design their products and packaging with re-use in mind. Large parts of consumer waste could be transformed by re-use and better product design, from soft drinks to product packaging to food containers to electronic components. A shift toward banning single-use containers would help, including highly visible items, such as beverage containers, polystyrene³⁵ food packaging and plates, and plastic bags.

Repair and maintenance is another step toward giving a much longer life to products that require large amounts of energy and GHG emissions to be produced. Rather than just requiring that companies recycle their products after consumption, requiring extended warranties on durable products would push manufacturers to ensure repair, maintenance and even the capacity to be upgraded. This is of particular relevance for modern electronic gadgets like cell phones, which have a lifespan as short as 18 months before being “trashed.” Business models based on leasing are a related concept that shifts incentives towards re-use, repair and maintenance (more on this in the next section).

Collaborative consumption³⁶ or sharing is another system that has been around for a long time with public libraries being a good example. Some communities are building on this idea with shared garden equipment sheds, toy or tool “libraries.” Sharing underused products decreases resource consumption while fostering community building and trust. Growth of the Internet has

While recycling has received most of the attention as a green waste management priority, it is reduction of waste that should be the most important objective.

34 Warren Mabee, *Circular Economies and Canada's Forest Sector* (presented at Work in a Warming World, Toronto, 2011), http://warming.apps01.yorku.ca/wp-content/uploads/WP_W.Mabee_Nov-2011_.pdf. Mabee uses the term “circular economies,” an analogous concept to closed-loop.

35 Commonly known by its trademarked name Styrofoam.

36 Rachel Botsman and Roo Rogers, *What's Mine Is Yours: The Rise of Collaborative Consumption* (New York: HarperCollins, 2010).

also enabled dematerialization—digital music, video, books and magazines are the most obvious examples—a pure reduction in materials to support essentially the same consumption.

Many material-intensive practices are facilitated by both externalized costs and subsidies. For example, junk mail is subsidized by low postal rates, telephone directories including not one but two versions of the “yellow pages” business directories arrive each year on Vancouver doorsteps—each a brick of paper that many households never even crack open in the era of the Internet. Free local newspapers are not much different, including versions that are delivered to households’ doorsteps without subscriptions, with a pound of advertisements in order to convey a handful of news stories.³⁷

In each case, trees were felled and transported to a pulp mill, where they were made into paper. Content was then printed on the paper and the final product then transported, again using fossil fuel, around the province. Inevitably, it will enter a recycling bin within a year (in the case of the Yellow Pages) or mere moments (in the case of junk mail). At no direct cost to the household, this model makes “economic” sense only because of massive externalized costs along the way. Electronic substitutes are obvious and already well-established, although it is important to note that not all households have Internet access. First steps could be along the lines of a campaign in Seattle for an “opt-in” model with phonebooks, in which residents must choose to have a paper phonebook delivered to them.³⁸ While customers can ostensibly opt out of getting Vancouver’s yellow pages, such efforts are not always successful. Furthermore, they put the onus on households to speak up rather than on businesses to ask permission.

37 An unofficial count by one of the authors in 2011 of the Vancouver Courier newspaper yielded about 16 pages of news content out of 48 pages of newsprint, and the paper was also bundled with a large stack of glossy inserts for various large chain stores.

38 Zero Waste Seattle website, “Phone Book Opt-In,” retrieved November 10, 2011, www.zerowasteseattle.org/phone-book-opt-in-campaign.

Building a Resource Recovery Economy

BC IS INTERCONNECTED into a global economy in which its historic role has been resource extraction—wood and paper products, minerals and metals, and increasingly fossil fuels (coal, oil and gas)—for export markets. While most services and a number of goods are produced in BC for the domestic market, resource exports pay for the province’s consumption of a wide range of goods imported from other provinces and countries.

For economies like BC, closing the loop is thus no small task. BC’s resource-based economic model has, in many ways, been subsidized through tax credits, low royalty rates, cheap electricity and public infrastructure. In addition, some production costs have been externalized onto ecosystems and people through pollution and GHG emissions. Many valuable materials that are collected from recycling programs are merely bundled and exported onto global markets, with the same shortcomings as other commodity markets, including price fluctuations that can undermine local efforts. International trade itself is subsidized by underpriced fossil fuels across the transportation sector.

Large external costs undermine sound economics, in which market prices act as a signal to allocate resources (because price includes costs of production plus a mark-up that is the producer’s profit). When prices do not tell the truth because environmental costs of raw materials extraction, production and transportation (GHG emissions and other forms of pollution) are externalized, we have a recipe for wasteful and excessive consumption. Such imbalances also shape markets for recycled materials, and the viability of re-use, repair and maintenance activities that reduce our carbon footprint.

In this section, we address the key economic drivers that would support the transition to a low-waste, low-carbon economy. This is tantamount to the creation of green jobs in BC because these activities are inherently more local and labour-intensive. The current problem is that doing the right thing comes at a cost disadvantage—almost everyone is familiar with an instance of a product breaking down and having it be cheaper to buy a new one than get it fixed. Closing

Doing the right thing comes at a cost disadvantage—almost everyone is familiar with an instance of a product breaking down and having it be cheaper to buy a new one than get it fixed.

the loop requires economic incentives that increase the efficiency of materials use and develop robust markets for resource recovery. Pricing mechanisms that internalize costs as well as sound regulations and standards can also shape the economics of waste and resources.

EXTRACTION OF RAW MATERIALS

As a small, open economy with deep roots in resource extraction, BC exports substantial volumes of raw materials. BC Stats reports that the province has exported close to one million tonnes of metallic minerals per year over the past decade.³⁹ For example, the BC Ministry of Energy and Mines reported production of 5.5 tonnes of gold, 71 tonnes of silver, 193,878 tonnes of copper, 2,604 tonnes of lead, 32,917 tonnes of zinc, and 8,261 tonnes of molybdenum in 2010,⁴⁰ and 26 million tonnes of coal.⁴¹ Better data are needed to understand the flows of materials into the domestic economy, as well as exports and imports.

Resource extraction and processing are highly energy-intensive activities that have climate and other environmental (e.g. endangered species) and health (e.g. air, water and soil pollution) impacts. Such external costs have only recently been addressed through public policy (effluent discharge regulations, for example). Yet, since BC's prosperity is rooted in those forestry, mining and other resource industries, it is no surprise that a policy orientation that aspires to increase resource extraction and exports still dominates Victoria (witness the BC government promoting a liquefied natural gas export industry that fundamentally contradicts its GHG reduction targets legislation⁴²).

An industrial policy shift away from encouraging the extraction of raw resources and toward supporting the use of recycled materials and fostering local manufacturing would include:

- Eliminating historical subsidies to resource development such as preferential tax treatment (e.g. flow-through shares in mining), cheap electricity (through BC Hydro, residential and commercial ratepayers subsidize, in particular, mining and oil and gas, BC's dirtiest industries), and transportation infrastructure.
- Changes in BC's royalty regime for the extraction of virgin materials. An approach that better captures the economic rents from extracted public resources would also help close the gap between the cost of acquiring virgin materials and those of recycled materials.
- Regulations that prohibit activities with adverse environmental consequences are also required (for example, regimes around tailings ponds from mines).

39 D. Schrier, "BC's Mining Sector Digging Up More Export Dollars," BC Stats, *Infoline* 11-37, Sept 16, 2011, www.bcstats.gov.bc.ca/releases/info2011/in1137.pdf.

40 BC Ministry of Energy and Mines website, "Rank and Production of Selected Metals within Canada," www.empr.gov.bc.ca/Mining/MineralStatistics/MineralSectors/Minerals/ProductionandValues/Pages/RankandProduction.aspx.

41 BC Ministry of Energy and Mines website, "Annual Coal Production Statistics," www.empr.gov.bc.ca/Mining/MineralStatistics/MineralSectors/Coal/ProductionandValues/Pages/AnnualCoalProduction.aspx.

42 See Mare Lee, *BC's Legislated Greenhouse Gas Targets vs Natural Gas Development: The Good, The Bad and the Ugly* (Vancouver: CCPA-BC, October 2012), www.policyalternatives.ca/natural-gas-ghgs.

DRIVING MARKET DEMAND FOR RECYCLING

Recycling is perhaps the most successful environmental campaign to induce behaviour change, although few know what happens to materials once the blue box is picked up. Metro Vancouver's recent report on the recycling market shines light on the waste and recycling business in five areas—carpet, electronics, glass, organics, paper and plastic—and includes public and private sector haulers, depots where materials are sorted, and on to final markets that may be local or overseas.⁴³

While the characteristics of each category are different, there are both supply and demand side constraints. Key barriers include a lack of domestic processing capacity in areas such as carpet, non-refundable glass and paper. In many cases, local processing is minimal so there is an orientation toward bundling materials for sale in domestic or foreign markets, with all of the vulnerability to shifts in market demand and price that exist in commodity markets. Two paper recycling facilities closed in BC in recent years due to adverse shifts in market conditions.

Policy can play a major role in developing and deepening recycling markets in BC and moving local processing up the value chain. Bans from landfills or increasing tipping fees for disposal in landfills would help drive incentives for recycling. Some materials, such as compost or glass, are more inherently local due to their weight and associated costs of transportation. Areas where there are currently large shares of recycled materials that are exported include paper and plastics. In these areas, the province should focus on maintaining and creating capacity to process, recycle and re-manufacture, while ensuring a base level of long-term market demand through public procurement of recycled products and materials.

Policy can play a major role in developing and deepening recycling markets in BC and moving local processing up the value chain.

The Metro Vancouver recycling market report notes, for example, that even though carpet recycling is happening in other jurisdictions, a lack of processing capacity means carpet is almost exclusively disposed, with a small amount exported to other jurisdictions for recycling. The report recommends a disposal ban as well as a new carpet-to-carpet EPR program as policy drivers, noting that California's carpet EPR program established in 2010 has spurred new collection and processing businesses.

Public sector procurement can support the use of local, recycled materials in government operations, as is done in California. Incentives or requirements can be created that favour local, recycled content (e.g. the cheapest offer does not necessarily get the contract) and highest-and-best-use of products (e.g. hand-dismantling is important to recover critical alloys and rare metals from electronics).

Governments can also set *minimum recycled content standards* for new products in the broader marketplace.⁴⁴ Recycled-content manufacturing laws have been successful for waste reduction in other jurisdictions, including New York State.⁴⁵ The percentage of recycled content in a product could be a mandatory disclosure and a materials trust fund could provide rebates to companies based on the percentage of secondary materials used in their product.⁴⁶

43 *Recycling Market Study*, supra note 6.

44 Helen Spiegelman, *Transitioning to Zero Waste: What can local governments do NOW?* (Product Policy Institute, 2006).

45 New York State, *Processing & Marketing Recyclables in New York City*, Chapter 1: Recycling Economics (prepared by the Bureau of Waste Prevention, Reuse and Recycling, 2004).

46 Bette K. Fishbein, *Germany, Garbage, and the Green Dot: Challenging the Throwaway Society* (New York: Inform Inc., 1994).

The overall framework for management of material flows through the economy may eventually resemble *supply management* systems (in agriculture there are models that match domestic supply and demand, as well as serving as an export pooling board). Direct public investments in new capacity should be considered if no private sector alternative exists, and could buffer against factory closures due to shifts in market demand. A provincial Crown corporation should be examined for areas where market barriers are persistent and not meeting broader waste reduction and recycling objectives. Such an entity could be used to overcome the ebbs and flows of global commodity market prices for recycled materials, play a “middle man” role connecting supply to purchasing agreements in the public sector, engage in value-added processing and re-manufacturing for BC markets, and serve to gain market power where materials are exported.

There may be trade policy implications to this approach. Strictly speaking, preferring Canadian companies in government procurement would discriminate against foreign companies, which is prohibited in international trade agreements. Recycled content provisions applied in a non-discriminatory manner (with rules applied equally to domestic or foreign companies) would not be contrary to trade agreements, but because of transportation costs there would still be a large advantage to local production.

INNOVATIVE RE-USE

Developing a re-use economy would contribute to improving the efficiency of materials use while maintaining high standards of living. In BC there is much scope for an innovation agenda around dematerialization, re-use, and repair/maintenance, aided by regulation prohibiting excess packaging and single-use products.

The most compelling example of re-use is beer bottles. Refillable bottles are reused an average of 15 times before being broken up and recycled, and because of deposit-and-return systems there is a very high collection rate.⁴⁷ While Avalon dairy also uses refillable bottles for milk, most other beverage containers, glass or plastic, are not refilled. Moving up the pollution prevention hierarchy to reduce (tap water instead of bottled water) and re-use (requiring refillable beverage containers) would save the energy costs of producing a new bottle for each beverage (even if recycled materials are used). Most containers and packaging for everyday use could be re-developed along these lines.

Cultivating re-use markets could also build on models of re-use in BC and elsewhere, and rolled out across the province. While re-use websites like Craigslist target the exchange of reusable goods, some small-scale geographic hubs are also worth note, such as North Okanagan Reuses and Freecycle.org. Some waste drop off sites in regional districts have their own “free stores” where people drop off items and pick what they want. The Reuse It Centre in Whistler (run by the Whistler Community Services Society) and now the ReBuild it Centre also are good examples of physical sites for these services that fund community programs.

Repair and maintenance were commonplace in the past, but low costs of purchasing new products have undercut this economic activity. This is a function of the massive economies of scale in global production, but also externalized costs in the form of low wages and poor quality working conditions overseas, and GHG-intensive production and transportation networks. An interesting example of repair economics is Free Geek in Vancouver, which takes computers, even if not work-

⁴⁷ *Recycling Market Study*, supra note 6.

ing well, and refurbishes them. It also aims to teach people how to refurbish and use computers, and had a system where volunteers could work to earn their own computer.

One important way of re-establishing repair and maintenance markets could be to require much longer warranties on products. Existing warranties are generally of limited duration (typically, one year), whereas companies should be required to service and maintain the products to discourage, for example, disposable electronics. But even larger appliances in households could be placed under a model so that servicing costs do not encourage replacement instead of repair.

Extended warranties could also encourage the diffusion of business models based on renting and leasing, rather than owning. This could partially address larger issues of trendiness and fashion that drive the consumer electronics industry (perfectly good cell phones and MP3 players disposed of by the millions in favour of the latest models) through replacing components (faster processor, more memory) rather than entire products.

Most importantly, leasing changes the relationship between producers and consumers.⁴⁸ With direct ownership, producer responsibility post-sale is limited and consumers are left on the hook for shoddily-manufactured goods after the usual limited warranty has run out. However, if a product—refrigerator, television, microwave—is leased, the consumer is free to shift to an alternative supplier in the event of frequent product failure or bad service. This possibility creates an incentive for producers to provide high-quality, long-lasting products and excellent service (e.g., rapid replacement of broken or obsolete components) if they wish to retain or increase market share and would significantly reduce the waste associated with planned obsolescence.

Examples of cooperative economies and collaborative consumption are beginning to emerge in BC, but certainly need more attention and investment. Many goods sit idle for much of their lives. The Vancouver Tool Library (VTL), for instance, is a cooperative tool lending organization. Annual VTL memberships allow residents access to a range of tools, for tasks ranging from bicycle repairs to garden maintenance. Another Vancouver example is the Spool of Thread Sewing Lounge, a small business also in East Vancouver, which provides its patrons with the space, machines and materials required for sewing. The VTL and Sewing Lounge exempt their members and patrons from the need to each *individually* purchase, possess and maintain their own tools. These organizations demonstrate how new models of sharing and buying services as opposed to products can not only connect neighbours, but also reduce the materials and energy moving through BC's economy.

A re-use economy will be aided by regulation prohibiting excess packaging and single-use products. In BC there is much scope for an innovation agenda around dematerialization, re-use, and repair/maintenance.

MAKING COLLECTION EASY FOR HOUSEHOLDS AND BUSINESSES

Efforts to increase diversion rates have made the task of post-consumer materials collection much more complicated. There is much work to be done to make collection systems more coherent and comprehensive in a manner that facilitates efficient and effective resource recovery.

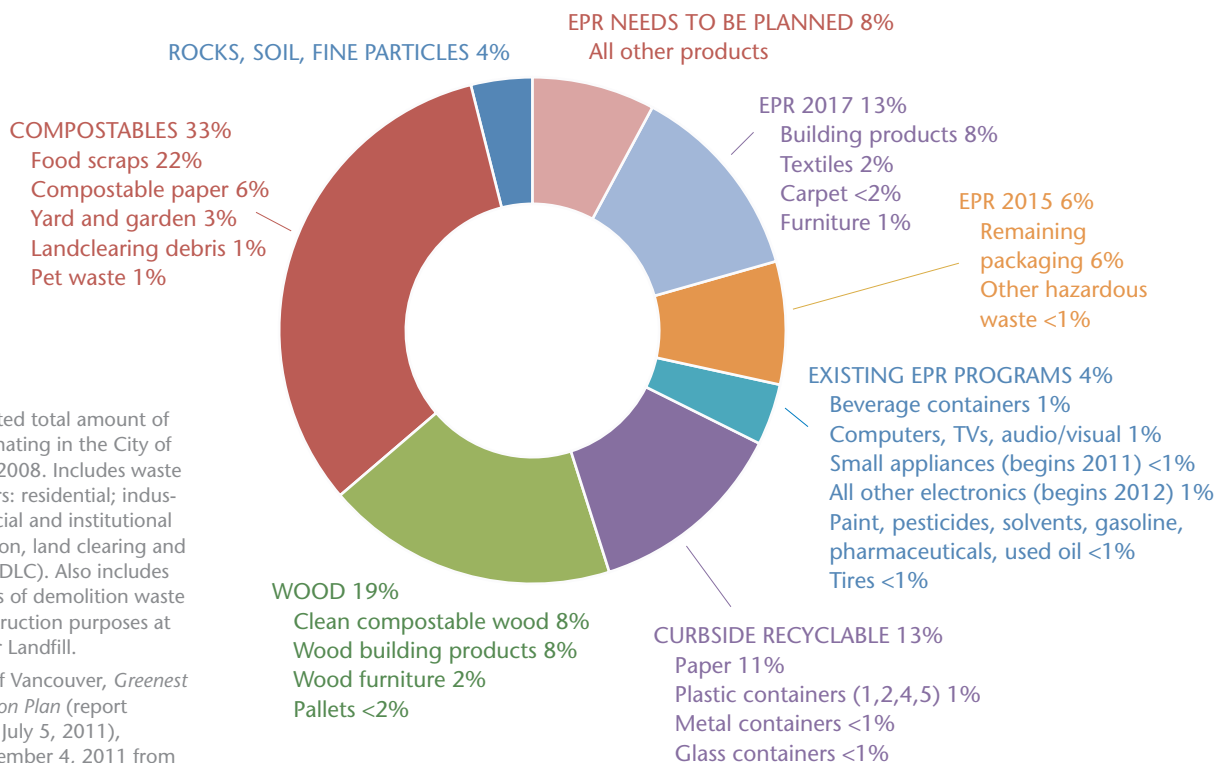
In urban areas, municipal governments or their contractors pick up garbage destined for landfills or incinerator, as well as streams of recycling or organics (which vary from district to district) for some residences, while institutions, commercial and industrial (ICI) buildings or demolition, land-clearing and construction (DLC) projects usually rely on private collection and disposal/

⁴⁸ A useful discussion on this topic can be found at European Parliament Directorate General for Internal Policies, *Leasing Society*, 2012, www.europarl.europa.eu/committees/en/envi/studiesdownload.html?languageDocument=EN&file=79330.

diversion.⁴⁹ In rural areas, drop off locations at transfer stations or landfills and depots may be in place rather than curbside collection. More recently, extended producer responsibility (EPR, also known as “stewardship” or “take back”) programs put the onus on producers for post-consumer recycling of materials.

Whereas municipal curbside collection has focused on *materials* (with diversion of glass, metals and paper for recycling), EPR programs have been implemented around *products* that are not readily compatible with curbside collection, because of reuse (beer bottles), bulk (large appliances), complexity (electronics) or hazard (paint, batteries). See the Appendix for a list of stewardship programs in place and under development (which are linked nationally through the Canada-Wide Action Plan for EPR⁵⁰). The City of Vancouver’s product composition approach to its waste stream visually shows existing diversion through recycling of metals, paper, glass and plastic, and potential of new EPR and composting programs to drive up diversion rates. As Figure 4 shows, of Vancouver’s waste going to landfill or incinerator, roughly half could be recycled and a third could be composted. Only 4% of the waste stream (rocks, soil and fine particles) does not fit the framework and some of this may require special treatment or landfilling due to toxicity.

FIGURE 3: CITY OF VANCOUVER’S WASTE BREAKDOWN



Notes: Estimated total amount of garbage originating in the City of Vancouver in 2008. Includes waste from all sectors: residential; industrial; commercial and institutional (ICI); demolition, land clearing and construction (DLC). Also includes 68,645 tonnes of demolition waste used for construction purposes at the Vancouver Landfill.

Source: City of Vancouver, *Greenest City 2020 Action Plan* (report to Council on July 5, 2011), retrieved November 4, 2011 from <http://vancouver.ca/ctyclerk/cclerk/20110712/documents/rr1.pdf>

49 Note that there are a variety of collection systems and that which parties pay and manage the collection varies by community, end user type and discard stream. Some municipalities may pick up some materials from multi-family dwellings and businesses in addition to single-family homes.

50 Canadian Council of Ministers for the Environment, *Canada-wide Action Plan for Extended Producer Responsibility*, www.ccme.ca/assets/pdf/epr_cap.pdf.

Existing EPR programs typically rely on consumers to bring products to return locations (depot or store). Because of multiple collection methods for each program this can be complicated for consumers, and requires a high level of public awareness about what can be returned and where.⁵¹ Between EPR and municipal collection, there is a need for a more coherent system that makes it easy for consumers to do the right thing and that ensures high collection rates — and guard against cross-contamination that makes materials less valuable and can result in higher residual wastes (most waste experts caution against cheaper “single stream” collection efforts that do not source separate materials for this reason).

Collection possibilities include curbside pickup, on-street bins, retail return points, and designated depots. The right mix depends on the characteristics of materials and the particular circumstances of the regional district or municipality. A large segment of BC’s population lives in urban areas that can be served well by a combination of curbside pickup and (new) neighbourhood-level depots. In many rural parts of BC, greater emphasis would need to be placed on comprehensive depots. One-stop resource recovery depots in urban areas are better suited for long-lived products, particularly those that are bulky (e.g. mattresses), complex (e.g. electronics) or that need special handling (e.g. batteries, tires). Recovery depots should be located in close proximity to households (community-scale) and be able to accept all products. In addition, customers should be able to return any product to the retail location where it was purchased (e.g. as is already the case with certain beverage containers).

A new EPR framework for packaging and printed paper (PPP) is being developed provincially, and is led by four major industry associations. Discussions during this process have led to a number of concerns about how the system will operate, with implications for outcomes (single-stream versus multi-stream collection), collection services (the role of existing municipal recycling programs and the contracts they have in place), and labour (pressure for greater privatization, de-certification of unionized workers and lower wages in the industry).

While the EPR program may lead to a more coherent province-wide system, many details remain to be resolved before it is implemented in 2014. Given the nature of the materials collected, it is important that the PPP program: reduce waste generation rather than just provide an alternative collection system for recycling; avoid incineration; support the creation of green jobs and decent work across the sector; recognize investments made by municipal governments in developing the existing infrastructure; and, be part of a system that supports BC-based processing and value-added economic development.

Collection possibilities include curbside pickup, on-street bins, retail return points, and designated depots. The right mix depends on the characteristics of materials and the particular circumstances of the regional district or municipality.

51 The Recycling Council of BC operates a hotline and online service to inform BC residents on recycling options for many products.

PUSHING EPR PROGRAMS UP THE POLLUTION PREVENTION HIERARCHY

In theory, EPR programs create a financial incentive for companies that should lead to better design of products for the environment and an emphasis on re-use. In practice, EPR has mostly served to increase collection and recycling, a lower level of the pollution prevention hierarchy. This may be because there has been a focus on getting new programs up and running without a concurrent emphasis on improving the quality of the existing programs. BC's EPR regulation is outcomes based rather than prescriptive, which should be more effective; however the sole target noted in the regulation is that a program must be designed to be able to eventually meet the provincially set target of a 75% recovery rate. Adding some additional requirements for EPR programs could spur them to achieve higher performance levels more quickly.

For established EPR programs (older than five years), a second tier of more stringent requirements could include:

- Higher, product subcategory-specific recovery targets.
- Higher consumer awareness targets.
- Higher access-to-collection targets.
- Increased research and development.
- Reduce, reuse and repair goals, including program and product-specific targets for local processing and warranties. These could serve to dramatically increase the share of reusable or refillable products, especially those with a single owner and short life span.
- Better labeling for products, particularly packaging, to assist end users in determining what can be collected for recycling. Easy to identify labels with intuitive colours and symbols could help to achieve high diversion rates. Ideally, labeling would be standardized on a national basis, but national standards are feasible only if all provinces and territories include the same products in their programs, which is one intention of the Canada-wide Action Plan for EPR.
- Economic incentives such as the proven deposit-and-return system or other measures where collection rates lag.
- Minimum environmental, labour and social standards to ensure that the programs result in green jobs.
- Requiring differential fees based on environmental performance. Visible fees on products would be eliminated, and (included-in-price) differential fees would be applied based on factors such as repair availability, warranty length, energy use, lifecycle GHG emissions, ease of recycling and disassembly, and type of materials used.
- More stringent reporting requirements, subject to third party audits.
- Broadening of the membership of boards of non-profit stewardship organizations to stakeholder groups beyond industry participants.

Developing a Green Jobs Agenda

IN 2011, THERE WERE ABOUT 5,100 jobs in waste management and remediation services in BC.⁵² About a quarter (24%) of these were in waste collection, two fifths (43%) in waste treatment and disposal, and a third (33%) in remediation and other waste management services. A 2008 analysis of the economic impact of BC's EPR programs found that stewardship management (including recycling) created about 1,600 full-time equivalent jobs (FTEs).⁵³

These tend to be well-paying jobs, with average weekly wages of about \$1,000 in 2007,⁵⁴ although there is a wide range of pay between unionized work done for municipalities and work that is contracted out. A model is San Francisco, noted for its commitment to zero waste policies, whose municipal government has been committed to paying starting wages double that of the state minimum wage (\$20 per hour versus \$10.24 per hour), plus health benefits, and hiring of economically disadvantaged people.⁵⁵

To estimate green jobs possibilities from zero waste policies we primarily draw on research on employment associated with recycling and re-use in the US, UK and Europe. BC as a small, sub-national jurisdiction will likely face additional challenges in realizing employment gains. Still, those employment gains are predicated on a more localized economy that cycles materials through the economy rather than disposing of them.

Employment arising from recycling materials can be 10 times higher per tonne than disposal, but requires robust markets for recycled materials (non-ferrous metals and plastics have the highest economic value, glass and yard waste the lowest). About half of recycling employment in the

WHAT'S A GREEN JOB?

“Green jobs provide decent work while either contributing to a reduction in greenhouse gas emissions or producing no or at least low environmental impact, and jobs that specifically help the economy or society adapt to the impacts of climate change.”

— Lee and Carlaw, *Climate Justice, Green Jobs and Sustainable Production in BC* (2010)

52 Statistics Canada, CANSIM database, based on Survey of Employment, Payrolls and Hours, Table 281-0023. This breakdown also includes jobs in sewage and liquid waste that are not considered in this paper.

53 *Economic Impacts of the BC Recycling Regulation*, supra note 30.

54 Including overtime. 2007 is the last year for which there are data. Statistics Canada, CANSIM Table 281-0027 - Average weekly earnings (SEPH).

55 Virali Gokaldas and Global Alliance for Incinerator Alternatives, “San Francisco: Zero Waste by 2020,” *Truth Out*, November 4, 2012, <http://truth-out.org/news/item/12520-san-francisco-zero-waste-by-2020>.

US is in paper mills, steel mills, plastics converters and metal foundries. Moreover, job creation associated with recycling outweighs jobs losses in waste disposal and virgin materials mining and manufacture.⁵⁶

Friends of the Earth (FOE) analyzed green jobs potential in the UK and EU from recycling, reuse and remanufacturing of municipal, commercial and construction wastes. FOE considered job creation among collectors, brokers, processors, end users, re-manufacturers or re-users, and recycling equipment manufacturers. For every 100 jobs created in the processing and manufacturing of recyclable materials, only 13 jobs were lost in corresponding up- and downstream industries.⁵⁷

If we apply the FOE framework to BC waste generation, there is potential for approximately 12,300 direct jobs from 100% recycling of BC's waste (Table 2). With an existing provincial diversion rate of 43%, this would mean about 7,000 new direct jobs (these are net of job losses in waste management and virgin materials mining and manufacturing). These would become *actual* jobs only if we develop domestic markets for recovered materials and reduce waste exports.

TABLE 2: GREEN JOB POTENTIAL FROM 100% RECYCLING IN BC		
Category	Direct jobs multiplier (jobs per kt)	Total potential jobs
Paper and paperboard	1.8	1,922
Plastics	9.3	2,780
Organics (compostable)	0.4	565
Organics (non-compostable)	0.4 to 5	326
Metals	5.4 to 11	1,272
Glass	0.75	189
Inorganic building materials	4.9	4,359
Electronic waste	4.9	256
Household hazardous	4.9	247
Household hygiene	4.9	288
Fines/misc.	4.9	139
Total		12,341

Source: Authors' estimates based on FOE (2010, see note 57).

As noted, BC's EPR and municipal recycling programs sell collected materials in secondary markets, often for export to other jurisdictions for processing. The potential for new jobs requires that we sort and process materials domestically. Requirements for re-usable containers would also improve the efficiency of the system and create jobs in more localized bottling and distribution plants (there may be additional costs of transportation energy for greater weight, but also shorter distances traveled). These estimates do not include even greater potential jobs gains in the more labour-intensive repair and refurbishment of products.

56 CASCADIA, *Recycling and economic development: a review of existing literature on job creation, capital investment, and tax revenues* (King Country Linkup, 2009).

57 Friends of the Earth, *More Jobs, Less Waste: Potential for job creation through higher rates of recycling in the UK and EU* (2010).

Developing jobs in resource recovery will require new investments in education and training, facilities and infrastructure, and systems and strategies to dramatically reduce material throughput in the economy. This work is more labour-intensive than existing collection and disposal/diversion systems. Resource recovery has potential to create green jobs in BC in sophisticated collection and sorting systems, and from redirecting recovered material from export markets towards domestic re-use, re-manufacturing and recycling activities.

Because there may also be job losses from reduced resource extraction and in existing landfilling and incineration practices, “just transition” programs will be needed that facilitate new skills development. On balance, it is anticipated that job creation impacts would be larger than losses, but policy should actively seek to create those jobs by developing the sectors cited above. Promoting and supporting unionized workforces would push green jobs to ensure decent wages and working conditions. In BC, unionized public employees in municipal curbside collection programs are potential green jobs that are sometimes under threat due to privatization, but also have an opportunity for expansion as organics collection grows. There are also examples of municipalities contracting waste collection jobs back into the public sector because private services have proved unsatisfactory. In any event, provincial policies should ensure living wages and decent working conditions for all green jobs down the road to full resource recovery.

Promoting and supporting unionized workforces would push green jobs to ensure decent wages and working conditions.

Beyond Recycling: Next Steps for BC

Reaching near-zero waste by 2040 is a challenging but realistic goal. The provincial government needs to assume a strong coordinating role to make this happen.

A ZERO WASTE MANDATE for BC could lead to benefits in terms of greenhouse gas reductions and development of green jobs, although this is a journey that will take a couple decades to realize. Reaching near-zero waste by 2040 is a challenging but realistic goal.⁵⁸ The provincial government needs to assume a strong coordinating role to make this happen, given the current mix of provincial policy set by the Ministry of the Environment, solid waste management plans developed by regional districts, privately-run EPR programs, as well as private haulers, non-profits and binners (collectors of bottles and cans, often low-income). A more coherent provincial system should also consider an intermediate “market maker” entity, which could be a new provincial Crown corporation, to close the loop by connecting resource recovery to new production within BC. The BC Utilities commission has also been suggested as a forum to set fair pricing for quasi-public utilities like curbside collection.

Flowing from the forgoing discussion, we suggest the following broad directions and guiding principles for BC:

- **MOVE UP THE POLLUTION PREVENTION HIERARCHY**—Major changes are needed to reduce the amount of materials (and the energy and GHG emissions required to produce them) *entering* production. This means shifting away from handling materials at the end of life and toward efficient design, dematerialization, and leasing economies that dramatically reduce material throughput.
- **MAKE IT EASY FOR CONSUMERS TO DO THE RIGHT THING**—To get to zero waste as a new social norm, it must be mandatory, convenient and financially attractive. Shifts in how products are designed, packaged, labelled and collected after use are needed to improve diversion rates and support an effective system.

58 In accordance with Climate Justice Project reports calling for zero fossil fuels by 2040, this same date is an achievable target for zero waste (also consistent with a broader definition of waste that includes GHGs). Three decades is a reasonable timeframe to allow for a *smooth transition* to zero waste. (Although we note that, if pushed, BC could likely achieve zero waste much sooner.)

- **MAKE PRICES TELL THE TRUTH**—To overcome distorted market price signals, shifts in taxes and incentives, as well as bans, regulations and standards will be required. This means consumers would face (potentially higher) prices that better reflect costs of production and resource recovery, while possibly increasing demand for better quality goods, and sharing or leasing services.
- **PROCESS MATERIALS AND MANUFACTURE IN BC AS MUCH AS POSSIBLE**—Developing capacity for BC-based green manufacturing may be the most challenging part of a plan, shifting away from the export of diverted materials from municipal solid waste or EPR streams.
- **CREATE GREEN JOBS IN THE TRANSITION TO A LOCAL AND GREEN ECONOMY**—In the medium-term a shift to well-paid, decent green jobs in all parts of the resource recovery sector is desired, though this may mean retraining and some transitions from status quo operations.
- **SEEK SOCIAL, HEALTH, LABOUR AND ENVIRONMENTAL CO-BENEFITS**—Improvements in local economic development, public health and other environmental fronts should go hand in hand with reductions in GHG emissions.

We estimate that by 2020, reduced generation and more aggressive recycling and composting lead to 4.9 million tonnes CO₂e savings by displacing organics from landfills and reducing the need for energy-intensive extraction and processing activities. By 2040 this rises to 6.2 million tonnes.

A ZERO WASTE PATHWAY FOR BC

In Tables 3 and 4 we model a Zero Waste Pathway for BC. We begin with a baseline of 2010 solid waste generation of 5 million tonnes, and allocate the total across broad product categories in line with a detailed assessment of Metro Vancouver’s waste generation and diversion.⁵⁹ Numbers include residential, industry, institutional and commercial (ICI) and demolition, land clearing and construction (DLC). Note that numbers include only materials that are collected after consumer use—for example, they do not include re-use in the home or via garage sales, nor do they count backyard composting.

We model both reductions in waste generation as well as increases in diversion rates across these material categories for 2020 and 2040. We assume a commitment by governments to implement new programs, standards and regulations, most of which are in place by 2020, but longer-term changes in product design and robust substitutes for existing products take longer to phase in, as well as to establish new norms for society’s behaviour around conserving materials. Overall, we estimate a 13% reduction in generation by 2020, and a 45% reduction by 2040—a major shift toward decreasing materials and energy throughput in the economy. Other changes in materials, and source-separated collection systems, push the economy close to 100% recycling of materials at the end of life by 2040.

Using emission factors from Morris’s work, we estimate the GHG reduction potential of these zero waste policies. By 2020, reduced generation and more aggressive recycling and composting lead to 4.9 million tonnes CO₂e savings by displacing organics from landfills and reducing the need for energy-intensive extraction and processing activities. By 2040 this rises to 6.2 million tonnes. Not all of these savings would occur in BC due to global supply chains, but a growing share does occur

⁵⁹ Baseline for BC in 2010 is based on aggregate numbers from BC Stats. Materials breakdown is for Metro Vancouver in 2010, estimated 2010 and 2020 diversion rates, and GHG emission factors from Morris (2009, supra note 26). Note that Metro Vancouver has higher diversion rates than many other regional districts, but also the most comprehensive data on waste generation, disposal and diversion.

TABLE 3: 2020 ZERO WASTE FRAMEWORK AND GHG IMPACT

	Reduction rate	Diversion rate	Diversion (tonnes)	Remaining waste (tonnes)	GHG impact (tonnes)
Paper and paperboard	20%	75%	640,665	213,555	2,876,066
Plastics	25%	50%	123,141	123,141	391,733
Organics (compostable)	20%	75%	846,866	282,289	709,116
Organics (non-compostable)	10%	50%	149,449	149,449	167,661
Metals	4%	80%	160,005	40,001	438,878
Glass	0%	85%	214,515	37,856	35,180
Inorganic building materials	0%	85%	1,075,757	189,839	152,961
Electronic waste	20%	75%	31,295	10,432	105,904
Household hazardous	10%	90%	40,804	4,534	0
Household hygiene	30%	10%	4,109	36,983	0
Bulky objects	20%	35%	9,372	17,405	8,666
Fines/misc.	10%	10%	2,545	22,909	0
Totals	13%	74%	3,298,523	1,128,392	4,886,166

TABLE 4: 2040 ZERO WASTE FRAMEWORK AND GHG IMPACT

	Reduction rate	Diversion rate	Diversion (tonnes)	Remaining waste (tonnes)	GHG impact (tonnes)
Paper and paperboard	60%	95%	405,755	21,356	3,523,181
Plastics	80%	90%	59,108	6,568	614,237
Organics (compostable)	50%	95%	670,435	35,286	864,235
Organics (non-compostable)	50%	90%	149,449	16,605	289,596
Metals	16%	95%	166,255	8,750	510,701
Glass	0%	95%	239,752	12,619	39,319
Inorganic building materials	25%	95%	901,738	47,460	173,206
Electronic waste	60%	95%	19,820	1,043	129,732
Household hazardous	20%	95%	38,285	2,015	0
Household hygiene	90%	95%	5,577	294	0
Bulky objects	60%	95%	12,719	669	17,693
Fines/misc.	50%	80%	11,313	2,828	0
Totals	44%	95%	2,680,205	155,493	6,161,902

Note: Estimates draw on data in Table 1, and are based on BC Stats aggregate data for waste generation in 2010, plus breakdowns by category for Metro Vancouver from Morris (2009, see note 28).

Sources: Authors' calculations based on Morris (2009, see note 28) and BC Stats (2012).

in BC over time due to re-localization trends arising from much higher global fuel prices plus policies that create demand for local recycled materials and as new small-scale manufacturing technologies emerge (e.g. 3D printing).

- **PAPER PRODUCTS:** More than one fifth of waste generation is from various forms of paper and paperboard. We assume a 20% reduction in generation by 2020 and 60% by 2040, through policies that restrict large sources of single-use paper for which there are online substitutes (phone books, newspapers, magazines) or that are gratuitous (junk mail, paper plates), while re-use policies displace packaging (boxes) and technology reduces the need for office paper. Diversion rates rise from 58% in 2010 to 75% in 2020 and 95% in 2040.
- **PLASTICS:** Various forms of plastic do not comprise a large share of waste by weight, but are very significant in terms of volume (which matters when estimating remaining space in a landfill). There are many opportunities to reduce plastic packaging in the economy: single-use beverage containers are phased out in favour of re-usable containers (glass and re-usable plastics), plastic bags are replaced by cloth bags, and compost programs virtually eliminate the need for garbage bags; other short-lived plastics such as dollar-store toys (especially those with toxic properties) are phased out. We assume such measures can reduce generation by 25% by 2020 and 80% by 2040. Remaining plastics must be durable, re-usable, and at end of life, recyclable or compostable. They are clearly labelled, so that diversion rates rise to 50% by 2020 and 90% by 2040.
- **ORGANICS (COMPOSTABLE)**—Composting yard waste and food scraps is the “low hanging fruit” of waste management, and comprises 28% of current generation. Actions already underway to ban organics from landfill in Metro Vancouver by 2015 can easily be extended to other jurisdictions. Comprehensive programs for multi-unit buildings and workplaces, schools, food services and restaurants are needed to increase collection rates. We assume a diversion rate of 75% by 2020 and 95% by 2040. But reductions in generation are also possible (20% by 2020 and 50% by 2050) through more aggressive rollout of backyard and neighbourhood composting (tied to community gardens and other urban agriculture), as well as measures to reduce the large proportion of food that is wasted (such as better systems management, distribution of excess food collection from restaurants, use of food as animal feed, etc.).
- **ORGANICS (NON-COMPOSTABLE)**—This category includes many treated wood products, plus textiles, leather and rubber that are harder to re-use. Because they tend to be more durable products, much of 2020 generation already exists. We assume a 10% reduction in generation by 2020 from expanding re-use markets, rising to 50% in 2040 as restrictions on materials that cannot be composted or easily recycled are brought in, and technology is developed to recycle the materials. Diversion of 50% in 2020 is possible, rising to 90% in 2040.
- **METALS**—Recycling of metals is already mature and we assume these trends continue. We assume only a 4% reduction in generation for 2020 due to phase out of aluminum beverage containers in favour of re-usable containers. By 2040, generation is reduced by 16%, due to 50% reduction in aluminum use, and 10% reduction in other metals use for cans and containers. Metals exist in a closed loop with 80% recycling by 2020 and 95% by 2040, leading to significant reductions in the energy needed for extraction and processing of raw materials.

Product leasing programs and new warranty provisions would remove incentives for planned obsolescence, and create a market for local repair and maintenance.

- **GLASS**—More aggressive re-use policies for a wide range of products make glass more common by displacing plastics and metal, but we assume these forces cancel each other out and do not reduce generation in 2020 or 2040. Recycling rates increase to 85% by 2020 and 95% by 2040.
- **INORGANIC BUILDING MATERIALS**—This category includes gypsum/drywall, masonry, ceramic, rock, dirt, asphalt, carpet and other inorganic materials common in construction, demolition and renovation. In this category much of the 2020 generation already exists, so we assume no reduction in generation by 2020, but an increase to 85% diversion. More progress is made by 2040 with a 25% reduction in generation due to requirements for deconstruction plans at building permit stage, commitments to longer-lasting buildings, and increased refurbishment of existing buildings rather than full demolition.
- **ELECTRONIC WASTE**—Increased attention to the short life spans of many computers and electronic gadgets is already putting e-waste reduction on the policy agenda. Increasing standards for EPR programs push for longer-lasting and more durable products with replaceable/exchangeable/upgradable parts (screens, RAM, processors, power cords). Product leasing programs and new warranty provisions would remove incentives for planned obsolescence, and create a market for local repair and maintenance. In line with these policy directions, we assume a decrease in generation of 20% by 2020 and 60% reduction by 2040, while recycling pushes diversion rates to 75% and 95% respectively, enhanced by the increasing scarcity of some component materials.
- **HOUSEHOLD HAZARDOUS**—New regulations remove toxic, non-biodegradable items from the marketplace, while technology applications enable customers to right-size their orders or to facilitate re-use markets for paints. Reductions in generation are modest (rechargeable batteries, pesticide bans), but products in this stream are designed for safe environmental and health impacts.
- **HOUSEHOLD HYGIENE**—The most significant item in this category is disposable diapers, which are phased out in favour of natural, re-usable or compostable diapers. Animal litter is diverted to the composting stream. Other items, such as tampons and sanitary napkins, are compostable (or re-usable methods where possible). These measures enable a reduction of 30% by 2020 and 90% by 2040. Diversion is small (10%) in 2020, but product design changes drive this up to 90% diversion of the remaining small amount of materials by 2040.
- **BULKY OBJECTS**—Larger appliances (“white goods”) and furniture comprise this category, and much of the 2020 generation already exists. Reduction is achieved through improved warranties, repair and maintenance, and leasing models (similar to electronics and small appliances), which increase product life spans (like fridges and washing machines of previous decades, products are once again built to last). Generation is reduced by 50% by 2040 and diversion rates rise to 95%.
- **FINES**—This includes assorted and unidentifiable leftovers, which are assumed to decrease in line with overall reductions in waste generation. Much of this fine waste is re-used as raw material for shoring up dykes in areas at risk of flooding due to rising sea levels. Post-incineration combustion residues are eliminated in line with phase out of incineration capacity in BC. By 2040, generation is reduced by 50% and diversion rises to 80%.

RECOMMENDATIONS

The previous discussion considers the long view of change for a shift in thinking from *managing waste* to fundamentally *reducing waste* and *closing the loop* on resources. In the short term, we recommend the following for the BC government, in concert with regional districts.

INTEGRATE GHG EMISSIONS INTO WASTE MANAGEMENT PLANNING

BC should establish formal targets for reductions in waste generation as well as increased diversion, and these plans should fully account for GHG implications in concert with climate action. There are many opportunities for synergistic waste-to-resource management and climate policies, and these would benefit from a coordinated provincial approach. The province should require that regional districts re-draft solid waste management plans in line with zero waste objectives. The province should also invest in getting better data on material flows in BC, including imports and exports at a macro level and uniform generation and diversion data at a regional district level.

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DO NOT EXPAND INCINERATION (WASTE-TO-ENERGY) CAPACITY

In line with waste reduction, re-use and recycling, Metro Vancouver should not build new incineration capacity (or anywhere else in BC), while existing incineration should be phased out. Incineration has adverse consequences for health and GHG emissions, and requires a steady stream of waste that is inconsistent with zero waste objectives. Even if energy is produced from incineration, it is uneconomic energy as it destroys useful materials that are costly to replace from virgin sources. The opportunity cost of focusing limited resources (staff time, public funds) on developing new incineration capacity is to miss out on the gains that could have been achieved had these resources been directed toward waste reduction.

REQUIRE PROVINCE-WIDE COMPOSTING

Banning organic materials from landfills is a top priority in terms of GHG emissions, and will take effect in Metro Vancouver as of 2015. Similar requirements across BC should be applied. Stronger incentives for backyard and neighbourhood level composting should be employed where possible. New collection services and infrastructure will be needed in many cases (multi-unit buildings, and commercial and institutional buildings, in particular) and these represent a logical transition for municipal collection workers.

PHASE OUT SINGLE USE PRODUCTS AND PACKAGING

Materials that are very short-lived in the hands of end users should be required to be re-usable and (after a long life) recyclable or compostable. This would apply to most packaging that could be returned to stores or suppliers at time of purchase or shortly thereafter. BC should implement deposit and return systems in support of re-use mandates (all beverage containers, including milk and soft drinks; food containers and cutlery; packaging for electronics) and require that stores take back re-usable containers and packaging for any product they sell. Other single-use items should be phased out, such as junk mail, telephone directories, disposable plates, cutlery and food containers, and plastic bags.

MOVE CAUTIOUSLY ON THE PACKAGING AND PRINTED PAPER (PPP) FRAMEWORK

BC's in-progress development of an EPR framework for PPP covers much of what is currently collected at curbside by municipalities. While a more uniform, province-wide approach is needed for closing the loop, a key concern includes potential moves toward "integrated resource management" that mix more types of waste together, instead of multiple streams of materials. A new framework must also respect municipal government investments, existing labour contracts, and should ensure that all jobs in the sector provide decent work in terms of pay and working conditions. There is also an opportunity for regulation to push producers up the pollution prevention hierarchy, and to roll out the framework to the ICI as well as residential sectors.

ESTABLISH MINIMUM RECYCLED CONTENT REQUIREMENTS

Creating local demand for recycled materials is a key element. BC should implement re-use requirements, minimum recycled content requirements for a wide range of products (perhaps with fees for non-complying imports). Public sector procurement should also strongly support keeping material flows in BC rather than be exported. Minimum recycled content and deconstruction plans should apply to new development applications. Exports should be allowed only after local demand takes its share.

INVEST IN PROCESSING CAPACITY TO MOVE UP VALUE CHAIN

Developing BC-based green manufacturing and reprocessing industries may be the most challenging part of a plan, but this is needed to close the loop on resources. BC will need to make public investments in support of a shift away from landfills and incinerators, and toward waste reduction, re-use, repair and maintenance, and finally, recycling and composting. A variety of post-consumer collection options will be required, ranging from curbside, the ICI sector, on-street and neighbourhood collection points, to requiring that stores take back any product and packaging they sell. In addition, facilities and collection infrastructure at all levels, from homes and offices to local sorting depots to re-manufacturing will be needed, with a public presence required in many cases.

DEVELOP A GREEN JOBS AND JUST TRANSITION FRAMEWORK

Policies are needed to help create well-paid, decent green jobs in the resource recovery sector, including policy to support retraining and job transitions from status quo operations. A sector-wide approach that includes collective bargaining and a commitment to decent wages and working conditions is important to this end. There are many social enterprises and individual binners who have an economic stake in the waste management system, and these should be supported where possible (for example, on-street bins for collecting plastic bottles and containers in the City of Vancouver have doors so binners can collect them for return to a depot).

SUPPORT RESEARCH AND INNOVATION AIMED AT REDUCING MATERIAL THROUGHPUT

Research funding for universities, in collaboration with non-profits and private sector operators, could lead to a "network centre of excellence" approach in resource recovery and waste management with an emphasis on efficient design, product durability and service economies that dramat-

Developing BC-based green manufacturing and reprocessing industries may be the most challenging part of a plan, but this is needed to close the loop on resources.

ically reduce material throughput. In addition, funds to support pilots and start-ups, innovative business models (such as leasing), re-use centres, dematerialization (white and yellow pages), and other sharing/cooperative projects would lower waste generation. Recently, the City of Vancouver in collaboration with the Vancouver Foundation provided grants in support of innovative projects related to the city's Greenest City Action Plan. Supporting a new service economy could include new business models, such as product leasing and sharing (tools, vehicles co-ops). Repair and maintenance are also part of a more durable materials economy, and could be supported by more stringent warranty requirements for producers.

BAN OR TIGHTLY REGULATE MATERIALS THAT ARE TOXIC OR NON-RECYCLABLE

Materials flowing through the economy should be safe for human, plant and animal health. A wide range of potentially toxic chemicals and additives exist in the marketplace, many of which have not been tested for health or other environmental impacts. The "precautionary principle," which puts the onus on producers to demonstrate their products are safe, should be the bedrock of materials regulation in the economy. Also, compostable or "bio" plastics are controversial, despite seeming a positive contribution on the surface. Existing varieties are not easily composted, contaminate plastics recycling and compete with agriculture for land. While these cannot be ruled out altogether, careful thought should be given to the strategy for these materials.

SHIFT INCENTIVES THROUGH PRICING AND REGULATION

Economic incentives are essential in motivating both producer and consumer behaviour and can be enhanced with through ecological fiscal reform (e.g., resource quotas and auctions; green taxes and fees). Reforming the royalty regime for resource extraction would make recycling more economical. Fees for disposal by landfill should be steadily increased. European nations have used disposal fees to fund recycling programs—at European levels of \$20 to \$40 per tonne, BC's 2010 waste disposal levels would raise \$60 to \$120 million. Subsidies and similar conservation disincentives such as the subsidized postal rates enjoyed by junk mail should be removed. EPR programs should be required to move up the pollution prevention hierarchy over time. A mix of regulations and standards, including new codes that require new buildings be designed for deconstruction and recycling, banning materials from entering the marketplace and landfills will be required.

CHALLENGE PERVASIVE ADVERTISING

Changing consumer culture reaches beyond the (already wide) scope of this paper. But some forward thinking on reducing the pervasiveness of advertising comes from the UK's Compass Institute, which argues that households should be able to choose to avoid advertising and recognizes the harms that can come from unfettered advertising. They recommend a new regulatory framework that would include strict bans on advertising in public spaces, for alcoholic products, on product placement in television, and on television advertising to children under 12 (among other areas). In addition, they call for restrictions on the collection of personal information online (used for advertising), taxes on advertising that encourages greater consumption, and requirements that ad agencies provide a portion of workers' time to positive social and environmental campaigns.⁶⁰

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⁶⁰ Zoe Gannon and Neal Lawson, *The Advertising Effect: How do we get the balance of advertising right* (Compass UK, 2011), www.compassonline.org.uk/publications/.

CONCLUSION: FROM WASTE TO RESOURCE

While it is possible to close the loop in theory, this implies an economic system very different from today's open economy of exports and imports, and would profoundly alter the relationship between people and the natural world. In today's world predicated on continuous economic growth and increasing energy and material consumption, much of what we propose here is anathema to many "stakeholders" in the economy. In short, meaningful progress will be difficult, but changes we implement today will be much less painful than if we wait for nature to impose its own limits tomorrow.

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It should be clear that a coordinated and multi-faceted approach to materials management is necessary, involving a wide range of strategies, tactics, roles, responsibilities and stakeholders. Fortunately, BC is starting with a breadth of experience and some successes in existing collection systems, EPR programs and legislative initiative. The next stage involves scaling up these systems that work and filling in their gaps.

Following the directions laid out in this paper, zero waste policies have great potential to help reduce GHG emissions and create green jobs. Furthermore, a provincial policy mandate for zero waste creates an important opportunity to develop a more localized economy better positioned to weather global challenges—climate change, market volatility and resource scarcity—on the horizon. Indeed, zero waste is not only about a better provincial solid waste vision: it is also an interconnected and forward-looking strategy that could bolster a range of economic activities, enhance BC's resilience in the face of global change and enable our population to achieve a high standard of living within the means of nature.

APPENDIX

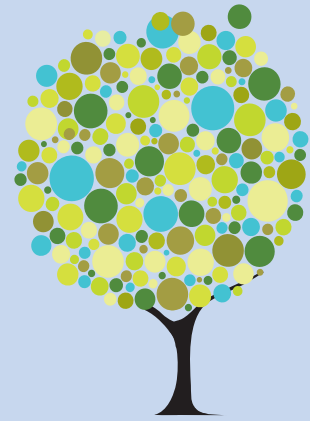
EXISTING STEWARDSHIP PROGRAMS IN BC		
Existing Stewardship Programs	New Products Added	Canada-wide Action Plan: Recommended Programs by 2015 and 2017
Electronic and electrical, fluorescent lamps, batteries, smoke detectors, thermostats, cell phones, batteries, small appliances, large appliances; electrical and electronic tools; medical devices; automatic dispensers; lighting equipment; toys, leisure and sports equipment; monitoring and control instruments; IT and telecommunications equipment Paints Used lubrication oil, filters, and containers Beverage containers Tires Pharmaceuticals Domestic pesticides, gasoline, solvents and flammable liquids Antifreeze Lead-acid batteries	2014: Packaging and printed materials (residential)	2015: Packaging and printed materials Household hazardous and special wastes Automotive products 2017: Construction and demolition materials Furniture Textiles and carpet Appliances, including ozone-depleting substances

Source: Updated by authors, based on BC Ministry of Environment, Recycling Regulation (2004): Policy and Regulatory Setting, fact sheet, www.env.gov.bc.ca/epd/recycling/guide/pdf/recycling-reg-overview.pdf.



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THE CLIMATE JUSTICE PROJECT

The Climate Justice Project is a multi-year initiative led by CCPA and the University of British Columbia in collaboration with a large team of academics and community groups from across BC. The project connects the two great "inconvenient truths" of our time: climate change and rising inequality. Its overarching aim is to develop a concrete policy strategy that would see BC meet its targets for reducing greenhouse gas emissions, while simultaneously ensuring that inequality is reduced, and that societal and industrial transitions are just and equitable.

www.climatejustice.ca



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