Smart Prosperity Institute

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ECONOMIC TOOLS TO REDUCE HOUSEHOLD WASTE AND RELATED GREENHOUSE GAS EMISSIONS

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Smart Prosperity Institute (formerly Sustainable Prosperity) is a national research network and policy think tank based at the University of Ottawa. We deliver world-class research and work with public and private partners – all to advance practical policies and market solutions for a stronger, cleaner economy.

Key Messages

- Reducing household waste in Canada has the potential to reduce direct and lifecycle GHG emissions, and is an important step towards meeting our climate change commitments.
- While diverting waste (such as through reuse or recycle programs) can save energy and GHG emissions compared with extracting and transporting raw materials, waste prevention strategies are more environmentally and economically effective.
- Environmental pricing and economic incentives can be used to reward waste prevention, return/reuse of items, and recycling. Currently these policy tools are under-utilized in Canada.
- Variable waste collection pricing rewards households that prevent waste or increase recycling, and helps shift production and consumption behaviour towards less wasteful practices. It also encourages people to develop innovative ways to avoid generating waste, including by repairing, sharing or reusing items. Many Canadian and international examples point to the effectiveness of this policy tool.
- Charges (or even bans) on single-use items have been successful in Canada for plastic bags, and could be extended to other areas such as single-use plastic cups, Polystyrene take-out containers, and plastic plates.

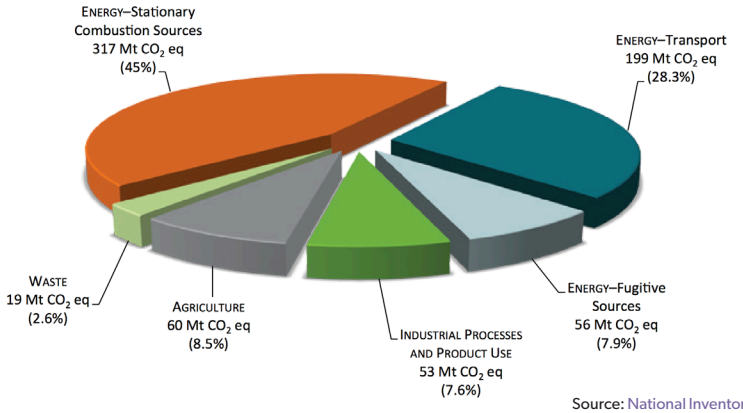
- Economic incentives to reduce waste include deposit return schemes (such as for glass bottles) and financial rewards for recycling non-typical items such as batteries or electronic waste. These financial incentives can be championed and managed by producers or mandated by governments, and can be financed through small environmental fees on product sales.

- Canada has significant scope to increase the use of these environmental pricing and incentive-based instruments. In some cases, this means simply expanding the reach and scope of existing programs, or promoting best-practice standardization across Canada. This will require coordination by all levels of government – to develop an integrated policy package that rewards less wasteful practices and that ultimately cuts associated GHG emissions.

INTRODUCTION

Until recently, waste has been seen as only a minor contributor to climate change. Canada's National Inventory Report shows the waste sector as being responsible for less than 3% of Canada's overall greenhouse gas (GHG) emissions, dwarfed by other sectors such as transportation or stationary combustion sources like oil & gas.[1] However, this statistic only includes direct emissions from waste treatment and management - in other words, the methane that is actually rising up from landfills as garbage decomposes, or a small amount of emissions from incineration facilities.

Canada's Greenhouse Gas Emissions 2016



Source: National Inventory Report 2018

From a lifecycle perspective (i.e. accounting for all emissions connected to the good), the production, movement, and retailing of products that eventually become waste, are responsible for significantly more GHG emissions from various sectors of the economy not typically associated with waste, such as energy, transportation, agriculture, and industrial processes.

In other words, all products come with "baggage" in the form of embedded or embodied GHGs that were emitted along the supply chain before reaching consumers. These steps along the supply chain include: emissions arising from the energy that was needed to extract the raw materials required for production; emissions from the energy required during manufacturing as well as other emissions from industrial processes; combustion emissions from transportation; and emissions

arising from all the energy and land-use required for marketing and retail. Only then are there the emissions arising from the collection and disposal or diversion of the item when it becomes waste.

In a related study, the US Environmental Protection Agency (EPA) estimated that as much as 42% of total US greenhouse gas emissions are associated with the energy used to produce, process, transport, and dispose of commodities and food (29% from goods and 13% from food).[2] Every step in this material flow results in environmental impacts, including but not limited to GHG emissions.

As such, reducing and diverting waste can be an important step in GHG mitigation and Canada's overall climate change approach.

There are opportunities to reduce waste at every step of the supply chain. Using fewer materials in design and manufacturing is key, while changes in behavior, business models, and process modification can lead to waste and cost savings in the upstream manufacturing, distribution and retail sectors. These upstream changes are fundamental to preventing waste from being generated in the first place, and are therefore more effective than recycling or managing waste once it has already been created.

For example, in the product design stage, there are opportunities to ensure more resource-efficient final products that are also more durable and can be easily recycled. In the production stage, there are opportunities to reduce waste by ensuring more sustainable sourcing of material flows. Minimizing waste is an important element of the Circular Economy model that is discussed in other Smart Prosperity Institute policy briefs.[3] Generally, the Circular Economy looks to maintain the value of products, materials, and resources as long as possible, including by minimizing the generation of waste throughout supply chains.

The focus of this Policy Brief is on economic policy tools to encourage waste prevention and diversion at the final consumer stage. It does not elaborate on how extended producer responsibility schemes are designed or deployed. When we throw things away, we often don't think about the environmental externalities that the product has caused during its lifecycle existence, including the related GHG emissions. Environmental pricing instruments help address these costs to society, and by doing so encourage people to reduce waste whenever possible (such as by buying more durable goods, donating items for second hand use, or being more mindful about what is placed in the garbage bin) or alternatively (and less optimally) help society maintain some of the value of what they do discard (such as by encouraging recycling programs).

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Current Context of Waste Generation in Canada and Globally

It is important to note that Canada's available statistics for waste generation are poor compared to other peer countries such as the EU, with data gaps particularly large for industrial and commercial waste.[4] What we do know, is that more than half of municipal solid waste (i.e. that collected by local governments or private companies which have reported to Statistics Canada) is non-residential, so collected from areas such as offices, buildings, or construction sites.[5] Moreover, total municipal waste is very small compared to industrial waste coming from areas such as mines or agriculture[6], which have unique and sometimes serious problems beyond the scope of this article. Waste in Canada is a complex challenge, and this policy brief only explores a slice of this challenge.

In the absence of mandatory recycling regulations, recycling only works in an economic sense if there is a market for the recycled product and if the price of the recovered products/materials is more than the cost of recovering it from the waste diversion stream.

Canadian residential waste statistics do not demonstrate environmental progress. Total municipal waste that is generated in Canada has increased by 11% in the last 12 years, including both diversion and disposal. At a household level, the amount of waste heading to landfills increased by 18% from 2002 to 2014[7]. This growth exceeds Canadian population growth, meaning that residential waste per capita continues to rise, in contrast to our peer OECD countries where residential waste has actually been decreasing per capita on average.

Global trends in waste generation are also dismal. Per capita waste generation is closely related to high quality lifestyles, consumption rates, and economic development.[8] As the world's economies grow, and emerging economies continue to develop, per capita waste generation rates are rising in all non-OECD countries (although they are still well below the OECD average). These factors, coupled with rapid population growth and urbanization, mean that global municipal waste generation is expected to nearly double from 1.3 billion tonnes per year in 2012, to 2.2 billion tonnes by 2025; Of this, 70% is expected to end up being landfilled or incinerated.[9]

While Canadian municipalities are producing more and more waste, they are also recycling/diverting more. Material has piled-up faster in our recycling and organic waste bins, increasing by 36% over the 2002-2014 time period[10]. This means that households are consuming more, creating more garbage, but also recycling/diverting more.

Some Challenges and Opportunities with Recycling

In Canada, more than two thirds of garbage is sent to landfill, far exceeding the OECD average.[11] Recycling is an important part of the solution and can save energy and GHG emissions compared with extracting and transporting raw materials. When things are landfilled, we have often missed the opportunity to extract the most value from the products, which in turn can save associated GHG emissions.

In most cases, manufacturing materials and products from recycled sources requires less energy and therefore results in fewer GHGs than if only virgin or primary resources are used. For example, in the US, the Environmental Protection Agency estimates that recycling just 10 plastic bottles saves enough energy to power a laptop for more than 25 hours; or that recycling 1,000 sheets of office paper can save the energy equivalent of consuming 6 litres of gasoline.[12] Saving energy translates into saving upstream GHG emissions, depending on the GHG intensity of the energy supplied. Recycling also helps avoid many environmental problems associated with landfills (e.g. air quality, land use, pest infestations, fire risks, potential for chemicals and heavy metals to leak into the ground and water table, etc.).

Although it's a positive sign to see Canadian recycling volumes continue to increase across Canada, recycling is not without its own environmental and economic challenges. Unfortunately, recycling should not necessarily equate to a clear conscious when it comes to throwing stuff away because:

- In the absence of mandatory recycling regulations, recycling only works in an economic sense if there is a market for the recycled product and if the price of the recovered products/materials is more than the cost of recovering it from the waste diversion stream. Municipal governments often compete to find markets for recyclable material, which may involve shipping material overseas. Marine shipping by bulk cargo produces GHG and other

emissions, and has other environmental considerations such as potential oil leaks, marine collision, sewage, and ballast water challenges (often responsible for the spread of invasive species).

- Until recently, China has been a major end-market for North American lower-value plastics, paper and other recyclable materials[13]. On December 31 2017, China significantly decreased its tolerance for contaminated materials, banning certain imports, and effectively closing the market for much of Canadian recyclables. Without access to the Chinese end-market, recyclable material has been piling up in Canadian municipal facilities, sometimes ending up in landfills. The restrictions on the Chinese end-market for recyclables has also hurt the related revenues for municipal governments, challenging the economic viability of recycling programs in some instances. Implications might include stricter sorting requirements (to help compete in new domestic or international markets) or increased user fees to keep recycling programs viable.

- Proper sorting of recyclable material continues to be a social and financial challenge in municipalities. For example, last year, the City of Toronto collected 204,000 tonnes of recycling, but 52,000 tonnes (or 26%) of that total was garbage that had been placed in the wrong bin[14]. Often this is because products are made of increasingly complex materials and composite grades of plastic (e.g. think of the multiple plastics in packaging material from web-based shopping, or the foil lining in juice boxes for example). It is more and more difficult for households to know which parts of items are and are not recyclable. Ultimately, household sorting programs, as well as new technology at sorting plants, will need to be increasingly improved and deployed.

There are some solutions to help lower contamination rates of recycled products and therefore ease recycling and improve the chance of finding a robust market. For example, in 2011, the Province of British Columbia's amended environmental regulation laws to transfer the cost of recycling from consumers to producers. Producers that sell products in British Columbia pay fees to Recycle BC on a quarterly basis based on how many kilograms of each material they sold in the province. The organization then ensures that packaging and printed paper is collected from households and recycling depots, sorted and then responsibly recycled. Recycle BC is among more than 20 extended producer responsibility (EPR) programs introduced in BC over the last two decades.[15]

In addition, products and packaging could be designed with recycling optimization in mind. Applying product/material standards across jurisdictions to optimize recycling would be an effective policy lever but would need a coordinated response across Canada - and ideally internationally given the global nature of trade. For example, specifying which plastics may be used in packaging, or establishing limits on composite materials, would significantly facilitate recycling efforts (e.g. banning plastic bottles that also have a polymer film sleeve for labelling or advertising covering).[16]

However, the bottom line is that recycling is not a silver bullet solution to the waste issue, and preventing the generation of waste in the first place has the potential to reduce energy, resource use and GHG emissions more effectively and more efficiently than recycling or diversion.

Food Waste, Climate Change, and Agriculture:

According to Canada's National Inventory Report, agriculture is responsible for 9% of Canada's GHG emissions (59Mt in 2015), with emissions arising from enteric fermentation (animal gases during digestion), manure management, and nitrous oxide from agriculture soils.[17]

When the lifecycle emissions of actually getting that food to table are included, GHG emission estimates would increase substantially. For example, as with other sectors, emissions arising from the provision of food should consider emissions from the energy, transportation, and industrial and agricultural processes associated with growing, processing, transporting, and disposing of food. The supply chain stretches from farms to processing plants, marketplaces, retailers, food-service operations, and the cooling systems in home refrigerators.

There are also significant amounts of water, fertilizer, pesticide, and land use required to produce agriculture commodities, each of which has its own lifecycle emissions footprint. Internationally, farming already uses 38% of ice-free land, and uses as much as 70% of total extracted fresh water.[18]

Meanwhile, much of this energy, resource use, and associated GHG emissions is wasted when food does not get eaten. According to the Food and Agriculture Organisation (FAO) of the United Nations, approximately 30% of food produced for human consumption around the world is either lost or wasted each year.[19] The FAO estimates that this is equivalent to 1.3 billion tonnes of food, worth US$1 trillion in retail value. In Canada, the cost of food waste has been estimated to be at least $31 billion annually.[20]

Food waste occurs at all stages of the food supply chain, from agricultural production, post-harvest distribution, storage, transportation, processing, retail (including wholesale, supermarket and fresh food market, etc.), and consumption (home and restaurant).

In developing countries 40% of losses occur at post-harvest and processing levels (e.g. rotting en route, or spoiling in markets) while in industrialized countries more than 40% of losses happen at retail and consumer levels (e.g. where more is purchased than is eaten). This number can be distributed between the major waste categories, such as: wastage from cereals (34% of total), meat (21%) and vegetables (21%).[21]

A 2013 United Nations study used a "carbon footprint" methodology to estimate the global GHG emissions associated with food waste. The study found that in 2005, 3.3 billion tonnes of carbon dioxide equivalent was emitted into the atmosphere due to food that was wasted. The study notes that if food waste were a country, it would appear third – after the US and China (using 2007 data) – in terms of largest global emitters.[22]

A 2017 study prepared for Canada's National Zero Waste Council used the EPA Waste Reduction Model to estimate potential lifecycle GHG savings from food waste prevention, disposal and diversion strategies.[23] The study finds that Canadian GHGs could be reduced by as much as 8.1Mt between 2015 and 2030 through changing household behaviour to prevent/reduce food waste, as well as solid waste management practices that better capture the potential to recover food waste as compost and clean energy.

Policymakers both domestically and internationally are increasingly aware of this issue. The 12th United Nations Sustainable Development Goal is 'Responsible Consumption and Production'. This includes the goal to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses by 2030 (SDG 12.3).

ENVIRONMENTAL PRICING AND INCENTIVE BASED SOLUTIONS

The following section discusses some environmental pricing and incentive based instruments to help prevent and divert household waste.

From a jurisdictional lens, waste is normally viewed as a provincial government issue, where in practice, it is local governments (i.e. municipal or regional governments) that are generally responsible for providing waste management services. However, the responsibility under the Canadian protection act for managing and reducing waste is shared between the federal, provincial, territorial and municipal governments. Governments have many levers to address components of waste, such as legislated extended producer responsibility programs, regulations, and bans. The following section describes environmental pricing and economic incentive policy options. Choices related to these policy tools may change as waste is viewed with a climate change or circular economy lens – where all three levels of government have important but differentiated roles in waste reduction and waste management strategies.

In addition, the federal government provides funding towards capital investments in municipal environmental infrastructure (water supply, sanitation, waste management) and can contribute to operating costs. As such, the federal government could insert waste prevention and reduction criteria into their investment decisions for local government infrastructure (e.g. composting, recovery of energy from waste, etc.). Infrastructure spending and other investments by provinces could also include waste criteria to facilitate prevention and recycling efforts.

Increasingly in Canada and internationally, price signals are also being implemented by the private sector through industry-managed extended producer responsibility (EPR) programs and retail incentives. The motivation behind some of these programs is to stay ahead of potential regulation. But for other programs, these are important tools to secure recycled resources and materials for more circular supply chains.

Getting the Prices Right

As we've seen, environmental damages are imposed along the full product lifecycle of supply chains. The things we buy or sell often require the extraction of finite raw materials; the consumption of countless joules of energy during production; the use of land, chemicals and water; and many hours of freight shipping by road, air, and water, both domestically and internationally. All of these steps result in environmental costs in the form of externalities, including, but not limited to, the cumulative effect of the resulting GHG emissions. Without proper price signals, these costs are not considered by the final user who discards the product into the waste stream.

Creating the right price signals is a key policy tool for encouraging producers and consumers to be more waste conscious. Pricing external environmental costs (externalities) helps reflect environmental damages in those costs faced by consumers and producers. Since people will aim to avoid paying these costs, environmental pricing mechanisms help to change behaviour and investment away from environmentally harmful practices. They also allow the market to develop innovative ways of avoiding these costs, including by making cleaner investments.

While the federal backstop national carbon pricing system (to be implemented on January 1, 2019) is a notable exception, Canada generally ranks low in terms of using economic pricing mechanisms for the environment. Canada's environmental pricing revenue is the third lowest in the OECD at 1.2% of GDP.[24] There remains significant scope to consider how environmental pricing and incentive based mechanisms can be applied within waste prevention and diversion policy packages.

Variable Waste Disposal Fees

Canada has one of the lowest average landfill dumping fees in the OECD.[25] There is therefore little incentive for municipalities to promote recycling or other waste diversion strategies. Most Canadian municipalities collect waste at the curbside with minimum restrictions, with a flat fee to cover these services charged through property taxes. This type of fee structure means that households pay the same amount regardless of how much waste they generate. In other words, there is no financial incentive to recycle or divert organic waste, or to avoid single-use, packaging, or low-quality items.

Some jurisdictions have implemented user pay systems, in which households are charged on the basis of the quantity of waste generated. This encourages waste reduction strategies since the more you throw away, the more you pay. Most of these communities charge residents by volume, based on the number of bags or cans set out at the curb (with a weight limit per bag or can). Others require their residents to purchase special garbage bags, tags, or stickers that include the cost of waste collection in the purchase price. A few jurisdictions have opted for weight-based systems where waste is weighed at the curb. Weight-based systems offer a clear incentive for reducing waste at the margin, but this type of system is more expensive to run.

Although pricing by volume or weight provides a direct incentive to save money by cutting down on waste, some municipalities have opted for simpler solutions such as mandating a maximum bag per household. For example, Halifax's "Clear Bag" program provides curbside pickup for five clear garbage bags and one black bag per household. Although this type of system does not encourage waste reduction at the margin (e.g. per kilogram of waste), it still makes households more conscious of the volume of waste they generate – and can lead to behavioural changes since the content of the clear garbage bags are visible to neighbours and friends. Halifax's system has produced a 24% decrease in garbage sent to landfills since the program was introduced in 2015.[26]

There are at least 200 communities in Canada where residents pay directly for every bag of garbage set out on the curb, or for each bag of garbage over a set limit. Other structures include the City of Toronto's garbage-bin fee that increases with the size of the container. However, the majority of Canadian households do not face financial incentive for reducing waste or increasing diversion practices.[27]

Changing the fee structure to variable rates has been shown to work internationally. More than 5000 communities across the United States have Pay-As-You-Throw (PAYT) programs in place. In most of these programs, residents are charged a fee for each bag or garbage-can of waste they generate. Since the program means that the less individuals throw away, the less they pay, there is a strong incentive to reduce waste (e.g., by avoiding bulky or heavy packaging). The EPA notes that participating communities have reported significant waste reduction and increases in recycling rates.[28]

Source: Region of Waterloo - Garbage Tags

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The EPA's PAYT program is also seen as more equitable in the sense that individuals benefit from their efforts to recycle or cut down on waste. Under a flat fee system, residents who recycle and prevent waste actually subsidize their neighbors' "wastefulness". In addition, variable rate pricing can include revenue neutrality in its design. This means that the variable rate structure is set up to cover the waste management costs, and property taxes are lowered by the equivalent amount as what is collected from variable waste fees. This improves public perception towards the program including any accusation of "double taxation" or increased costs. Collected revenue can also be used to address inequality concerns for low-income families, by offering lump-sum payments to offset the cost of the program.

Many other jurisdictions around the world have adopted variable pricing systems for waste collection. In cities such as Seoul (South Korea) and Taipei (Taiwan) residents are required to purchase special garbage bags that are colour-coded by waste category (but then there are no additional fees for waste collection). Also, since the 1990s Berlin (Germany) has had a variable charge depending on the bin size and collection frequency, on top of its quarterly fixed charge. Berlin's per capita waste generation has fallen by 18% in 18 years, with its overall recycling rate doubling from 21% in 1996 to 42% in 2012.[29]

When it's no longer free to put out garbage, behaviour changes. For example, consumers might opt for more durable items, or products with less packaging. In addition, recycling becomes more attractive and there is more reason for communities to invest in better recycling technologies, thereby spurring innovation in this field.

Smart policy would combine variable pricing within an integrated policy package. For example, simultaneously increasing community recycling services (including organic composting systems), as well as imposing stricter requirements for proper recycling habits. Ensuring that littering or illegal dumping charges are in place and enforced is also key to overall policy success. Finally, special consideration will be needed for multi-family developments (e.g. condos, townhouses, etc.) where recycling is typically more challenging.

Although municipal governments generally hold the policy levers to determine rate structures, provinces can enact legislation that mandates or promotes implementation of variable pricing for residential solid waste management. If variable pricing is recognised for its ability to significantly reduce waste and associated lifecycle GHG emissions, it is worth questioning whether the federal government could also hold this lever.

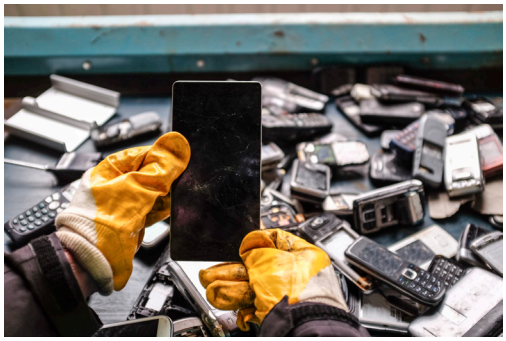
Deposit Return Schemes

Legally mandated deposit return schemes have been used in Canada to capture high quantities of empty beverage containers for decades. Bottle deposit refunds for recyclable beverage containers are best known across Canada for beer, wine and liquor containers.

In Ontario, around 80-90% of alcohol containers with a deposit are returned to the Beer Store or Liquor Control Board of Ontario. According to the Ontario government, since 2007, about 3 billion alcohol containers have been diverted from landfill under this Ontario Deposit Return Program. Ontario estimates that every additional 1000 tonnes of recycled waste generates seven new jobs in the province.[30]

Refillable bottles use significantly less energy and water than manufacturing new bottles from either virgin or recycled materials. A glass refillable alcohol bottle is typically refilled 15 times.[31] Other returned containers are recycled into useful new products such as carpeting, insulation, and plastic lumber.

Bottle deposit mandated legislation extends beyond alcohol containers in many other parts of Canada. British Columbia was the first Canadian province to establish a mandatory deposit-return system in 1970, and collects deposits on all ready-to-serve beverages containers, with the exception of milk (e.g. juice, pop, bottled water, alcohol containers, etc.). Saskatchewan, New Brunswick, Nova Scotia, Newfoundland, Prince Edward Island, Yukon, the Northwest Territories, and Quebec have similar programs (Quebec's is just for alcohol and pop containers). Alberta goes a step further, as the first jurisdiction in North America to also accept milk containers since 2009. Manitoba collects deposits for beer containers. Many of these programs also include a "container recycling fee" which is non-refundable and helps finance the programs.[32]



Given the success of these beverage container deposit-return programs, there could be opportunity to expand incentive based mechanisms to other areas (e.g. household batteries, e-waste) and coordinate best practices across Canada.

Bottle and container deposits give consumers a direct financial incentive to recycle. Deposits range from CAD$0.05 to CAD$0.40 per unit depending on the material and size of the container. The success of the program is demonstrated through total return rates, ranging from 61.6% in Newfoundland to 88.2%, in NWT, with an average of 80% across Canadian systems.[33]

Given the success of these beverage container deposit-return programs, there could be opportunity to expand incentive based mechanisms to other areas (e.g. household batteries, e-waste) and coordinate best practices across Canada. New industry partnerships for deposit returns for electronics (e.g. cell phones) or batteries is not new to Canada, but is industry led.[34] More coordinated programs could be applied to targeted commodities such as deposit returns for electronics where a proportion of the refund would be tied to the state of the article. For example the entire deposit could be returned if the item can be reused or repaired, and only a portion if the item is suitable only for recycling.

Both electronics (e-waste) and batteries can pose serious environmental challenges beyond significant lifecycle GHG emissions. Moreover, this type of recycling offers significant cost savings for producers. A poll of 3,055 adults in the United Kingdom revealed that less than half of those surveyed (47%) realized that batteries are made of valuable heavy metals which can be reused (including lead, mercury, cadmium, zinc, manganese and lithium).[35] As an industry-led initiative in Canada, participating Canadian Tire stores charge and return CAD$20 to consumers when they return a used car battery. This type of program could be standardized and improved across jurisdictions.

Economic Incentives used under Extended Producer Responsibility Programs or Product Stewardship Programs

Dozens of recycling programs for non-typical items exist in each province, through extended producer responsibility programs, product stewardship programs, and other related initiatives across Canada.[48] These include programs for agriculture products (e.g. pesticide containers, seed and grain bags, livestock medication, plastic bale wrap, etc.); automotive products (e.g. tires, oil, oil filters, antifreeze containers, etc.); electronic equipment (e.g. mobile devices, appliances, power tools, exercise machines, etc.); refrigerators; plastic bags; mercury containing products; and pharmaceuticals.

Waste, Climate Change and our Oceans:

One plastic bag can cause significant damage to marine life through ingestion or entanglement, or by suffocating plants and animals such as a coral reef. That plastic bag might end up killing an endangered sea turtle for example, when the turtle easily mistakes it for a jellyfish, blocking its digestion system.

Plastic marine debris is of particular concern due to its long life span, and the physical and chemical hazards/toxins it presents. Globally, around 8.3 billion tonnes of plastic have been produced since 1950, the vast majority ending up in landfills or the natural environment (averaging 400 years until nature is able to break it down).[36] Less than nine percent of these plastics have been recycled. Each year, somewhere around 4.8 to 12.7 million tonnes of plastic enters the world's oceans.[37] This plastic interacts with almost 700 marine species threatening their natural habitat and survival.[38]

Plastic waste swarms beaches, harming tourism (often in developing countries dependent on tourism industry revenue), the fishing industry, and navigation. Floating plastics also contribute to the movement of invasive species, causing indirect harm to local ecosystems.[39] From massive whirlpools of floating junk, to barely visible microbeads, the damage that plastic is causing to our oceans is ever more obvious.

The oceans, which cover three quarters of the earth's surface, play a vital role in the global climate system, generating oxygen and absorbing carbon dioxide from the atmosphere. Basically oceans are responsible for planet Earth being habitable for humans by driving global atmosphere and water systems.[40] The importance of oceans' association with climate change cannot be underestimated. Oceans are the largest carbon sink in the world, absorbing about a third of human-caused (anthropogenic) GHGs.[41]

These types of programs can return raw materials such as precious metals and other resources to supply chains (an important Circular Economy concept), as well as help mitigate lifecycle GHGs. Most of these programs are managed and run by producers or retailers, highlighting the key role they can play in waste diversion, as well as the potential opportunities associated with producers taking responsibility for the full lifecycle of their products.

Financial incentives offer the opportunity to increase the popularity of such programs and lead to higher rates of utilization. For example, providing direct cash incentives, store points or coupons to consumers that recycle has been shown to raise community diversion rates. This type of feature highlights the role of industry and the private sector in being a proactive part of the solution to waste challenges.

Advanced disposal fees (or "Eco Fees") are currently used by producers to fund recycling programs on items such as used tires across Canada.[49] The fees are levied at purchase and are normally used to fund the estimated costs of recycling treatment. However, the fees are sometimes buried in receipts where consumers are often unaware of the fee or its use. Collecting fees more transparently would help raise awareness to recycling possibilities, but the fee could also be structured in a way to help incentivise customers to return their product to recycling facilities. For example, a portion of the fee could be returned to consumers or service providers to offer a direct cash incentive for the service.

Lessons can be drawn for this type of program from the Western Canada Used Oil Program which provides incentives to service providers (e.g. haulers and processors) to ensure recovery and safe disposal of used motor oil, as a way to prevent damaging discharges into sewers, watercourses and groundwater.[50] Sales and imports of oil are subject to a fee, or "environmental handling charge", which is then used to fund a financial return incentive that is paid to authorised collectors when used oil is recycled (e.g. into heating oil). The monetary reward provides these businesses with an incentive to maximise the amount of oil collected and recycled.

Producer-funded recycling programs will help reclaim materials and can also be beneficial to a firm's environmental image and public relations. Recently, clothing retailers have begun to experiment with these types of schemes for textiles: clothing donation bins are set up in retail chains where shoppers get a coupon or discount on a future purchase. According to some estimates, the popularity of these schemes at H&M, Levi's, Adidas and Reebok has meant that over 600,000 kilograms of old garments has been collected in Canada since 2013.[51]

About 35% of the clothes that are collected through these schemes are recycled and used for products like carpet padding, painters' cloths or insulation, with a small percentage recycled into new clothing. A large portion of used clothing is also shipped to second hand clothing markets, often in Africa and Central and South America, where they may end up in landfill if they can't be sold or donated.

Refilling containers at home or in stores is yet another way to reduce waste. For example, many common household products, such as cleaning products, are currently sold in single-use bottles and consist mainly of water with only a small amount of active ingredients. New grocery stores such as NU Grocery in Ottawa offer waste-free shopping where products are offered in bulk or redeemable glass containers. In some cases, refilling containers ends up costing less and saving consumers money at check-out counters.

Other examples of producer incentives include: Best Buy, which offers a $2 coupon for every empty ink cartridge returned ; MAC cosmetics, which offers a free lipstick in return for recycling six packaging items (e.g. empty lotion bottles); Apple, which offers gift cards for returning reusable Apple products; and Lush, which offers a free "fresh face mask" for the return of empty containers.

In short, small financial rewards, coupons or gifts can lead to higher recycling rates by providing consumers with a financial incentive to return their products. These programs can be managed by individual businesses, or alternatively through government regulated extended producer responsibility programs.

Tax Breaks for Used Item Repair or Refurbishing

When items are broken or get old, there is a tendency in society to simply throw them in the garbage. The actual cost of throwing things away would normally reflect the cost of buying a new one compared to any service or repair fees. If service or repair fees are high, then there is more reason to discard the existing item in favour of a new one.

But repairing or refurbishing existing items significantly cuts down on waste, and all of the GHG emissions involved in getting a new product and discarding the old one. As such, governments should look to encourage repair infrastructure and second-hand consumption whenever possible.

The Swedish government, for example, introduced tax breaks on repaired items such as bicycles, clothes, and shoes, by cutting the value-added tax (VAT) on these items from 25% to 12% in 2017. Sweden is also adding income tax credits that would allow people to claim back half of the labour costs on repairs to appliances such as fridges, ovens, dishwashers and washing machines.[52] These tax credits on appliances are meant to spur the creation of new innovation, including a new home-repairs service industry – which could also boost employment.

Any tax incentive that lowers the relative cost of repairing or reusing items has the potential to sway behaviour away from a "buy-use-toss-buy" cycle. Saving money on taxes offers an incentive to choose to repair items rather than throwing them away, and also offers incentive for businesses to innovate in these areas. For example, Sweden's efforts have encouraged innovative ideas such as repair cafés and social workshops, where people can share their knowledge and repairs are available for free or much cheaper than in stores.[53]

Canada could consider income tax credits (although these can add to the complexity of the tax system), or sales tax exemptions for repairing/reusing behaviours that lead to less waste and corresponding GHG emissions. Extending the lifespan of products through reuse, repair and refurbishing, ensuring more durable original product design, and increasing an items use-intensity rather than quantity sold (through sharing for example) are all important concepts of the Circular Economy model.

Charges and Bans on Single-Use Items and Packaging

More than one trillion plastic bags are consumed worldwide each year. According to the US EPA, the US uses over 380 billion plastic bags and wraps yearly, requiring 12 million barrels of oil to create. Charges for plastic bags have been shown to lead to significant reductions in use, thereby decreasing the associated energy emissions and oil production by-product used to make plastic bags.[54] Experience in the UK, Ireland and elsewhere has shown that the equivalent of a USD 9-cent charge on plastic bags can reduce their use by as much as 60-80%.[55]

Jeopardizing the health of oceans in turn jeopardizes their numerous services. For example, as oceans continue to absorb more and more man-made carbon dioxide, their capacity as a carbon storehouse could diminish, significantly adding to the climate challenge. Anthropogenic carbon dioxide is stored primarily in the upper ocean and has already caused a decrease in pH of about 0.1 at the ocean surface, known as ocean acidification, with consequences such as coral bleaching.[42]

The direct link between the oceans' ability to absorb and store carbon dioxide and marine litter is not well understood, with research only beginning to emerge in this area.[43] For example, it has been theorised that the ingestion of plastic by mesopelagic fish (fish that normally live at depths of 100-200 meters below the surface) may have an effect on climate change. These fish come nearer to the surface at night to feed on carbon rich plankton, but could instead be digesting micro plastics, upsetting their natural ability to help store carbon at deeper depths. One study found that 35% of the mesopelagic fish studied had ingested plastics.[44]

Oceans are highly complex systems and are the primary regulator of the global climate. Rising levels of GHG emissions and plastic waste are two of the most disturbing ways that human activity is threatening our oceans. It is estimated that about 80% of marine debris originates as land-based trash and the remaining 20% is attributed to at-sea intentional or accidental disposal or loss of goods and waste.[45] Global plastics production is expected to double in the next decade.[46] Without global solutions such as waste management infrastructure improvements, the cumulative quantity of plastic waste that could enter the ocean from land is predicted to increase by an order of magnitude between 2010 and 2025.[47]

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Charges for plastic bags at grocery stores are increasingly common in Canadian jurisdictions. The success of these programs could be extended to other single-use items such as disposable plastic cups and takeaway boxes. This type of charge is currently being considered in the United Kingdom, particularly to help reduce pollution in the world's oceans.[56]

In Canada in 2012, an estimated 14.4 million pounds (80%) of polystyrene (Styrofoam) waste was sent to landfills, missing the opportunity to produce recycled products such as commercial insulation. However, although polystyrene is technically 100% recyclable, it rarely is – often because it is contaminated with food waste, or because the appropriate recycling technologies don't exist locally.[57] This is why some jurisdictions have adopted local restrictions on polystyrene use, such as for restaurant take-out containers. Replacing this patchwork of initiatives with more uniform provincial or national single-use charges, bans or other requirements could be a sensible policy direction.

Some cities have determined that single-use charges are not sufficient and have decided to ban certain single-use items altogether.[58] For example, the City of Montreal implemented its long-planned ban on plastic bags on January 1, 2018. In 2016, France became the first country in the world to ban plastic cups, plates, and cutlery.[59]

Although Canadian municipalities have led the way on plastic bag bans and charges, there have been questions about whether the federal and provincial governments could also hold levers to ban or limit single-use items.[60] For example, the Canadian government recently banned the manufacture of microbead plastics (the tiny balls present in some items such as toothpaste and showergels) using the Canadian Environmental Protection Act.[61]

In terms of packaging, governments have the ability to instigate performance-based regulations, for example limiting the mercury content in a product. This can be extended to mandating a minimum percentage (by market share) of re-useable packaging sold each year. For example, in its proposal amending the Packaging and Packaging Waste Directive, the European Parliament has called for new reuse targets (non-binding) of 5% by 2025 and 10% by 2030.[62]

CONCLUSION

Reducing waste in Canada has the potential to reduce direct and lifecycle GHG emissions, and is an important step in meeting our climate change commitments. As our increasing waste stream is a sign of our growing prosperity, there is ever more reason to ensure that prices reflect the environmental damages that our consumption and disposal behaviours are causing. Currently there are very few financial incentives to reduce the amount Canadians throw away, with market forces often encouraging wasteful behaviour (e.g. cheap non-durable items, low dumping fees, high repair costs, faraway recycling facilities, etc.).

Although recycling and reusing items can save energy and related GHG emissions compared to extracting and transporting raw materials, preventative strategies are far more environmentally and economically effective. Preventing waste along the supply chain is an important element of the Circular Economy Model, which also includes a multitude of other benefits beyond GHG emissions such as reducing pressures on landfills, resource extraction and water.

Consumers and producers should face the right price signals related to waste. Pricing external environmental costs (externalities) helps reflect environmental damages within the costs faced by consumers and producers. Variable waste collection pricing (based on volume or weight) rewards people for preventing waste or increasing recycling, and helps shift behaviour and consumption towards less wasteful practices. It also encourages people to develop innovative ways of avoiding producing waste, including by repairing, sharing or reusing items.

Single-use items lead to unnecessary resource extraction and the GHGs associated with their shipment across international borders, to retailers and eventually to landfills. Charges or bans of single use items have been successful in Canada for plastic bags and could be extended to other areas such as single-use plastic cups, polystyrene take-out containers, and plastic plates.

Economic incentive policies include deposit return schemes (mirroring those related to glass bottles) and financial rewards for recycling non-typical items such as batteries or e-waste. These financial incentives can be introduced and managed by producers or mandated by governments and could be financed through small environmental fees on product sales.

Canada has significant scope to increase the use of these pricing, regulatory and incentive instruments to drive the shifts in behaviour and investment needed to achieve waste prevention and reduction. In many cases, this means simply expanding the reach and scope of existing programs, or promoting best-practice standardization across Canada.

A policy package would consider the benefits and drawbacks of various policy tools and how they might complement each other. For example, variable waste collection fees provide a strong incentive for households to prevent waste, but would likely do little to curb the use of single-use plastic bags (since they are lightweight and can be compressed). This will require coordination by all levels of government to develop an integrated policy package which ultimately rewards less wasteful behaviour.

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