A Zero Waste Agenda for BC

By Marc Lee, Belinda Li, Sue Maxwell, Tamara Shulman

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ZERO waste
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The CCPA–BC is located on unceded Coast Salish territories, specifically the lands belonging to the xʷməθkʷəy̓əm (Musqueam), Skwxwú7mesh (Squamish) and səl̓ílwətaɁɬ /Selilwitulh (Tsleil-Waututh) Nations.

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The time has come to move beyond conventional recycling and get serious about well-designed material conservation and management policies that can simultaneously support local economic development and social justice goals.

BRITISH COLUMBIA IS AHEAD OF MOST NORTH AMERICAN jurisdictions in implementing composting and recycling programs. And yet, our lives are systemically burdened by endless amounts of packaging, with the mass proliferation of plastic, in particular, an environmental tragedy of our times. The core problem is not unique to BC: a culture of consumption and an extraction-oriented economic system that contributes to solid waste, pollution and climate change.

This study looks at the possibilities for upstream, proactive solutions to dramatically reduce the volume of materials that flow through the economy, and therefore also reduce the associated energy consumption and carbon emissions. We believe the time has come to move beyond conventional recycling and get serious about well-designed material conservation and management policies that can simultaneously support local economic development and social justice goals. We discuss how BC can get there by building on existing strengths, changing systems and abandoning wasteful consumption habits.

With a focus on redesign, innovation and shifting culture, we propose zero waste as a goal for 2040. The overall directions of our zero waste approach include:

- Dramatic reductions in waste production, including banning single-use packaging and embracing reusable packaging and containers.
- Bold policies in support of repair and maintenance to give much longer lifespans to electronics and appliances.
- Tougher regulations to ensure more coordinated and effective materials management (recycling and compost collection) at the end of life, as well as greater local processing and high labour standards.
- A public presence, through a new Crown corporation, to fill in gaps in the system and serve as a coordinator and market maker.
- Stronger public procurement and minimum recycled content requirements that generate local demand for recycled materials.
- A green jobs and just transition framework to ensure high employment standards and decent work across the sector.
- Phasing out incineration as an option for waste materials and closing other loopholes for waste disposal.

- New regulatory frameworks in two pressing areas, plastics and construction/demolition waste.
- More system-wide planning and data collection in the public domain to shine a light on where materials are flowing after consumption, including recycling and composting, landfills and incineration, as well as greenhouse gas (GHG) impacts.

We estimate that BC generated 6.59 million tonnes of waste in 2018, of which 59 per cent was recycled. Most of the remainder was disposed of in landfills, except for the 260,000 tonnes incinerated at Metro Vancouver's Waste-to-Energy facility in Burnaby (more than one-quarter of the region's waste is incinerated).

Better recycling and composting

BC's recycling activities are heavily integrated into global markets where recycled materials are just another low-value commodity. Recycling in BC is comprised of many Extended Producer Responsibility (EPR) programs, including curbside collection and many others that rely on consumers to return the product in a particular way or to a specific location. A high level of awareness is needed about what can be returned and where—and the default may often just be the trash. To drive larger local economic benefits and to ensure high-quality, equitably assessed and fairly priced service across BC, a stronger public presence is needed.

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DEVELOP A CROWN CORPORATION FOR ZERO WASTE

A Crown corporation, funded by EPR programs, would be engaged to ensure higher levels of collection and recycling, and a more coherent collection system, including:

- Coordinating community-level collection depots (including rural areas) where all recycling that is not currently picked up at curbside could come to be collected and sorted, while repaying deposits. The one-stop resource recovery depots could also include long-lived products that are bulky (e.g., mattresses), complex (e.g., electronics) or that need special handling (e.g., batteries, tires).
- A more effective and easy-to-use collection system for bins on the street and in public and private buildings. These would benefit from standardization of receptacles (e.g., consistent colour-coding and signage) across all settings.
- Take up collection responsibilities for BC government operations and underserved rural areas, and provide competition to private collection companies when time for renewal of contracts with municipalities and the industrial, commercial and institutional (ICI) sector.
- Improved collection and processing infrastructure for organics and compost management.

CREATE LOCAL MARKETS FOR RECYCLED MATERIALS

The BC government should implement a "step code" of increasingly stringent minimum recycled content requirements to increase demand for recycled materials. The BC government has failed to leverage its own large presence to help shape purchasing decisions across government. A coordinated approach could use aggregated procurement policies to drive demand for recycled materials, including those collected by the new Crown corporation. This could be integrated

with bans on materials that do not fit into this system (such as single-use plastic films) or the addition of surcharges for disposal in landfills.

RAISE THE BAR FOR EXTENDED PRODUCER RESPONSIBILITY (EPR) PROGRAMS

Outstanding categories under the *Canada-wide Plan for EPR* need to be regulated, including packaging and printed paper (offices and commercial buildings), textiles, furniture, and construction and demolition materials.

The provincial government should add more stringent performance and reporting requirements for all EPR programs.

The provincial government should add more stringent performance and reporting requirements for all EPR programs including:

- *Higher targets for product-subcategory-specific collection, consumer awareness and access to collection.* Add targets for re-use and refillables and incentives to eliminate packaging, and fines for materials not recovered. Ensure producers pay the full costs for the services.
- *Reduce, reuse and repair goals, including program and product-specific targets for local processing and warranties.* These could serve to dramatically increase the market share of reusable or refillable products, especially those with a single owner and short lifespan. Economic incentives, such as the proven deposit-and-return system or other measures, could be mandated where collection rates lag. Programs should fund innovation.
- *Bans of products and packaging materials going to incinerators and cement kilns, and the rejection of using plastics to make fuel.*
- *Better labelling 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, labelling would be standardized on a national basis.
- *More stringent reporting requirements*, such as data gathering across BC from EPR program–funded waste composition audits.
- *High labour standards to ensure that the programs result in decent jobs with fair compensation.* Systems to allow participation in programs by a broader array of service providers (including private sector ones), as long as they meet the standards.
- *High environmental standards and consideration of other social benefits and impacts.* Differential fees for products and packaging based on environmental performance would be applied based on factors such as repair availability, warranty length, energy use, life-cycle GHG emissions, upstream environmental impacts, ease of recycling and disassembly, and type of materials used.
- *Broadening of the membership of boards of non-profit stewardship organizations to stakeholder groups beyond industry participants.* Current programs are fully managed by producers (board members are often not even residing in BC) and so lack any insight or oversight from customers, local governments, workers or NGOs.

BETTER COMPOSTING AND ORGANICS MANAGEMENT

Organic materials and compost management is more inherently local. Public policy should aim to shrink food waste while deepening local demand for finished compost.

- *Set rigorous food waste reduction and organics capture targets.* BC should adopt food waste reduction targets and a comprehensive program for food waste prevention across sectors with measurement and accountability built in.
- *Use education, monitoring and enforcement to reduce food waste and diversify how food scraps are managed across sectors.* Reduce and divert organics using robust behaviour change programs, source separation bylaws and enforcement across sectors.
- *Develop comprehensive organics processing infrastructure.* Land use management plans should be aligned to foster local and regional composting efforts, from home and community composting to larger infrastructure development. Support improved collection and infrastructure development by including it in our proposed zero waste Crown corporation and establishing a province-wide organics disposal ban by 2030.
- *Strengthen end-market development for finished compost.* Public sector procurement policies can play a pivotal role in mandating and promoting the use of compost (e.g., construction projects, land development, roadside stabilization, civic landscapes).

Beyond recycling

To date, companies have not had to design their products and packaging with re-use in mind.

Much of what we call recycling is, in fact, less desirable "downcycling," 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). While downcycling plastics is an improvement over incineration, it ultimately creates waste because after several cycles the degraded materials can no longer be recycled. To date, companies have not had to design their products and packaging with re-use in mind, and relying only on a recycling model has major limitations.

TRANSFORM CONSUMER WASTE THROUGH INNOVATIVE RE-USE AND BETTER PRODUCT DESIGN

- *Eliminate materials.* Collaborative consumption or sharing is another practice that has been around for a long time, with public libraries being a prime example. The growth of car-sharing options in Vancouver has been notable, including point-to-point service, Evo, and the car co-op, Modo, while the bike-sharing service, Mobi, offers another shared transportation option.
- *Emphasize re-use and refilling.* Shift toward banning single-use containers, from soft drinks to product packaging to food containers. An innovation agenda for BC could focus on developing a supportive regulatory framework for the re-use of quality goods and refillable systems.
- *Facilitate repair and maintenance.* The Right to Repair movement is growing in Canada, and in the EU it has been successful in getting regulation changes where washing machines, dishwashers and fridges must have spare parts available for seven to ten years, where spare parts must be delivered within 15 days and repair information made available to professional repair people. In addition, we should require much longer warranties on products and companies should be required to service and maintain the products.

DEAL WITH PLASTICS

Plastic waste has become a huge environmental problem, with half of plastics being made for single-use applications and only 20 per cent of plastics in BC being recycled. The eventual goal should be to substitute all plastics with non-toxic materials that can be reused for a long time before being recycled or composted.

- *Ban single-use plastics.* People are ready to change the wasteful single-use culture associated with plastics, in favour of more bulk options, reusable containers and packaging, and tap water. Care must be taken to ensure the switch is to reusable products and not another form of single-use product. Change the cultural expectations around disposable, convenience, health and sanitation through campaigns that bring in thought leaders and cultural players (e.g., marketing, media).
- *Cap the amount of virgin plastics that can enter the economy and set timelines for reduction to zero by 2050.* Plastic manufacturers would then need to acquire the rights to produce or import plastics, and pass on any higher costs to consumers. Such an approach would value plastics more and treat plastic as a resource. This would also allow us to set priorities about where plastics are most beneficial and hard to replace.

The eventual goal should be to substitute all plastics with non-toxic materials that can be reused for a long time before being recycled or composted.

- *Tax virgin plastics.* The price of plastic should include associated environmental costs and resource management costs (i.e., disposal, recycling and re-use costs) at the outset. Higher prices would induce innovation and conservation in terms of consumers and industry, and would level the playing field vis-à-vis recycled plastics. This could be part of deposit-and-return systems so that each piece of clean plastic has value.
- *Streamline the number of plastics in circulation.* A successful plastic recycling system would need to focus on a narrower range of resin types that are source-separated after consumption. There would also be restrictions on certain contaminants, like labels and inks. A more harmonized approach would make it easier for consumers and industry alike.
- *Stimulate our small- and medium-sized businesses to reuse and recycle plastics or use alternates.* This could include support in the pre-competitive space for developing standardized reusable containers and products, alongside work to ensure that plastic and pellet processing occurs in BC. Shift from a global economic system that focuses on plastic materials to a more local economy based on reusable materials such as glass. Require recycled content in plastics that are used, but ensure that the first priority is reduction in plastic used and longevity of the product over a mere change in source material.

DEVELOP SYSTEMS FOR CONSTRUCTION AND DEMOLITION MATERIALS

The construction and demolition (C&D) sector represents 50 per cent of waste generation and 30 per cent of disposal in Metro Vancouver. The province should create model municipal solid waste policies and regulations that can be adopted at variable rates, but with a provincial "backstop" in the spirit of the BC Energy Step Code.

- *Set provincial targets for this waste sector* along with robust measurement and reporting. Targets should then be integrated into regional district solid waste management planning with requirements for differential tipping fees to drive change. Requirements for municipalities would likely include model demolition permits, deconstruction checklists, monitoring and reporting requirements, as well as a deposit and refund system based on audited tipping fee receipts, permit applications and site waste management plans.

- *Mandate stronger overview, monitoring, and reporting of all private and public waste processing and recycling facilities.* This will help to ensure high quality data and remove challenges in verifying material flows. Review trade regulations to ensure proper processing of materials and no leakage of waste. Ensure all local solid waste plans work towards progressively more strict sectoral diversion targets.
- *Develop a comprehensive policy and regulatory framework*, including building code changes to encourage design for disassembly, deconstruction-ready design standards, and provincial regulation for embodied carbon. Research will be required, as will collaboration among multiple ministries that look at climate and environment, housing, procurement, labour and economic development. In addition to policy and regulatory changes, investments in technology and workforce training will also be needed.
- *Use public sector procurement to build a salvaged and reused materials marketplace.* Provincial and other public sector procurement could take the lead in catalyzing the demand for salvaged materials, and other circular building practices. Provincial demonstration of best practices can help drive government entities to use salvaged materials and meet embodied carbon targets, further helping to drive markets for the materials.
- *Ensure the infrastructure needed is in place.* Invest in the creation of salvaged materials and re-sale hubs and processing facilities. Investments in industrial symbiosis approaches and networks can ensure that materials are efficiently moved between users in the province.

USE ZERO WASTE POLICIES TO REDUCE CARBON EMISSIONS AND SUPPORT A JUST TRANSITION

Recycling of materials reduces the need for emissions-intensive extraction and processing of virgin materials, although such emissions reductions may well be offshore. Reduction, dematerialization and re-use strategies go even further by displacing the need for new emissions-intensive manufacturing and transportation.

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- *Reduce emissions from upstream resource extraction.* We modelled GHG reductions associated with our zero waste program. By 2030, reduced generation and more aggressive recycling and composting will lead to 3.4 million tonnes CO_2 equivalent (CO_2e) savings by displacing organics from landfills and reducing the need for energy-intensive extraction and processing activities. By 2040, this will rise to 7.1 million tonnes CO_2e.
- *Phase out incineration.* Emissions from the Burnaby incinerator in 2017 totalled 288,000 tonnes CO_2e, of which 40 per cent was from fossil-fuel-derived products (e.g., plastics, certain textiles, rubber) and 60 per cent from biomass and organic materials (wood and compost in particular). For the moment, the region has put off looking at adding a new incinerator. As we move to zero waste, the existing facility should be phased out.

Zero waste practices as detailed above in areas like re-use, repair and maintenance are more inherently local than the current model and, with proactive policy, could develop thousands of high-quality, long-term stable jobs in BC. In reducing the material and energy throughput of our economy, we must also simultaneously seek to improve wages and working conditions for workers, reduce inequality and boost quality of life for all, and contribute to racial, gender and social justice.

- *Invest in re-use and repair for local, green jobs.* Managing waste for resource recovery has the potential to create jobs in more sophisticated collection and sorting systems, and there will also be additional jobs to educate, develop systems and policy, gather data

and manage programs and staff. Repair activities create as much as 200 times more jobs than landfilling and incineration—recycling creates 50 times and remanufacturing creates 30 times more jobs. Requirements for reusable containers would create jobs in more localized plants by keeping materials circulating in BC.

- *Put high employment standards at the core of a jobs plan.* Much work in the waste sector in the past has also given rise to health and safety challenges, while shifts in policy may lead to challenging labour transitions for existing workers. A sector-wide labour framework is thus advised, given the significant potential for new sub-contractors and changes in approach to collection and processing. This should include collective bargaining rights, successorship protections to ensure appropriate preservation of work, advanced skills training and other transitional supports as part of the move forward.

Introduction

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 programs.[1] British Columbia is ahead of most North American jurisdictions in implementing composting and recycling programs. And yet, our lives are systemically burdened by endless amounts of packaging, with the mass proliferation of plastic, in particular, an environmental tragedy of our times.

The core problem is not unique to BC: a culture of consumption and an extraction-oriented economic system that contributes to solid waste, pollution and climate change. Corporations producing ever-greater quantities of "stuff" for consumption are now pushing ecological limits across multiple dimensions—resource extraction; habitat loss; reduced biodiversity; solid waste generation; air, land and water pollution; soil nutrient loss; energy use; and carbon emissions. Our current practices have gotten better at sorting materials after consumer use, but the throughput of materials in the economy has only gotten larger.

The challenge of our times is not to recycle a little more, but to fundamentally redesign systems to reduce the amount of waste that is created in the first place. That is, aggressive product design change, materials reduction and a long life of repair and re-use *before* recycling. Too many everyday products have a useful lifespan of mere moments before being trashed, including many single-use items like plastic bags, bottles and packaging.

Until 2018, the limits of this economic model had been largely hidden from view due the ability of rich countries to export large amounts of waste to China. This trend has shifted as China's National Sword policy imposed stringent limits on the import of plastic waste and other items to be recycled that have high contamination levels. Combined with the surge in domestic use of plastic, these factors have resulted a significant reckoning in global markets for recycled materials. Other low-income countries may pick up some of the slack for accepting materials for recycling, and this points to another negative of global consumerism: disadvantaged populations tend to disproportionately bear the brunt of pollution from resource extraction, production and/or waste disposal.

The challenge of our times is not to recycle a little more, but to fundamentally redesign systems to reduce the amount of waste that is created in the first place.

1 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.

This study updates and extends a 2013 Climate Justice Project report, *Closing the Loop: Reducing Greenhouse Gas Emissions and Creating Green Jobs through Zero Waste in BC*.[2] It considered the possibilities for reducing both solid waste and carbon (greenhouse gas or GHG) emissions, while maintaining a high quality of life from the products and services we use. Through upstream, proactive solutions the goal is a dramatic reduction in the volume of materials that flow through the economy, and therefore the associated energy consumption and carbon emissions. These moves beyond recycling are consistent with more localized supply chains and materials management. We believe the time has come for getting serious about well-designed material conservation and management policies that can support local economic development and social justice goals, and we discuss how BC can get there by building on existing strengths, changing systems and abandoning wasteful consumption habits. The overall directions in our paper are:

We believe the time has come for getting serious about well-designed material conservation and management policies that can support local economic development and social justice goals.

- An aggressive shift to reducing waste in the first place, through actions like banning single-use packaging, and toward re-use, such as refillable beverage containers. In addition, bold policies in support of repair and maintenance can give much longer life to electronics and appliances.
- Tougher regulations to ensure more coordinated and effective materials management (recycling and compost collection) at the end of life, as well as more local processing and higher labour standards.
- A stronger public presence in the area through a new Crown corporation to fill in gaps in the system and serve as a coordinator and market maker, along with policies that reduce waste and generate local demand for recycled materials (public procurement and minimum recycled content requirements).
- More system-wide planning and data collection in the public domain to shine a light on where materials are flowing after consumption, including recycling, composting, landfilling and incineration.
- Deeper dives into two major areas for action: plastics, and construction and demolition waste.
- An update of previous research on the potential for green jobs development and GHG emissions reductions.

2 Lee, Marc et al. *Closing the Loop: Reducing Greenhouse Gas Emissions and Creating Green Jobs through Zero Waste in BC*. Vancouver: Canadian Centre for Policy Alternatives, 2013. https://www.policyalternatives.ca/publications/reports/closing-loop.

TERMINOLOGY CHECK: ZERO WASTE AND A CIRCULAR ECONOMY

We use the terms *waste* or *waste generation* for all of the materials that exit our homes, workplaces and other public places after consumption. Wastes are eventually disposed of by landfilling and incineration. The history of waste policy has been to increasingly divert materials that can be recycled back into the production system, and those that can be composted back into soil or organic nutrients. In spite of some recycling success, our economic model is still very linear—where materials are extracted, processed and manufactured into goods, used and then trashed.

A *circular economy* approach emphasizes a more aggressive re-use of products and materials so that wastes become inputs into production as materials cycle through the economy. The circular economy discourse has generally been adopted by large business interests, however, with much emphasis on technological solutions, which are still predicated on an extractive economy and do not necessarily reduce material throughput.

The term *zero waste* has been defined as "the conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health."[a] Zero waste policies place much greater emphasis on upstream, proactive solutions—rethinking systems, aggressive materials reduction, redesign and re-use before recycling and composting.

Although zero is perhaps more an aspirational than an operational goal, the key idea is to dramatically shrink our ecological footprint[b] through absolute reductions in energy and material flows (fossil fuels, electricity, wood products, minerals and metals) into the economy and the wastes (solid and liquid waste, and air pollution and carbon emissions) that flow out. In addition, there is no free ride when it comes to the energy needed to make a better recycling system. What is truly transformative is to reduce the material throughput of society, in order to live within our ecological means. Reduction and re-use shift the conversation upstream to highlight changes in production, rather than better post-consumer collection and recycling.

The term *zero waste*, however, has often been used in ways that are misleading to consumers. For example, modest recycling efforts have been branded as zero waste. Or the suggestion by Metro Vancouver that incineration of waste is consistent with zero waste. Positive visions include the City of Vancouver's adoption of a 2040 target for zero waste along with a strategic plan,[c] and the C40 Cities *Zero Waste Declaration*, which commits to 50 per cent reduction and 70 per cent diversion of waste by 2030 from 2015 amounts.[d]

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a Zero Waste International Alliance. "Zero Waste Definition." July 2020. http://zwia.org/zero-waste-definition/.

b The ecological footprint of a person or community is a measure of the environmental impact expressed as the amount of land required to sustain their use of natural resources and absorb the wastes.

c City of Vancouver. "Zero Waste 2040." July 2020. https://vancouver.ca/green-vancouver/zero-waste-vancouver.aspx.

d C40 Cities. "Advancing Towards Zero Waste Declaration." July 2020. https://www.c40.org/other/zero-waste-declaration.

The state of waste in BC

With so many players, the overall waste management system is opaque and there are many gaps in public understanding of what happens to waste after it is collected.

WASTE MANAGEMENT IN BC IS A COMPLICATED AFFAIR. High-level policy is set by the BC government, but local responsibility for collection rests with municipalities, and disposal to landfills or incineration is coordinated by regional districts. There is also a high degree of private sector activity in recycling, including Extended Producer Responsibility (EPR) programs, in which producers are responsible for a product after it is consumed. A major change to EPR since our last report is the advent of Recycle BC, an association of private producers of paper and packaging, which took over responsibility for residential packaging and paper, including "blue box" recycling in many BC municipalities. Many other products are covered by EPR programs as well. Private collection also includes large corporate waste haulers emptying dumpsters for office towers, shops and multi-unit buildings.

With so many players, the overall waste management system is opaque and there are many gaps in public understanding of what happens to waste after it is collected. BC does not publish comprehensive province-wide statistics on recycling, composting and disposal. Moreover, a lot of what is recorded as recycling just means materials do not enter landfills or incinerators. Much of this is not true recycling, in which materials are used repeatedly for the same purpose, but downcycling, where materials recovered are used for other purposes (e.g., glass from bottles smashed in landscaping aggregate, not used to make new bottles).

We estimate the numbers for BC in Table 1 based on available provincial data plus high-quality estimates from Metro Vancouver and the Capital Regional District, and supplemented by data from Extended Producer Responsibility (EPR) programs that handle a large share of recycling activities. BC's solid waste generation—the sum of all recycling, composting and disposal in landfills or the Burnaby incinerator—was 6.6 million tonnes in 2018, and approximately 59 per cent of this material by weight was recycled.[3]

3 These figures and those below are for municipal solid waste only. They do not include vast amounts of waste upstream from the extraction and processing of raw materials (such as tailings dams or wood waste), nor do they include air pollution, carbon dioxide and other greenhouse gas emissions. Finally, these figures do not include liquid wastes through municipal sewer systems or private collection from septic tanks.

Table 1: Estimated BC waste stream, 2018

Category	Indicative products	Estimated BC waste generation (tonnes)	Share of total	Estimated BC recycling (tonnes)	Recycling rate (%)
Paper and paperboard	Office paper, newsprint, cardboard, phone books, books, magazines, tissue paper, paper plates, wrappers	915,025	13.9%	509,793	56%
Plastics	Shopping and garbage bags, beverage containers, other containers, toys, lawn furniture	498,005	7.6%	101,020	20%
Organics (compostable)	Yard waste, food scraps	1,309,653	19.9%	662,295	51%
Clean wood	Unfinished wood, pallets	368,192	5.6%	82,662	22%
Painted or treated wood	Painted or treated wood, composite wood products	271,935	4.1%	—	0%
Textiles	Clothing and draperies	76,784	1.2%	573	1%
Organics (non-compostable)	Rubber, leather, and composite products	35,997	0.5%	—	0%
Metals	Aluminum, copper, steel	221,769	3.4%	135,851	61%
Glass	Beverage containers, food containers, mirrors, windows, lightbulbs	161,885	2.5%	103,329	64%
Inorganic building materials	Drywall, masonry, ceramics, asphalt, carpet	2,245,829	34.1%	2,104,106	94%
Electronic waste	TVs, cell phones, computers and displays, small appliances	57,925	0.9%	23,802	41%
Batteries	All types of batteries	24,841	0.4%	21,355	86%
Household hazardous	Medical (needles, equipment), paints, solvents, pesticides, used oil for vehicles, containers for hazardous products	70,074	1.1%	41,947	60%
Household hygiene	Diapers, animal litter, tampons, sanitary napkins	187,596	2.8%	—	0%
Bulky objects	Furniture, mattresses	14,487	0.2%	—	0%
Large appliances	Stoves, fridges, dishwashers	37,098	0.6%	37,098	100%
Tires	Vehicle tires	44,948	0.7%	43,711	97%
Fine particles/ misc	Unidentifiable remains, combustion residuals	44,019	0.7%	—	0%
All categories		**6,586,061**	**100.0%**	**3,867,540**	**59%**

Note: These data refer mainly to post-consumer solid wastes. They do not include such categories as over-burden, mining wastes and gaseous discharges (carbon dioxide is the single largest waste by weight in industrial economies). See methodological appendix for details on how numbers were estimated.

Sources: Authors' calculations based on data from Metro Vancouver, the Capital Regional District, the Columbia Shuswap Regional District, the District of Squamish and BC Stats.

There are three major sources of solid waste (i.e., all discarded materials, including garbage, recycling and compost). In Metro Vancouver, these sectors break down as:[4]

- Homes: Single- or multi-family residential buildings account for about 30 per cent of total *waste generation* (that is, recycling and composting, as well as disposal), and 39 per cent of *waste disposal* (landfills and incineration only).
- Offices and workplaces: Called industrial, commercial and institutional (ICI), this sector accounts for 20 per cent of generation and 31 per cent of disposal.
- Construction and demolition: The C&D sector accounts for 50 per cent of generation and 30 per cent of disposal. (We look in detail at this often-overlooked sector in Section 5.)

On a per-person basis, the BC government estimates that, in 2018, BC-wide disposal (i.e., waste remaining after recycling and composting programs) was 544 kg. The BC government has set a target to reduce this amount to 350 kg per person.[5]

Landfills and incineration

In many jurisdictions, incineration has raised important environmental justice issues, as low-income and visible minority households are disproportionately burdened by living near the incinerators, with adverse impacts on health.

For most of BC's history, and for most of the province outside of Metro Vancouver today, waste management was and is landfilling. Since 1988, Metro Vancouver has operated an incinerator (called the Waste-to-Energy Facility, since the combusted waste generates electricity). That facility processes about 260,000 tonnes of waste per year, more than one-quarter of regional waste disposed (891,200 tonnes).[6] The remainder of Metro Vancouver's waste goes to the landfill in Delta, BC, private landfills (for some construction and demolition materials) and out-of-region landfills. The rest of the province uses landfills, usually in local regions, but sometimes out-of-province.

Incineration has appeal 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 near the incinerators, with adverse impacts on health.[7]

Our 2013 report was highly critical of Metro Vancouver's Integrated Solid Waste and Resource Management Plan, which put a high priority on new incineration capacity to divert material waste from landfills and to generate energy. This focus undermined zero waste goals by simultaneously diverting organizational capacity and funds from additional work on zero waste actions. Although new waste incineration capacity appears to be off the table for the time being, at the Burnaby incinerator site there is a push to connect waste heat to a nearby neighbourhood through a district heating system (and thereby replace the now-defunct Norampac mill as a

4 Metro Vancouver. *Recycling and Solid Waste Management, 2018 Report*. Vancouver: Metro Vancouver, 2018. http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/2018_Annual_Recycling_and_Solid_Waste_Management_Summary.pdf.

5 Government of British Columbia. "Zero Waste & the Circular Economy." Accessed October 2020. https://www2.gov.bc.ca/gov/content/environment/waste-management/zero-waste.

6 Metro Vancouver. "About Metro Vancouver's Waste-to-Energy Facility." Accessed November 2020. http://www.metrovancouver.org/services/solid-waste/wte-and-disposal/waste-to-energy-facility/about/Pages/default.aspx.

7 Platt, Brenda et al. *Stop Trashing the Climate*. Washington, DC: Institute for Local Self-Reliance, 2008. https://ilsr.org/stop-trashing-the-climate/.

customer of the plant's waste heat).[8] If that were to occur, a decrease in waste flow or a closure of the facility (normally a good thing) could lead to a disruption of the energy system for customers. Financial repercussions have already been felt by Metro Vancouver with the loss of customers for its waste-based energy.

Even in terms of solid waste management, actual results of incineration are disappointing. The residue left to go to landfill from the incinerator in Burnaby has been estimated at 16 to 20 per cent of the original tonnage.[9] While the fly ash is disposed of as hazardous waste, more recently Metro Vancouver has been using the incinerator's bottom ash in concrete for its projects.[10] Because the composition of each load of bottom ash is unknown, this practice may be unsafe and does not conform to the precautionary principle—that preventative measures to protect health and the environment should be taken even if harms are not conclusively established scientifically.[11] In addition, analysis of Metro Vancouver data shows that even with the revenue from electricity sales, the operating costs for incineration are more per tonne than landfilling and capital costs are higher. GHGs per tonne processed are also higher than in landfills. Metro Vancouver's incinerator was BC's 24th largest single-facility source of GHGs in 2018.[12]

Backdoor incineration is also occurring in cement kilns, undermining the push for redesign of products and packaging that cannot be recycled. While *mixed* municipal solid waste would not get burned in cement kilns, there has been a significant increase in cement kilns accepting source-separated materials such as tires, mixed plastics and other materials to burn. Permitted pollution emissions for cement kilns are not as strict as for the Burnaby incinerator. This de facto waste incineration circumvents the process and standards for solid waste planning by regional districts and can pose a health risk.

Solid waste disposal has remained the same from 2010 until 2018, while we recycle and compost higher amounts of materials. This shows the need to focus on action beyond recycling toward reduction, repair and re-use.

Recycling

Over the past few decades, new systems have been implemented to divert materials away from landfills and incineration, and back into economic life. Recycling and composting programs have been successful in increasing the share of waste diverted from landfills and incineration, an increase to 59 per cent in 2018 from 43 per cent in 2010.[13] Nonetheless, total waste generation rose from 4.8 million tonnes in 2010 to 6.6 million tonnes in 2018. Essentially solid waste disposal has remained the same from 2010 until 2018, while we recycle and compost higher amounts of materials. This shows the need to focus on action beyond recycling toward reduction, repair and re-use (as discussed in Section 3).

8 Metro Vancouver. *2020–2024 Financial Plan*. Burnaby: Metro Vancouver, 2019. http://www.metrovancouver.org/services/financial-services/programs-budget/BudgetPublications/2020-2024_Financial_Plan.pdf.

9 Metro Vancouver. *2019 Biennial Report Integrated Solid Waste and Resource Management Plan*. Burnaby: Metro Vancouver, 2020. http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/2019ISWRMPBiennialReport.pdf.

10 Seccia, Stefania. "Burnaby incinerator fails several toxicity tests." *Burnaby Now*, September 13, 2013. https://www.burnabynow.com/news/update-burnaby-incinerator-fails-several-toxicity-tests-1.623832.

11 ScienceDirect. "Precautionary Principle." From Reference Module in Earth Systems and Environmental Sciences, 2013. Accessed August 10, 2021, https://www.sciencedirect.com/topics/earth-and-planetary-sciences/precautionary-principle.

12 Based on data from Government of BC. "Industrial facility greenhouse gas emissions." 2018. https://www2.gov.bc.ca/gov/content/environment/climate-change/data/industrial-facility-ghg.

13 2018 data are from the calculations noted in Table 1 and Appendix 1. 2010 data are from *Solid Waste Generation in British Columbia 2010–2025 Forecast*. Victoria: Government of British Columbia, 2012. https://www2.gov.bc.ca/assets/gov/data/statistics/nature-environment/solid_waste_generation_2010_2025.pdf.

Recycling collection occurs via curbside services, depots and other methods specific to certain products. Binners—people who collect recyclable containers with refundable deposits—are also an informal but important part of the urban collection sphere.[14] The social enterprise, United We Can, in Vancouver's Downtown Eastside, reports processing more than 24 million beverage containers per year, a cash value of $2 million in deposits, and their recycling depot supports 120 full- and part-time jobs, with 600 to 700 binners collecting containers.[15]

Recycling in BC is increasingly regulated by Extended Producer Responsibility (EPR) frameworks. EPR is rooted in the "polluter pays" principle, with producers required to create systems for post-consumer collection and sorting of materials for resale back into the marketplace (which can be global in scope). Broad policy terms are set out in the 2009 Canada-wide Action Plan for EPR from the Canadian Council of Ministers of the Environment (CCME).[16] BC is ahead of other provinces with 19 EPR programs in place,[17] and is proposing to develop several new EPR programs.[18]

For some municipalities that made the switch to Recycle BC, this transition has led to higher-paying unionized jobs replaced by externally contracted and lower-paying non-unionized jobs.

The longest-running EPR program is for beer bottles and cans, managed by the BC Brewers' Recycled Container Collection Council. This familiar deposit-and-return program predates the term EPR and includes re-use of beer bottles, which are re-used about 15 times before being recycled into new bottles. This refill model is the gold standard for the types of reforms emphasizing re-use that we discuss later in the paper, although we note that represents only 7 per cent of total sales.[19] Cans are just recycled back into new cans, but still in a closed loop as metals can be recycled continuously. Other non-alcoholic beverage containers with deposits (cans, glass and plastic) are handled by Encorp Pacific, which has depots across the province and drop-off bins on the street. This system has also largely been successful in collecting beverage containers, although it is limited to recycling not re-use.

The largest EPR program is Recycle BC, which began in 2014 (as Multi-Material BC) with responsibility for the collection of residential packaging and printed paper, also known as "blue box" curbside recycling that was previously collected by some municipalities. This was a major structural shift in the provincial curbside recycling system, with widespread impacts for municipalities, businesses and workers, and raising broader public interest considerations like accountability and oversight. Municipalities can choose to collect their own recycling or receive a take-it-or-leave-it "incentive" from Recycle BC to do collection. For some municipalities that made the switch to Recycle BC, this transition has led to higher-paying unionized jobs replaced by externally contracted and lower-paying non-unionized jobs. In the City of Vancouver, union representation,

14 McIntyre, Gordon. "Binners' Project: Record earnings while keeping neighbourhoods clean." *The Vancouver Sun*, June 18, 2020. https://vancouversun.com/news/binners-project-record-earnings-while-keeping-neighbourhoods-clean/wcm/ba4d3c5d-aa0c-4a01-ae8e-c217615b64d8/.

15 United We Can. "Services." Accessed June 2020. http://www.unitedwecan.ca/services.

16 Canadian Council of Ministers of the Environment. *Canada-Wide Action Plan For Extended Producer Responsibility*. Winnipeg: Canadian Council of Ministers of the Environment, 2009. https://ccme.ca/en/res/cap-epr_e.pdf.

17 See list on Recycling Council of BC website: https://www.rcbc.ca/content/epr-programs-summary. EPR programs include paints and paint containers, solvents, flammable liquids, residential fluorescent lamps, cell phones, computers and various types of e-waste, used oil and oil containers, oil filters, tires, pharmaceuticals, batteries, mercury-containing thermostats and pesticides, antifreeze, small appliances, smoke detectors, a host of other electric products, and residential packaging and printed paper.

18 This includes mattresses, additional hazardous products including syringes and propane canisters, and more electrical products including electric vehicle batteries and solar equipment. Government of British Columbia. "Province approves local bans, takes action on plastics." September 2020. https://news.gov.bc.ca/releases/2020ENV0051-001715.

19 BC Brewers' Recycled Container Collection Council. Annual *Report to the Director*. Mississauga: BC Brewers' Recycled Container Collection Council, 2019. https://envirobeerbc.ca/wp-content/uploads/2020/06/BRCCCs-2020-Annual-Report-to-Ministry-Covering-2019-Calendar-Year.pdf.

through a strong collective agreement with the Canadian Union of Public Employees local 1004, helped ensure affected workers were transitioned through a Labour Adjustment Plan to other engineering services.[20] In other municipalities where non-unionized workers may have been affected, we do not know whether they were rehired under the new system. This history points to potentially challenging labour transitions (more on this in Section 6).

Like all the BC EPR programs, Recycle BC is governed by the producers. Recycle BC has a four-person board that includes the large transnational corporation Unilever, Canadian grocery giant Loblaws, BC's Save-on-Foods (owned by billionaire Jimmy Pattison) and the international consultancy Deloitte. In reality, Recycle BC comprises almost 1,200 producers for whom it is able to charge fees based on the amount and type of packaging and printed paper produced. A large number of smaller producers have been exempted, and large newsprint companies notably refused to join the program. Because materials from those small producers are also collected, the reported statistics on the recovery rate of materials is artificially high.[21]

Even in materials management, Recycle BC has not lived up to its potential. There has been essentially no effort put into the redesign, as had been the central idea behind EPR, with the emphasis purely on achieving better economies of scale in recycling. BC regulations have also failed to drive such innovation. Recycle BC is also making hard-to-recycle plastics into engineered fuel to burn despite a commitment not to burn materials.[22, 23]

Recycle BC has a four-person board that includes the large transnational corporation Unilever, Canadian grocery giant Loblaws, BC's Save-on-Foods (owned by billionaire Jimmy Pattison) and the international consultancy Deloitte.

In June 2020, Recycle BC switched its contract for post-collection processing of materials to Green For Life (GFL) Environmental, a large corporation with North America-wide operations. The previous contract with Green by Nature (a consortium of Merlin Plastics, Cascade Recycling and Emterra Environmental Services) to process materials after collection included a restructuring of materials handling infrastructure across BC and a new $20 million container recovery facility that sorts materials into eight different materials for sale to end markets.[24] Such gains in local processing may now be lost to continent-wide systems via GFL Environmental.

Other EPR programs are for specific products, so separate systems have been implemented and tailored to those products. For example, many pharmacies collect pharmaceuticals and there are depots to return light bulbs. These different collection systems require a high level of consumer awareness and willingness to expend time and effort to return a product properly.

As with Recycle BC, other EPR programs have not encouraged significant redesign of products and packaging. A central challenge for these programs is that BC represents a relatively small market in the global marketplace, and e-commerce is also complicating matters around materials coming into the province. Costs for complying with EPR programs are low compared to other aspects. Because we measure waste by weight, lightweight materials are easy to overlook in spite of their problems.

The sole *regulated* target of BC's Recycling Regulation is to recover (i.e., collect) at least 75 per cent of products, but there are no set targets for reduction, re-use, repair, product lifespans,

20 Canadian Union of Public Employees local 1004. "Members Update." September 2016. https://cupe1004.ca/category/updates/.

21 The total amount produced is limited to what is reported by the members of Recycle BC, whereas the amount of recycling collected includes materials produced by non-members.

22 Recycle BC. *2019 Annual Report.* North Vancouver: Recycle BC, 2020. https://recyclebc.ca/wp-content/uploads/2020/06/RecycleBC2019-Final.pdf.

23 Recycle BC. "Multi-Material BC committed to recycling, not incineration." 2014. Accessed March 2021. https://recyclebc.ca/multi-material-bc-committed-to-recycling-not-incineration/.

24 Lantz, Daniel and Allen Langdon. "One province, one system." *Resource Recycling*, January 2017. https://resource-recycling.com/recycling/2017/02/06/one-province-one-system/.

awareness nor recycling. As such, the programs to date have focused on collection over these other aspects. For such problematic areas, more stringent regulations and bans need to be put in place (e.g., plastic bag and straw bans are a good start). The 2009 CCME action plan stresses that EPR alone is not sufficient and complementary regulations and policies are needed, including disposal bans, restrictions on toxic substances, green procurement, and other guidelines and environmental performance agreements.[25]

NEXT STEPS FOR BETTER RECYCLING

In the next section, we push for more aggressive reduction, re-use and repair policies to reduce the overall amount of waste generated. That is, we want a more fundamental shift to dramatically reduce the throughput of materials in our economy. Before we move "beyond recycling" we consider some steps to improve and deepen recycling markets. In particular, some aspects of collection and processing should be treated as a public utility that is regulated to ensure high-quality, equitably accessed and fairly priced service across BC.

We want a more fundamental shift to dramatically reduce the throughput of materials in our economy.

Develop a Crown corporation for zero waste. To get to a more closed-loop, localized recycling system that supports an economy with much lower material throughput (including re-use and repair), it may make more sense to consider some aspects of collection and processing as a Crown corporation or a public utility regulated to ensure high quality, equitable service across BC. A Crown corporation could be funded by EPR programs to ensure higher levels of collection in support of a more coherent collection system. Because most EPR programs rely on consumers to return the product in a particular way or to a specific location, this requires a high level of awareness about what can be returned and where—and the default may often just be the trash. A Crown corporation could help in several respects:

- Coordinate community-level collection depots (including rural areas) where all recycling not currently picked up at curbside could come to be collected and sorted, while repaying deposits. One-stop resource recovery depots could also include long-lived products that are bulky (e.g., mattresses), complex (e.g., electronics) or need special handling (e.g., batteries, tires).
- Create a more effective and easy-to-use collection system for bins on the street and in public and private buildings. In particular, these would benefit from standardization of receptacles (e.g., consistent colour-coding and signage) across all settings.
- Take up collection responsibilities for BC government operations and hard-to-serve rural areas, and provide competition to private collection companies when it is time for the renewal of contracts with municipalities and the ICI sector.

Create local markets for recycled materials. The BC government should implement a "step code" of increasingly stringent minimum recycled content requirements to increase demand. The BC government is also failing to leverage its own large presence to help shape purchasing decisions across government, as well as managing recycling and waste on the other side. A coordinated approach across all of government could use aggregated procurement policies to drive demand for recycled materials that would be collected by the new Crown corporation. This could be integrated with policies to ban materials that do not fit into this system (such as single-use plastic films) or adding a tipping fee surcharge for disposal in landfills to spur recycling activities.

25 Canadian Council of Ministers of the Environment. *Canada-Wide Action Plan For Extended Producer Responsibility*.

Raise the bar for EPR programs. Outstanding categories under the Canada-wide Plan for EPR need to be regulated, including packaging and printed paper (offices and commercial buildings), textiles, furniture, and construction and demolition materials.

The provincial government should add more stringent requirements for EPR programs including:

- Higher targets for product-subcategory-specific collection targets, consumer awareness and access to collection. As appropriate, add targets for reusable and refillable products, and incentives to eliminate packaging.
- Reduce, re-use and repair goals, including program- and product-specific targets for local processing and warranties. These could serve to dramatically increase the market share of reusable or refillable products, especially those with a single owner and a short lifespan. Economic incentives, such as the proven deposit-and-return system, or other measures could be mandated where collection rates lag. Programs should fund innovation.
- Ban products and packaging materials from incinerators and cement kilns, and reject using plastics to make fuel. Fines for materials not recovered and producers to pay the full costs for the services.
- Better labelling 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, labelling would be standardized on a national basis.
- More stringent reporting requirements. Data gathering across BC from EPR program-funded waste composition audits.
- High labour standards to ensure that the programs result in decent jobs with fair compensation, and systems to allow participation in programs by a broader array of service providers (including private sector ones) as long as they meet the standards.
- High environmental standards and consideration of other social benefits and impacts. Differential fees based on environmental performance would be applied based on factors such as repair availability, warranty length, energy use, lifecycle GHG emissions, upstream environmental impacts, ease of recycling and disassembly, and type of materials used.
- Broadening of the membership of boards of non-profit stewardship organizations to include stakeholder groups beyond industry participants. Programs are fully managed by producers (often board members are not even residents in BC) and so lack any insight or oversight from consumers, local governments, workers or NGOs.

The BC government is also failing to leverage its own large presence to help shape purchasing decisions across government, as well as managing recycling and waste on the other side.

Composting

Organic materials consist of yard trimmings, clean wood items, food-soiled paper, and edible and inedible food. In Canada, approximately 5.6 million tonnes of organic waste are generated each year, of which 4.3 million tonnes are disposed of in landfills or incinerators.[26] Organic materials make up approximately 40 per cent of the waste stream in BC jurisdictions.[27] While we focus on

26 National Zero Waste Council. *Food Waste Management + Climate Action: National GHG Reduction Potential.* Burnaby: National Zero Waste Council, 2017. http://www.nzwc.ca/Documents/FoodWasteClimateChange-Report.pdf.

27 Ministry of Environment and Climate Change Strategy. "Prevent Food Waste." Accessed March 2020. https://www2.gov.bc.ca/gov/content/environment/waste-management/food-and-organic-waste/prevent-food-waste.

organic materials below, we also note pervasive packaging and plastic wraps accompanying much of our food, including takeout containers and supermarket products (see Section 4 on the Plastics Predicament).

Conversion of organic materials into compost has a myriad of benefits, including stormwater management, water conservation, erosion reduction, plant disease suppression and overall soil health. It can be used for farm and ranch land, mine and contaminated soil remediation, civic landscapes and roadside applications. There is also growing awareness of the importance of storing carbon in the soil, also known as carbon sequestration. Carbon-rich soil is essential for healthy crops; a recent University of BC study found that soil organics carbon has dropped more than 60 per cent in the Fraser Valley over the last 30 years.[28] Use of compost mitigates climate change and creates thriving, more resilient landscapes.

Use of compost mitigates climate change and creates thriving, more resilient landscapes.

Significant progress has been made on organics management in BC in the last decade. City-wide composting now complements recycling collection in many BC cities. Backyard and other on-site, mid-scale composting help to reduce the overhead costs of composting and to keep the materials local, but this is not necessarily an option for multi-unit buildings, nor for woody and other organic materials that do not decompose as quickly, nor for items that can cause pest issues if not managed diligently.

Organics can be collected through various programs at the residential and commercial level to be processed on-site or at a local facility (either a composting or anaerobic digestion site). The resulting processed soil amendment products have different uses depending on their content and quality (e.g., landscaping, construction, gardening or agriculture). Organic material can also be used to generate energy through anaerobic digestion, although preventing waste in the first place and converting organic material into compost remain key to emissions reductions.[29]

Supporting organics management across the food waste reduction hierarchy is critical for optimizing food waste avoidance while processing remaining inedible parts at various scales. Establishing food waste reduction targets and measuring progress toward those targets is critical to moving the needle on food waste. BC is part of the Pacific Coast Collaborative (PCC), a group of West Coast provincial, state and municipal partners who have committed to reducing food waste by 50 per cent by 2030.[30]

The BC government established a target of 75 per cent of BC's population being covered by organic waste disposal restrictions by 2020. To date approximately 64 per cent of the population (e.g., Metro Vancouver, the Capital Regional District and the Regional District of Nanaimo) lives in regions with organic disposal bans in place, while others, including Fraser Valley, Cowichan Valley and North Okanagan, have similar bylaws approved but have not yet fully implemented changes.

Many BC jurisdictions offer subsidized home composters and aerators, and some provide how-to workshops. There is also interest in on-site and community-scale composting systems in many regions. On-site organics management systems can be particularly advantageous in commercial settings and there are several ways to store, reduce volume, compost, and even use anaerobic

28 Paul, S.S., et al. "Tracking changes in soil organic carbon across the heterogeneous agricultural landscape of the Lower Fraser Valley of British Columbia." 2020. https://www.sciencedirect.com/science/article/abs/pii/S0048969720325110.

29 Digestate produced through anaerobic digestion still needs a secondary process with additional carbon added to create compost.

30 Pacific Coast Collaborative. "Help Us Cut Food Waste in Half By 2030." Accessed August 10, 2021, https://pacificcoastcollaborative.org/food-waste/.

digestion processes at a smaller scale. Food rescue initiatives to manage surplus food items across the supply chain have gained popularity.

Jurisdictions with residential food scraps collection have had significant success in reducing food going to landfill. For example, in Metro Vancouver, jurisdictions found that garbage tonnage went down by an average of 33 per cent when food scraps collection programs were established with weekly "green bin" and every-other-week garbage collection.[31] It is more challenging for BC's rural communities to build a business case for organics collection and they more frequently have yard trimming drop-off depots, encourage residents to home compost and rely on smaller-scale organics processing systems.

BC's organics processing facilities primarily consist of composting facilities that use static piles and windrow systems to process commingled yard trimmings and food scraps. They are regulated under the BC Organics Material Recycling Regulation (OMRR), although there is concern from stakeholders that the regulation is not implemented and enforced sufficiently. Many of the Lower Mainland's larger compost facilities have struggled with odor issues as the amount of food scraps captured has increased. At least one facility has closed as a result and some collected organic materials are going to more remote facilities. In 2017, Surrey established a facility that generated renewable natural gas as well as finished compost. Other bio-digesters serve agricultural communities and are able to accept small amounts of cleaner pre-consumer food scraps.

To support organics processing infrastructure in BC and meet the CleanBC commitment to help communities achieve 95 per cent organic waste diversion, the BC government has created an Organics Infrastructure Program with $30 million to invest in composting and anaerobic digester facilities. Diversification of organics processing facility types using an integrated approach to prevent food waste and use smaller-scale systems as well as larger-scale facilities will be key to supporting BC's ongoing organics management.

NEXT STEPS FOR ORGANICS AND COMPOSTING

Because of the weight of organic materials and compost, management is more inherently local. Public policy should aim to shrink food waste while deepening local demand for finished compost.

Set rigorous food waste reduction and organics capture targets. Establishing food waste reduction targets, measuring progress toward those targets, and holding regional districts accountable through solid waste management plans is critical to moving the needle to reduce wasted food. BC should adopt food loss waste reduction targets[32] and a comprehensive program for food waste prevention across sectors with measurement and accountability built in.

Use education, monitoring and enforcement to reduce food waste and diversify how food scraps are managed across sectors. Expand food waste avoidance and organics capture using robust behaviour change programs that integrate social marketing, required source separation bylaws and enforcement. Compliance for capturing organics from offices and commercial and institutional buildings should also be fully implemented and regulated.

Compliance for capturing organics from offices and commercial and institutional buildings should be fully implemented and regulated.

31 Pitre, Marcel. "Single Family Every-Other-Week Garbage Collection - Status Update." From Agenda Item 5.5 for GVRD Zero Waste Committee, April 7, 2016. http://www.metrovancouver.org/boards/ZeroWaste/ZWA-April_14_2016-Agenda.pdf.

32 Such as stated in United Nations Sustainable Development Goal 12.3, https://sdgs.un.org/goals/goal12.

Develop comprehensive organics processing infrastructure. Land use management plans should be aligned to foster local and regional composting efforts, from home and community composting to larger infrastructure development.[33] Improved collection and processing infrastructure should be part of the mandate of our proposed zero waste Crown corporation. Composting programs should be supported by a province-wide organics disposal ban by 2030.

Strengthen end-market development for finished compost. End-market development to optimize use of finished compost is also a critical component of organics management. Public sector procurement policies can play a pivotal role in mandating and promoting the use of compost (e.g., construction projects, land development, roadside stabilization, civic landscapes).

33 The Institute for Local Self Reliance sets out a "hierarchy to reduce food waste and grow community" starting with reduction of food waste and rescue of food, then smaller, local solutions before larger interventions and infrastructure. Platt, Brenda. "Hierarchy to Reduce Food Waste & Grow Community." April 4, 2017 https://ilsr.org/food-waste-hierarchy/.

Beyond recycling

MUCH OF WHAT WE CALL RECYCLING IS, IN FACT, less desirable "downcycling," 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). While downcycling plastics is an improvement over incineration, it ultimately creates waste because after several cycles the degraded materials can no longer be recycled. For paper products, downcycling is the norm, as fibre length and strength diminish with each use (the material ultimately can be composted).

We can do better by moving up the pollution prevention hierarchy (Figure 1 shows our version). In BC there is much scope for an innovation agenda around dematerialization, re-use, and repair/maintenance by moving up the hierarchy toward redesign, reduction and re-use to shrink material throughput. Developing the economy based on these ideas would contribute to improving the efficiency of materials use while maintaining a high standard of living.

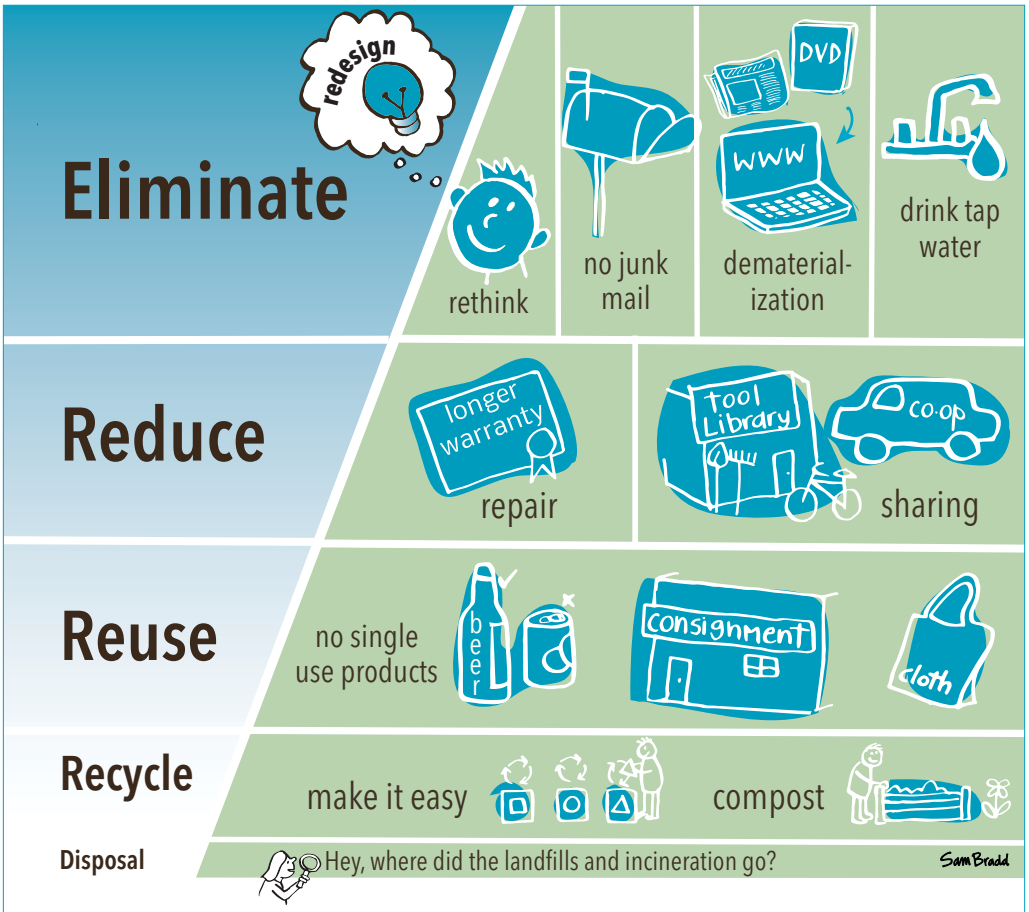
In BC there is much scope for an innovation agenda around dematerialization, re-use, and repair/maintenance by moving up the hierarchy toward redesign, reduction and re-use to shrink material throughput.

Eliminating materials

Dematerialization—digital music, video, books and magazines, for example—represents a pure reduction in materials to support essentially the same consumption. These electronic substitutes are now well established, although it is important to note discrepancies across households in terms of internet access. And there is still some resource cost in terms of energy used for digital transactions, which should be factored in (consider Google's vast server farms). While phone books and the Yellow Pages have generally become objects of the past, "junk mail" advertising and fundraising appeals are subsidized by low postal rates and increasingly include all manner of unsolicited greeting cards, pens, socks and gloves, and free local newspapers still circulate.

Some of these changes merely involve going back to the past. Tap water in BC is among the best in the world, so in the vast majority of BC communities, there is no need for bottled water sold in plastic that is rarely recycled. Better testing of tap water to ensure it meets standards could be helpful to assure public confidence. A ban on plastic straws has been enacted in Vancouver with some businesses choosing to eliminate the straw while others use paper-based alternatives.

Figure 1: Getting to zero waste



Source: Infographic by Sam Bradd from Lee, Marc et al. *Closing the Loop: Reducing Greenhouse Gas Emissions and Creating Green Jobs through Zero Waste in BC*. Vancouver: Canadian Centre for Policy Alternatives, 2013. https://www.policyalternatives.ca/publications/reports/closing-loop. Design adapted in 2021.

Sharing underused products decreases resource consumption, but can also foster community-building and trust.

Collaborative consumption,[34] or sharing, is another practice that has been around for a long time, with public libraries being a prime example. The growth of car-sharing options in Vancouver has been notable, including point-to-point service, Evo, and the car co-op, Modo, while the bike-sharing service, Mobi, offers another shared transportation option. Some communities are building on this idea with pocket libraries for books and toys, and shared garden equipment sheds. The Vancouver Tool Library allows residents access to a range of tools for tasks ranging from bicycle repairs to garden maintenance. Spool of Thread Sewing Lounge is a small business in East Vancouver, which provides its patrons with the space, machines and materials required for sewing. The Thingery, a cooperative lending library of a wide range of tools, furniture, outdoor equipment and other accessories, has three locations in Metro Vancouver.

These services exempt their members and patrons from the need to each *individually* purchase, possess and maintain their own tools. Sharing underused products decreases resource consumption, but can also foster community-building and trust. In addition, re-use websites like Craigslist target the exchange of reusable goods, and some small-scale geographic hubs are also worth

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

note, such as Freecycle.org and many community-specific Facebook sites. Some waste drop-off sites in regional districts, such as "share sheds" in the Cariboo Regional District, have their own "free stores" where people drop off items and pick what they want. The Re-Use-It Centre and the Re-Build-It Centre in Whistler (run by Whistler Community Services Society) are also good examples of physical sites for these services that fund community programs.

Re-use and refilling

Excessive packaging has become the norm—people have become accustomed to buying products with varying degrees of packaging. To date, companies have not had to design their products and packaging with re-use in mind, and relying only on a recycling model has major limitations.

Glass in the secondary market has little resale value. To be recycled it must be clean and separated by colour—mixed-colour glass is not recycled into new glass but turned into aggregate. However, glass has great potential for container re-use, as is the case for much of the wine and beer in BC and Europe. While some have argued that heavier glass leads to greater transportation emissions than plastic containers, this argument only makes sense when transporting over large distances. A more local approach to reusable glass containers does not pose a large carbon cost.

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 compelling historical example is beer bottles. Refillable beer bottles can be reused up to 15 times before being broken up and recycled, and because of deposit-and-return systems there is a very high collection rate.[35] Avalon Dairy uses refillable bottles for milk, but most other beverage containers, whether glass or plastic, are not refilled. Requiring refillable beverage containers would save the energy costs of producing a new bottle for each beverage. There are also examples of reusable mug share programs. Most containers and packaging for everyday use could be redeveloped along these lines.

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, polystyrene (Styrofoam) food packaging and plates, and plastic bags. The future is closer to what can be seen from Vancouver retailers such as Nada and The Soap Dispensary, which sell products only in reusable and refillable containers, or through the reusable packaging company Loop.[36] Vancouver's Famous Foods recently began a pilot using a vending machine to dispense liquid soap and detergent.[37] More of these types of options are popping up in many BC communities including Kamloops, Victoria, Whistler, Vernon, Fernie, Kelowna and others.

Cultivating re-use markets could also build on models of re-use in BC and elsewhere. The Share Reuse Repair Initiative is working in the Metro Vancouver area to prevent waste, support lighter living and enable circular innovation.[38]

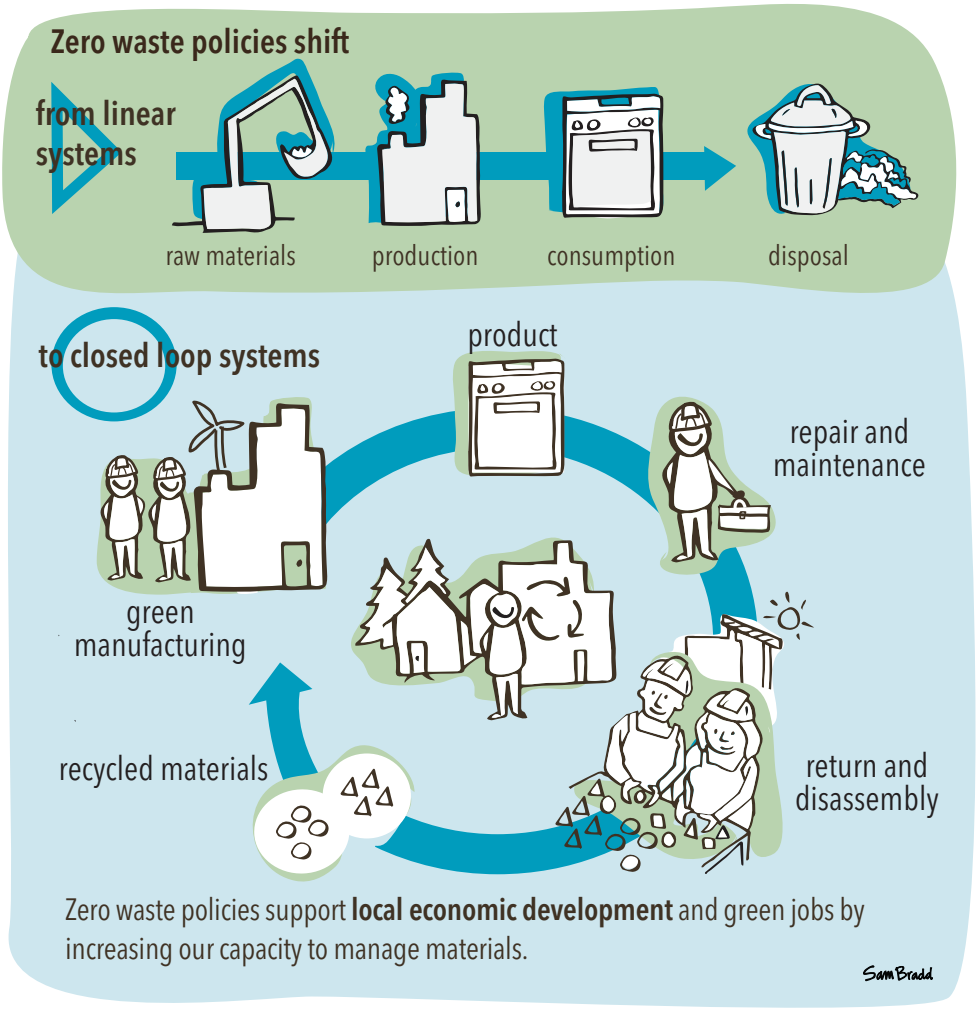
35 BC Brewers' Recycled Container Collection Council. "The Good News." Accessed March 2021. https://envirobeerbc.ca/the-good-news/.

36 While Loop may contribute to a norm-shift toward reusables, the company is also working mostly with large, multi-national brands, many of which still employ resource-intensive, extractive and exploitative methods to produce their goods. See Peters, Adele. "Giant brands love Loop's zero-waste packaging—and now it's coming to a store near you." *Fast Company*, Feb 10, 2020. https://www.fastcompany.com/90460018/giant-brands-love-loops-zero-waste-packaging-and-now-its-coming-to-a-store-near-you.

37 Laborie, Aurore. "Vancouver startup sets up first zero-waste refill vending machine in city." *Daily Hive*, February 8, 2021. https://dailyhive.com/vancouver/startup-zero-waste-vending-machine.

38 Share Reuse Repair Initiative. Accessed March 2021. https://www.sharereuserepair.org/.

Figure 2: Shifting to closed-loop systems



Source: Infographic by Sam Bradd from Lee et al. *Closing the Loop*, 2013. Design adapted in 2021.

An innovation agenda for BC could focus on developing a supportive regulatory framework for the re-use of quality goods and refillable systems. Re-use within the same systems is much more controllable than recycling markets. Three levels of re-use are relevant: using within your own system (kitchen or restaurant, dishes); working with community and vendors to provide reusable containers and packaging; and, sending it somewhere else for another use where it may not be clear what happens (more like recycling, where we do not know what is kept and what is disposed).

In 2018, the Kijiji Second-Hand Economy Index ranked BC as the highest with 86 per cent of British Columbians participating with an average of 99 transactions a year, and the report notes

Table 2: Estimated re-use in Metro Vancouver in 2018

Material category	Annual re-use rounded value (to nearest 100 tonnes)
Textiles and accessories — sold	22,000
Textiles and accessories — industrial wipes	6,700
EPR programs	22,400
Food	2,900
Hotels and hospitality sector	900
Office furniture	1,200
IT equipment	1,300
Construction/demolition materials	4,900
Online for selected materials	25,800
Total	**88,100**

Source: Metro Vancouver. *2019 Biennial Report Integrated Solid Waste and Resource Management Plan*. Burnaby: Metro Vancouver, 2020. http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/2019ISWRMPBiennialReport.pdf.

the second-hand economy has been growing.[39] Metro Vancouver estimates that 88,100 tonnes of materials were reused in the region in 2018.[40]

Repair and maintenance

Repair and maintenance need to be scaled up toward giving much longer life to products that require large amounts of energy and GHG emissions to be produced. Commonplace in the past, 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. Another factor is planned obsolescence: some products do not last as

39 Chan, Cheryl. "BC tops in second-hand economy, according to new report." *Vancouver Sun*, November 4, 2019. https://vancouversun.com/news/local-news/b-c-tops-in-second-hand-economy-according-to-new-report.

40 Metro Vancouver. *2019 Biennial Report Integrated Solid Waste and Resource Management Plan*. Burnaby: Metro Vancouver, 2020. http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/2019ISWRMPBiennialReport.pdf.

long as their predecessors because of design choices that make many products harder to fix, even if parts are available.

An interesting example of repair economics is Free Geek in Vancouver, which takes computers, even if not working well, and refurbishes them. It also aims to teach people how to refurbish and use computers and it has a system where volunteers can work to earn their own computer. Repair cafés that bring together knowledgeable volunteers with people with items needing repair are becoming more common across BC. There are also more websites like ifixit.com that share manuals and instructions for how to repair items.

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. 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.

One important way of re-establishing repair and maintenance markets could be to require much longer warranties on products. Extended standard manufacturing warranties could also encourage the diffusion of business models based on renting and leasing, rather than owning.

Extended standard manufacturing 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 (e.g., perfectly good cell phones and tablets 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. With direct ownership, 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 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.

The Right to Repair movement is growing in Canada, and in the EU it has been successful in getting regulation changes where washing machines, dishwashers and fridges must have spare parts available for seven to ten years, spare parts must be delivered within 15 days and repair information must be made available to professional repair people.[41] In Austria, they are moving to provide incentives for repair like not taxing repair services and providing a "repair bonus" to fund part of the repair, and Vienna is funding a repair network.[42] In France, a bill was proposed to give electronics a score on repairability, with information on the price of spare parts, a requirement for how long they are available and a legal delivery time.[43] In Norway, most consumer electronics have a five-year warranty and the UK has plans to require manufacturers to tell consumers how long software will be supported for.[44] Similar steps in BC could significantly help extend product lifespans.

41 European Commission. "The new ecodesign measures explained." October 1, 2019. https://ec.europa.eu/commission/presscorner/detail/en/qanda_19_5889.

42 Right to Repair EU. "Austria Makes Repair More Affordable." September 22, 2020. https://repair.eu/news/austria-makes-repair-more-affordable/.

43 Right to Repair EU. "Major steps for durability and Right to Repair taken in France." January 6, 2020. https://repair.eu/news/major-steps-taken-for-durability-and-right-to-repair-in-france/.

44 Right to Repair EU. "Right to Repair is blossoming all over Europe." June 25, 2020. https://repair.eu/news/right-to-repair-is-blossoming-all-over-europe/.

The plastics predicament

GLOBALLY, PLASTICS ARE BEING PRODUCED AND WASTED AT AN ALARMING RATE. Of the estimated 8,300 million tonnes of plastics produced since 1950, around half was manufactured from 2002 to 2015.[45] According to a recent national study by Deloitte, approximately 4.7 million tonnes of plastics are introduced to the Canadian market on an annual basis (more than 125 kg per capita), with half of plastics produced for short-lived or single-use applications. Packaging, construction and automotive uses accounted for 69 per cent of plastic end-use.[46]

The good news is that societal awareness of the negative environmental consequences of plastic waste has grown substantially. Most of the focus has been on the impacts of plastics pollution on the marine environment, such as the widespread prevalence of microplastics in aquatic environments and harm to wildlife. More recent research is also showing risks to human health as microplastics become ubiquitous in the environment, such as its presence in food sources and soil. Microplastics have even been found in pristine natural areas due to wind and rain.[47] A recent federal science assessment of plastic pollution found that it "has been found on shorelines and in surface waters, sediment, soil, groundwater, indoor and outdoor air, drinking water and food. It has also been found in wildlife."[48]

One key contributor to the growth in plastics is light-weighting of packaging. Product manufacturers are shifting away from metal, glass and paper in favour of plastic containers and flexible packaging. These lighter packaging options have advantages in that they save shipping weight, but they are also less recyclable, more challenging to handle at the end-of-life and may leach chemicals. The benefits from lighter packaging materials accrue for producers who are shipping materials long distances, more so than for local producers.

One key contributor to the growth in plastics is light-weighting of packaging. Product manufacturers are shifting away from metal, glass, and paper in favour of plastic containers and flexible packaging.

45 Geyer, Roland et al. "Production, use, and fate of all plastics ever made." *Science Advances*, July 19, 2017. https://advances.sciencemag.org/content/3/7/e1700782.full.

46 Deloitte and Cheminfo Services Inc. *Economic Study of the Canadian Plastic Industry, Markets and Waste: summary report, prepared for Environment and Climate Change Canada.* Gatineau: Environment and Climate Change Canada, 2019. https://publications.gc.ca/collections/collection_2019/eccc/En4-366-1-2019-eng.pdf.

47 Simon, Matt. "Plastic Rain Is the New Acid Rain." *Wired*, June 11, 2020. https://www.wired.com/story/plastic-rain-is-the-new-acid-rain/.

48 Government of Canada. "Science assessment of plastic pollution." 2020. https://www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/science-assessment-plastic-pollution.html.

While plastics are labelled 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. If anything, the variety of resin types and grades make recycling a challenge as they do not mix. While some high-grade plastics are recycled in a closed loop (pop bottles, made from PET plastic, are the best example), most plastic is downcycled into different products, while other plastic types are bundled together for export or incineration. In fact, recycling rates for plastics are typically lower than any other consumer product. Deloitte found that in 2016 only 9 per cent of plastic was recycled, with 4 per cent incinerated, 86 per cent landfilled, and 1 per cent leaked into the environment.

Recycled resins reduce the amount of virgin plastics required, but the quality of recycled resins tends to be lower, and the product produced is often not as recyclable or must be downcycled (e.g., shopping bags made from PET bottles cannot be recycled). Furthermore, plastics made from post-consumer recycled plastics are often dyed black to mask the different colours from the different resins, but these black plastics cannot be sorted optically in material recovery facilities. While some solutions, such as switching to detectable black pigments, have been proposed, they are only voluntary guidelines.

Oil and gas companies see the use of petrochemicals to produce plastics as a future driver of demand, as the world switches to electric vehicles and reduces fossil fuel combustion for energy.

The use of plastics is forecast to increase if no steps are taken to minimize this growth. Oil and gas companies see the use of petrochemicals to produce plastics as a future driver of demand, as the world switches to electric vehicles and reduces fossil fuel combustion for energy. Some businesses have taken steps to reduce the use of plastic packaging through reducing unnecessary packaging or substituting plastic with other materials. While some companies, such as Amazon and Apple, have shifted to using primarily cardboard instead of polystyrene to pack their products, this may shift the environmental burden to forests, rather than emphasizing re-use. Moreover, these steps have been overshadowed by the surge in plastics production overall.

The plastics industry has started to produce more plastics with recycled resins or bio-based materials as a way to make the industry more sustainable. The bio-based plastics market has grown tremendously in the past few years and is anticipated to grow 22 per cent per year globally.[49] Like recycled resins, bio-based plastics reduce the reliance on fossil fuels to produce virgin plastics but may instead compete with alternatives like growing food. Bio-based plastics include those that are biodegradable, such as polylactic acid (PLA) derived from corn or thermoplastic starch (TPS) derived from starchy vegetables, and those that are not biodegradable such as Bio-PET. In response to the growing public concern about the impacts of plastics, many companies have made commitments to taking actions to address this, but it remains to be seen if this will result in meaningful change or is merely a public relations exercise.

In addition to bio-based plastics, there are also biodegradable and compostable plastics. In theory, biodegradable just means they break down under natural conditions into microplastics, but there is no certification nor standard for using the term biodegradable.[50] Compostable plastics that have been certified by a third-party agency (e.g., Biodegradable Products Institute) are expected to biodegrade in industrial composting facilities into soil amendment and oxygen. However, the standards used for testing (e.g., ASTM D6400) are typically lab-controlled conditions that are

49 Markets and Markets Research. *Bioplastics & Biopolymers Market by Type, End-Use Industry, Region – Global Forecast to 2025*. Pune: Markets and Markets Research, 2020. https://www.reportlinker.com/p03948154/Bioplastics-Biopolymers-Market-by-Type-Application-and-by-Region-Trends-Forecast-to.html?utm_source=GNW.

50 The Canadian Council of Ministers of the Environment Strategy on Zero Plastic Waste includes developing guidance on use of terms by 2021. Canadian Council of Ministers of Environment. *Canada-wide Action Plan on Zero Plastic Waste Phase 2.* Winnipeg: Canadian Council of Ministers of the Environment, 2020. https://ccme.ca/en/res/ccmephase2actionplan_en-external-secured.pdf.

rarely replicable at actual facilities, which may result in compostable plastics not breaking down, or not breaking down fast enough.

The federal science assessment also found that "although biodegradable, compostable, biobased, and oxo-degradable plastics are increasingly being used as alternatives to conventional plastics, there is a lack of significant evidence that they will fully degrade in natural environments."[51] Furthermore, compostable plastic products are almost indistinguishable from conventional plastic products and are often screened out as contamination at composting facilities. They can also contaminate the feedstock for recycling of regular plastics.

China's 2017 National Sword policy banned the import of 24 types of solid waste, including waste plastics, unsorted scrap paper and textiles.[52] Previously, about half of scrap plastics were imported by China. The ban thus represents a significant disruption in the recycling system, and it highlighted the high contamination rates and low recyclability of many of these material streams. Many "recyclables" were, in fact, so contaminated that they were not recyclable. Countries in Southeast Asia have increased their imports of scrap plastic, making pellets to sell to Chinese end-users.[53] Declines in global plastics markets may also drive increased incineration.[54]

In Canada, government action on plastic has been painfully slow, and most typically framed as improving recycling rather than reducing volumes flowing through the economy. Because of strong public support for reducing plastics, some new actions are underway, but they risk being undermined by industry lobbying. The federal government announced in 2020 plans to list plastics as a toxic substance in the Canadian Environmental Protection Act and ban some single-use plastics by 2021.[55] The Canadian Council of Ministers of the Environment has developed the Canada-wide Action Plan on Zero Plastic Waste, with actions on ten key areas including labelling, single use items, design, markets, recycling capacity, awareness, clean up and research.[56]

In Canada, government action on plastic has been painfully slow, and mostly typically framed as improving recycling rather than reducing volumes flowing through the economy.

In British Columbia, the CleanBC Plastics Action Plan includes some modest improvements, including bans on some kinds of single-use packaging, more recycling options for single-use items, expanding beverage container returns and preventing plastic waste.[57] These actions could have been much more aggressive in terms of bans, and much of their focus is on improved recycling without any mention of re-use and refilling opportunities to reduce the amount of plastics in circulation. The BC government committed to phasing out single-use plastics province-wide in

51 Government of Canada. "Science assessment of plastic pollution." 2020. https://www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/science-assessment-plastic-pollution.html.

52 Xinhua. "China announces import ban on 24 types of solid waste." *China Daily*, July 21, 2017. http://www.chinadaily.com.cn/china/2017-07/21/content_30194081.htm.

53 Staub, Colin. "Where exports displaced from China are finding a home." *Plastics Recycling Update*, January 17, 2018. https://resource-recycling.com/plastics/2018/01/17/exports-displaced-china-finding-home/.

54 Kinneman, Thomas. "China's garbage ban upends US recycling – is it time to reconsider incineration?" *The Conversation*, August 21, 2018. https://theconversation.com/chinas-garbage-ban-upends-us-recycling-is-it-time-to-reconsider-incineration-98206.

55 Government of Canada. *A proposed integrated management approach to plastic products: discussion paper*. Gatineau: Environment and Climate Change Canada, 2019. https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/plastics-proposed-integrated-management-approach.html.

56 Canadian Council of Ministers of Environment. *Canada-wide Action Plan on Zero Plastic Waste*. Winnipeg: Canadian Council of Ministers of the Environment, 2020. https://ccme.ca/en/res/ccmephase2actionplan_en-external-secured.pdf.

57 The BC government announced that it will raise the minimum beverage container deposit rate to 10 cents, will add dairy (and similar) beverages to the deposit-and-return program, will approve some municipal plastic bag bans, will change the Community Charter to allow more restrictions on single-use items, and will establish a framework for plastic bans. https://cleanbc.gov.bc.ca/plastics/.

its 2020 election platform.[58] Plastic accounts for a large share of garbage incinerated in Burnaby, and a Globe and Mail report noted that concrete manufacturer, Lafarge Holcim, is looking to burn plastic as fuel for its cement plant and kiln in Richmond.[59]

Also notable at the local level, in 2018 the City of Victoria passed a bylaw to reduce single-use plastic bags, and subsequent legal challenges resulted in the provincial government approving this ban and others, as well as developing a framework to accommodate more.[60] Later in 2018, the City of Vancouver passed a number of bylaws as part of its Single-Use Item Reduction Strategy. These bylaws include a combination of bans and fees to be rolled out from 2020 to 2021 on items such as foam cups and takeout containers, plastic straws, plastic utensils, plastic shopping bags and plastic cups.

Next steps

The eventual goal should be to substitute all plastics with non-toxic materials that can be reused for a long time before being recycled or composted.

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 and it needs to be properly managed. The eventual goal, however, should be to substitute all plastics with non-toxic materials that can be reused for a long time before being recycled or composted.

Ban single-use plastics altogether. People are ready to change the wasteful single-use culture associated with plastics, in favour of more bulk options, reusable containers and packaging, and fresh water. Care must be taken to ensure the switch is to reusable products and not another form of single-use product. Change the cultural expectations around disposability, convenience, health and sanitation through campaigns that bring in thought leaders and cultural players (i.e., marketing, media).

Cap the amount of virgin plastics that can enter the economy and set timelines for reduction to zero by 2050. Plastic manufacturers would then need to acquire the right to produce or import plastics and pass on any higher costs to consumers. Such an approach would value plastics more and treat plastic as a resource. This would also allow us to set priorities about where plastics are most beneficial (e.g., certain health-care applications).

Tax virgin plastics. The price of plastic should include associated environmental costs and resource management costs (disposal, recycling and re-use costs) at the outset. Higher prices would induce innovation and conservation in terms of consumers and industry and would level the playing field vis-à-vis recycled plastics. This could be part of deposit-and-return systems, so that each piece of clean plastic has value.

Streamline the number of plastics in circulation. A successful plastics recycling system would need to focus on a narrower range of resin types, source-separated after consumption. There would also be restrictions on certain contaminants like labels and inks. A more harmonized approach would make it easier for consumers and industry alike.

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58 BC NDP. "Platform: Tackling Climate Change, Protecting Nature." 2020. https://www.bcndp.ca/platform#pillar3.

59 Lewis, Jeff and Molly Hayes. "Reduce, reuse, recycle, rejected: Why Canada's recycling industry is in crisis mode." *Globe and Mail*, May 14, 2019. https://www.theglobeandmail.com/canada/article-wish-cycling-canadas-recycling-industry-in-crisis-mode/.

60 Basu, Brishti. "B.C. approves plastic bag ban bylaws for Victoria, other municipal governments." *Victoria Buzz*, September 12, 2020. https://www.victoriabuzz.com/2020/09/b-c-approves-plastic-bag-ban-bylaws-for-victoria-other-municipal-governments/.

Stimulate our small- and medium-sized businesses to reuse and recycle plastics or use alternates. We need government to support an economic transition of small businesses dependent on single-use items. This could include support in the pre-competitive space for developing standardized reusable containers and products. Work to ensure that plastics and pellet processing occurs in BC. Shift from a global economic system that focuses on plastics materials to a more local economy that uses reusable materials, such as glass. Require recycled content in plastics, but ensure that the first priority is reduction in plastic used and longevity of the product over a mere change in source material.

Construction and demolition materials

Embodied carbon from the building sector represents 11 per cent of global GHG emissions with concrete, iron and steel producing about 9 per cent of annual GHG emissions.

THE CONSTRUCTION AND DEMOLITION (C&D) SECTOR represents 50 per cent of waste generation and 30 per cent of disposal in Metro Vancouver. As the CCME noted in its 2019 *Guide for Identifying, Evaluating and Selecting Policies for Influencing Construction, Renovation and Demolition Waste Management*,[61] this waste sector "is expensive to manage, poses risks to human health and the environment, and represents a missed opportunity to recover value from discarded materials." In the built environment, there is increasing focus on both the volume of construction and demolition waste and its outsize climate change impact.

Cumulatively, construction and maintenance of infrastructure and homes utilizes the most materials of any process humans undertake and represents a massive source of so-called "embodied carbon." Embodied carbon from the building sector represents 11 per cent of global GHG emissions with concrete, iron and steel producing about 9 per cent of annual GHG emissions,[62] so reduction and re-use is a significant climate mitigation opportunity.

C&D waste is made up of asphalt (paving and roofing), concrete, wood (both clean and treated or painted), drywall, bricks, metal, glass, plastic, cardboard and other smaller subcategories of materials. Accounting for these materials in diversion processes can be looked at it in different ways and is not fully standardized across local governments. Some items, such as asphalt and concrete, are heavy and so their weight, when recycled, can drive up the recycling percentage, and where targets exist, can almost entirely meet weight-based waste diversion targets that are not material-stream specific. Other items, such as wood, are not as dense and are more labour-intensive to sort, so, they are of a lower priority than denser materials. However, because of their shape and size, they can actually take up more space by weight in the landfill. Diversion percentages alone may not reflect the true impact of prevention or diversion of these materials going to waste from a landfill perspective, or, importantly, from a value perspective.

61 Canadian Council of Ministers of Environment. *Guide for Identifying, Evaluating and Selecting Policies for Influencing Construction, Renovation and Demolition Waste Management*. Winnipeg: Canadian Council of Ministers of the Environment, 2019. Accessed August 10, 2021, https://www.ccme.ca/en/res/crdguidance-secured.pdf.

62 Architecture 2030. "2030 Challenge for Embodied Carbon." (n.d.). https://architecture2030.org/new-buildings-embodied/.

These materials also represent a lost economic opportunity. A 2020 study by Unbuilders, the Vancouver Economic Commission and BC Institute of Technology articulates a hierarchy, starting with salvage (re-use of materials in their original role) then recycling (re-use in other roles, regardless of quality). They found that 30 per cent of wood in a typical project is salvaged when deconstructed compared to a traditional demolition project's 1 per cent. Impressively, the study found that at current valuations of approximately $2,400/tonne for salvaged old-growth lumber, moving to a mandatory deconstruction approach for applicable single-family homes in Metro Vancouver would generate upward of $340 million in salvageable material every year. Even with an 85 per cent decrease in the value of material, accounting for increased supplies, the researchers estimated an over $50 million annual market.[63] The same report noted the challenges in setting weight-based targets for green demolition given the weight differences among the material types.

In BC, construction and demolition waste generated over 2.8 million tonnes of waste in 2018. By weight, much of it was considered recycled; the definition of recycling includes downcycling activities. Due to the use of private landfills in the Lower Mainland and elsewhere, data on this waste sector are not as robust as for others. There is also some variation in how to account for materials that are collected and what counts as recycling; in some cases waste-to-energy burning of wood has been counted as recycling.

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While some municipalities have enacted requirements for diversion and record keeping, these systems need to be stronger to encompass all buildings in all jurisdictions with high targets, stronger incentives and robust verification processes (e.g., higher deposits for mandated green demolition or deconstruction). Given the timing difference between when the materials are gathered and when prospective buyers may take them, there is a need for hubs where these materials can be collected and made available for sale.

New approaches to address C&D waste and the waste of embodied carbon are emerging, like "design for disassembly," and "buildings as material banks," that utilize prefabricated and modular components (a clear opportunity for BC with our significant mass timber industry) and design approaches that minimize material usage and promote ongoing re-use of materials and components from existing buildings. These are attractive as ways to increase construction productivity and meet emissions reductions goals. One of the goals in the City of Vancouver's Climate Emergency Action Plan—to reduce embodied carbon in new construction by 40 per cent by 2030—is simultaneously a major opportunity for BC's sustainable materials sector, but also carefully calibrated to encourage greater use of salvaged materials.

Next steps

Set provincial targets for this waste sector along with robust measurement and reporting. Targets should then be integrated into regional district solid waste management planning with requirements for differential tipping fees to drive change. Requirements for municipalities would likely include model demolition permits, deconstruction checklists, monitoring and reporting requirements, as well as a deposit and refund system based on audited tipping fee receipts, permit applications and site waste management plans. The province should create model municipal

63 Elliott, Kinsey et al. "The Business Case for Deconstruction." *Vancouver Economic Commission*, July 2020. https://www.vancouvereconomic.com/research/the-business-case-for-deconstruction/.

solid waste policies and regulations that can be adopted at variable rates, but with a provincial "backstop" in the spirit of the BC Energy Step Code.

Provincial demonstration of best practices can help drive government entities to use salvaged materials and meet embodied carbon targets, further helping to drive markets for the materials.

Mandate stronger overview, monitoring and reporting of all private and public waste processing and recycling facilities. This will help to ensure high quality data and remove challenges in verifying material flows. Review trade regulations to ensure proper processing of materials and no leakage of waste. Ensure all local solid waste plans work towards progressively more strict sectoral diversion targets.

Develop a comprehensive policy and regulatory framework, including building code changes to encourage design for disassembly, deconstruction-ready design standards, and provincial regulation for embodied carbon. Research will be required as will collaboration among multiple ministries that look at climate and environment, housing, procurement, labour and economic development. In addition to policy and regulatory changes, investments in technology and workforce training will also be needed.

Use public sector procurement to build a salvaged and reused materials marketplace. Provincial and other public sector procurement could take the lead in catalyzing the demand for salvaged materials, and other circular building practices. Provincial demonstration of best practices can help drive government entities to use salvaged materials and meet embodied carbon targets, further helping to drive markets for the materials.

Ensure the infrastructure needed is in place. Invest in the creation of salvaged materials and resale hubs and processing facilities. Investments in industrial symbiosis approaches and networks can ensure that materials are efficiently moved between users in the province.

A zero-waste jobs and just transition agenda

ZERO WASTE PRACTICES AS DETAILED ABOVE in areas like re-use, repair and maintenance are more inherently local than the current model, and with proactive policy could develop thousands of high-quality, long-term stable jobs in BC. As we seek to reduce the material and energy throughput of our economy, we must also simultaneously seek to improve wages and working conditions for workers, reduce inequality and boost quality of life for all, and contribute to racial, gender and social justice.

As we seek to reduce the material and energy throughput of our economy, we must also simultaneously seek to improve wages and working conditions for workers, reduce inequality and boost quality of life for all, and contribute to racial, gender and social justice.

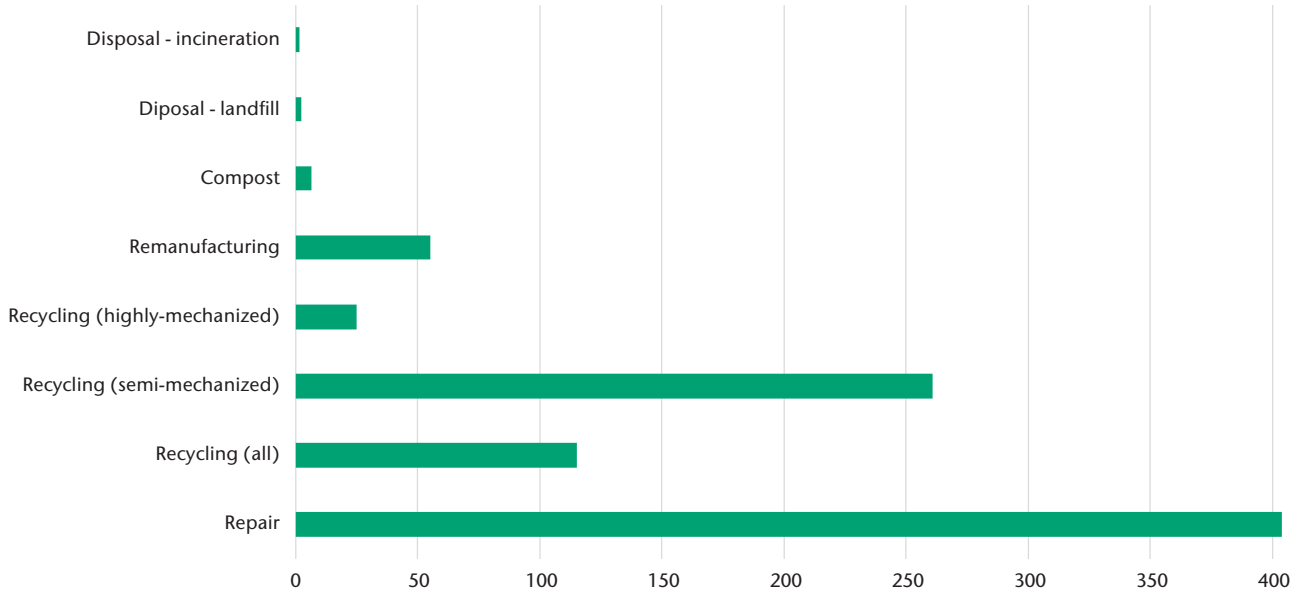
In 2019, there were 7,710 jobs in waste management and remediation services in BC, and another 12,800 in repair and maintenance services (30,750 if we count automotive repair and maintenance).[64] These jobs were generally well paying with average incomes in waste management and remediation services at $69,300 per year ($37.48 per hour) and repair and maintenance (except automotive) at $64,385 per year ($35.83 per hour).

Job creation associated with recycling typically outweighs jobs losses in waste disposal and virgin materials mining and manufacture, and employment gains are predicated on a more localized economy that can be encouraged through proactive industrial policies to create robust markets for recycled materials (such as procurement policies and setting minimum recycled content requirements, as we discuss below). The potential for new jobs requires that we sort and process materials domestically, develop domestic markets for recovered materials and reduce recycling exports. On balance, it is anticipated that job creation impacts would be larger than losses, but policy should proactively seek to create those jobs by developing the sectors cited above.

Estimates of jobs are typically limited to recycling and do not account for more sophisticated re-use and refilling opportunities, nor repair and maintenance operations (as discussed above in Section 4). Requirements for reusable containers, for example, would create jobs in more localized bottling and distribution plants (there may be additional costs of transportation energy for greater weight, but also shorter distances travelled). Managing waste for resource recovery has the potential to create jobs in more sophisticated collection and sorting systems, and in addition

64 Statistics Canada, labour statistics consistent with the System of National Accounts, by job category and industry, Table 36-10-0489-01. This does not include jobs in sewage and liquid waste that are not considered in this paper.

Figure 3: Number of jobs in zero waste modes versus traditional (per 10,000 tonnes per year)



Source: Ribeiro-Broomhead, John and Neil Tangri. *Zero Waste and Economic Recovery: The Job Creation Potential of Zero Waste Solutions.* Berkeley: Global Alliance for Incinerator Alternatives, 2021. www.doi.org/10.46556/GFWE6885.

to those jobs, there will also be jobs to educate, develop systems and policy, gather data and manage programs and staff.

This work is significantly more labour-intensive than existing collection and disposal/diversion systems. Using data from the Global Alliance for Incinerator Alternatives' (GAIA's) 2021 *Zero Waste and Economy Recovery* report, Figure 3 shows job potential across different modes of waste processing using data from 16 countries and finds repair activities create 200 times more jobs than landfilling and incineration—recycling creates 50 times and remanufacturing 30 times more jobs.[65] GAIA's report concludes that "implementing zero waste strategies to meet current and future waste management needs not only reduce greenhouse gas emissions and air pollution but also provide significantly more jobs than disposal-based systems."

Beyond these broad estimates, a BC-specific analysis of economic and employment impacts, conducted for the BC Ministry of the Environment, estimated some 2,269 net jobs from BC's EPR programs (Table 3).[66] These numbers are promising, and with additional coverage of EPR programs these numbers will grow. However, BC's EPR programs currently create more jobs outside the province than within, so increased efforts to re-localize systems point to additional job creation potential in BC. Delivering on the jobs potential will require new investments in

65 Ribeiro-Broomhead, John and Neil Tangri. *Zero Waste and Economic Recovery: The Job Creation Potential of Zero Waste Solutions*. Berkeley: Global Alliance for Incinerator Alternatives (GAIA), 2021. www.doi.org/10.46556/GFWE6885.

66 Bartlett, Veronica et al. *Assessment of Economic and Environmental Impacts of Extended Producer Responsibility Programs in BC in 2014*. Burnaby: Morrison Hershfield, 2016. Table 46. https://www2.gov.bc.ca/assets/gov/environment/waste-management/recycling/recycle/rel-res/2014_assessment_of_economic_environmental_impacts_of_extd_producer_responsibility_programs_bc.pdf?bcgovtm=CSMLS.

Table 3: Employment impact of BC EPR programs, 2014

	Total value of recovered materials ($million)	Jobs created (BC only)	Net jobs created (outside BC)	Jobs lost due to reduced landfilling	Net jobs created
Batteries	1.4	19	6	4	17
Beverage containers	21.6	26	716	101	641
Electronic and electrical products	14.2	542	694	34	1,202
Lamps and lighting equipment	0.5	10	5	1	14
Packaging and printed paper	6.1	125	140	37	228
Paint and household hazardous waste	0.1	2	12	2	12
Tires	1.8	77	—	19	58
Used oil and antifreeze products	1	114	2	18	97
Total	**46.7**	**915**	**1,575**	**217**	**2,269**

Source: Bartlett, Veronica et al. *Assessment of Economic and Environmental Impacts of Extended Producer Responsibility Programs in BC in 2014*. Burnaby: Morrison Hershfield, 2016. https://www2.gov.bc.ca/assets/gov/environment/waste-management/recycling/recycle/rel-res/2014_assessment_of_economic_environmental_impacts_of_extd_producer_responsibility_programs_bc.pdf?bcgovtm=CSMLS.

education and training, facilities and infrastructure, and systems and strategies to dramatically reduce material throughput in the economy.

The type of shift to zero waste that we describe above will take many years, if not decades, as it is transformational in terms of how we conceive of waste and materials management. Thus, workers are likely to be affected by changes in systems, such as from reduced landfilling and incineration practices, or even shifts in contracting arrangements, as we have seen in the shift to Recycle BC for residential curbside recycling. That is, the transition is more than a numbers game and public policy efforts to support workers should also be on the table.

Much work in the waste sector in the past has also given rise to health and safety challenges, so high employment standards need to be at the core of a jobs plan. Moreover, as flagged in the recycling section, shifts in policy may lead to challenging labour transitions for existing workers. In the City of Vancouver, a strong collective agreement was able to insulate city workers from layoff and provide a just transition in the transfer of packaging and printed paper recycling to the Recycle BC EPR program. However, such protections are not necessarily available to newly hired or existing workers in many other areas.

A sector-wide labour framework is thus advised, given the significant potential for new sub-contractors and changes in approach to collection and processing. This should include collective bargaining rights, successorship protections to ensure appropriate preservation of work, advanced

Much work in the waste sector in the past has also given rise to health and safety challenges, so high employment standards need to be at the core of a jobs plan.

skills training and other transitional supports as part of the move forward. There is a lot to be learned from the emergence of "just transition" programs in coal-producing regions like Spain, Germany, and even Alberta's coal-fired electricity phase-out. Proactive labour market policies can facilitate employment transitions and new skills development without heavy burdens being placed on existing workers. Provincial policies should ensure living wages and decent working conditions for all green jobs along the road to full resource recovery.

Using zero waste policies to reduce carbon emissions

CLIMATE CHANGE IS INTIMATELY CONNECTED TO A CULTURE OF WASTEFUL CONSUMPTION. Carbon dioxide is BC's single largest waste by weight—55 million tonnes in 2018,[67] compared to 2.5 million tonnes of solid waste disposed (see Table 1). Carbon pollution goes into the atmosphere rather than a landfill, an invisible but substantial product of burning fossil fuels for energy to power our industries, businesses, homes and vehicles.

Zero waste policies should seek to simultaneously reduce both carbon pollution and solid waste, and to better understand the linkages between the two. Reported greenhouse gas emissions from waste management appear to be very small because they narrowly focus on the direct emissions from landfills, some 3.5 million tonnes of CO_2 in BC's GHG inventory in 2018, or 5 per cent of BC's total. However, the emissions profile of our waste is much larger when the emissions associated with extracting raw materials and manufacturing wasteful products are considered.

Landfill emissions stem from the decomposition of organic materials (food, wood, yard scraps) in the absence of oxygen, which produces methane, a greenhouse gas 86 times more heat-trapping than CO_2 over a 20-year period.[68] Methane is the principal hydrocarbon in "natural gas" and combusting it converts it to carbon dioxide and water, which greatly reduces its climate impact.

Government policy has been to increasingly capture methane gas produced in landfills for energy or at least to flare it off (converting it to the CO_2). BC's Landfill Gas Management Regulation requires gas capture technologies be applied to landfills that generate 1,000 tonnes or more of

Zero waste policies should seek to simultaneously reduce both carbon pollution and solid waste, and to better understand the linkages between the two.

67 BC Ministry of Environment. "British Columbia Greenhouse Gas Inventory." Accessed August 12, 2021. https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-inventory. Figure does not count other GHGs, such as methane, nor CO_2 emissions from changes in land use. BC's total GHG inventory, including net deforestation and other GHGs, was 68 Mt CO_2 equivalent in 2018.

68 Myhre, Gunnar et al. "Chapter 8: Anthropogenic and Natural Radiative Forcing." *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge (UK) and New York: Cambridge University Press, 2013. https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf.

methane per year.[69] The 2018 CleanBC plan proposes that communities "achieve 95% organic waste diversion for agricultural, industrial, and municipal waste—including systems in place to capture 75% of landfill gas" and that residential gas consumption includes 15 per cent of such renewable gas supply by 2030.

It is not clear whether these are realistic targets nor meaningful. Some landfills, called bioreactor landfills, have put in systems to accelerate methane capture and production. In all cases, it will be technically challenging and financially costly to collect 75 per cent of gas spread out across a landfill. Diversion of organics from landfill should be the top priority and this would shrink the amount of methane produced in landfills. In other words, landfill gas is not really renewable, as it is from waste, and it is at best a complementary effort to the real solution of avoiding organics going to landfill.

A narrow accounting of waste based on landfills and incineration fails to make the connection between post-consumer waste and the much larger emissions from the extraction of raw materials, and the production and transportation of goods.

Incineration produces the greenhouse gases, carbon dioxide and nitrous oxide, from the combustion process. Emissions from the Burnaby incinerator in 2017 totalled 288,000 tonnes (CO_2 equivalent), of which 40 per cent was from fossil-fuel-derived products (e.g., plastics, certain textiles, rubber) and 60 per cent was from biomass and organic materials (wood and compost in particular).[70]

Because energy is generated from this process (called waste-to-energy or WTE), incineration emissions are not counted under "waste" in the provincial GHG inventory and instead are counted under the category of "electricity and heat generation." 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 eight to ten barrels of oil to make the products resulting in a tonne of garbage.[71] 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.

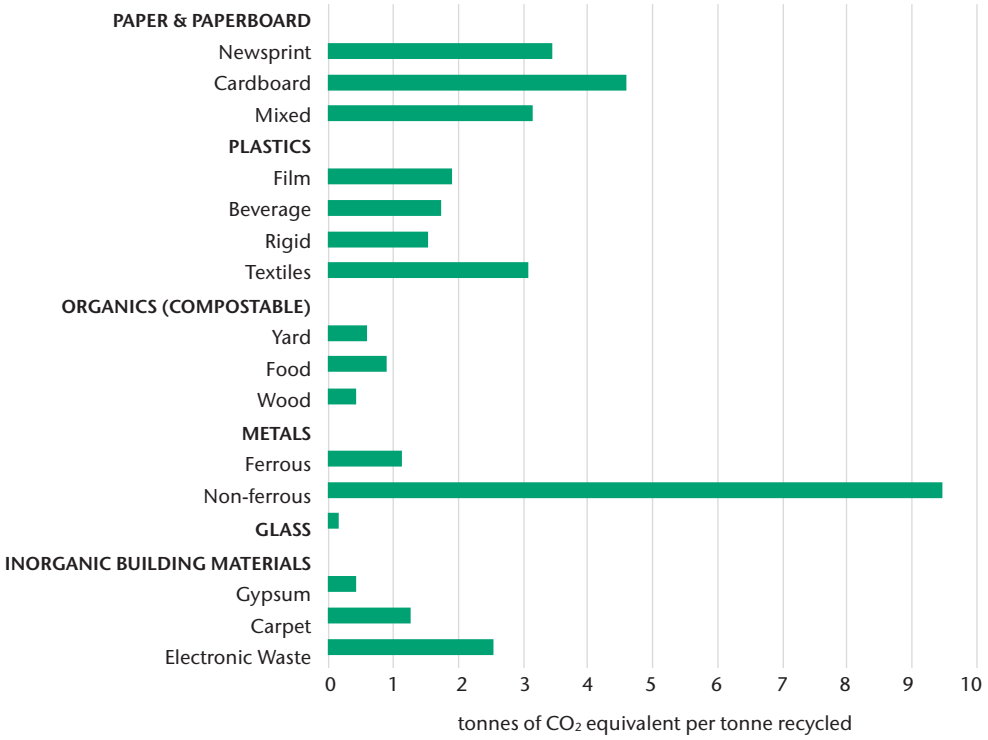
A narrow accounting of waste based on landfills and incineration fails to make the connection between post-consumer waste and the much larger emissions from the extraction of raw materials, and the production and transportation of goods. Recycling of materials reduces the need for emissions-intensive extraction and processing of virgin materials, although such emissions reductions may well be offshore. 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. Thus, from a life-cycle perspective, the greatest opportunity for GHG emissions reduction comes from preventing emissions produced in energy-intensive extraction and manufacturing processes. A more accurate accounting of our GHG impact from our consumption can be seen when we look at the systems-based GHGs from extraction to manufacturing to product purchase. A systems-based analysis for the US found that

69 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 were about 35 landfills in BC that met this requirement, and which comprise about 90 per cent of methane emissions as of 2006. See Golder Associates. *Inventory of Greenhouse Gas Generation from Landfills in British Columbia.* Burnaby: Golder Associates, 2008. http://www.env.gov.bc.ca/epd/codes/landfill_gas/pdf/inventory_ggg_landfills.pdf.

70 BC Ministry of Environment and Climate Change. "Industrial Facility Greenhouse Gas Emissions: 2017 Consolidated BC Emissions Report Summary." https://www2.gov.bc.ca/gov/content/environment/climate-change/data/industrial-facility-ghg.

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

Figure 4: GHG emission reductions from recycling and composting



Source: 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 Belkorp Environmental Services, 2009).

products and packaging accounted for 44 per cent of US GHG emissions and the provision of food accounted for another 12 per cent.[72]

Looking beyond waste management practices in BC, we note that international trade matters, as well. British Columbians consume many products and services produced outside the province, and thus we should be mindful of the emissions embodied in the goods and services we consume. Likewise, BC exports natural resources and counts in its GHG inventory the carbon emissions associated with getting them to market, but not the emissions associated with the combustion of the fuel in the importing jurisdiction.

A circular economy approach reduces the need for upstream raw materials extraction and processing, saving energy and carbon emissions.

This exercise also links to BC's GHG targets and actions to reduce them. A circular economy approach reduces the need for upstream raw materials extraction and processing, saving energy and carbon emissions. Much of the CleanBC plan is aimed at reducing emissions from buildings and passenger transportation, with only minimal efforts aimed at the large swath of emissions from industry.

Figure 4 shows common material types and the average GHG savings per tonne recycled. The most significant emissions reductions per tonne of material are for non-ferrous metals such as

72 Stolaroff, Joshua Kane and Bill Sheehan. *Products, Packaging and US Greenhouse Gas Emissions*. Berlin: ResearchGate GmbH, 2009. https://www.researchgate.net/publication/327060546_Products_Packaging_and_US_Greenhouse_Gas_Emissions.

Table 4: 2040 zero waste framework and GHG impact

	2030 zero waste pathway			2040 zero waste pathway		
Item	**Reduction rate**	**Diversion rate**	**GHG Impact (tonnes)**	**Reduction rate**	**Diversion rate**	**GHG Impact (tonnes)**
Paper and paperboard	35%	75%	1,628,084	80%	95%	3,816,379
Plastics	40%	45%	535,639	80%	90%	1,326,392
Organics (compostable)	30%	80%	488,075	60%	95%	835,867
Clean wood	10%	40%	40,078	40%	90%	104,133
Painted or treated wood	20%	10%	136,168	40%	10%	213,978
Textiles	30%	50%	151,664	50%	75%	204,939
Organics (non-compostable)	0%	10%	6,437	20%	30%	16,737
Metals	15%	80%	77,238	30%	95%	100,191
Glass	0%	85%	5,621	0%	95%	—
Inorganic building materials	20%	95%	213,075	35%	97%	366,037
Electronic waste	20%	75%	69,283	60%	95%	135,760
Batteries	5%	90%	—	10%	95%	—
Household hazardous	10%	80%	—	20%	90%	—
Household hygiene	30%	10%	—	90%	95%	—
Bulky objects	20%	35%	2,934	60%	95%	7,153
Large appliances	20%	100%	8,354	40%	100%	16,709
Tires	0%	100%	—	0%	100%	—
Fine particles/misc	10%	50%	—	50%	80%	—
Totals			**3,362,651**			**7,144,275**

Note: Estimates draw on data in Table 1.

Source: Authors' calculations using emissions factors from J. 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 Belkorp Environmental Services, 2009).

aluminum because of the very high energy- and GHG-intensity of production. Paper recycling also makes a significant contribution because it supports carbon sequestration in forests (by avoiding new logging).

Table 4 models a zero waste pathway for BC and implications for GHG emissions (see Appendix 2 for more details on pathways in each sub-category). We model both reductions in generation, as well as increases in diversion rates across these material categories for 2030 and 2040. We assume a commitment by governments to implement new programs, standards and regulations, most of which should be in place by 2030, but longer-term changes in product design and robust substitutes for existing products take longer to phase in, as does establishing new social norms for conservation. Overall, we assume a 24 per cent reduction in total waste generation by 2030, and a 50 per cent 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 90 per cent recycling of materials at the end of life by 2040.

By 2030, reduced generation and more aggressive recycling and composting will lead to 3.4 million tonnes CO_2e savings by displacing organics from landfills and reducing the need for energy-intensive extraction and processing activities. By 2040, this rises to 7.1 million tonnes CO_2e. Not all of these savings would occur in BC due to global supply chains, but a growing share does occur 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).

By 2030, reduced generation and more aggressive recycling and composting will lead to 3.4 million tonnes CO_2e savings by displacing organics from landfills and reducing the need for energy-intensive extraction and processing activities.

Conclusion: From waste to resource

We need to move from mindless to thoughtful consumption and place more value on the strength of our social fabric, equity and right relations with our ecosystems and other societies.

WHILE IT IS POSSIBLE TO CLOSE THE MATERIAL LOOP IN THEORY, this implies an economic system very different from today's open economy of exports and imports, and it 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. However, since our last report, we are more directly witnessing the severity of the consequences of pursuing endless growth and consumption. With this call to action has come a series of movements to change the system.

In addition to changing our economic system, we need to change our culture of consumption and how we think we will achieve happiness and fulfillment. We need to move from mindless to thoughtful consumption and place more value on the strength of our social fabric, equity and right relations with our ecosystems and other societies. In short, meaningful progress will have its challenges, but the changes we implement today will be much less painful than if we wait for nature to impose its own limits in the future.

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

Revisiting the zero waste hierarchy

This study has taken the long view of change: a shift in thinking from *managing waste and increasing recycling* to fundamentally *eliminating waste* and *closing the loop* on resources. 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 will create an important opportunity to develop a localized economy better positioned to weather global changes—climate change, market volatility, resource scarcity, food system collapse and a growing recognition of the need

for equity and fair treatment of people—that are increasing in intensity. Indeed, zero waste is not only about a better provincial solid waste vision, it is also an interconnected and forward-looking strategy that would bolster a range of economic activities, enhance BC's resilience in the face of global change, and enable our population to live securely within the means of nature.

We propose that BC adopt zero waste as a goal for 2040. Below we review the main directions for the BC government, working in concert with regional districts, citizens, businesses and EPR programs. In addition to the specific directions noted in earlier sections for recycling and organics, plastics, and construction and demolition waste, these directions reflect the zero waste hierarchy and should inform a comprehensive provincial zero waste strategy.

Focus on redesign, innovation and shifting culture

Waste planning should consider education, culture shift and behaviour change, with more of a focus on the social than the engineered systems. EPR programs should be required to have redesign and innovation elements. There should be an innovation strategy for research and development of reduce, re-use and recycling solutions in BC. Education on material flows should be integrated into the school curriculum. Research funding for universities, in collaboration with non-profits and private sector operators, could lead to a "network centre of excellence" approach in reducing consumption, resource recovery and waste management with an emphasis on social interventions, 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 (eliminating or creating opt-in only for products no longer needed, such as phone books), and other sharing/cooperative projects would accelerate the transition to lower waste generation.

Zero waste is not only about a better provincial solid waste vision, it is also an interconnected and forward-looking strategy that would bolster a range of economic activities, enhance BC's resilience in the face of global change, and enable our population to live securely within the means of nature.

Account for greenhouse gases and ecosystem impacts in zero waste 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 and ecosystem impacts in concert with climate action. There are many opportunities for synergistic waste reduction and climate policies, and these would benefit from a coordinated provincial approach. The BC government should require that regional districts redraft solid waste management plans in line with the zero waste hierarchy. The BC government should develop systems to measure GHG (both embodied energy of products, as well as the direct impact of handling materials) and ecosystem impacts and to incorporate this into decision-making frameworks and solid waste planning.

Reduction and re-use should be fundamental to waste planning

The provincial government should drive EPR programs toward redesigning systems and products to use less materials and less toxic and problematic materials. A reduction strategy should include phasing out single-use products and packaging (in particular, see the recommendation in the plastics section). There is a need to develop a provincial strategy for reducing the use of packaging and using reusable and refillable packaging and containers, starting with food packaging, beverage and takeout containers, and requiring that stores take back reusable containers and packaging for any product they sell. Toxic materials, such as pesticides, should be reduced through bans for certain applications.

Extend product lifespans

Keeping products used as much and as long as possible can reduce material throughput. Repairing, sharing and reusing should be encouraged through eliminating taxes on re-use/repair or sharing services, investing in repair, and developing a Right to Repair framework for appliances and electronics, as a start. The provincial government should work toward mandatory extended warranties on products to counter planned obsolescence and to ensure products can be easily repaired.

Develop a Crown corporation to help collect materials and manage flows

The provincial government should work toward mandatory extended warranties on products to counter planned obsolescence and to ensure products can be easily repaired.

A Crown corporation could support a more coherent collection system, in particular for rural areas, and as one-stop community drops for the myriad of items covered by EPR programs and organics management. It should support improving the quality of the recycled materials supply, decreasing contamination, and maximizing the value of materials. Accelerate the standardization for separating materials in the right receptacles (e.g., consistently colour-coded) across all settings, with producers to fund post-consumer sorting. Funding would come from EPR programs. Based on enhanced collection, a Crown corporation could also look to strategic investment in processing capacity and infrastructure where needed, particularly for re-use.

Create demand for recycled materials

For the materials remaining after the steps above have occurred (particularly around reducing single-use items and right-to-repair), creating local demand for recycled materials is a key element. The BC government should implement a "step code" of increasingly stringent minimum recycled content requirements to increase demand. BC could also coordinate across all of government and use aggregated procurement policies to drive demand for recycled materials.

Develop a strategy for construction and demolition waste

This strategy should include changes to the building code to prioritize better use of materials and approaches, such as mass timber and "buildings as material banks." New programs should be created to encourage retrofitting and maintaining existing buildings, and to regulate in favour of disassembly, deconstruction, and material re-use when building new buildings. Municipal bylaws should also be developed for deconstruction rather than demolition, and to encourage the re-use of materials. This could also include creating industrial symbiotic partnerships and using public procurement to catalyze the re-use market. As individual municipalities and the BC government work to address the "embodied carbon" associated with construction materials supply chains, it will be critical to ensure a strong linkage between these policies and those targeted at a circular built environment, to ensure carbon is sequestered for as long as possible in these materials, and that the materials recoup as much value as possible in their cycle(s) of re-use.

Improve data collection and publish as open data

The BC government should develop a comprehensive accounting of material flows in the economy from upstream resource extraction and imported materials, to recycling, composting and disposal. BC should use the zero waste hierarchy to define which materials are included for each level and ensure reporting follows that. Regional districts and EPR programs should report on the most detailed level that they have available (not averages across multiple material or product

types) and standardize reporting and requirements. The final destination of each material flow should be clear. These data should be publicly available by regional district and for the whole province. These data should also reflect GHG and ecosystem impacts.

Develop a green jobs and just transition framework

Policies are needed to ensure 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, successorship protections and a commitment to decent wages and working conditions is important to avoid precarious and/or unsafe work. There are many social enterprises and individual binners who have an economic stake in the waste management system, and these workers should be supported as much as possible.

Remove energy recovery as an option for waste materials

Incineration has adverse consequences for health and GHG emissions and requires a steady stream of waste that is inconsistent with a zero waste goal. The BC government should work to phase out existing waste burning capacity (such as waste-to-energy, incineration, pyrolysis, refuse-derived fuel, burning waste at cement kilns, plastics to fuel, chemical recycling, etc.). No new capacity should be built in BC nor used elsewhere by BC jurisdictions and EPR programs. Use of waste as energy must not be classified as renewable energy. This will reduce GHGs, as well as human and ecosystem health impacts.

A sector-wide approach that includes collective bargaining, successorship protections and a commitment to decent wages and working conditions is important to avoid precarious and/or unsafe work.

Ensure loopholes for waste disposal are closed

Ban the export of waste by private haulers to ensure that all waste has gone through an extensive inspection to ensure compliance with waste bans. Ensure that any waste sent out of the province is sent to an approved landfill that meets or exceeds BC standards. This will provide incentive for waste haulers to adhere to regulations, and for communities managing the waste to decrease the volumes sent to landfill. Mandate waste bans to apply to all disposal facilities, including transfer stations, landfills, waste-to-energy facilities, and mixed waste/dirty material recovery facilities, to avoid circumvention.

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 will create an important opportunity to develop a localized economy better positioned to weather increasingly intense global changes, such as climate change, market volatility, resource scarcity, food system collapse, and a growing recognition of the need for equity and fair treatment of people. Indeed, zero waste is not only about a better provincial solid waste vision, but also an interconnected and forward-looking strategy that would bolster a range of economic activities, enhance BC's resilience in the face of global change, and enable our population to live securely within the means of nature.

Appendix 1: Estimating material generation in BC

Disposal estimates

Waste composition study data were obtained from Metro Vancouver (2018),[73] the Capital Regional District (2016),[74] the Columbia Shuswap Regional District (2018),[75] and the District of Squamish (2016).[76] These data sets were selected as they were published online within the past five years, include multiple sectors, represent different regions of British Columbia, and have sorting categories that could be generally aligned for comparison.

For each data set, the sorting categories were first recoded to match the material categories listed in Table 5. Each data set had an average percentage composition of waste by sector, as well as a blended average across sectors. For the purpose of these disposal estimates, the blended average was used. The blended average composition was calculated by adding together sub-categories that mapped to each recoded category. For example, in the Capital Regional District, the Paper and Paperboard category was the sum of the following sub-categories:

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73 Metro Vancouver. *Solid Waste Composition Monitoring Program.* Burnaby: Metro Vancouver, 2018. http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/Solid_WasteComposition_Study_2018.pdf.

74 Capital Regional District. *Solid Waste Stream Composition Study*. Victoria: Capital Regional District, 2016. https://www.crd.bc.ca/docs/default-source/recycling-waste-pdf/WasteCompositionStudy2016.pdf?sfvrsn=baab36ca_4.

75 Columbia Shuswap Regional District. *2018 Waste Characterization.* Salmon Arm: Columbia Shuswap Regional District, 2018. https://www.csrd.bc.ca/sites/default/files/2018%20Waste%20Characterization%20Study%20-%20Salmon%20Arm.pdf and sub-regional studies for Golden, Sicamous and Revelstoke, https://www.csrd.bc.ca/sites/default/files/2018%20Waste%20Characterization%20Study%20-%20Golden.pdf, https://www.csrd.bc.ca/sites/default/files/2018%20Waste%20Characterization%20Study%20-%20Sicamous.pdf and https://www.csrd.bc.ca/sites/default/files/2018%20Waste%20Characterization%20Study%20-%20Revelstoke.pdf.

76 District of Squamish. *Squamish Zero Waste Strategy*. Squamish: District of Squamish, 2017. https://squamish.ca/assets/Uploads/df879e6c80/Squamish-Zero-Waste-Strategy-2017.pdf.

Table 5: Data sorting categories

Category	Indicative products
Paper and paperboard	Office paper, newsprint, cardboard, phone books, books, magazines, tissue paper, paper plates, wrappers
Plastics	Shopping and garbage bags, beverage containers, other containers, toys, lawn furniture
Organics (compostable)	Yard waste, food scraps
Clean wood	Unfinished wood, pallets
Painted or treated wood	Painted or treated wood, composite wood products
Textiles	Clothing and draperies
Organics (non-compostable)	Rubber, leather and composite products
Metals	Aluminum, copper, steel
Glass	Beverage containers, food containers, mirrors, windows, lightbulbs
Inorganic building materials	Drywall, masonry, ceramics, asphalt, carpet
Electronic waste	TVs, cell phones, computers and displays, small appliances
Batteries	All types of batteries
Household hazardous	Medical (needles, equipment), paints, solvents, pesticides, used oil for vehicles, containers for hazardous products
Household hygiene	Diapers, animal litter, tampons, sanitary napkins
Bulky objects	Furniture, mattresses
Large appliances	Stoves, fridges, dishwashers
Tires	Vehicle tires
Fine particles/misc	Unidentifiable remains, combustion residuals

- Newsprint
- Printed paper
- Corrugated cardboard
- Paper packaging—dry goods
- Paper packaging—liquids
- Paper beverage containers—deposit
- Books
- Other paper (non-recyclable)

The quantity of disposed material (in tonnes) by category was calculated by multiplying the percentage composition by the total annual disposed material for all sectors associated with each data set (either a total for the whole jurisdiction or per facility, depending on how the data was collected). An average kg of disposed material by category per capita was also calculated by dividing the annual quantity by the population served.

A blended average weighted composition for British Columbia was calculated by splitting the data sets into three groups. The first group is Metro Vancouver, which covers 51 per cent of the province's population and was therefore assigned a weighting of 51 per cent. The second group includes the Capital Regional District and the District of Squamish, which are considered representative of smaller cities and areas closer to populated centres and was given a weighting of 24.5 per cent. The third group includes the four facilities from the Columbia Shuswap Regional District (Revelstoke, Sicamous, Golden, Salmon Arm), which is considered representative of rural and less populated areas, and was also given a weighting of 24.5 per cent. Note that there is an understanding that these data sets may not cover all types of communities, but this is an improvement over past estimates that were heavily weighted by data collected in urban areas.

The blended average weighted composition for British Columbia was multiplied by the annual total disposed waste in the province to calculate the quantity of disposed waste by material category.

Recycling estimates

Publicly reported, comprehensive recycling data by material category (both products collected by the regional district and by product stewards) were only available from Metro Vancouver.[77] Therefore, this data set served the basis for recycling estimates, with a few adjustments to account for differences between regions. Note that Metro Vancouver counts energy recovery from wood waste as recycling. For this report, energy recovery is not counted as recycling. Since the Metro Vancouver recycling data do not differentiate between end points, the recycling estimate was adjusted by splitting the reported wood recycling as 20 per cent recycling and 80 per cent disposal. This adjustment is a rough approximation based on anecdotal knowledge that most wood waste is sent to energy recovery because that offers the most attractive market price compared to recycling options.

To get a sense of how recycling rates are different between regions, the per capita disposal estimates were used as a proxy. For example, the per capita disposal rates for compostable organics

77 Metro Vancouver. *Annual Recycling and Solid Waste Management Summary*. Burnaby: Metro Vancouver, 2018. http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/2018_Annual_Recycling_and_Solid_Waste_Management_Summary.pdf.

were much lower in Metro Vancouver and the Capital Regional District compared to the Columbia Shuswap Regional District, and the District of Squamish is in between. This is likely indicative of green bin collection programs, which are better established in more urban regions. Based on the relative differences in per capita disposal rates, the recycling rate of compostable organics was assumed to be 75 per cent lower in rural areas compared to urban areas. A similar comparison was made for other materials such as paper, plastics, glass, metals, textiles and wood, which were assumed to be 20 per cent lower in rural areas. In general, the per capita disposal estimates were fairly similar between Metro Vancouver and the Capital Regional District, and to some degree, the District of Squamish. Therefore, Metro Vancouver recycling rates were weighted to account for 75.5 per cent of BC, and the adjusted rural recycling rates were weighted at 24.5 per cent to calculate a blended average per capita recycling estimate.

The provincial recycling estimate was calculated by multiplying the population of the province by the blended average per capita recycling estimate.

The disposal and recycling estimates were added together to calculate the generation estimate.

Appendix 2: Modelling a zero waste pathway for BC

WE BEGIN WITH OUR ESTIMATES OF 2018 SOLID WASTE generation of 6.6 million tonnes (Table 1) and allocate the total across broad product categories in line with a detailed assessment of Metro Vancouver's waste generation and diversion, augmented by data from other BC jurisdictions.

Numbers include residential; industrial, commercial and institutional (ICI); and demolition, land clearing and construction (C&D). Note that numbers only include 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.

Paper products

More than one-fifth of waste generation is from various forms of paper and paperboard. We assume a 35 per cent reduction in generation by 2030 and 80 per cent by 2040, due to trends, such as decreased newspaper, magazine and office paper use, and new policies such as: cardboard packaging replaced by reusables, especially for delivery packages; ICI printed paper and packaging in the *Recycling Regulation*; bans on single-use items; bans on junk mail and unaddressed mail; EPR for books; beverage containers moving to reusables. Diversion rates rise to 75 per cent in 2030 and 95 per cent in 2040.

Plastics

Various forms of plastic do not comprise a large share of waste by weight, but they 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 reusable containers (deposit-and-return systems for glass and reusable plastics); bans on other single-use plastics, such as wraps and films; plastic bags are replaced by cloth and paper bags, and compost programs virtually eliminate the need for garbage bags; other short-lived plastics, such as dollar-store toys and unwanted free promotional

merchandise (especially those with toxic properties) are phased out. In health care, there is a shift back to sterilization of reusable items. In addition, a smaller set of more recyclable resins form the core of any plastic used in the economy, with increased local recycling capacity, and minimum recycled content policies, while burning of plastics for fuel is phased out.

We assume such measures can reduce generation by 40 per cent by 2030 and 80 per cent by 2040. Remaining plastics must be durable, reusable, and, at end of life, recyclable. They are clearly labelled, so that diversion rates rise to 45 per cent by 2030 and 90 per cent by 2040.

Organics (compostable)

We assume a diversion rate of 80 per cent by 2030 and 95 per cent by 2040 due to: increases in food waste and organics disposal bans; food recovery systems; and better markets for finished materials. Reductions in generation are also possible (30 per cent by 2030 and 60 per cent by 2050) through more aggressive roll-out 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.).

Clean wood

We envision a longer-term shift from use of concrete to wood for building construction, as more wood is used to lower costs and embodied carbon emissions (new wood buildings lock in carbon for many decades). We also see the need to ensure that burning of clean wood for fuel is not counted as recycling. As such, we revised the amount of current diversion (lower than what is currently reported). Thus, we only see a minor drop in generation of 10 per cent in 2030. Pallets, a major category of wood waste, move to re-use, while some clean wood is downcycled to become fibre for paper or is chipped for compost. We also see decreased burning or incineration of clean wood, strong deconstruction policies and new EPR programs for construction and demolition and furniture.

Painted or treated wood

Like clean wood, much of this stock is already in circulation. These items include wood used as building materials or in furniture. A zero waste future includes the development of EPR programs for construction and demolition materials, as well as furniture, and a concurrent focus on policies to develop and promote alternatives, longer-lasting higher-quality items, preservation of buildings, re-use, refurbishment and repair. This would result in a reduction of 20 per cent in generation with diversion of 10 per cent by 2030, and reduction in generation by 40 per cent and diversion of 10 per cent by 2040.

Textiles

Textiles have the strong potential for reduced consumption and increased recycling, and they should be included in an EPR program. Programs and policies should promote choosing fewer, higher-quality items, properly caring for items, re-use, sharing, repair, recycling and recycled content. Work is needed to ensure design for recycling includes policy on fibre mixes, restrictions on dyes and contaminants, and labelling. Disposal bans would also be needed. We assume this results in reduction of material generation of 30 per cent by 2030 and 50 per cent by 2040. Diversion rates of the materials remaining are 50 per cent by 2030 and 75 per cent by 2040.

Organics (non-compostable)

This category includes leather and rubber that are harder to reuse. While currently regulated automotive tires are not disposed, there are additional tire types that should be added to the Recycling Regulation, such as bicycle tires, wheelchair and scooter tires, tires used for household equipment, and industrial tires. The EPR program for textiles should include clothing made of these materials too and some of the same actions noted above would apply here. As such, by 2040, we assume a 20 per cent reduction in generation and 30 per cent diversion.

Metals

Recycling of metals is already mature and we assume these trends will continue, plus increased recycling capacity in BC, greater repair and refurbishment of products, and a move to refillables/reusables for food. We assume only a 15 per cent reduction in generation for 2030 due to phase out of aluminum beverage containers in favour of reusable containers. By 2040, generation is reduced by 30 per cent, due to 50 per cent reduction in aluminum use, and 10 per cent reduction in other metals used for cans and containers. Metals exist in a closed loop with 80 per cent recycling by 2030 and 95 per cent by 2040, leading to significant reductions in the energy needed for extraction and processing of raw materials.

Glass

More aggressive re-use policies for a wide range of products make glass more common by displacing plastics and metal, so we assume these forces do not reduce generation in 2030 or 2040. Recycling rates increase to 85 per cent by 2030 and 95 per cent by 2040 as EPR for remaining products (such as windows and mirrors) is introduced along with better recycling processing infrastructure.

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 2030 generation already exists, so we assume only 20 per cent reduction in generation by 2030 through on-site asphalt recycling and extending the life of buildings and carpet (i.e., reducing the need for new construction), but a slight increase to 95 per cent diversion through EPR programs for carpet, gypsum and other construction and demolition materials. More progress is made by 2040 with a 35 per cent reduction in generation due to requirements for deconstruction plans at building permit stage, commitments to longer-lasting buildings, using permeable surfaces instead of asphalt and concrete, and increased refurbishment of existing buildings rather than full demolition. By 2040, we assume 97 per cent diversion of materials.[78]

Electronic waste

Increased attention to the short lifespans 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 (e.g., screens, RAM, processors, power cords). Product leasing programs and new warranty

78 This should be achievable as the diversion rate in 2018 was 95 per cent, in part due to the relative weight of concrete and asphalt compared to the other materials in this category.

provisions remove incentives for planned obsolescence, create a market for local repair and maintenance, and develop new product leasing business models. EPR programs are expanded to cover all electrical products. In line with these policy directions, we assume a decrease in generation of 20 per cent by 2030 and 60 per cent reduction by 2040, while recycling pushes diversion rates to 75 per cent and 95 per cent 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 and education enable customers to right-size their orders or to facilitate re-use markets for paints. Reductions in generation are modest (e.g., rechargeable batteries, pesticide bans) but products in this stream are designed for safe environmental and health impacts. EPR programs are expanded to cover all products in this category.

Household hygiene

The most significant item in this category is disposable diapers, which are phased out in favour of natural, reusable or compostable diapers. Animal litter is diverted to the composting stream. Other items, such as tampons and sanitary napkins, are switched to reusable methods where possible or are compostable. These measures enable a reduction of 30 per cent by 2030 and 90 per cent by 2040. Diversion is small (10 per cent) in 2030 but product design changes drive this up to 95 per cent diversion of the remaining small amount of materials by 2040.

Bulky objects and large appliances

Much of the 2030 generation already exists. Reduction is achieved through improved warranties, repair and maintenance, and leasing models (similar to electronics and small appliances), which increase product lifespans (like fridges and washing machines of previous decades, products are once again built to last). Mattresses and furniture are included in the Recycling Regulation. Generation is reduced by 60 per cent by 2040 and diversion rates rise to 95 per cent.

Fine particles/miscellaneous

This includes assorted and unidentifiable leftovers, which are assumed to decrease in line with overall reductions in waste generation. Much of this (non-toxic) fine waste is reused as raw material for shoring up dikes 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 per cent and diversion rises to 80 per cent.

ZERO waste
BRITISH COLUMBIA

Zero Waste BC is a non-profit society working to drive systemic change towards Zero Waste in BC. It provides research, analysis and guidance to inform policies and practices related to materials consumption, solid waste and more.

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The Canadian Centre for Policy Alternatives is an independent, non-partisan research institute concerned with issues of social, economic and environmental justice. Founded in 1980, it is one of Canada's leading progressive voices in public policy debates.

The CCPA–BC is located on unceded Coast Salish territory, including the lands belonging to the xʷməθkʷəy̓əm (Musqueam), Skwxwú7mesh (Squamish) and səl̓ílwətaɁɬ /Selilwitulh (Tsleil-Waututh) Nations.

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