Successful Plastic Packaging Management Programs and Innovations

Washington Plastic Packaging Management Study

Prepared for the Washington State Department of Ecology

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Report for the Washington State Department of Ecology

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Disclaimer

Executive Summary

The Plastic Packaging Evaluation and Assessment law (Chapter 70.380 RCW) directs the Department of Ecology (Ecology) to submit, by October 31, 2020, a report on the evaluation and assessment of plastic packaging[1] in Washington. Ecology has hired Cascadia Consulting Group and a team of subcontractors to produce this report, which must include:

1. Findings regarding the amount and types of plastic packaging sold in the state, as well as the management and disposal of plastic packaging.
2. Recommendations to meet the goals of reducing plastic packaging, including through industry initiative or plastic packaging product stewardship, to:
    a. Achieve 100 percent recyclable, reusable, or compostable packaging in all goods sold in Washington by January 1, 2025.
    b. Achieve at least 20 percent postconsumer recycled content in packaging by January 1, 2025.
    c. Reduce plastic packaging when possible, optimizing use to meet the need.
3. Options to meet plastic packaging reduction goals that are capable of being established and implemented by January 1, 2022, for the purposes of legislative consideration. For proposed options, Ecology must identify expected costs and benefits of the proposal to state and local government agencies to administer and enforce the rule, and to private persons or businesses, by category of type of person or business affected.

In order to make informed recommendations within the final report, this Task 3 sub-report:

- Uses a geographical scan to detail policies, programs, and technologies which are available to manage plastic packaging in line with: a) the waste management hierarchy, and b) the circular economy. Commentary is provided on how each is leading to the reduction, reuse, and recycling[2] of plastic packaging. A qualitative assessment of the applicability of the option to Washington is also provided (Task 3A).

[1] For the purposes of this study, "packaging" means material used for the containment, protection, handling, delivery, or presentation of goods by the producer for the user or consumer, ranging from raw materials to processed goods. A full definition, as well as plastic packaging material definitions are included in Appendix A.1.0.
[2] The term "recycling" as it is commonly used often refers to the process of collecting and sorting material for reprocessing into feedstock. Where possible, we have tried to use precise language to indicate when

- Sets out the comparative costs and savings to different stakeholders of packaging stewardship programs in other jurisdictions. This enables parallels to be drawn as to the potential impact to Washington stakeholders should a similar program, potentially just for plastics, be implemented in the state (Task 3B).
- Identifies existing organizations and organization types that could play a role in the management of a plastics stewardship program in Washington (Task 3C).
- Identifies existing databases of plastic packaging producers that were used in other programs (Task 3D).[3]

We recognize that the intention of the Washington Legislature in Chapter 70.380 RCW was to identify solutions that will mitigate the impact of plastics in our environment. This can be achieved through a reduction in use, as well as ensuring that plastics that are sold into the market are either reused, recycled, or composted. Our intent in this Task 3 sub-report is to identify plastic packaging management programs, policies, and technological innovations that have demonstrated success or have the potential to provide a future role in ensuring that plastic packaging is reduced, reused, recycled, or composted.

Research Findings

The geographic scan identified 23 different examples of policies and programs to address plastic packaging—organized into six types—and 53 technology providers. While the team sought to find examples specific to plastic packaging, the extended producer responsibility (EPR) programs that are included address plastic packaging as part of a broader packaging management system. No plastic-only EPR program was identified during the scan. Policy measures that address one specific packaging material can lead to unfair market distortion as well as unintended environmental and financial consequences associated with a potentially less-understood material substitute and, as a result, EPR programs have typically been used to address packaging and products more generally rather than specific material types. The EPR case studies included in Section 2.1.3 detail how plastics can be managed successfully as part of a wider packaging EPR program.

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we are referring to the process of collecting materials for recycling versus the actual transformation of used products and packaging into feedstock for new materials.

[3] The scope of work for the study is included in Appendix A.6.0

Policy and Programs

Policymakers have two broad types of instruments available for changing consumption and production habits: command and control regulatory approaches; and incentives, or market-based policies. Outside of the policy sphere, there are also voluntary agreements or commitments. For example, individual producers making minimum recycled content targets or, more collaboratively, through the Ellen MacArthur Foundation's Plastic Pact [1], which sets a common vision for addressing plastic.

The six types of policy measures addressed in this report span all the instruments discussed above. These include:

1) **Product or Material Disposal Bans:** Disposal bans seek to drive diversion of materials deemed recyclable while product bans that seek to stop the use of a specific product, mainly single-use plastic items. Polices reviewed include Nova Scotia's and Vermont's recyclables landfill ban, Vermont's plastic trifecta ban, and Seattle's plastic bag ban.
2) **Fees/Charge/Tax/Levy**: These market-based policy measures seek to drive changes in consumption and/or production, modulate the effects of other market distortions, or correct for externalities not fully accounted for in current pricing and market dynamics. Often, these measures are intended to achieve similar goals as product or material disposal bans but through the use of economic/market signals rather than through command-and-control regulation. The policies reviewed were either disposal or product related, and included California's Integrated Waste Management Fee, the United Kingdom's Landfill Tax, and Chicago's bag fees.
3) **EPR Programs**: EPR is a policy approach that transfers financial, and sometimes operational, responsibility for end-of-life management (and, in some cases, other impacts) of products and packaging to producers and, when well-designed, creates incentives for producers to incorporate environmental considerations into the design of their products and packaging. We review systems in Belgium, British Columbia, France, Germany, Norway, Ontario, and Oregon. Each program is different and has regulatory, structural, and operational components that are pertinent to Washington as it considers how to manage plastics in the future. For this study, we include some deposit return systems (DRS) that are also considered a form of EPR and cover beverage containers.
4) **Minimum Recycled Content Targets**: Recycled content policies seek to stimulate market demand and drive use of recycled feedstocks produced from materials collected for recycling. Many companies are committing to recycled content targets on their own but, in light of a long history of unmet voluntary private sector targets, there is a push to require such targets through policy, such as the legislation

advanced in California and Washington in recent legislative sessions (though both bills were vetoed by their respective governors).

5) **Reusable Product Facilitation:** These policy measures seek to support overall reduction of resource consumption and waste generation through reuse of products that would otherwise be recycled or disposed. There has been a popular upswing in reusable product use by consumers over the last several years. Governments can help facilitate this shift by revising health and safety laws to account for reusable products or even require retailers to provide reusable foodware for eat-in dining, both of which have been reviewed in Berkeley, CA. Berkeley (CA), Portland (OR), and Freiburg, Germany are all testing reusable programs operated by third parties for to-go cups or takeout containers.

6) **Multi-faceted Measures:** These policy measures seek to address multiple challenges posed by plastic packaging simultaneously, through a combination of tools described above. The European Union (E.U.) has implemented its Single-Use Plastics Directive, which uses a combination of interventions to tackle commonly littered items. California is attempting a similar approach through SB 54 but was not successful in the last legislative session.

Key Takeaways

The key takeaways, including strategic considerations and lessons learned from the research on plastic packaging management programs and innovations, are detailed below.

1) Product or Material Disposal Bans

Both Vermont and Nova Scotia have banned disposal of materials for which there are recycling options, such as beverage containers or organics, in order to reduce the material going to landfill or incineration and encourage disposal options higher up the waste management hierarchy.

Key Considerations:

- What would be the likely impact of banning a certain plastic or all plastics from landfill? One might be that more plastic is incinerated which ultimately may be a worse environmental outcome.
- What is the intended end-of-life management alternative for the targeted material? E.g., is there an established recycling service, or will one be able to be developed by the date that the ban comes into effect? Bans on landfill disposal of plastic could have the unintended consequence of increasing the amount incinerated, so bans may be more appropriate for specific design attributes that are disruptive to the recycling process rather than intended as a stimulant for recycling.

- If a recycling option is not available or viable, consumers and/or manufacturers of the material will likely switch to an alternative material, which may be equally or less ecologically advantageous. Before implementing a ban, an assessment of the life cycle impacts of possible alternatives should be investigated, so that greater environmental impact is avoided.
- Can the ban be enforced effectively? If so, how, by whom, and at what cost?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

Lessons Learned:

- Structure of the legislation is extremely important to prevent loopholes.
- Policy measures such as product or material bans that seek to address one specific packaging material can lead to unfair market distortion as well as unintended environmental and financial consequences if consumers and producers switch to alternative materials with potentially negative impacts, if those are not appropriately addressed in the policy. Some of these unintended consequences can be observed from early plastic bag bans and are now starting to be seen in Europe following the introduction of its Single-Use Plastics Directive, detailed in Section 2.1.6.

2) Fee/Charge/Tax/Levy

Environmental fees, charges, taxes, and levies can be placed on:

- Items disposed to landfill such as in California, which instituted a fee on disposal to generate revenue to support recycling programs. The United Kingdom (U.K.) in 2005 introduced an escalating landfill tax which enabled alternative waste management practices higher up the waste management hierarchy to become a financially viable option.
- Specific products/materials such as the U.K.'s new tax that applies to plastic packaging produced in or imported into the U.K. that does not contain at least 30 percent recycled plastic.

Key Considerations:

- Landfill fee/tax:
    - Is a plastic-specific landfill fee feasible to implement and enforce? What level of fee would have to be levied to create the necessary market conditions to create financially viable and sustainable recycling alternatives?
    - Where will revenue go and who will manage it?
- Material fee/tax:

  - What materials should be covered and how should these be determined?
  - At what level will the tax be set and how will the system be designed and implemented?
- For taxes related to recycled content requirements, how will producers demonstrate compliance? What systems are needed to audit and enforce compliance and what are the penalty measures for non-compliance?
- What are the potential negative impacts and how can they be mitigated?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

Lessons Learned:

- Consumers and producers may switch to viable alternatives that have negative environmental impacts if those are not appropriately addressed in the policy.
- When properly designed, taxes and fees can modulate the effects of other market distortions or correct for externalities not fully accounted for in current market dynamics and create economic conditions that enable more sustainable alternatives to be financially viable and negate the need for bans. However, they are traditionally not popular in the U.S. and are often fiercely objected to by the industries whose products or services would be taxed.

3) Extended Producer Responsibility

EPR policies extend a producer's financial, and sometimes operational, responsibility to the post-consumption stages of its products. When designed to include eco-modulation of fees linked to environmental criteria, EPR also creates incentives for producers to incorporate environmental considerations into the design of their products and packaging. EPR programs have been a primary tool in Europe and Canada for addressing packaging waste, including plastic packaging, and EPR is being increasingly adopted across the globe. EPR programs for packaging, including those in France, Germany, Belgium, British Columbia, and Ontario which are detailed in this report, vary to some degree in their designs but the figure below provides a general picture of the roles and responsibility by stakeholder under EPR systems for packaging.

Figure E 1 EPR Roles and Responsibilities

Each of the EPR programs detailed in this report cover all types of packaging, not just plastic packaging. It is impossible to isolate the costs and impacts related to plastic packaging versus other packaging covered, but the program designs and outcomes that are described are relevant for plastic packaging management along with other packaging types. For this study, deposit return systems (DRS) are also considered a form of EPR that, in Oregon, Norway, and elsewhere in the world have been successful in driving high (≥90 percent) recovery rates for beverage containers (including plastic, glass, and aluminum). While the recovery rate for PET

containers is lower than those for glass and aluminum in U.S. states with DRS programs (63.1 percent in 2017), it is significantly higher than PET bottles recovered from states without DRS programs (16.6 percent in 2017) [2].

Each of the programs reviewed provide insights and perspectives to the key components of EPR for packaging:

- **British Columbia (B.C.)**: Provides insight into the relationship between producers (acting through a producer responsibility organization or "PRO") and municipalities both in terms of operational delivery and payments for services.
- **France**: Highlights a program advanced in its thinking around how to modulate producer fees to encourage more sustainable packaging material design.
- **Germany**: A system that moved from a single to a multiple PRO model to try to promote competition and drive down costs.
- **Belgium**: A system that has separate EPR programs for residential and commercial packaging.
- **Ontario**: A program that is transitioning from one in which producers contribute 50 percent of the costs of a municipality-determined system to one where producers take full operational and financial control so that they can meet the higher diversion targets expected to be adopted by the province under the new EPR system.
- **Norway**: A DRS operated by a non-profit PRO that represents best-in-class system design and achieves recovery rates for beverage containers above 95 percent.
- **Oregon**: The first DRS in the U.S., Oregon's producer-operated system has demonstrated success in re-stimulating beverage container recovery through expanded coverage, increased deposits, innovations in redemption channels, and reintroduction of refillable bottles.

Key Considerations:

- What materials should be included in the program and what sectors should be covered? Because no plastic-specific EPR program exists elsewhere, it is especially important to consider what the impact would be of having an EPR program for plastic packaging only compared to an EPR program that addresses all packaging types with modulated fees that discourage the use and production of packaging with greater environmental impacts.
- What material-specific targets should be included in legislation and how should these be determined? How will these increase over time?

- Is a there a government agency or other authority in a position to carry out program oversight, monitoring, auditing, and enforcement activities to ensure that producers comply with their obligations and that freeriding is limited?
- How are producers defined? Should small producers be exempt from regulation (e.g., through a de minimis clause) or should all producers be required to register, report, and pay fees of some kind?
- What are the program's objectives and how are those reflected in other program requirements or performance targets?
- Is there a mechanism for using financial incentives (rewards) and disincentives (penalties) to drive changes in packaging designs that align with the program's objectives (e.g., eco-modulation of fees)? Is this mechanism controlled by government or private industry?
- What level of operational responsibility and control should be assigned to producers? What level of responsibility and control should municipalities retain?
- What are the boundaries and definitions of costs that producers will be expected to cover? For example, will producers be expected to pay costs associated with litter clean-up or to cover the costs of managing material that is landfilled or sent to compost facilities?
- What level of flexibility and opportunity for collaboration should producers have in determining how to meet obligations? Should the system promote/require multiple PROs to operate in a competitive environment?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

Lessons Learned:

- It is important to consider the feasibility and potential impacts of having an EPR program for plastic packaging only compared to an EPR program that addresses all packaging types with modulated fees that discourage the use and production of packaging with greater environmental impacts.
- In order to use EPR as a policy tool to mitigate the negative impacts of plastics in the environment, it is likely important to target all plastic packaging, regardless of whether it is generated through the residential sector or the industrial, commercial, and institutional (ICI) sector.
- Strong governance is critical to ensure that producers comply with their obligations, all system participants are treated fairly, and that freeriding is limited.
- Clearly defined roles and responsibilities for each stakeholder are necessary (a model for this is provided in Section 2.1.3) as well as a clear definition of "producer" and of the products covered.

- Targets that are material-specific can drive collection efforts for a wider range of materials and packaging formats and correct weight-based biases that have skewed collection efforts under packaging EPR programs in the past.
- EPR programs can include other performance targets or design features to drive actions that serve other policy objectives beyond recovery rates.
- EPR programs vary in the amount of responsibility assigned to producers. It is important to carefully consider the amount of operational and financial responsibility assigned to producers, and development of payment mechanisms and levels between producers, municipalities, and a potential oversight agency need to be carefully considered as part of discussions on operational responsibility.
- Some EPR systems are transitioning from a single PRO to a multi-PRO model, but the benefits of this shift are still uncertain, and a well-designed single PRO model may continue to deliver important benefits. A decision about whether to promote/require multiple PROs or allow a single PRO should carefully consider the experiences and studies of both types of programs in relationship to the policy objectives and local regulatory context.

4) Minimum Recycled Content Targets

Many companies are instituting voluntary targets on their own, though these are changeable and most rely on self-reporting with have no regulatory oversight or enforcement. Policy that sets targets has the potential to gain industry support, as was the case in the development of legislation advanced recently for beverage containers in California and Washington (though both were ultimately vetoed). While incorporating post-consumer recycled resin into new products does reduce use of virgin resin, plastic can only be mechanically recycled a few times depending on the type of resin and end product before its quality degrades to the point where it must be "downcycled" into a lower value product.

Key Considerations:

- Which products/materials are appropriate to be covered and on what basis should this determination be made?
- What material-specific targets should be included in legislation and how should these be determined?
- How will targets progressively increase over time to ensure continued innovation and development of systems to collect and process material to meet recycled content demand?
- How will enforcement ensure compliance, and what will the penalties be for non-compliance? How will the system be designed to verify the use of recycled content?

- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

Lessons Learned:

- Though industry may support recycled content targets, they may also seek loopholes or request concessions that can lessen a policy's potential for impact. (This situation led to the California legislation being vetoed, as the governor believed too many concessions had been made.)
- While voluntary targets and individual corporate commitments are admirable, several of the largest consumer packaged goods (CPG) companies have been criticized for repeatedly failing to meet similar commitments made in the past.
- While beverage containers are suitable candidates for recycled content minimums, such laws can be expanded to include additional product categories such as plastic bags.

5) Reusable Product Facilitation

Portland (OR), Berkeley (CA), and Freiburg (Germany), have all started community-based reusable product programs. Berkeley has also made it mandatory for retail establishments to provide reusables for eat-in dining and to charge for single-use cups. Additionally, Berkeley has addressed health and safety concerns for reusables through policy standards and guidelines for food and beverage retail establishments. The U.K. is considering requiring all dine-in restaurants to use reusable foodware; this could come into effect immediately as the U.K.'s Waste Regulations 2011 requires producers of waste to follow the waste management hierarchy.

Key Considerations:

- What products/materials are most appropriate to include in reusable programs?
- How can industry objections regarding food safety and hygiene concerns regarding reusable products be addressed and preempted?
- At what scale can/should reusable programs be efficiently and feasibly operated? Is there a statewide measure that could encourage such programs?
- Is there infrastructure from another program (e.g., a container deposit system) that could be utilized for a reusable program?
- Is funding going to be made available to businesses to support their transition and enable equitable adoption, including by small/disadvantaged businesses?
- What else can/should be done at the state level to support transitioning to reusables?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

Lessons Learned:

- Reusables programs are still in their infancy in the U.S.
- Third-party organizations have emerged to fill a need for reusable washing and delivery, but policy is likely needed to enable economy of scale investment decisions.

6) Multi-faceted Measures

Under the E.U.'s Single-Use Plastics Directive, the ten most commonly littered items found on beaches are being targeted with a combination of bans, fees, redesign mandates, recycled content requirements, and EPR programs in development throughout Europe. In the U.S., bills in California and at the federal level aim to address plastic pollution through combinations of policy interventions including updated DRS, bans, EPR, and recycled content minimums.

Key Considerations:

- How can this type of policy be designed to address new problematic items as they arise, or to prevent such items from making it to market to begin with?
- What might be the unintended environmental and financial consequences of targeting single-use plastics only, rather than all single-use items, if consumers and producers switch to alternative materials with potentially less-understood attributes and/or greater negative environmental impacts?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

Lessons Learned:

- Unintended consequences, including shifts to alternative materials, must be examined when implementing a far-reaching piece of legislation, as they can have profound impacts on the market and the future of environmental policy.

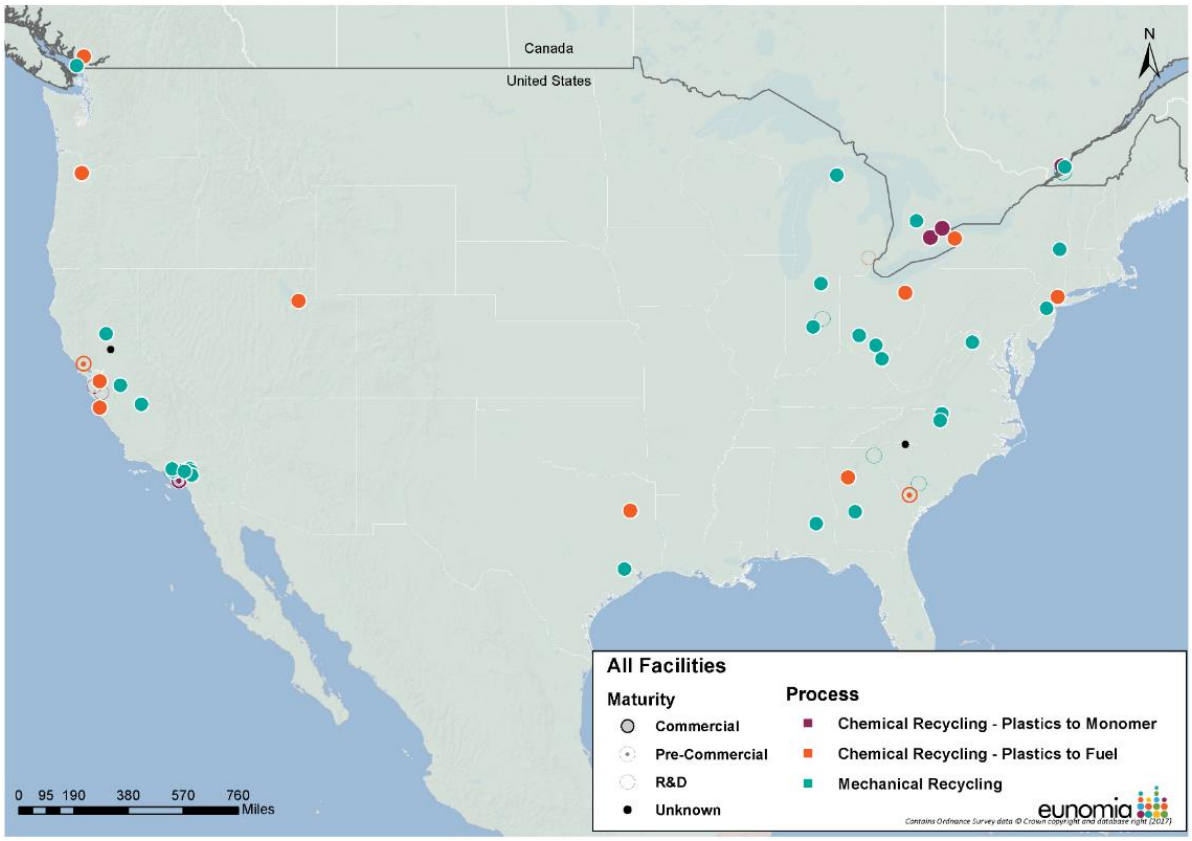
Processing and Supply Chain Technology

There are several technology options for supporting the management of plastic packaging; we discuss three technologies here: two processing technologies—mechanical and chemical recycling—which physically process and transform material, and blockchain, a supply chain technology that can be used in conjunction with various policy approaches to aid with compliance and accountability. There is also research and development for redesigning plastic, though it is highly dependent on resin type and application. In general, it is very difficult to introduce new polymers given the strong market hold of incumbents.

A summary of the locations of relevant commercial scale mechanical and chemical recycling facilities is provided in Figure E 2. The figure includes both polymer-to-monomer chemical

recycling facilities as well as polymer-to-fuel. It should be noted that there is debate about whether polymer-to-fuel chemical recycling can be truly considered recycling rather than waste-to-energy, however we have included it for the sake of completeness. We use the term "chemical recycling" throughout as it is a commonly used and recognized term.

Figure E 2 Location of Identified Mechanical and Chemical Recycling Facilities that are at Commercial Stage in the U.S. and Canada



Mechanical Recycling

Mechanical recycling involves the washing, grinding, extruding, and pelletizing of plastic waste. In some cases, a recycler also sorts mixed plastics into individual plastics first before processing them as a single plastic polymer material. Plastic pellets, also known as pre-production pellets or nurdles, as well as plastic flake are the building blocks for nearly every plastic product on the market. In general, plastics must be separated by resin before they can be mechanically recycled. Typically, a plastic preprocessor specializes in mechanical recycling of one resin type, though some recyclers do more.

Of the 34 mechanical plastic recycling facility operators summarized in Appendix A.4.1, only one sorts and recycles mixed plastics from residential, single-stream collection: Merlin Plastics. One other accepts post-consumer plastic film from material recovery facilities (MRFs). Both facilities

are based in Canada. The majority of the other mechanical recycling companies accept single polymer streams, much of it from pre- or post-commercial or industrial sources, or from DRS programs. Mechanical recyclers that do recycle residentially-sourced materials primarily focus on PET, HDPE/LDPE, with a few also recycling PP. These resins have more reliable market demand for post-consumer resin (PCR) plastic pellets, and sufficient volume from residential sources exists to make mechanical recycling viable under current market conditions. There is currently not enough mechanical recycling capacity in the U.S. to process all of the plastic packaging produced (even before considering imported plastic).

The financial viability of mixed plastic packaging recycling facilities in North America has been uncertain, with existing facilities highly dependent on securing long-term contracts based on known tonnage ranges, which EPR programs that mandate high recycling rates for residential packaging (including plastics) can provide. The mixed plastics recycling facility operated by QRS in Baltimore, which had to rely on the value of sorted plastics to operate, closed in 2018.

Chemical Recycling

There are two types of chemical recycling processes: one based on the depolymerization of plastic into its constituent monomers, and the other that first turns the plastic into a fuel and then further cracks the fuel into monomers through processes such as pyrolysis and steam cracking.

The depolymerization process takes considerably less energy than the pyrolysis/steam cracking process; however, it is limited in terms of what materials it can process. Polyethylene terephthalate (PET) is the most common resin chemically recycled; BP is investing $25 million in a facility in Illinois that will depolymerize black and colored PET food trays and colored bottles. Our technology scan also identified a company called Pyrowave that has a patented Catalytic Microwave Depolymerization (CMD) that has the potential to break down expanded polystyrene (EPS, commonly referred to as “Styrofoam”) into wax and monomers for food grade applications. The company has an R&D facility in Montreal. The other company of interest working on depolymerization is Loop Industries, based in Terrebonne, Quebec, Canada which is working with PepsiCo and a number of other brands.

As previously mentioned, there is much debate about whether chemical recycling, where polyolefins (HDPE, LDPE, PP, PE) are converted into a fuel, can really be classified as recycling. The amount of energy to take the process past the pyrolysis stage through the steam cracking stage to convert the oil to a monomer also prevents this from being a financially viable option at this time, in addition to the environmental considerations associated with this type of processing.

While chemical recycling technology is quickly evolving, it is far from being able to take a mixed plastics stream and create monomers that can be used to make new plastic products at a

commercial scale. The need for a secure supply of a sufficient quantity of relatively clean plastic calls into question its role in managing mixed, post-consumer plastic streams.

Blockchain

Blockchain, a supply chain technology, can support policy approaches for managing plastic packaging. When applied to supply chains – or reverse supply chains, such as for waste management – blockchain is used to create an immutable ledger, a complete record of the movement of goods that has been verified at every transfer point. It can be used in combination with RFID or QR code technology to coordinate with physical products, such as recyclable packaging.

While the use of blockchain for recycling collection is still very immature, in theory, it can be used in concert with programs such as EPR to ensure compliance within the waste management process, allowing governments and producers to better track their products at end-of-life. The tracked materials must still go on to either a mechanical or chemical recycling facility for processing.

Costs and Savings to Stakeholders under Existing Stewardship/EPR Programs

Generally, stewardship and EPR programs move the end-of-life management costs for targeted materials from municipalities and ratepayers/taxpayers to producers and consumers. While this shift is beneficial to taxpayers and to governments, EPR programs nonetheless come with some costs. As described through the case studies on EPR for packaging presented in this report, new systems and investments are required to manage producer obligations. Examples of some of the types of expenses that can be incurred through the establishment of EPR include the creation of new organizations such as PROs, reporting and data management systems, or new collection and sorting/reprocessing infrastructure. Implementing EPR requires adjustments from all stakeholders involved in the recycling value chain. The design of the program will determine the degree of impacts on these stakeholders in terms of roles, responsibilities, costs, and savings.

EPR System Costs

- In EPR systems in which producers are required to take financial responsibility and can influence operational management, data gathered on system costs is used to recover those costs from producers using fees based on the actual proportional costs of individual material/packaging types.
- Annual system costs—which are the amounts paid by producers using the fee structures described above—for the EPR programs reviewed in this report range from $11 USD per capita (France, 2017) and $14 USD (BC/Ontario, 2018) to $27 USD per capita (Germany,

2013). Note that it is difficult to compare the costs of different systems, even between two Canadian provinces. This is because the cost of the system depends on many factors, including the outcomes that are required to be met, the operational systems established to deliver the outcomes, the geography and demographics of the areas, and waste composition.

Municipalities and Households

- The total or partial financial responsibility for covering the cost of the system transfers from municipalities and ratepayers/taxpayers to producers and their customers. The level of financial responsibility shifted to producers ranges from 50 percent currently in Ontario to 100 percent in Germany, Belgium, and B.C.
- In some programs, municipalities continue to directly deliver or procure services while other jurisdictions transfer recycling collection service delivery entirely to producers.
- In BC, where the majority of municipalities remain involved in service delivery, some municipalities have reported that these reimbursements are higher than their total costs to provide collection services while other municipalities have reported that the reimbursements do not fully cover their costs but nonetheless offset a substantial portion. In all cases, B.C. municipalities operating as contracted service providers commit to passing the savings on to households, either through direct credits on utility bills or by using the funds to offset costs for other services provided, such as curbside organics collection or waste prevention programs.

Producers

- EPR programs are a means of ensuring that the "polluter pays" principle is applied to waste management. Producers placing packaging on the market are required to register and report their sales in order to determine their regulatory obligations, which they must meet in order to avoid non-compliance penalties and be able to sell their products in the jurisdiction.
- Producer costs vary by program and can include:
    - **Producer fees:** These are the fees established by the PRO necessary to cover the cost of the system and will vary by material and the objective of the fee, e.g., does it aim only to cover the cost of collection and processing (net of revenue) of the specific material, or does it also encourage producers to use packaging that is easier to recycle or has a reduced carbon impact? Total fees reflect the quantity of material placed on the market. Producer fees are modulated to varying degrees. Modulation can simply reflect the cost of collection and processing net of revenue for individual materials or they can include an "eco-modulation" element based on environmental criteria, such as for packaging that is easier to recycle or includes recycled content. France's system, for instance, includes

bonuses and penalties relating to packaging design features, such as awareness-raising logos and paper printed with mineral-based ink. Producer fee schedules for British Columbia and Ontario's EPR programs for packaging for 2020 are provided in Appendix A.2.0.

- **Registration/administration fees**: Producers are sometimes charged fees to cover the administration, auditing, and enforcement of the system by the regulatory authority. For example, in Ontario, producers under an individual producer responsibility model are required to register with the regulatory authority, the Resource Productivity and Recovery Authority (RPRA). There is a fee associated with registration which effectively covers the cost of the authority's compliance monitoring and enforcement activities.
- **PRO fees**: These fees are paid by producers if they are required or choose to join a PRO to manage compliance on their behalf. These fees cover the administrative costs of the PRO, not direct costs associated with system operations.

Regulatory Authority

- Where there is a regulatory authority that oversees the system, such as in Ontario, the cost of the oversight by the regulatory authority is paid for through producer registration fees. These fees are most often dependent on the amount of material placed on the market by producers or on their market share.
- Costs vary based on the number of producers in the state and the amount of data-sharing between geographically similar EPR programs.

The King County Responsible Recycling Task Force recently commissioned a report to examine what a transition to an EPR framework for packaging would look like in Washington State. The report provides further detail on the roles of existing and new stakeholders as well as impacts to them under an implementation model for EPR [3].

Potential EPR Advisory or Management Organizations

Within an EPR framework, oversight organizations are especially important. They ensure that producers and/or PROs are meeting the requirements outlined in the legislation in terms of participation, payment, reporting, performance, and compliance. Such organizations could include:

Washington-based:

- *Department of Commerce:* Possible advisor or administrator
- *Department of Revenue:* Possible advisor or administrator
- *Department of Ecology:* Possible advisor or administrator

- *Department of Health/County Public Health Departments:* Possible regulation and/or enforcement of reusables
- *Ag Container Recycling Council (ACRC):* Possible coordination, infrastructure, or stewardship of agricultural plastics
- *Liquor & Cannabis Control Board:* Possible enforcement of manufacturer obligations
- *PaintCare:* Possible model or advisor for packaging stewardship
- *Photovoltaic Module Stewardship and Takeback Program:* Possible model or advisor for packaging stewardship
- *Recycling Development Center:* Possible model or advisor for recycled content and recyclability
- *Washington Materials Management Financing Authority:* Possible model or advisor for packaging stewardship
- *Washington Utilities and Transportation Commission (WUTC):* Possible model or advisor for auditing, penalty assessment, flow control, as well as stakeholder on relevant boards and commissions

Outside of Washington:

- *AMERIPEN:* Possible industry steward or advisor
- *Association of Plastics Recyclers (APR):* Possible industry advisor
- *California Department of Resources Recycling and Recovery (CalRecycle):* Possible model for administrator
- *Health Products Stewardship Association (Canadian pharmaceuticals):* Possible model for packaging stewardship system
- *Manitoba Framework:* Possible model for packaging stewardship system
- *Recycle BC:* Possible model for packaging stewardship system
- *The Recycling Partnership:* Possible advisor for packaging industry collaboration
- *Sustainable Packaging Coalition (SPC)/How2Recycle:* Possible model or advisor for labelling standards, recycled content credit trading and tracking

EPR Database Creation

In order for EPR to work properly, it is essential that both producers, and the packaging that they put on the market, are accurately accounted for. This requires a database, created and managed by the governing entity responsible for the EPR program. This could be a regulatory authority, such as is done by RPRA in Ontario, or by the PRO, such as is done by Recycle BC in B.C., with non-confidential information shared with the regulatory agency.

Moreover, there are a number of EPR programs for packaging which already have databases of producers. These could provide a useful point of comparison, if an EPR program were to be implemented in Washington, to identify potentially obligated producers.

In the Canadian provincial stewardship programs for packaging and paper products (PPP), each program maintains their own list of producers or "stewards," some of which are publicly available. The list of stewards in each of the four programs supported by the Canadian Stewardship Services Alliance (CSSA), including B.C., Saskatchewan, Manitoba, and Ontario is available in Appendix A.5.0.

Structuring the enabling legislation to ensure proper reporting from producers and requiring registration from all obligated packaging producers is essential for a well-functioning EPR system.

Glossary

Below are the definitions of terms as they are used throughout this report.

Circular Economy – an economic system in which participants strive to (a) minimize the use of raw materials, (b) maximize the useful life of materials and other resources through resource recovery, and (c) minimize waste generated from products and packaging at end-of life [4].

Diversion Rate – sometimes used interchangeably with recycling rate, the diversion rate quantifies the amount of material collected for recycling and diverted from landfill disposal. Diversion rates do not necessarily equal recycling rates, as at least some of the material collected for recycling does not end up being made into new products.

Expanded Polystyrene (EPS) – a rigid cellular plastic foam found in a multitude of shapes and applications, often referred to by the brand name "Styrofoam."

Extended Producer Responsibility (EPR) – a mandatory type of product stewardship that includes, at a minimum, the requirement that the manufacturer's responsibility for its product extends to post-consumer management of that product and its packaging. There are two related features of EPR policy: (1) shifting financial and management responsibility, with government oversight, upstream to the manufacturer and away from the public sector; and (2) providing incentives to manufacturers to incorporate environmental considerations into the design of their products and packaging.

Freeriding – when one firm (or individual) benefits from the actions and efforts of another without paying or sharing the costs [5].

Greenwashing – misleading advertising by a company or organization to make consumers think that the organization's activities or products are more environmentally friendly than they truly are.

High-density Polyethylene (HDPE) – a strong, durable, lightweight, and chemically resistant plastic material popular for a variety of applications, including milk jugs. Coded as plastic resin #2.

Industrial, Commercial, and Institutional (ICI) – a waste-generating sector. The ICI sector includes hospitals, hotels and motels, office buildings, educational institutions, and large manufacturing establishments.

Low-density Polyethylene (**LDPE)** – a soft, flexible, lightweight plastic material. It is often used for sandwich bags and cling wrap. Coded as plastic resin #4.

Material Recovery Facility (MRF) – an establishment primarily engaged in sorting mixed recyclable materials into distinct categories and preparing them for shipment [6].

Organics – organic waste refers to biodegradable, compostable waste of plant or animal origin from residential or ICI sources. Examples include food scraps, grass clippings and garden waste and sometimes soiled paper products (e.g., tissue, paper towels), boxboard, and animal or human waste [7].

Packaging and Paper Products – Materials, including plastic containers, paper, cardboard, glass, and metal, collected through recycling programs. Several EPR programs have been established to manage PPP.

Plastic Packaging – plastic packaging for the purposes of this assessment has been defined in the following way:

> 'Packaging' means material used for the containment, protection, handling, delivery, or presentation of goods by the producer for the user or consumer, ranging from raw materials to processed goods. Packaging includes, but is not limited to, all of the following:
>
> > *(A) Sales packaging or primary packaging intended to constitute a sales unit to the consumer at the point of purchase and most closely contains the product, food, or beverage.*
> >
> > *(B) Grouped packaging or secondary packaging intended to brand or display the product.*
> >
> > *(C) Transport packaging or tertiary packaging intended to protect the product during transport.*
>
> For this study, "plastic packaging" includes the materials defined in the Washington 2015-16 Statewide Waste Characterization Study under the "Plastic Packaging" category except for PLA compostable packaging (#28).
>
> A list of plastic packaging considered in this study can be found in Appendix A.1.0.

Polyethylene Terephthalate (PET) – a clear, strong, and lightweight plastic that is widely used for packaging foods and beverages, especially convenience-sized soft drinks, juices, and water. Coded as plastic resin #1.

Polypropylene (PP) – a thermoplastic used in a variety of applications to include packaging for consumer products, like yogurt pots and margarine containers and many plastic bottle caps. Coded as plastic resin #5.

Polystyrene (PS) – a transparent thermoplastic that is found as both a typical solid plastic as well as in the form of a rigid foam material. Often used for producing disposable cutlery and dinnerware and coded as plastic resin #6.

Polyvinyl Chloride (PVC) – a common thermoplastic used in construction and generally known for its hardness. Coded as plastic resin #3.

Processor – parties that provide services that may include: sorting, counting, weighing, measuring, controlling, surveying, processing, and verifications. They may be responsible for scrap buying/selling, overseas shipping and brokering, and materials transformation.

Producer – a producer is an organization or company that is a resident, and a brand owner, first importer or franchisor that supplies designated packaging to consumers in a jurisdiction where stewardship obligations have been regulated.

Producer Responsibility Organization (PRO) – the entity (usually a not-for-profit organization) designated by a producer or producers to act on their behalf to administer an EPR or product stewardship program.

Product Stewardship – the act of minimizing the health, safety, environmental, and social impacts of a product and its packaging throughout all lifecycle stages, while also maximizing economic benefits. Under a product stewardship framework, the manufacturer, or producer, of the product has the greatest ability to minimize adverse impacts, but other stakeholders, such as suppliers, retailers, and consumers, also play a role. Stewardship can be either voluntary or required by law.

Recycling – transforming or remanufacturing waste materials into usable or marketable materials for use other than landfill disposal or incineration. The term "recycling" as it is commonly used often also refers to the process of collecting and sorting material for reprocessing into feedstock. Where possible, we have tried to use precise language to indicate when we are referring to the process of collecting materials for recycling versus the actual transformation of used products and packaging into feedstock for new materials.

Contents

List of Tables, Figures and Boxes

1.0 Introduction

Task 3 Description

Plastic serves many essential and valuable functions in society and offers performance and durability at a low cost compared with many other types of materials. It can often be the least carbon-intensive material choice, and in certain applications, plastic offers some environmental benefits that cannot be ignored. However, plastic pollution has become a growing environmental concern over the past several decades. In the past few years, plastic waste has gained widespread attention in mainstream media and is a common target of public outrage. It is a commonly identified source of litter and marine debris and poses major issues and challenges to the traditional recycling system.

In recent years, governments have responded to this issue with a plethora of policies and strategies. Yet, there is no one action that can remedy the extent of the challenge posed by plastic packaging. Governments trying to enact effective and meaningful policies must examine the success and failures of interventions throughout the world and consider carefully how to structure legislation that yields the greatest environmental, economic, and social impacts.

This report provides an overview of plastic packaging interventions across the globe to inform Washington lawmakers on how best to approach the issues of plastic packaging in their state. Consistent with the objectives outlined by the Washington legislature in Chapter 70.380 RCW, this report, comprising Task 3 of the designated study, aims to provide an overview of the different policy types as well as program and technology options that can be utilized to deal with plastic packaging. A more detailed emphasis on extended producer responsibility (EPR) programs is provided in order to present different models for this increasingly popular approach, including possible organizations that could inform the establishment of such a program in Washington and details on initiating the creation of a database of producers.

Plastic packaging for the purposes of this assessment has been defined in the following way:

> *'Packaging' means material used for the containment, protection, handling, delivery, or presentation of goods by the producer for the user or consumer, ranging from raw materials to processed goods. Packaging includes, but is not limited to, all of the following:*
>
> *(A) Sales packaging or primary packaging intended to constitute a sales unit to the consumer at the point of purchase and most closely contains the product, food, or beverage.*
>
> *(B) Grouped packaging or secondary packaging intended to brand or display the product.*
>
> *(C) Transport packaging or tertiary packaging intended to protect the product during transport.*

For this study, "plastic packaging" includes the materials defined in the Washington 2015-16 Statewide Waste Characterization Study under the "Plastic Packaging" category except for PLA compostable packaging (#28). Compostable and bioplastics are were not evaluated as part of this study, though these plastics and their impacts on the waste system in Washington are an area for future research.

A list of plastic packaging considered in this study can be found in Appendix A.1.0.

The objective of Task 3 is to highlight successful plastic packaging programs and innovations that can:

1. Inform the final recommendations to Ecology on potential polices that should be considered when determining how the state is to:
    a. Achieve 100 percent recyclable, reusable, or compostable packaging in all goods sold in Washington.
    b. Achieve at least 20 percent post-consumer recycled content in packaging.
    c. Reduce plastic packaging when possible, optimizing the use for when plastic is really beneficial and necessary.
2. Be used to evaluate, design, and estimate cost for a future system that is able to manage plastic packaging produced and used by commercial, industrial, and residential premises within the state.

Approach

The project team carried out a jurisdictional scan to identify policy, program, and technology options for managing plastics packaging specifically. Where plastics specific case studies were not identified, the scan was widened to packaging more generally.

With respect to policies and programs, the scan covered both North America and Europe. However, the scan for technologies that are either commercially available or in development focused on activity in North America because these were considered more likely be an option for Washington in the medium- to long-term as these companies would have already assessed the market conditions.

Section 2.0 presents an overview of how policies, programs, and technologies can play a role in addressing plastic packaging. For each example, a qualitative assessment is made regarding their applicability to Washington and the success of the option in leading to a reduction in, and the reuse and recycling of, plastic packaging.

Section 3.0 provides more detailed information on specific product stewardship or EPR programs that include requirements for managing plastics with an emphasis on identifying costs and savings to stakeholders.

Section 0 provides an evaluation of relevant organizations that could participate in or serve as a model for the development of an EPR system in Washington.

Section 5.0 discusses the need for and the process of creating a database of obligated producers for an EPR system in Washington.

2.0 Task 3A: Conduct a Review of Innovations to Reduce, Reuse, Recycle or Otherwise Successfully Manage Plastics and Plastic Packaging

The jurisdictional scan identified 23 different examples of policies and programs (organized into six types) and 52 technology providers (organized into three main types) that are being increasingly used to manage plastics and plastic packaging in North America and Europe. Policies are detailed in Section 2.1 and technologies in Section 2.2.

2.1 Policy

Environmental policy is the strongest mechanism by which governments can set environmental standards. Policymakers have two broad types of instruments available for changing consumption and production habits in society: traditional regulatory approaches (sometimes referred to as command-and-control approaches) that set specific standards across polluters, and economic incentives (market-based instruments) that correct for externalities not fully accounted for in current market dynamics or modulate the effects of other market distortions and rely on market forces to adjust producer and consumer behavior. Market-based approaches should focus on internalizing the environmental and financial costs of mitigating and managing plastic packaging across the value chain.

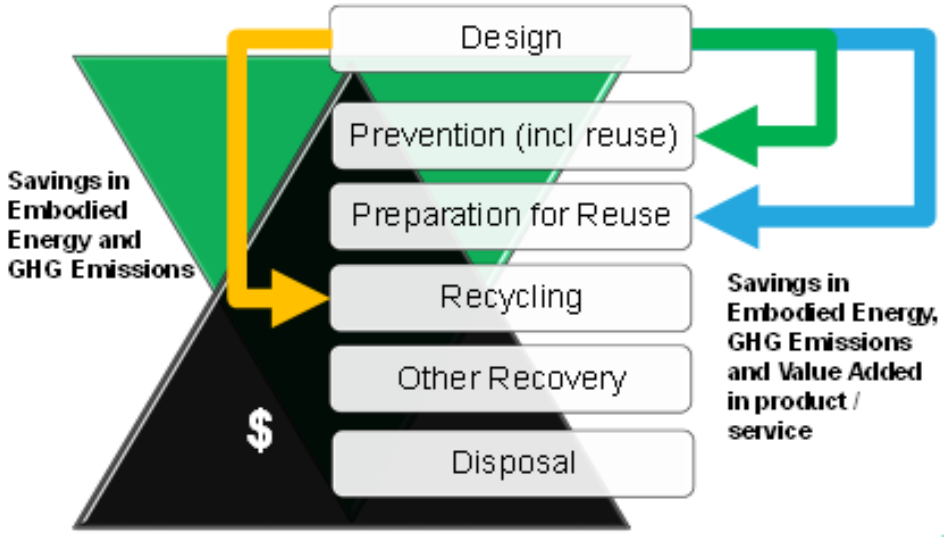
When designing policy to address the issue of plastics, it is important to take a view towards enabling a system that delivers the principles of the circular economy, where use of raw materials is minimized, material use and life is maximized through recovery, and waste is minimized at end-of-life. This means focusing on policy mechanisms that:

- Design out waste
- Keep materials in productive use for as long as possible
- Regenerate natural systems [8]

When product and packaging waste is managed in line with circular economy principles, it is possible to achieve maximum greenhouse gas (GHG) emissions savings because packaging and

products supplied into the market and managed at end-of-life will have lower embodied energy and GHG savings compared to those managed under a linear economic model. It is clear that a greater portion of the embodied energy in products is preserved when waste is managed in the upper tiers of the waste management hierarchy (prevention, reuse, recycling) as opposed to lower tiers of 'recovery' (such as waste-to-energy incineration) and disposal. The use of embodied energy as a measure of the circular economy has previously been explored by Eunomia on behalf of Zero Waste Europe [9]. Figure 1 below provides a graphical overview of the waste management hierarchy showing the most beneficial waste management option – prevention – at the top and the least beneficial – disposal – at the bottom and the associated savings in GHG emissions.

Figure 1 Waste Management Hierarchy and Associated Emissions Savings



Washington's primary environmental regulation is the State Environmental Policy Act (SEPA), enacted in 1971. SEPA gives state and local agencies the tools to allow them to consider and mitigate the environmental impacts of proposals for private projects and constructing public facilities or adopting regulations, policies, and plans [10].

The Waste Reduction, Recycling, and Model Litter Control Act, also of 1971, establishes statewide programs to prevent and clean up litter, reduce waste, and increase recycling. These programs are funded by the 0.015 percent litter tax on manufacturers', wholesalers', and retailers' gross proceeds on 13 categories of consumer products [11].

In terms of waste management, the current priority in Washington, like much of the U.S., is on combating plastic pollution while continuing to advance waste management practices that are in line with the waste management hierarchy and with GHG emissions reduction goals.

In April 2019, Chapter 70.370 RCW was codified, which provides additional tools and directs funding for planning and development of incentives for businesses to develop end markets for recyclables in Washington in response to the recycling crisis of 2018/2019 through several interventions, including:

- Creation of a Recycling Development Center within the Department of Ecology (Ecology) to further the development of markets and processing for recycled commodities and products
- A statewide contamination reduction plan developed with stakeholder input by July 1, 2020
- An increase from 40 percent to 50 percent of funds from the Waste Reduction, Recycling, and Litter Control Account directed toward state litter collection efforts [12]

This section highlights policy options that can further enhance Washington's plastic waste management and litter reduction efforts.

The policy examples provided in this section illustrate a broad range of mechanisms for mitigating the impacts of waste. While some examples are specific to plastic and plastic packaging, others are more general, but still provide relevant points of reference to Washington. Examples range from material-specific bans to mechanisms that attempt to pass the cost of environmental and other externalities back to those parties that are best positioned to mitigate these costs. Table 2-1 provides an overview of the policy options discussed in Section 2.1 and how they relate to Washington and its packaging management goals. Washington State also recently passed a statewide plastic bag ban with an accompanying fee on paper and reusable bags, which will go into effect in 2021 (SB 5323).

Table 2-1 Policy Option Overview

Policy Instrument	Specific Examples
Bans	• Nova Scotia Landfill Disposal Ban for Recyclables • Vermont Recyclables and Organics Disposal Ban • Vermont Plastics Trifecta Ban • Seattle Plastic Bag Ban and Plastic Bag Fee
Fee/Charge/Levy/Tax	• California Integrated Waste Management Fee • United Kingdom Landfill Tax • Chicago Checkout Bag Tax
Extended Producer Responsibility (EPR, all packaging)	• France, Germany, Belgium, British Columbia, Ontario

Policy Instrument	Specific Examples
EPR Deposit Return Systems (beverage containers only)	• Norway, Oregon
Minimum Recycled Content Target	• California
Reusable Product Facilitation	• Freiburg, Germany FreiburgCup Program • Berkeley Cup Loan Service • Berkeley Single-Use Foodware and Litter Reduction • GO Box Pilot in Portland • California Refillable Sanitation Law
Multi-faceted Measures	• European Union Single-Use Plastics Directive • California Circular Economy and Pollution Reduction Act

For each policy instrument, an overview of what the policy aims to achieve is provided. This is followed by examples of where such a policy is in place in another jurisdiction along with a qualitative assessment of success. A further qualitative assessment of the suitability of the policy instrument to address plastics in Washington is then provided.

2.1.1 Bans

Bans can be approached in two ways: they can be used to completely phase out the use of a material for a specific application or to encourage a different approach to managing a material at the end of its life. In both cases, the goal is to mitigate environmental impacts. While bans on materials or processes that produce negative environmental effects appear to represent a simple solution to environmental issues, there are several complexities and challenges associated with such policies that must be considered.

When implementing a ban, due diligence must be exercised to investigate unintended consequences. When something is banned, alternatives naturally arise and the impacts of these must be considered. Additional regulation may be required to ensure that alternatives do not have the same or greater detrimental impact.

Furthermore, for a ban to be successful, there must be suitable penalties in place to deter non-compliance and sufficient resources to ensure that the ban is enforced. The risk of being caught for non-compliance must be greater than the reward for not complying – it is very difficult to strike this balance. Additional resources may be required to enforce bans to ensure their success and the legislative framework must be such that fines can be issued and prosecutions can be

pursued. The cost of adequate education and enforcement should be factored into any consideration of a ban. It would be ineffectual to implement a policy that cannot be enforced or for which the cost of enforcement is prohibitive to the success of the program.

Disposal Bans

Disposal bans attempt to keep recyclable and organic materials, as well as materials that pose operational risk and other hazards, out of landfills and waste-to-energy facilities. Disposal bans can be used to:

- Encourage the development of alternative end-of-life options for specific products or materials that will result in a reduction in environmental impact (e.g., banning organics disposal helps to create markets for the composting of this material and reduces landfill-related GHG emissions).
- Prevent direct environmental harm that would result from the landfilling of the material or product (e.g., banning disposal of a hazardous material such batteries or paint).

The onus for complying with a disposal ban can apply to a variety of parties (e.g., residents, businesses, landfill operators, waste haulers, etc.) and may depend on the product that is being banned. Proper enforcement of such policies is necessary to ensure their success.

Nova Scotia Landfill Disposal Ban for Recyclables

Program Description

Nova Scotia enacted a beverage container deposit program in 1994 through its Solid Waste Resource Management Regulations. These regulations established the Resource Recovery Fund Board Inc. (operating as Divert NS), an industry-led non-profit organization, to manage the program [13]. These same regulations established a landfill ban on beverage containers covered under the program to mandate their collection for recycling at end-of-life [14]. Under this ban, it is prohibited to dispose of beverage containers in the landfill and residents are responsible for adhering to this ban. The law also bans LDPE bags and packaging, #2 HDPE non-hazardous containers (e.g., ice cream containers, plastic jugs, detergent bottles, etc.), and other materials like newsprint, corrugated cardboard, etc. related to other recycling collection programs [15].

Residential garbage is put on the curb in clear garbage bags and are rejected by haulers if beverage containers or other banned items are found. This process helps increase awareness of the deposit system and other recycling collection programs.

Success

The complementary nature of the landfill ban and the beverage container deposit program have led to high levels of public awareness of both programs. According to a survey by Divert NS, public awareness was in the high-80 percent range [16].

Through the province's Environment Act and Environmental Goals and Sustainability Prosperity Act, the Government of Nova Scotia has set a target of 50 percent waste diversion and waste disposal of no more than 300 kg per person per year by 2015. The deposit return program helps the province towards these targets and, as a result, Nova Scotians send 50 percent less trash to the landfill on a per capita basis than the Canadian national average (though the province missed its goal of 300 kg. per person by 2015) [16]. From 2018 to 2019, the redemption rate for beverage containers covered by the program was 82.9 percent [13]. According to Divert NS's annual report, this reduced GHG emissions by 419.6 tonnes of CO_2 [17].

Vermont Recyclables and Organics Disposal Ban

Program Description

Beginning with lead-acid batteries, waste oil, large appliances, and paint in the early 1990s, Vermont has banned many items from disposal.

In 2012, Vermont passed the Universal Recycling law (Act 148) to tackle the state's stagnating recycling rates, which had remained at 30-36 percent for nearly two decades. The state's Department of Environmental Conservation (DEC) estimated that nearly half of this waste could be recycled, composted, or donated, prompting a set of laws to progressively ban the disposal of materials at landfills that could be properly managed higher up the waste management hierarchy. The Act created a phased approach to divert materials from the landfill from 2012 to 2020 [18].

The first materials to be banned from disposal were mandated recyclables in 2015. These included: paper, cardboard, aluminum, steel cans, glass bottles and jars, and plastic containers with resin codes #1 or #2 (PET and HDPE). The Act extended to include leaf and yard debris and clean wood in 2016 and will extend to food waste on July 1, 2020 (with earlier deadlines for institutions of varying sizes) [18].

Vermont's program puts the onus for compliance on multiple parties:

- Haulers are required to provide multiple collections for recyclables, leaf and yard debris, and food scraps to make collection of recycling and compost as easy as trash disposal.

- Residents are required to sort their waste and are incentivized through a pay-as-you-throw pricing system, in which trash is charged by the bag, but recycling and composting collection is free of charge.
- Municipalities are required to provide a recycling container next to every garbage container on all government buildings and land (including all parks, schools, town offices, etc.).

Vermont's DEC provides information to residents on what and how to recycle, including a "Recycle Like You Live Here" campaign, but outreach is limited by budget constraints [19].

Success

Following the implementation of the mandated recyclables ban, trash disposal decreased five percent statewide from 2014 to 2015 and diversion of recyclables increased by two percent over the same time period [20]. However, Vermont is still not capturing 100 percent of the recyclable material, which calls into question the government's ability to monitor and enforce the ban.

The implementation of the phased set of organics bans saw 53,254 tons of organic waste diverted from the landfill through composting and food rescue programs in 2015 and an increase in food donations by 40 percent from 2015 to 2016. Additionally, it is estimated that these laws, including the food waste portion to be implemented in 2020, will reduce GHG emissions by 37 percent by 2022 [21].

Material-Specific Product Ban

Legislative bans on specific single-use products, especially those made of plastic, have become increasingly common in recent years, both in the U.S. and globally. The most common items covered by these bans include:

- Carryout bags
- Straws
- Coffee stirrers
- Expanded polystyrene (EPS, aka "Styrofoam")
- Utensils
- Coffee cups

In the U.S., bans on these single-use plastic products are often coupled with fees on single-use products made of other material, particularly when the intention behind the policy is to move away from single-use items.

Early laws in the U.S. suffered from lack of specificity, which created loopholes that led to the use of alternative materials that were arguably less environmentally sound and had unintended negative consequences. For example, many plastic bag bans specify the thickness that classifies a bag as single-use vs. reusable. If this thickness is too low, retailers may provide bags that contain more plastic, but are unlikely to be reused. Overtime, these loopholes have been closed as more recent legislation has increased the designated thickness of allowable plastic bags to preclude use of those that may be intended for single-use and/or that include qualifying characteristics that are more likely to be found on bags that are actually intended for reuse. Additionally, the best practice for bans on plastic carryout bags is now accepted to include accompanying fees on paper bags.

Material-specific product bans are often fiercely objected to by the plastics industry. As a result of more municipalities seeking to put such bans in place, the plastics industry is now funding the passage of state preemption laws, which prevent and invalidate municipal laws that create bans or fees on single-use items, especially on single-use carryout bags [22]. There is the possibility that bag-specific preemption laws could set a precedent for preemption laws on other materials in order to slow momentum associated with material-specific bans in state and local governments.

There are a variety of benefits associated with bans and fees on single-use products, including reduced litter and impacts on marine and other wildlife. These benefits, however, must be weighed against potential downsides. Due to their disruptive nature to the status quo, bans may have negative market impacts that may lead to extensive opposition from industry groups that produce or use the banned products. Bans may also lead to shifts in production toward other potentially harmful materials.

Vermont Plastics Trifecta Ban

Program Description

In May 2019, Vermont passed S.113, an act relating to the management of single-use products. This bill represents the most comprehensive single-use plastic ban in the U.S., and tackles several commonly used single-use items, including plastic bags, EPS, and plastic stirrers.

Vermont's legislation is very specific in how the law applies to each included item:

- The law prohibits stores and food service establishments from providing single-use plastic carryout bags and includes the provision that any bags provided as "reusable" must have stitched handles. It also applies a $0.10 fee on paper bags to discourage a complete substitution [23].

- The law prohibits straws from being provided to customers unless they are specifically requested (the provided straw may or may not be plastic). Exemptions are provided for certain medical facilities.
- Plastic coffee stirrers are banned entirely.
- Food service items made of EPS are prohibited from being sold and food or beverages are prohibited from being sold in EPS, with certain exemptions for products packaged out of state [23].

Success

Vermont's plastics ban will go into effect in July 2020, so its success is yet to be determined.

Seattle Plastic Bag Ban and Paper Bag Fee

Program Description

In 2012, Seattle instituted a ban on plastic grocery bags and a $0.05 fee on paper bags. The law also requires that paper bags contain a minimum of 40 percent post-consumer recycled fiber content and that the recycled content percentage be displayed on the outside of the bag [24]. Like many similar laws, Seattle exempted dry cleaners, newspapers, produce bags, and takeout food deliveries from the ban, but added the disclaimer that plastic bags used for any of the exempted purposes cannot be green or brown tinted to distinguish them from compostable bags, which are also permitted for exempted purposes [24].

Success

In the four years following implementation, the city noted a 50 percent reduction in the number of plastic bags going to city landfills [25]. Dozens of other jurisdictions in Washington have passed local bag ban ordinances, and in March 2020, the state passed SB 5323, the Reusable Bag Act, a statewide ban/fee hybrid that bans plastic carryout bags and puts a $0.08 fee on paper bags. This bill passed the legislature with bipartisan support and cited land and marine litter, issues at recycling facilities, and the availability of alternatives as justification. Similar reasoning can be applied to additional legislation that addresses a wider range of single-use products that are a burden on Washington's environmental, social, and financial resources. Like Seattle's law, paper bags must include a minimum of 40 percent post-consumer recycled content and display the percentage on the bag [26]. The bill, now signed by the governor, will go into effect January 2021, and will supersede local bag bans and fees below $0.10, including Seattle's. The fee on paper bags will increase to $0.12 in 2026 [27].

Applicability to Washington

As previously mentioned, Washington State recently passed a statewide plastic bag ban with an accompanying fee on paper and reusable bags, which will go into effect in 2021 (SB 5323). A landfill ban, however, on plastics may be feasible for certain products or types of plastics in Washington. Key considerations when implementing a ban for a specific material are:

- Is there an alternative management option for the material at the end of its life, e.g., is there an established recycling service or will one be developed by the date the ban comes into effect?
- Once a ban is in place, consumers and/or manufacturers will switch to an alternative material, which may have similar or greater negative environmental impacts than the material that was banned. It is therefore critical that an assessment of the life cycle impacts of potential alternatives be carried out prior to enacting a ban.
- Can the ban be enforced effectively? If so, how, by whom, and at what cost?
- A disposal ban on material that municipalities are obligated to collect from residents (like that in Vermont) may be more successful and easier to enforce if it is put in place alongside an EPR program (described in Section 2.1.3) as this would include a system for reporting and auditing of information. It would also place the obligation for demonstrating compliance on producers as opposed to local governments, which likely do not have sufficient resources to monitor and enforce compliance. This approach was taken by the European Commission when developing its Single-Use Plastics Directive, the details of which are included in Section 2.1.6.
- Does the ban drive illegal disposal – dumping or flow control issues to other jurisdictions?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

2.1.2 Fee/Charge/Levy/Tax

Fees, charges, levies, and taxes are widely used mechanisms for correcting market failures that do not properly account for environmental externalities. By placing a per unit monetary charge (fee or tax) on pollution emissions or waste, they are designed to create appropriate incentives to change behavior patterns without requiring it. Such instruments can lead to large reductions in undesirable behavior and are often equivalent to or more effective than bans at achieving the same environmental outcomes. They can also raise much needed revenue for government agencies or other entities.

Despite their advantages, monetary instruments like fees, charges, levies, and taxes cannot guarantee a specific amount of pollution or waste reduction and may impose a great burden on

those that are unable to comply. It can also be argued that poorly designed taxes can themselves also lead to distortions in the market, or accentuate pre-existing distortions, with negative impacts on economic activity (see United Kingdom Landfill Tax section below).

Landfill Fee/Tax

As opposed to an outright ban, some jurisdictions are turning to taxes or levies on landfilled material to discourage landfilling in favor of disposal options that are higher up the waste management hierarchy.

Compared to other countries, sending material to landfill in the U.S. is especially cheap. Fees associated with landfilling apply to waste management organizations, such as haulers, who are required to receive a disposal facility permit from the government.

In addition to reducing the amount of waste going to landfill, landfill fees or levies can be used as a mechanism to generate a revenue stream for governmental and potentially non-profit entities to make other waste management options, such as recycling, more financially viable.

California Integrated Waste Management Fee

Program Description

California's Integrated Waste Management Fee is a revenue-generating instrument charged to operators of solid waste disposal facilities, such as landfills, that require a disposal facility permit from the Department of Resources Recycling and Recovery (CalRecycle).

The fee, established under the Public Resources Code of California (1990), was driven by media publicity around the lack of landfill space and an effort to increase diversion [28]. It is a quarterly fee based on all solid waste disposed of at each facility, using the rates provided in Table 2-2 [29]. The California Department of Tax and Fee Administration collects the fee and administers the program in cooperation with CalRecycle [30].

Table 2-2 Integrated Waste Management Fee Rates Since Implementation

Categories	January 1, 1990 – June 30, 1990 Rate Per Ton	July 1, 1990 – June 30, 1994 Rate Per Ton	July 1, 1994 – June 30, 2002 Rate Per Ton	July 1, 2002 – Present Rate Per Ton
Solid Waste	$0.50	$0.75	$1.34	$1.40

Categories	January 1, 1990 – June 30, 1990 Rate Per Ton	July 1, 1990 – June 30, 1994 Rate Per Ton	July 1, 1994 – June 30, 2002 Rate Per Ton	July 1, 2002 – Present Rate Per Ton
Non-hazardous Wood Waste	$0.75	$0.75	$0.75	$0.75

Source: California Department of Tax and Fee Administration [31].

The generated funds are used by CalRecycle to promote waste management programs including solid waste reduction, recycling, reuse, composting, and safe land disposal practices [32].

Success

Though the Integrated Waste Management Fee was intended to support collection for recycling, it has become little more than a cost of doing business for waste management operators. California has a recycling rate that is slightly better than the U.S. average – 44 percent [33] vs. 35 percent [34] – however it is unlikely that this difference is attributable to the Integrated Waste Management Fee alone, as there are many other recycling-related interventions in California. Despite the fee, the cost of sending material to landfill is still lower than the cost of alternative waste management options and as such is not a sufficient mechanism for encouraging approaches in the higher tiers of the waste management hierarchy.

United Kingdom Landfill Tax

Program Description

The U.K.'s Landfill Tax escalator, announced in 2005, was put in place to discourage landfilling material and to incentivize the switch to alternative waste management options higher up the waste management hierarchy. The tax was set at different amounts for inert and active wastes.

The tax has two bandings: inert waste, currently levied at £2.65 ($4.28 USD) per ton, and non-inert waste, currently levied at £84.40 ($136.45 USD) per ton, originally at £7 per ton ($11.38 USD) in 2008 increasing by £8 ($9.90) per ton until 2014 [35]. Furthermore, operators of landfill sites can offset up to six percent of their annual tax by contributing to environmental bodies under the Landfill Communities Fund.

When it was first introduced, the tax received widespread support from industry, municipalities, and non-profits as it was meant to be revenue-neutral by offsetting a reduction in National Insurance Contributions [36]. However, this is no longer the case and some revenue is generated

from the tax. These revenues are collected by HM Revenue & Customs (HMRC) and are directed to the general budget, with approximately 10 percent reserved for investment in related environmental bodies through the Landfill Communities Fund [37].

Success

The tax was a success because it was sufficiently high to allow alternative treatment technologies that otherwise could not compete with the low cost of landfilling to be financially viable.

It is important to mention that although this tax was successful at discouraging landfilling, it did not necessarily encourage disposal mechanisms at the top of the waste management hierarchy, but rather only to the next cheapest alternative which was energy-to-waste incineration.

Applicability to Washington

As is the case in California, fees or taxes on waste disposal can be applied for the sole purpose of generating revenue to provide funds to support existing or new waste management programs. It is almost impossible to evaluate the long-term benefits of programs funded in this way and in most cases the money is used to maintain the status quo and not drive sustainable, lasting improvements. Taxes that are put in place to create market conditions that allow for alternative treatment options to be viable will have long-term benefits if set at a sufficient level.

Washington currently has a 3.6 percent solid waste collection tax that is used to fund a range of waste- and non-waste programs and essentially serves the same function as a landfill tax (Chapter 82.18 RCW). Washington could consider increasing the current tax to create a greater disincentive for disposal, though the state already has some of the highest disposal fees in the nation. The cost of disposal also varies greatly across the state; tipping fees in 2019 ranged from as low as $28.57 per ton (Klickitat County) to as high as $400.00 per ton (Orcas Island) [38], so the efficacy of further reliance on this approach is questionable.

Key considerations for this approach include:

- Is a plastic-specific landfill tax or fee feasible to implement and enforce? What level of tax or fee would have to be levied to create the necessary market conditions to create financially viable and sustainable recycling alternatives?
- Where will revenue go and who will manage it?

Fees on Specific Items

U.K. Plastic Packaging Tax

Program Description

As part of the U.K.'s 2017 governmental budget, a new tax on plastic packaging was announced. The tax will affect all packaging made in or imported into the U.K. which does not contain at least 30 percent recycled content. The U.K. government launched a consultation process in February 2019, and the tax will take effect in April 2022.

Chicago Checkout Bag Tax

Program Description

In February 2017, Chicago imposed a $0.07 fee on the retail sale or use of plastic and paper carryout bags. Of the fee collected, $0.02 is retained by the retailer and $0.05 is remitted to the City for its general operating budget. Restaurants and families in the Supplemental Nutritional Assistance Program (SNAP) are exempt from the fee.

The decision to impose this fee came after a ban that was implemented in August 2015 but had unintended negative consequences, with many retailers providing thicker plastic bags and paper bags at no cost, negating the reduction of thinner single-use bags. The ban was repealed in November 2016 and industry met with government officials to craft an alternative. The result was the fee that applied to all carryout bags, regardless of material.

Success

According to a joint University of Chicago-New York University study, the $0.07 fee resulted in a halving of the number of plastic bags being used at grocery stores in Chicago. Additionally, the number of people bringing reusable bags increased by 2.5 times, and the number of people who didn't use a bag nearly tripled [39].

The fee was so effective in changing consumer behavior that the City actually collected $3.6 million less in revenue in its first year than it had projected [40].

Due to the overwhelming success of the city's bag fee, in 2020, bills in the state Senate and House were introduced to charge a fee on carryout bags across the entire state. Those bills, Senate Bill 3423 and House Bill 3335, would impose a $0.10 fee on all bags and are still under consideration [41].

Applicability to Washington

Fees of this type are often successful at incentivizing behavior change without requiring it by law. However, government must be careful with public perception of any instituted fees and try to ensure they are not perceived as an unnecessary tax. Furthermore, low-income groups must be protected from any undue burdens that a fee might impose – this is often done through exemptions for residents that meet certain income qualifications.

Such fees may be appropriate in Washington when used in conjunction with other policy interventions, such as a ban or a deposit return system, in order to increase the effectiveness of both measures. An example would be a ban on single-use plastic cutlery and a fee on other single-use cutlery. Similar reasoning can be applied to additional legislation that addresses a wider range of single-use products that are deemed a burden on Washington's environmental, social, and financial resources.

Key considerations for this approach include:

- What materials should be covered and how should these be determined?
- At what level will the tax be set and how will the system be designed and implemented?
- For taxes related to recycled content requirements, how will producers demonstrate compliance? What systems are needed to audit and enforce compliance and what are the penalties for non-compliance?
- What are the potential unintended consequences or negative impacts of this approach and how can they be mitigated? Are there any loopholes or potential undesirable material substitutions?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

2.1.3 Extended Producer Responsibility

Extended producer responsibility (EPR) is an environmental policy tool that transfers a producer's financial, and sometimes operational, responsibility for end-of-life management (and, in some cases, other impacts) of products and packaging to producers. When well designed, EPR can also create incentives for producers to incorporate environmental considerations into the design of their products and packaging. EPR can be applied to many product categories, including packaging, and can be used to make producers responsible for the end-of-life care of their products, regardless of where the material ends up (e.g., litter, garbage, recycling, etc.).

There is no single model for effective EPR. Though the E.U. has had an EPR system for packaging for over 20 years, each individual member state has chosen to implement the regulation slightly

differently, and the European Commission has only recently sought to provide guidance with the aim of providing some consistency. Differences in EPR models focus around the following key areas:

Roles and responsibilities of the different stakeholders:

- What is the role of government?
- To what degree is the design and operational control of the system passed on to producers?
- Who is responsible for monitoring compliance and issuing penalties for non-compliance?

Objective of the legislation:

- Is it solely meant as a mechanism for producers to cover the cost of an existing recycling collection system? (This is not recommended but is sometimes the case, for example, in Maine's current EPR bill ("An Act to Support and Increase the Recycling of Packaging" (LD 2104) [42]).
- Alternatively, is the legislation's purpose to facilitate a transition to a circular economy? If this is the case, it needs to be written in a way that supports and rewards producers that design their products and packaging for longevity or reuse, recycling, refurbishing, or repurposing.

Program scope:

- Does the program apply to all packaging or only to certain types of packaging? For example, certain container deposit return systems are essentially a form of EPR that is specific to beverage containers.
- Does the program cover packaging for the residential sector and/or commercial sectors?
- Does the program require producers to meet specific, time-bound targets for recycling rates or other performance standards?

Cost coverage:

- What costs are producers required to cover? Are financial obligations limited to covering the costs of separate collection and recycling of packaging only, or are they also responsible for covering the costs of managing the portion of their products and packaging that end up in the litter or garbage stream?

Packaging

If implemented correctly, EPR for packaging is an effective mechanism to improve recycling rates, reduce litter, incentivize system efficiencies, and reduce costs for end-of-life management.

An outcomes-based approach in EPR policies provides producers with flexibility on how to design and implement the system while encouraging innovation and continuous improvement in striving to meet prescribed performance objectives in the most cost-effective and efficient manner possible.

In the U.S., although there are stewardship programs for electronics, paint, and pharmaceuticals in place, along with a deposit return system (DRS) for beverage containers in some states (which are, in certain applications, a form of EPR and are discussed in the following section), there are no EPR programs for packaging more broadly in the U.S. yet, though packaging EPR legislation has been introduced or is in development in several states and at the federal level [43]- [44]- [45].

This section details EPR programs from Canada and Europe that are notable for a variety of reasons, detailed below. Further information on the details of these programs can be found in the case studies below and in reports "*Extended Producer Responsibility Policy Framework and Implementation Model: Residential Recycling of Packaging and Paper Products in Washington State,*" from the King County Responsible Recycling Task Force, "*Extended Producer Responsibility for Packaging and Paper Products: Policies, Practices, and Performance,*" *from the Product Stewardship Institute*, and from the Oregon Recycling Steering Committee Legal and Relational Frameworks Subcommittee Report in December 2019:

- **British Columbia**: Producers have full financial and operational responsibility for operating a reverse supply chain for residential packaging and paper products, but many local governments remain involved in residential recycling collection through contracting arrangements with the PRO. The provincewide post-collection system developed by the PRO (Recycle BC) has made it possible to collect and recycle a much wider range and quantity of plastic packaging compared to most other programs in North America.
- **France**: This program uses modulated fees to encourage more sustainable packaging material design by producers.
- **Germany**: This system moved from a single to a multiple PRO model to try to promote competition and drive down costs.
- **Belgium**: This system uses separate EPR programs for residential and commercial packaging.
- **Ontario**: This system is transitioning from one in which producers contribute 50 percent of the costs of a municipality-determined system to one where producers take full operational and financial control so that they can meet the higher recycling targets expected to be adopted by the province under the new EPR system.

More information on the costs associated with each EPR program and which entity is responsible for those costs can be found in Section 3.0.

British Columbia

B.C. has two EPR programs for packaging: one for beverage containers and one for residential PPP. Both systems are in place as the beverage container program was established first and is successful.

The following section focuses only on the EPR system for residential PPP collected curbside and through depots.

Program Overview

Table 2-3 British Columbia Program Key Facts

Key Fact	Details
Population	• 4.6 million [46]
Number of Households	• 2.1 million [46]
Year of Implementation	• 2014
Enabling Legislation	• Recycling Regulation [47] under the B.C. Environment Management Act • Launched its PPP EPR program on May 19, 2014 with the first stewardship plan submitted to the Ministry of Environment in November 2012. Recycle BC's second stewardship plan was approved by the Ministry in June 2019
Sectors Covered	• Residential
Packaging Materials Collected	• Residential paper, paper packaging and cardboard, paper cups and carton, aluminum containers, plastic containers, steel containers, glass bottles and jars (excluding beverage containers, which are managed separately under a DRS)[4]. Residents are required to separate glass into a different container for curbside collection or take glass to drop-off depots [48].

[4] B.C. collects additional materials at the depot only, these were not included. The full list of materials collected can be found at Recycle BC.

Key Fact	Details
Performance	• 78.1% of covered PPP collected, of which, 87.3% was managed by recycling and 3.4% was transformed into engineered fuel.[5]
Curbside Access	• N/A[6]
PRO Model	• Single PRO
PRO Responsibility	• Financial and operational
Collective or Individual Producer Responsibility	• Collective
Transition/ Implementation Period	• Detailed program planning began in the fall of 2012 and the program was launched in May 2014.

In response to requirements of the Recycling Regulation [49] under the B.C. Environment Management Act of 2003, Recycle BC (then known as Multi-Material BC) became the first EPR program in North America where producers assumed 100 percent financial and operational responsibility for a provincewide reverse supply chain for PPP from the residential sector in B.C.

Stakeholders Roles and Responsibilities

Government

According to the regulation, the Ministry of the Environment and Climate Change Strategy (MOECCS) is responsible for reviewing and approving program plans, created by a producer or the PRO that it is part of, every five years. The program plan outlines how the producer or PRO will meet the recovery targets, performance measures, and management requirements outlined in the Recycling Regulation.

If, in its review of the annual reports submitted by producers, MOECCS determines that producers have failed to carry out the activities outlined in their plans or have not made a good

[5] This number is not the same as "recycled." Recycle BC's recovery rate is determined by dividing collected tonnes by steward-reported tonnes. Of the tonnes collected, "87.3% of collected tonnes were managed by recycling; 3.4% of collected tonnes were managed through "recovery" (i.e., engineered fuel); and 9.3% were managed by disposal. See the 2018 Annual Report.
[6] Recycle BC does not report on curbside access, but that 98.3% of residents have access to curbside or deport recycling. See the 2018 Annual Report.

faith effort to meet the performance targets and did not inform/consult with MOECCS in advance about the failures, MOECCS can decline to approve next plan and can apply penalties to both individual producers and, if relevant, the PRO operating on their behalf.

Producers

All producers are required to register with MOECCS and participate in the packaging EPR program in order to sell their products in B.C. A producer may choose to discharge this responsibility individually or to join a PRO. More than one PRO is permitted and technically three operate in BC, but only Recycle BC currently actually handles non-deposit packaging.[7]

In B.C., the Recycling Regulation defines a producer as:

> *"(b)(i) a person who manufactures the product and uses in a commercial enterprise, sells, offers for sale or distributes the product in British Columbia under the manufacturer's own brand,*
>
> *(ii)if subparagraph (i) does not apply, a person who is not the manufacturer of the product but is the owner or licensee of a trademark under which a product is used in a commercial enterprise, sold, offered for sale or distributed in British Columbia, whether or not the trademark is registered, or*
>
> *(iii)if subparagraphs (i) and (ii) do not apply, a person who imports the product into British Columbia for use in a commercial enterprise, sale, offer for sale or distribution in British Columbia [47]."*

Programs delivered against a clear definition of "producer" are better equipped to deter free riders, as members have a better understanding of who operates in their sector.[8] In B.C., small businesses are exempt from participating in the program; a summary of de minimis provisions and thresholds in B.C. and other provinces can be found in the Canadian Stewardship Services Alliance (CSSA) *Guidebook for Stewards* [50].

Municipalities

Municipalities under the legislation's first right of refusal provision have three options with respect to the provision of collection services:

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[7] An organization called StewardEdge made a submission to MOECCS about 4 years ago to compete for packaging management, but it was rejected by as being inadequate. Other EPR programs in B.C., such as for e-waste, have multiple PROs operating.

[8] B.C. defines producers in Appendix D of Recycle BC's Packaging and Paper Product Extended Producer Responsibility Plan, June 2019.

- **Become a contracted collector to Recycle BC** – Two-thirds of the province, by population, at the end of 2019 operated under this arrangement for residential recycling collection service.
- **Transfer residential recyclables collection service to Recycle BC** – Thirteen communities have handed over curbside and multifamily recyclables collection responsibility to Recycle BC so far (including the City of Vancouver); constituting about one-third of the province.
- **Opt out** – A few remote outliers, representing a very small number of residents, remain outside the system.

Performance Targets

The historical regulated target in B.C. is to achieve a 75 percent collection target for designated materials. The proposed recovery targets in the latest Recycle BC Packaging and Paper Product Extended Producer Responsibility Plan are set out in Table 2-4. It should be noted that the targets are material specific as are net recovery targets (not including non-program contaminants or processing residuals) compared to an overall 65 percent collection target for the basket of recyclables which was in place for the first five years of the program.

Table 2-4 Latest Proposed Recovery Targets for PPP in B.C.

Material Category	2017 Recovery Rate (%)	Target Recovery Rate (%)	Year to Achieve Target
Paper	87	90	2020
Plastic	41	50	2025
Rigid Plastic	50	55	2022
		60	2025
Flexible Plastic	20	22	2022
		25	2025
Metal	66	67	2020
Glass	72	75	2020

Source: Packaging and Paper Product Extended Producer Responsibility Plan revised July 2018

B.C. Residential Recycling System Components Under EPR (Managed by Recycle BC)

The system that the producers in B.C. are now fully responsible for is divided into two main areas:

- **Collection services** in which municipalities can continue to play a role (the preferred approach by Recycle BC).
- **Post-collection services**, which includes consolidation, transfer, processing, and marketing of collected residential recyclables and has been fully taken over by Recycle BC. Recycle BC establishes contracts for material processing, manages those contracts, and keeps material revenues. B.C. municipalities have no role in material processing or marketing.

Producers are also responsible for ensuring that collection services meet certain access standards for residents.

- Those that had curbside or multifamily collection prior to 2014 were guaranteed collection service no less than every other week.
- Those that had curbside garbage for at least two years and a population of 5,000 were offered recycling service.
- Drop-off locations are available within a 30-minute drive for all urban residents and a 45-minute drive for rural residents.

Contractual Arrangements between Collection Entities (Municipalities and Private Sector Haulers) and Recycle BC

Recycle BC uses one master services agreement for all contracts (collection, post-collection, other services); the collection services portion was negotiated with municipalities. Under the master services agreement, there are separate standards for curbside and multifamily collection, depots, and post-collection services [51].

Payments for services provided by municipalities or contracted by municipalities are not directly based on actual costs incurred by each municipality individually. Rather, Recycle BC has conducted regular cost studies (completed in 2012, 2014, 2017, and planned for 2020) to set and adjust per household incentive payments for collection and offers a standard "market clearing price[9]" to all contracted collectors. This means that some municipalities receive payments that cover the cost of service provision, while others may receive payments that are below or even above the costs of service provision they were paying before. Contracts expire

[9] Clearing price is the equilibrium monetary value of a traded security, asset, or good. This price is determined by the bid-ask process of buyers and sellers, or more broadly, by the interaction of supply and demand forces. See Investopedia.

every five years, so municipalities are to provide a year's notice if they want to transfer service directly to Recycle BC (and then the transfer includes an 18-month transition period).

Collector and processor qualification standards, including reporting protocols, are the minimum operating standards that service providers (municipalities or their contracted hauler) are required to meet on a continuous basis in order to be eligible to provide collection, depot operation, and/or processing services under contract with Recycle BC.

Processing of Recyclables - Managed by Recycle BC Under Direct Contracts

Processing of recyclables was moved out of municipal control and fully under the control of Recycle BC at the onset of the provincewide program, so municipalities no longer have a role in processing or marketing recyclables. The benefit of this is that municipalities are no longer exposed to material value risk. When material markets are low, there is less revenue from the sale of material to offset payments to municipalities for collection services and leads to an increase in producer fees. In addition, materials collected from across the province can be consolidated and processed at an economy of scale not previously possible.

For post-collection (i.e., PPP consolidation, transfer and transport, processing, and delivery to end markets), Recycle BC procured a post-collection system through a competitive bid process initially in 2015, resulting in a provincewide PPP transfer and sorting system designed to maximize the value and reuse of the recyclables and minimize redundancy.

The current post-collection infrastructure is comprised of 32 receiving, consolidation, and transfer facilities. The goal at these facilities is to do the minimum to get materials to the 11 pre-conditioning facilities (PCFs), where material is handled and sorted to bale and ship fiber. Some PCFs also sort containers and directly market metals, but all plastics are sent to a single Container Recycling Facility (CRF) - a $20+ million facility opened in 2014 and operated by Merlin Plastics. A major change in the B.C. post-collection system will occur in May 2020, when a new post-collection contract goes into effect. The specifics of how the current post-collection infrastructure might change are not known at this time. It is also not known what technology or system will be used by the new post-collection group to manage collected plastics and other parts of the container stream.

End Markets for Processed Recyclables

When identifying end markets, Recycle BC prioritizes those located in Organization of Economic Cooperation and Development [52] (OECD) countries. It allows marketing of PPP to non-OECD countries only if those markets meet or exceed the environment, health, and safety standards equivalent to OECD standards.

Despite tightening world commodity markets as a result of China's National Sword import restrictions, Recycle BC has reported that over 87 percent of residential material collected—including plastic packaging, paper products, glass, and metal containers—are managed by recycling.[10]

The B.C. program represented the first time in North America that producers took on the commodity price risks for material marketing. Recycle BC pays a set price per ton for processing, and then developed a commodity revenue rebate calculation included in its RFP: tonnage multiplied by commodity value, based on regular in-bound audits for material-specific tonnages and price indices for commodities. Consequently, when the processor can successfully market the material, they keep the additional commodity value (i.e., the difference between the calculated value based on index prices and the actual revenues realized). Just as importantly, producers bear the risk and cost when markets are soft.

About 6,000 tonnes are currently managed by recovery as an engineered fuel. Less than one percent of residential plastics recycled last year in B.C. was sent overseas; foam polystyrene that is densified in B.C. is sent to Malaysia for recycling into picture frames made in China.

Future Directions and Reporting

Recycle BC's revised five-year Packaging and Paper Product Plan [53] was approved by MOECCS in 2019. Recycle BC remains the sole PRO for the full range of residential PPP in the province. Producers of PPP are required to register and report to Recycle BC. A checklist of requirements for reporting is found in Appendix A.2.1.

B.C. municipalities and many small and medium sized businesses are actively encouraging MOECCS to expand the program to include recyclable industrial, commercial, and institutional (ICI) materials.

Recycle BC is also engaged in pilot programs to work on "other flexible plastic packaging," one of the fastest growing packaging types on the market.

[10] This number is not the same as "recycled." Reported by Recycle BC, "managed by recycling" 87.3% of collected tonnes; 6,185 tonnes of recovered material was managed through "recovery" (i.e., engineered fuel) and 16,742 were managed by disposal. See the 2018 Annual Report.

France

Program Overview

France's EPR program is an exemplary model in the use of modulated fees to encourage more sustainable packaging material design by producers. Key facts are provided in Table 2-5.

Table 2-5 Key Facts of France's EPR Program

Key Fact	Details
Population	• 67.0 million [54]
Number of Households	• 28.8 million [55]
Year of Implementation	• 1992
Enabling Legislation	• Article L. 541-10 of the Environment Code (1975), decree on household packaging (1992) [56]
Sectors Covered	• Residential and commercial
Packaging Materials Collected	• Metals, plastics, paper and cardboard, and glass
Performance	• A total of 10.5 million tonnes of packaging waste[11] was placed on the market (POM) in both the residential and commercial sectors in 2015/2016, of which 6.4 million tonnes (61%) was calculated as being recycled under the current calculation method.[12] The current recycling rate for packaging from residential sources is 68%,[13] based on the current definition of recycling. The total calculated recycling rate for the commercial sector is 54%.

[11] Packaging is defined by ADEME as: "all the material elements which, without being part of the product itself, are sold with it in order to allow or facilitate its protection, transport, storage, presentation, packaging, identification and its use by consumers."
[12] Current recycling rate is reported by ADEME. See ADEME, "Tableau de bord des déchets d'emballages ménagers," November 2018.
[13] Includes metals collected from incinerator bottom ash, as reported in figures by ADEME.

Key Fact	Details
Curbside Access	• Approximately 80% [14]
PRO Model	• Effectively single PRO - CITEO
PRO Responsibility	• Financial
Collective or Individual Producer Responsibility	• Collective
Transition/Implementation Period	• The decree on household packaging of 1992 came into effect on January 1, 1993 [57].

Producers in France are required to ensure the proper end-of-life management of the products they place on the French market. This is done by transferring their obligation to a certified PRO to which they pay a financial contribution [58]. CITEO, originally known as Eco-Emballages, is the sole PRO for all curbside residential recycling, though other PROs are permitted. CITEO aims to encourage recycling collection and packaging waste reduction.

Through CITEO, producers are responsible for the cost of collecting packaging material for recycling. However, if 75 percent of packaging is recycled, a target outlined in the law, producer fees will cover 80 percent of the net costs of collection and sorting.

In France, municipalities, or groups of municipalities, provide the collection services for packaging and the contracts for material processing. The administration of 18 geographical regions are responsible for the direction and strategy of waste management within their geographical area and they compile regional waste prevention and management plans. The Environment and Energy Management Agency (Agence de l'Environnement et de la Maîtrise de l'Énergie (ADEME)) plays a key role in supporting the implementation of government waste management policy through national and regional programs. All producers must report the amount of packaging that they place on the market and the amount that is collected, to ADEME.

As a member state of the E.U., France is also subject to the laws of the European Commission, which implemented more ambitious targets related to waste management and recycling in 2019. In anticipation of meeting the E.U. targets, France has set intermediary mandates through a national pact on plastic packaging, "Pacte National sur les emballages plastiques" (the Pact)

[14] Glass is only collected at the curbside in approximately 20% of households, it is otherwise collected at community glass banks.

between the Ministry of Ecological and Inclusive Transition, leading retail and consumer goods producers, and NGOs. The Pact has set a goal of collectively reaching 60 percent of plastic packaging recycled by 2022 [59].

In the commercial sector, the end-user (not the producer) is responsible for collection and recovery operations. The only obligation for the producer is to put industrial end-users in contact with local waste management contractors [58].

Modulated Producer Fees

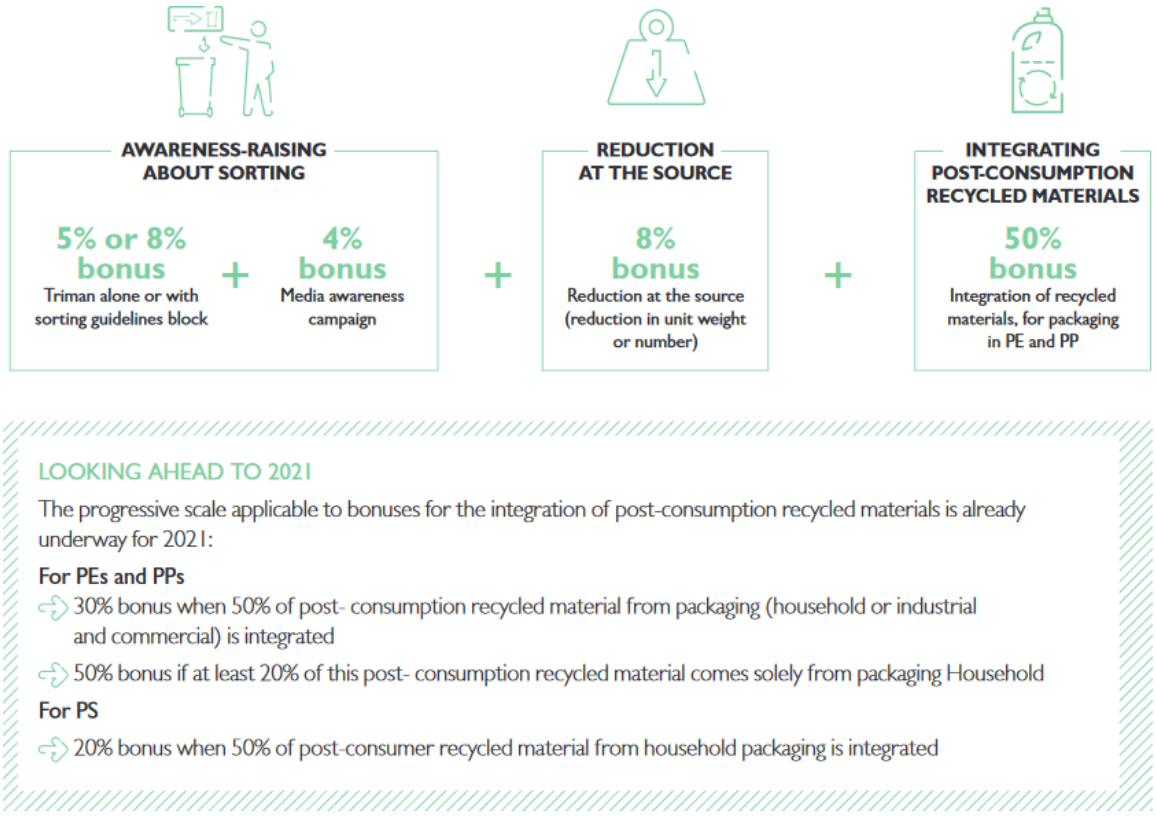
Producers in France are charged annual fees on a material-specific basis, based on the amount of material that they put on the market. Fee modulation – in the form of a series of bonuses and penalties – is then selectively applied. The aim of the modulation is to encourage the eco-design of packaging and integration of recycled materials by producers, as well as to encourage companies to use recyclable and less complex or 'disruptive' packaging, such as bottles with PET as the majority material that also contain aluminum, PVC, or silicone, and to promote awareness-raising about sorting [60].

Bonuses (fee reductions) are available in relation to:

- Plastic packaging already covered by the current sorting guidelines
- Rigid plastic packaging that can join an existing recycling channel
- Polyethylene (PE) containing at least 50 percent recycled material
- Reduction at source and recyclability improvement
- Awareness-raising

Figure 2 shows the bonus structure that was adopted in 2020 and the additional changes to come in 2021.

Figure 2 CITEO Fee Modulation Bonus Structure and Future Changes

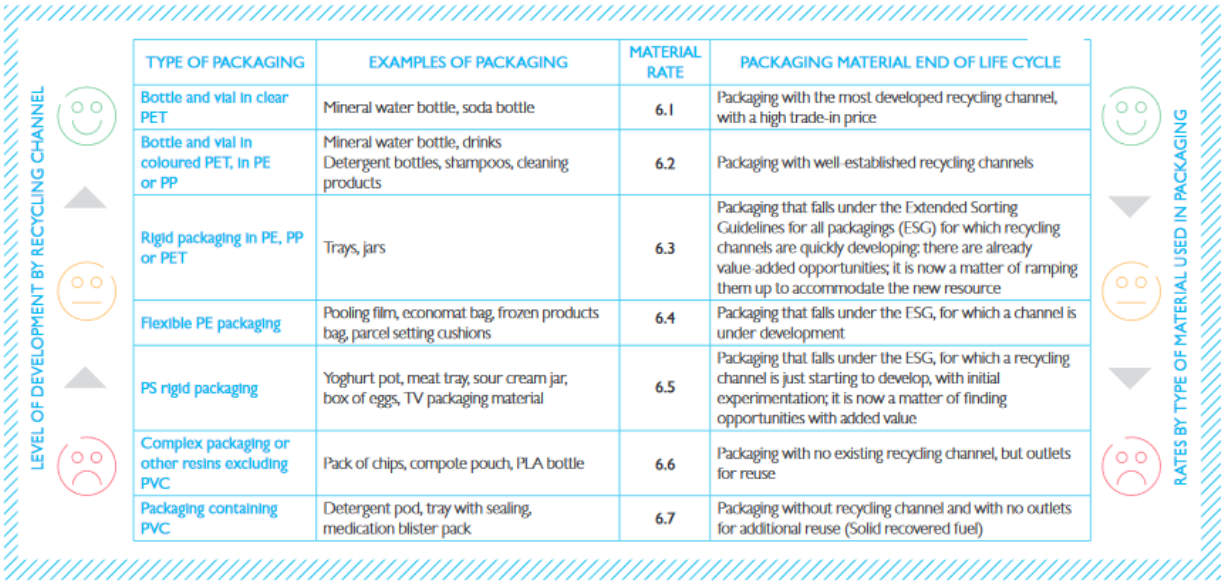


Source: CITEO

The new changes are in response to CITEO's acknowledgement that having a single level of basic fee for all plastic packaging, as was previously the case, is not necessarily appropriate. It is noted that the broad category of plastics covers a range of different resins and packaging types, which exhibit differing levels of maturity in terms of recycling, but that a single level fee for plastics does not give a price signal to encourage the use of plastics with more developed recycling channels. Accordingly, CITEO proposes to apply 'variable pricing' on the plastic fee to reflect this diversity.

Figure 3 shows CITEO's categorization of the maturity of recycling for different types of plastic resins and packaging types.

Figure 3 Relative Development of Recycling by Packaging Type



TYPE OF PACKAGING	EXAMPLES OF PACKAGING	MATERIAL RATE	PACKAGING MATERIAL END OF LIFE CYCLE
Bottle and vial in clear PET	Mineral water bottle, soda bottle	6.1	Packaging with the most developed recycling channel, with a high trade-in price
Bottle and vial in coloured PET, in PE or PP	Mineral water bottle, drinks Detergent bottles, shampoos, cleaning products	6.2	Packaging with well-established recycling channels
Rigid packaging in PE, PP or PET	Trays, jars	6.3	Packaging that falls under the Extended Sorting Guidelines for all packagings (ESG) for which recycling channels are quickly developing: there are already value-added opportunities; it is now a matter of ramping them up to accommodate the new resource
Flexible PE packaging	Pooling film, economat bag, frozen products bag, parcel setting cushions	6.4	Packaging that falls under the ESG, for which a channel is under development
PS rigid packaging	Yoghurt pot, meat tray, sour cream jar, box of eggs, TV packaging material	6.5	Packaging that falls under the ESG, for which a recycling channel is just starting to develop, with initial experimentation; it is now a matter of finding opportunities with added value
Complex packaging or other resins excluding PVC	Pack of chips, compote pouch, PLA bottle	6.6	Packaging with no existing recycling channel, but outlets for reuse
Packaging containing PVC	Detergent pod, tray with sealing, medication blister pack	6.7	Packaging without recycling channel and with no outlets for additional reuse (Solid recovered fuel)

Source: CITEO

Like bonuses, penalties aim to encourage the use of more recyclable material. The penalties are applied to producer fees based on the materials used. In 2020, the rates of existing penalties have increased, with further increases projected for 2021, as well as the introduction of new penalties.

The system consists of three levels. Level 1 penalties are new for 2020 and charged at a 10 percent rate (increasing to 50 percent in 2021). They include the use of characteristics such as rigid plastic that is dark in color and therefore undetectable by optical sorting systems, and polyethylene (PE) or polypropylene (PP) packaging with a density greater than one.

Level 2 penalties, charged at 50 percent (increasing to 100 percent in 2021) include using reinforced cardboard and Level 3 penalties, charged at 100 percent, include rigid plastics in opaque polyethylene terephthalate (PET) and packaging in 2020 in national sorting guidelines, but non-recyclable and non-recoverable [60].

All the fees that CITEO applies attempt to encourage the development of packaging that is easily recycled through mature recycling systems in France and to increase packaging recycling rates across the country.

Germany

Program Overview

Der Grüne Punkt, or Green Dot, was the first EPR system for packaging. Table 2-6 summarizes the program.

Table 2-6 Key Facts of Germany's Program

Key Fact	Details
Population	• 82.9 million [61]
Number of Households	• 41.4 million [62]
Year of Implementation	• 1991
Enabling Legislation	• Verwertung von Verpackungen (Packaging Ordinance) [63]
Sectors Covered	• Residential
Packaging Materials Collected	• Paper, cardboard, glass, cans, plastic, metal and composite packaging
Performance	• 76.2% [64]
Curbside Access	• N/A
PRO Model	• Multi-PRO
PRO Responsibility	• Financial and contracting of service providers
Collective or Individual Producer Responsibility	• Collective
Transition/ Implementation Period	• N/A

Der Grüne Punkt began in 1991 with producers and retailers organizing to form the PRO, Duales System Deutschland GmbH (DSD), after the passing of the Packaging Ordinance. The Ordinance required a separate stream of collection for packaging from household waste ("dual system") and made it mandatory for producers to ensure recovery of their packaging and to cover the costs to meet national recovery targets for each material. Obligated producers must register and

submit data based on the quantity of packaging handled to the Federal Ministry of the Environment; this includes mass flow verification.

From 1991 to 2001, the program was structured as a monopoly for DSD. In 2001, due to the government's concerns over the high cost of the system, the program opened for competition, with the first new PROs entering the market in 2006. DSD is still the largest PRO, but there are now nine dual system companies licensed to operate on the packaging waste management market [64]. Each obligated producer must contract a PRO to manage their packaging.

The PROs operate collection contracts with a three-year duration. Municipalities can participate in tenders but have to compete with private waste management companies. Those municipalities that do provide services are paid by the PROs, as are the private companies. Paper collection is reimbursed based on the proportion of paper classified as packaging within the curbside collection system [58]. The costs of the resulting contracts for collection are pooled by the PROs and paid according to their market share.

Since there are nine different PROs in Germany for packaging, they do not publish the fees for the EPR contributions or costs but negotiate them individually with producers. For 2018, it was estimated that the fee for plastics is approximately €520 ($569 USD) per ton and for beverage cartons is approximately around € 450 ($492) per ton [65].

In 2019, the Packaging Act was updated, targets were increased, and a central packaging registry was created. Incentives were introduced for the use of ecological packaging materials, as was the beginnings of fee modulation. This update intends to incentivize producers to take steps to reduce all packaging waste as much as possible, and promote institutional recycling and reutilization of materials, particularly single-use plastics [66].

Targets in the original packaging ordinance as well as the 2019 update are presented in Table 2-7.

Table 2-7 German Packaging Targets

Material	Target Packaging Ordinance (%)	Target 1st Jan 2019 (%)	Target 1st Jan 2022 (%)
Glass	75	80	90
Paper, board and cartons	70	85	90
Ferrous metals	70	80	90
Aluminum	60	80	90

Material	Target Packaging Ordinance (%)	Target 1st Jan 2019 (%)	Target 1st Jan 2022 (%)
Beverage carton packages	60	75	80
Other composites	60	55	70
Plastics	60	90	90
Mechanical recycling (plastic)	36	58.5	63

Source: DSD

Belgium

Belgium is unique, as it is one of the few programs to have EPR extend to both the residential and commercial sectors. Belgium has individual PROs for each sector, as described below. Key facts for the program are provided in Table 2-8.

Program Overview

Table 2-8 Key Facts of Belgium's Program

Key Fact	Details
Population	• 11.4 million [67]
Number of Households	• 5.0 million [68]
Year of Implementation	• 1993
Enabling Legislation	• Interregional Cooperation Agreement [69]
Sectors Covered	• Residential, Commercial, and Industrial
Packaging Materials Collected	• Metals, glass, paper/cardboard, beverage containers, plastics, wood
Performance	• Residential: 82.6% • Commercial: 80.7% [70]

Key Fact	Details
Curbside Access	• N/A
PRO Model	• Single PRO for residential and single PRO for commercial
PRO Responsibility	• Financial and contracting of service providers
Collective or Individual Producer Responsibility	• Collective
Transition/ Implementation Period	• The household packaging EPR program came into effect in 1997 and commercial packaging in 1998 [69]

Belgium prioritizes the principle of shared responsibility regarding their EPR systems for packaging, with all producers—in either the residential or commercial sectors—required to bear responsibility for the packaging that they put on the market.

Producers must register and submit packaging quantity and product data to one of three regional waste authorities. These authorities ensure regional participation in the Interregional Packaging Commission (IPC), which was created to enable uniform packaging waste management and monitoring of the implementation of legislation aimed at waste prevention and management [71]. The primary responsibilities of the IPC are to:

- Grant approval to packaging waste management organizations (e.g., Fost Plus) and audit their activities to suspend or renew their licenses.
- Monitor compliance with the regulations by packaging producers and approved organizations.
- Evaluate and approve prevention plans established by packaging producers and the sectoral federations.
- Ensure the smooth operation of the whole system [58].

The regional governments also approve the implementation plans written by the PROs. However, packaging recycling policy is a national EPR system, in place since 1993.

Producers may fulfill their obligations individually (in which case they report directly) or by joining a PRO: either Fost Plus for residential packaging or VALIPAC for industrial and commercial packaging [72].

Businesses that put packaging into both the residential and commercial sectors that do not want to self-report must register with both organizations.

Additionally, all obligated producers must submit a prevention plan to the IPC once every three years that includes a plan to increase recycling and recovery rates to achieve the targets over time.

Residential waste in Belgium is managed regionally. Each region determines their own waste policy (Brussels, Flanders, Wallonia) and is responsible for creating their own legal framework for waste management and for approving contracts between municipalities and Fost Plus. Local inter-municipal organizations handle the collection and treatment of waste, but packaging waste is directly handled by Fost Plus, including collecting, sorting, and processing.

Producers must sign a membership agreement (that can be terminated each year) through which Fost Plus provides specifications for collection and sorting, including a list of quality criteria.

Fost Plus is responsible for compensation provided to municipalities in Belgium, which front all of the costs of waste collection and sorting for residential packaging waste. Municipalities either provide the service themselves or contract the service to other providers and are reimbursed the price by Fost Plus. Approximately half of Belgian municipalities provide their own services and half contract with a hauler [58].

Although Belgium's EPR system only requires the collection of plastics for which a market price can be made (such as beverage containers), rather than invest in new technologies to create markets for hard-to-recycle plastics, some municipalities have found markets for some non-bottle plastics and collect them in addition to the collection associated with the EPR system.

To meet its members' obligations, Fost Plus signs contracts with municipalities (or inter-municipality organizations) for eight years. Municipalities can decide whether to use their own collection services or to hire a private waste collection contractor.

Fost Plus is not required to collect all household packaging, as long as they meet the 80 percent global recycling target and the minimum recycling target of 30 percent for plastics [58].

Fees under Fost Plus for residential rates differ from those under VALIPAC. Rates in 2019 for each are provided in Table 2-9; the difference in rates are reflective of the differing costs of collecting and managing materials under each program. Collection of packaging in the industrial sector is likely to be by stream, reducing processing costs, for example.

Table 2-9 Producer Fees under Each of Belgium's PROs in 2019

Material	2019 (€/ton) Fost Plus	2019 (€/ton) VALIPAC
Glass	31.1	14.50
Paper Cardboard	22.3	14.50
Steel	52.9	See metal
Aluminum	33.9	See metal
Metal	N/A	14.50
PET Bottles and flasks	346.3	See plastics
HDPE bottles and flasks	341.8	See plastics
Plastics other	510.3	N/A
Plastics all	N/A	39.50
Building sector plastics	NA	49.50
Drinks cartons	354.1	N/A
Wood	N/A	14.50
Textiles	N/A	14.50
Other recyclable materials	N/A	14.50
Non-recyclable materials	See energy from waste and disposed	53.00
Energy from Waste	616.10	N/A
Disposed	781.80	N/A

Source: Fost Plus and Valipac

Ontario

Ontario is a useful case study because it is in the process of transitioning from a system that is partially funded by producers and largely operated by municipalities, to a system that will be fully funded by producers and which will give producers more operational control over

collection and processing to drive efficiencies in the system and improve performance. Key facts are provided in Table 2-10.

Program Overview

Table 2-10 Ontario Program Key Facts

Key Fact	Details
Population	• 14.3 million
Number of Households	• 5 million
Year of Implementation	• 2002
Enabling Legislation	• Waste Diversion Act [73] • Waste-Free Ontario Act [74]
Sectors Covered	• Residential
Packaging Materials Collected	• Materials vary by municipality[15]
Recycling Performance	• 62% [75]
Curbside Access	• 95% [76]
PRO model	• Single PRO moving to multi PRO
PRO Responsibility	• Currently 50% financial, future 100% financial and level of operational to be determined
Collective or Individual Producer Responsibility	• Individual
Transition/Implementation Period	• The legislation was passed in 2002 and the program began in 2003 [77].

Current Ontario "Blue Box" System

Stewardship Ontario is (currently) the sole organization responsible for collecting fees from stewards to fulfill their funding and other obligations.

[15] See the full list of recyclables organized by municipality.

Under the current cost share model:

- Producers have no operational influence on how services are provided.
- Producers are responsible for paying 50 percent of system costs, net of material revenue based on benchmarked costs for service across different municipality categories.
- Municipalities continue to have control over delivery and contracting of collection and processing services and take all material revenue risk.

One of the distinguishing features of the Blue Box system in particular (and the waste diversion programs in Ontario in general) is the robust Municipal Datacall initially instituted at the inception of the Blue Box program in 2003 to track waste diversion program performance. The Datacall has continued and been significantly enhanced and modernized with the creation of the Resource Productivity and Recovery Authority (RPRA).

The current cost share model has led to many conflicts between producers and municipalities. Producers are frustrated because municipalities may deliver services differently and the system as a whole does not benefit from potential service efficiencies that would be driven by service consistencies and centralized material processing and marketing. This results in producers covering more costs than may be necessary. At the same time, municipalities do not trust the mechanisms by which costs are benchmarked and therefore believe that that producers may pick up less than the 50 percent set out in the Waste Diversion Act.

Key Ontario Blue Box Program Changes Under IPR (Individual Producer Responsibility) from 2020 to 2025

In 2016, the Ontario Legislature passed the Waste-Free Ontario Act (WFOA) [74], which replaced the Waste Diversion Act (WDA) of 2002 with a new producer responsibility framework that makes producers *individually responsible* and accountable for their products and packaging at end-of-life. Under this system, producers become directly accountable for recovering resources and reducing waste as required by regulation. The introduction of circular economy thinking in the WFOA is a key distinguishing feature of this legislation for Canada.

There are two schedules to the WFOA:

- Schedule 1 – The Resource Recovery and Circular Economy Act, 2016 (RRCEA) that sets out the new producer responsibility framework
- Schedule 2 – The Waste Diversion Transition Act, 2016 (WDTA) that sets out the operation of existing waste diversion programs (including their wind up that is now underway)

The WDTA also established the Resource Productivity and Recovery Authority (RPRA), the non-profit organization that is responsible for registration, oversight, compliance, and enforcement under Ontario's new producer responsibility regime and which has oversight of all Ontario's EPR programs: tires, electronics, and soon to be PPP. RPRA also has dedicated enforcement officers.

Following the transition (to be completed by the end of 2025), producers will become responsible for both funding and operating the program. Stewardship Ontario is required to submit a wind-up plan to RPRA by June 30, 2020, guided by three main principles:

- Parties affected by the transition to full producer responsibility are to be fully consulted on the development and implementation of the plan.
- The plan is to support competition and not adversely affect the marketplace for the collection and recovery of PPP in Ontario.
- Ontario's consumer/households access and experience with Blue Box recycling collection will not be negatively impacted during the transition.

In November 2019, the Ministry of the Environment, Conservation, and Parks (MOECP) announced its new framework for IPR describing key elements of the planned new regulation.

The three key elements of this approach are:

- *Regulations under the Resource Recovery and Circular Economy Act (RRCEA) replace government-approved stewardship plans*. Going forward under the new IPR regime in Ontario, the regulations (still to be developed) regulate *outcomes* (not plans) in key areas, including:
    - A hierarchy of producers that are responsible for meeting prescribed outcomes (either individually or collectively with other producers), i.e., indicating what needs to be done, not how to do it
    - The list of materials to be collected, e.g., a consistent list of materials across the province, and with material-specific targets and clearly determining eligible sources for Blue Box materials
    - Collection and management requirements, e.g., uniform collection and processing standards
    - Material-specific targets
    - Registration and reporting to verify outcomes
- *The Resource Productivity and Recovery Authority provides independent oversight, compliance and enforcement.* RPRA essentially acts as a clearinghouse for all obligated parties and information; this is intended in part to help address freeriding problems.

- Working Groups (representing Producers, Municipalities, and "Circular Economy" representatives) are now in place to support the development of an EPR Policy Paper in the second quarter of 2020, followed by draft regulations (modeled after the outcomes-based approach outlined above) with final regulations expected early in 2021, in anticipation of the first communities being transitioned in 2023.
- Discussions are currently in progress to set the level of recycling targets and the scope of recycling services that will be included. Municipalities are pushing for public space recycling collection and targets in excess of those set by Europe in the recent revision to the Packaging and Packaging Waste Directive.

Key Issues to be Resolved in Regulations and Implementation Planning for Ontario Blue Box Transition from Current System (50/50 Shared Model) to Full IPR

Several important issues need to be resolved as part of the regulatory development process over the next 12+ months, including:

- Understanding the impact of a multi-PRO model. PROs could be set up to cover all packaging types or a specific packaging type. For example, a specific PRO for producers of beverage containers could be established, if producers chose to achieve high targets through a DRS.
- The role that municipalities will have in both the collection and processing of material.
- The requirement for material-specific targets (and penalties) which will likely be included in the Ontario regulations; targets will be set and enforced by RPRA.
- In B.C. (during the first 5-year PPP program at least), producer responsibility for PPP included responsibility for market risks for recycled PPP materials. This may not be an issue for the regulations in Ontario, but certainly will be an issue during the program implementation stage.
- The scope of materials to be included as obligated under the PPP program. In B.C., compostable paper products (e.g., pizza boxes, used paper towels, etc.) are being considered for inclusion in the Recycle BC program. Municipalities in B.C. are pressing the MOECP for packaging materials from the ICI sector to also be included in the future. Some municipalities in Canada and in Europe are contending that litter and obligated PPP materials disposed at landfill should also be part of overall producer cost obligations.
- Finally, the issue of the scope of RPRA's final oversight, data collection, and enforcement authority is regularly being challenged by some producer business associations from the perspective of "making Ontario a less competitive place to do business, which increases costs for consumers [78]." Supporters of the new oversight regime state that "the loss of RPRAs strong regulatory powers to investigate industry recycling claims means Ontario will have no way to independently track if materials are recycled or sent to landfill [78]."

This issue will continue to be worked out by the MOECP as the new regulations are developed.

Applicability to Washington

EPR programs for packaging have been used in Europe for more than 20 years and EPR is being adopted as the primary policy tool for addressing the growing issues caused by packaging waste in Canada and elsewhere around the world. In the U.S., deposit return systems have used EPR principles to successfully facilitate recycling and reuse of beverage containers for decades.

The key takeaways from the EPR programs for packaging described above are summarized below:

- ***Scope:*** **While EPR programs have been used to address packaging waste broadly for many years, and new EPR programs and adjustments to existing programs are more directly focusing on driving plastics recovery, none regulate plastic packaging exclusively**. The research team is not aware of any EPR program in operation that addresses only plastic material. All programs reviewed as part of the jurisdictional scan address a product type, not a material type. There are EPR programs for packaging in general or for specific products like beverage containers, waste electronic and electrical equipment (WEEE), or paint. The primary reason for this is to avoid unfair market distortions and unintended consequences that may arise from treating certain materials used in a given application differently. In addition, applying EPR policies to a subset of materials that are collected and sorted with other materials in an integrated system poses significant operational and regulatory challenges, as is demonstrated by the limitations and challenges that have been faced in Ontario and Belgium, where producers are responsible for only a portion of the costs and/or materials collected through municipally operated curbside recycling programs.
- ***Scope*:** **The majority of EPR programs for packaging only cover collection for the residential sector (although DRS's cover beverage containers regardless of generating sector), not the ICI sector.** In order to use EPR as a policy tool to mitigate the negative impacts of plastics in the environment, it is likely important to target all plastic packaging, regardless of whether it is generated through the residential sector or the ICI sector. There is no known EPR system in operation where packaging from both sectors is managed in one program. It is likely that two separate EPR programs would be required to address both residential and ICI waste to account for differences in how services are provided to each sector and in the types of waste produced how it is generated.
- ***Government and Oversight:*** **Strong governance is critical to ensure that producers comply with their obligations, all system participants are treated fairly, and that free riding is limited.** The regulatory authority responsible for program oversight must

have sufficient resources to conduct ongoing monitoring, access to data, and the ability to issue penalties for non-compliance. It must also be adequately insulated from industry influence and must be trusted by all stakeholders to uphold the policy objectives of the EPR program in a fair and consistent manner. Ontario's Resource Productivity and Recovery Authority (RPRA, formerly Waste Diversion Ontario), which oversees all EPR programs in the province, is a good example of a governmental organization that was created for the sole purpose of overseeing producer responsibility requirements.

- ***Roles and Responsibilities:*** **Clearly defined roles and responsibilities for each stakeholder are necessary**, as well as a clear definition of "producer" and whether there are de minimis thresholds that might apply (e.g., exemptions for producers with a turnover of less than a certain amount, or that produce less than a certain quantity of product). Figure 4 outlines the broad roles and responsibilities of various stakeholders in an EPR system for packaging.
- ***Recycling Targets:*** **Targets that are material-specific drive recycling collection efforts for a wider range of materials and packaging formats and correct weight-based biases that have skewed recycling efforts under packaging EPR programs in the past.** Mature and new EPR programs in the E.U., B.C., and elsewhere are shifting to adopt recycling targets that are material-specific, increase over time, and prohibit the inclusion of contaminants or materials lost during sorting in performance calculations.
- ***Other Targets*****: EPR programs can include other performance targets or design features to drive actions that serve other policy objectives beyond recycling rates.** Each EPR program reviewed includes unique elements that address specific policy objectives of the jurisdiction. Examples of policy objectives that can be addressed through EPR programs for packaging include access to service and convenience of service for users, education and outreach requirements, increased recyclability of packaging, and increased use of recycled content. In the future, reductions in overall GHG emissions associated with packaging may also be adopted as a policy objective addressed through EPR programs. Policy objectives translated into mandated performance targets can influence the design and adoption of eco-modulated fee structures that reward or penalize producers based on the type and quantity of packaging for which they are responsible.
- ***Producer Operational Responsibility:*** **EPR programs vary in the amount of operational responsibility assigned to producers.** Each of the programs reviewed allow producers differing degrees of flexibility with respect to how services are provided and what materials are collected and processed. In France, municipalities effectively carry out the collection themselves and contract in groups for the processing of material, with the PRO having virtually no influence. In contrast, in Germany the PROs collectively contract for services. British Columbia's system is a hybrid model in which municipalities can provide the services themselves or contract them out to third parties using standardized forms. This allows municipalities to potentially realize savings as a result of

operating recycling, trash, and organics collections alongside each other. Beyond providing collection services, municipalities do not have any operational responsibility for processing the material, as this is the PRO's responsibility. Centralizing processing allows for greater investments in technology due to the economies of scale that result from processing larger volumes of material.

- ***Producer Financial Responsibility*: Payment mechanisms between producers and municipalities need to be carefully considered as part of discussions on operational responsibility**. Experiences from EPR programs elsewhere indicate that, unless producers, through their PRO, are contracting directly with service providers and taking on full operational control of the program, municipalities are unlikely to recover all their costs for delivering recycling collection services. Even in B.C., payments to municipalities are based on a range of standard rates and agreed costs, and as such, some municipalities report that payments do not fully cover service delivery costs. Under existing EPR programs, producers have so far also not been expected to pay for the costs associated with litter clean-up (although that is changing in Europe, see Single-Use Plastics Directive in Section 2.1.6 below) or to cover the costs of managing material that is landfilled or sent to composting facilities. An EPR system that required producers to pay for the full costs of the end-of-life of their products and packaging would provide stronger incentives to focus on packaging waste prevention and innovations that address end-of-life management in a more holistic way.
- ***PRO Model:* Some EPR systems are transitioning from a single PRO to a multi-PRO model, but the benefits of this shift are still uncertain, and a well-designed single PRO model may continue to deliver important benefits.** Germany is one of several European jurisdictions that has moved from a single PRO to a multi-PRO model; Ontario is also planning to do this in the near future. The argument for doing so is that it drives competition and allows for producer flexibility, reduces fees, improves performance, and results in greater innovation. Some argue that single PROs are essentially a monopoly and are slow to innovate. However, data from Germany's program suggests that a multi-PRO model can actually erode some of the benefits of a single PRO model and that future-oriented investment may be weakened by the additional risks implied by competition, both in relation to the supply of feedstock, and the implications for price-related competition. In addition, where competition exists, companies are more likely to be focused on demonstrating 'evidential compliance' in the least costly way. In other words, innovation might arise from companies trying to find loopholes and creative accounting mechanisms. Multi-PRO models can potentially create more opportunity for freeriding if reporting and enforcement requirements are not robust at the regulatory authority level. A single PRO model allows for significant investments in technology that can be spread across all producers and provides producers greater control over the reverse supply chain to obtain recycled material to use in their products. Finally, if producer fees are modulated in a way that rewards environmentally friendly product and

packaging design, which is the direction Europe is heading, then having multiple PROs competing on price seems problematic. The key to ensure a single PRO model is effective is to have well-written regulations, high targets, clear governance systems, and strong enforcement [79].

Key considerations for implementation of EPR policies to address plastic packaging include:

- What materials should be included in the program and what sectors should be covered? Because no plastic-specific EPR program exists elsewhere, it is especially important to consider what the impact would be of having an EPR program for plastic packaging only compared to an EPR program that addresses all packaging types with modulated fees that discourage the use and production of packaging with greater environmental impacts.
- Is a there a government agency or other authority in a position to carry out program oversight, monitoring, auditing, and enforcement activities to ensure that producers comply with their obligations and that freeriding is limited? How will it be funded?
- How are producers defined? Does the definition include producers, distributors, and importers? Should small producers be exempt from regulation (e.g., through de minimis clause) or should all producers be required to register, report, and pay fees of some kind?
- What material-specific targets should be included in legislation and how should these be determined? How will these increase over time?
- What are the program's objectives, including around education and outreach, and how are those reflected in other program requirements or performance targets?
- Is there a mechanism for using financial incentives (rewards) and disincentives (penalties) to drive changes in packaging designs that align with the program's objectives (e.g., eco-modulation of fees)? Is this mechanism controlled by government or private industry?
- What level of operational responsibility and control should be assigned to producers? What level of responsibility and control should municipalities retain?
- What are the boundaries and definitions of costs that producers will be expected to cover? For example, will producers be expected to pay costs associated with litter clean-up or to cover the costs of managing material that is landfilled or sent to compost facilities?
- What level of flexibility and opportunity for collaboration should producers have in determining how to meet obligations? Should the system promote/require multiple PROs to operate in a competitive environment?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

Figure 4 Roles and Responsibilities of Stakeholders in an EPR System for Packaging

Deposit Return System

A deposit return system (DRS), also called a container deposit system, is a legislatively designated system that places a small monetary deposit on a product, paid by the consumer at the time of purchase, which is refunded when the consumer returns the product packaging to a designated return location for reuse and/or recycling.

In the U.S., there are 10 states that have implemented DRS for beverage containers. All of these programs, commonly known as 'bottle bills' in the U.S., have elements of EPR in that producers are required to financially contribute to the operation of the system.

DRSs are an effective mechanism for maximizing the capture of beverage containers and can complement curbside recycling collection systems for other packaging material. In addition to higher overall packaging recycling rates, DRSs deliver decreased contamination levels and lower loss rates across the system when compared to curbside collection systems, resulting in a higher quality, more valuable secondary material output.

Best-in-class DRSs from around the world adhere to the following principles:

- **Governance**: Legislation must be enabling and not overly prescriptive on process, with a focus on outcomes. The role of government should be:
    - Setting and enforcing targets for redemption, recycling, and accessibility (i.e., convenience) and issuing penalties for non-achievement of targets and to address free riders. Targets that have traditionally focused on collection for recycling are now expanding into reuse, e.g., Romania is including specific refillable targets in new legislation.
    - Establishing the need for continuous improvement by putting in place mechanisms to adjust the level of deposits on products if redemption and recycling targets are not achieved for an agreed-upon number of consecutive years and ensuring that consumers can conveniently redeem containers; and
    - Establishing the roles and responsibilities of various stakeholders in the system, including those of government to include auditing and oversight.
- **Management**: Those parties responsible for the sale of beverages (essentially producers, distributors, and importers) are given the shared responsibility for meeting the requirements of the legislation through a collaborative administrative approach and free market-driven operational delivery, ensuring cost efficiency and compliance. This includes:
    - Putting in place a non-profit PRO to manage the system that is accountable to a government agency that has audit, compliance, and enforcement responsibility. Evidence from top-performing DRSs suggests that when producers are given the

responsibility for managing the system, they can put in place an operationally and financially efficient system that will:

  - Allow consumers easy access to different redemption points (retailers, bag drop programs, recycling centers).
  - Achieve redemption targets.
  - Afford them control of recycled material necessary to meet minimum recycled content obligations.
  - Improve system integrity through measures to prevent free riders and fraud.
  - Enabling and commissioning of services that:
    - Deliver return infrastructure and options to ensure consumers can redeem as easily as they can consume.
    - Offer technology driven solutions that drive efficiencies with respect to transport and provide transparent and accurate recording of units sold and containers returned for billing and fraud mitigation.
  - Optimize costs through a market-driven approach to infrastructure and fees to producers such that non-recyclable containers are eliminated.

- **Delivery:** Organizations appointed by the PRO are given the responsibility for operational delivery and are required to report on their achievement of, and compliance with, program financial, legal, environmental, and social goals using a variety of key performance indicators that may or may not be specified in legislation.

Producers are required to:

- Demonstrate that they have met specified redemption and recycling rates and either report on performance as individual producers or as an industry through the non-profit organization.
- Arrange for the collection and processing of material from redemption locations.
- Provide financial compensation to those accepting empty containers from consumers and paying out the deposit refunds – this is usually done through a handling fee.
- Provide enough redemption points to ensure consumer convenience.

Countries across the world whose DRSs comply with these principles, such as those in Norway and Germany, achieve recovery rates in excess of 95 percent (for plastic, glass, and aluminum beverage containers). While the recovery rate for PET containers is lower than those for glass and aluminum in U.S. states with DRS programs (63.1 percent in 2017), it is significantly higher than PET bottles recovered from states without DRS programs (16.6 percent in 2017) [2].

With the increased focus on management of single-use products, countries from Turkey to Indonesia are exploring the possibility of DRS, with new systems being established in Scotland, Portugal, and Malta within the next three years. In 2010, 36 countries and states had DRS in place covering 279 million people. According to the Container Recycling Institute, by 2019, the number of jurisdictions with DRS had increased to 58, covering 612 million people [80].

Norway

Program Description

Norway's DRS was established in 1999 by the beverage industry after the government introduced an environmental fee on beverage containers. Under the Norwegian system, beverage producers and importers that do not participate in the DRS are required to pay a fixed fee of NOK 0.97 ($0.09 USD) plus an environmental fee of NOK 4.74 ($0.46 USD) per can and NOK 2.85 ($0.27 USD) per plastic bottle [81]. For those that do sign up with the DRS, the level of the fee decreases linearly as recycling rates increase from 25 percent, and if the recycling rate reaches at least 95 percent, the fee is reduced to zero. The beverage industry concluded that a DRS was the most effective mechanism to achieve the 95 percent target and minimize their tax liability. The system is fully in line with producer responsibility principles and means the industry can use its experience and expertise to design the most cost-effective and efficient system.

Infinitum is the non-profit organization that owns and runs the DRS on behalf of the industry. The 95 percent target – combined with the tax if it is missed – means Infinitum is accountable for the system's success and is committed to maximizing return rates. The Infinitum board includes representatives of the beverage and retail industries, so the system is driven to achieve these targets as cost effectively as possible, as they are accountable to the companies funding the system. Infinitum publishes an annual report, including details of its revenues, costs, and performance results. This report includes the number of containers sold with a deposit, which can help producers detect any freeriding.

Infinitum reports that it has worked continuously to improve the efficiency of its system – aiming to reduce costs while increasing the number of containers collected. They invest in advertising campaigns to promote the system and raise awareness among consumers. They set fees per container placed on the market on an annual basis, so producers can estimate their costs in advance. Infinitum also monitors fraud and determines the most cost-effective fraud prevention measures – balancing the costs of these against the potential losses from fraud.

Table 2-11 Variable Handling Fees in Norway

	Can ($ USD equiv)	Plastic Bottle ($ USD equiv)
Manual	0.006	0.012
Non-compacting RVM	0.006	0.012
Compacting RVM	0.025	0.031

Norway uses a return-to-retail model with a mix of reverse vending machines (RVMs) and manual services, depending on whether the retailer chooses to provide an RVM. Containers can be returned to 15,000 shops, kiosks, and petrol stations across the country, meaning consumers do not have to travel far or make a special trip to redeem their deposit [82]. Retailers are compensated for RVM costs through handling fee payments (see Table 2-11). Retailers can calculate whether it is economical to invest in an RVM, based on likely units that will be redeemed. Higher fees incentivize compacting RVMs because they reduce Infinitum's costs by improving the bulk density of containers (which reduces transport costs) and preventing multiple redemptions (which reduces fraud costs).

While there are 15,000 return locations, there are only 3,700 RVMs in Norway [83]. Despite this, 93 percent of containers are returned to an RVM; this enables Infinitum to make the logistics operation as efficient as possible as the RVMs compact the containers and provide data for predicting return patterns and determining collection schedules.

In response to the growth in online shopping, Norway has made provisions for people to return their empty drinks containers via a home delivery service provided by retailers. Consumers can buy Infinitum bags from their online retailer, which are barcoded and embedded with a code to track the bag and its contents [84]. This means all retailers are treated fairly and people who do not have the time or capacity, due to health issues or other barriers, to visit a shop can still return their containers for a refund. Approximately one percent of returns in Norway are currently via the home delivery return system.

Success

In 2018, Norway collected 567,763,101 cans (87.3 percent of all cans sold) and 564,117,169 bottles (88.6 percent of plastic bottles sold) [85]. Infinitum's operating costs that year were NOK

2,464,797,000 ($236,939,703 USD), translating into a cost per container of NOK 2.18 ($0.21 USD) [85].

One factor that has likely contributed to Norway's high recycling rate for beverage containers is the relatively simple deposit structure of NOK 2 ($0.21 USD) for plastic and metal containers ≤ 0.5 liter and NOK 3 ($0.31 USD) for plastic and metal containers > 0.5 liter. This offers clarity and consistency, while recognizing the higher purchase price of larger beverages and ensuring the deposit value is proportionate. The deposit value, which was recently increased in 2018 to support a higher return rate, is adjusted when necessary to keep up with inflation. As a result of the higher deposit value, Infinitum expects the return rate to return to above 90 percent for 2019. [16]

Oregon

Program Description

In 1971, Oregon became the first U.S. state to introduce a DRS. Initially, the system was limited to carbonated water and soft drinks, beer, and malt beverages and charged a deposit of $0.05 per container. Bottled water was added in 2009 and additional beverages in 2011, but the biggest change to the laws was in 2017, when Oregon increased its deposit from $0.05 to $0.10. This followed an amendment to the legislation that required the deposit to be increased if the redemption rate fell below 80 percent for two consecutive years [86]. This flexible approach recognizes the link between deposit values and return rates, and the need to periodically review the deposit value.

Oregon originally relied on a return-to-retail model for container redemption but began to open standalone redemption centers that are collectively owned by the Oregon Beverage Recycling Cooperative (OBRC) in 2010. OBRC is a cooperative corporation owned by Oregon beverage distributors and grocery retailers, formed in January 2009 to manage DRS operations [87]. As an industry operator, they have pioneered innovations to increase the efficiency and effectiveness of the DRS in Oregon. These include the BottleDrop program, where residents can be refunded their deposits via a mobile app after dropping off labeled bags of redeemable beverage containers. OBRC is also pioneering the return of refillable bottles in the state, introducing an industry standard bottle (ISB) that is redeemed through the same redemption system and is

[16] According to Infinitum, the deposits were previously NOK1.00 (€0.11) and NOK2.50 (€0.26) but were increased by the Norwegian Environment Ministry in 2018.

being adopted by local craft breweries, further reducing waste and encouraging the management of material further up the waste management hierarchy.

In 2019, Oregon passed SB 522, which institutes a fine of $250 on those who return 50 or more out-of-state containers in one day at redemption locations. This bill was aimed specifically at fraud originating from Washington [88].

Success

Before the deposit value was increased, the return rate (from January to March 2017) was 59 percent [89]. Following the increase in the deposit value from $0.05 to $0.10, Oregon achieved 82 percent redemption between April and December [89]. As of the end of 2018, the DRS in Oregon had achieved an 85 percent redemption rate and diverted 181 million pounds of beverage containers from the landfill [90]. In terms of social benefits, a total of $1 million has been raised for Oregon non-profits through the program since it began (in 2018 alone, $766,076 was raised) [90].

Applicability to Washington

There are compelling reasons to consider adopting a DRS in Washington and prioritizing beverage containers specifically (including all beverage container material types, not just plastic). Beverage containers are a major source of litter and marine debris, and Washington's recycling rate for beverage containers is low compared to jurisdictions with DRS, such as its neighbors Oregon and British Columbia. Beverage containers also represent most of the plastic packaging by weight and are the most readily recyclable plastic material.

There are also some limitations and considerations to adopting a DRS in Washington, namely that its current recycling collection system is highly dependent on revenue from sale of beverage containers as commodities to finance recycling collection and processing. Washington would need to consider impacts on the curbside residential and commercial recycling collection system if DRS were to be instituted in the state. There is also currently strong political opposition to a DRS program.

2.1.4 Minimum Recycled Content Target

Recycled content policies seek to stimulate market demand and drive use of recycled feedstocks produced from materials collected for recycling. Minimum recycled content requirements, whether set in legislation or adopted in corporate policies, have been gaining traction across the globe to reduce the reliance on virgin material and create a more robust secondary materials market. While incorporating recycled resin into new products does displace virgin resin, plastic can only be mechanically recycled a few times before its quality degrades to the point where it

must be "downcycled" into a lower value product. For many applications it also still requires the addition of at least some virgin resin to maintain quality.

In addition to being supported by environmental organizations, minimum recycled content laws have the potential to gain industry support through proper consultation and promotion. Due to their flexibility in implementation and compatibility with current business practices, recycled content laws are more palatable to many corporations than other circular economy interventions. Many consumer packaged goods (CPG) companies have already announced recycled content commitments as part of their corporate sustainability goals, some of which are detailed in Appendix A.3.0, though several companies have also been criticized for failing to meet similar commitments made in the past.

As international markets for recycled material have tightened, both as a result of China's 2018 decision to ban imports of several types of recyclables and the subsequent closures of alternative markets, domestic processing of recyclables will likely increase in the coming years, leading to a greater, and therefore cheaper, supply of recycled material to use as inputs into new products. Already, investments in American processing plants have increased and some previously closed plants have reopened [91].

Recycled content laws, in addition to delivering positive environmental outcomes on their own, may themselves drive the need for DRS and EPR legislation, and prior studies have identified the complementary nature of these policies [92]. Given the high quality of material that comes out of DRS programs, increasing the demand for recycled content will undoubtedly increase the business case for DRS. According to Sen. Udall (D-NM), 47 percent of the plastic containers recycled in the U.S. come from the 10 deposit states [93]. This constitutes the majority of the recycled feedstock for domestic manufacturing.

Federal recycled plastic content laws are determined by the U.S. Food and Drug Administration (FDA), which is responsible for regulating processing, packaging, and labeling of all foodstuffs and beverages [94]. They are also responsible for determining the safety and qualifications of recycled plastics used for the manufacturing of new plastics for products (i.e., bottles), and work to set standards to ensure that:

- Contaminants from post-consumer material do not appear in final food/beverage products made from recycled materials.
- Recycled post-consumer material not regulated for food-contact use can be incorporated into food-contact use packaging.
- Additives in the recycled plastics comply with FDA regulations for food-contact use [94].

The FDA has created numerous guidance documents to help manufacturers evaluate their own recycling processes and ensure proper practices. In order to be approved for recycling plastic for food-contact, producers must provide contaminant tests, a full description of their own recycling process, as well as proposed conditions of recycled plastic (temperature, type of food, duration of food-plastic contact, etc.). Individual state laws build on FDA regulation, with the most recent proposal in California aiming for the most stringent recycled content regulation in the world.

Critical factors to consider when setting minimum recycled content legislation include:

- Which products/materials are appropriate to be covered.
- What material-specific targets should be included in legislation and whether to require progressively stretching targets.
- Whether to include a mechanism for producers to demonstrate that they have met the targets.
- What penalties, if any, to set for non-compliance.
- Are there sufficient post-consumer quantities to meet recycled content targets? Can the collected post-consumer materials be effectively used to make the desired end product (e.g., beverage containers)?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

California

Policy Description

In 2019, California came close to passing bill AB 792, which would have instituted a minimum recycled content requirement of 50 percent for PET and HDPE containers sold in the state by 2030. The bill originally called for 100 percent recycled content, but was amended due to industry lobbying, opting instead to use a phased approach, beginning with a 10 percent recycled content requirement in 2021, 25 percent in 2025, and 50 percent by 2030. Opponents argued that not enough safe plastic existed for a 100 percent recycled content benchmark. This led to legislators to include what some described as potentially significant "off ramps," or loopholes, for companies to seek waivers that could limit the law's effectiveness. The bill passed on September 14, 2019 by wide margins after the amendments were made to appease opposition groups.

Governor Newsom ultimately stated that the bill was too "burdensome" and "costly" for the state, as "The waiver petitions allowed under this bill would put the burden on the state to prove to manufacturers that their products can meet recycling goals, rather than making clear that manufacturers have the responsibility to create products that can meet these goals [95]."

Despite his initial support and his general environmentally progressive agenda, Governor Newsom vetoed this bill.

The previous year, California passed AB 1294, a law pertaining to recycled content claims. This measure extends a requirement for manufacturers or suppliers of plastic products making claims related to the recycled content of a plastic product to maintain information and documentation to support that claim. This law aims to prevent greenwashing and protect California consumers from companies making unsubstantiated environmental claims [96].

The focus on recycled content in California builds upon earlier, related legislation, specifically the Rigid Plastic Packaging Container (RPPC) Law, implemented in 1995, which was designed to reduce plastic packaging waste by imposing requirements on product manufacturers of rigid containers. However, while recycled content is addressed in the law, it is only one option for compliance. Manufacturers must ensure that their products satisfy only one of the following:

- Be made from 25 percent post-consumer recycled content.
- Achieve a 45 percent recycling rate.
- Be reused at least five times.
- Reduce source material (ten percent by container weight, product concentration of at least ten percent, or a combination) [97].

Some packaging is unaffected by this law, as it exempts food and beverage containers [98].

Recycled content mandates have proven to be a successful policy mechanism for increasing film recycling. California has also legislated a ten percent recycled content minimum for garbage bags to drive the circular economy, which has been cited as a major driver of post-consumer resin demand for polyethylene film. While no systematic evaluation of the law has been carried out, a representative from EFS-plastics in Ontario noted that "Seventy percent of our customers are supplying the California marketplace…If another area were to enact legislation similar to California, that would be the exact signal that we and our competitors need in order to invest in additional infrastructure [99]."

Applicability to Washington

In early 2020, the Washington House and Senate passed ESHB 2722/SB 6645, a bill relating to minimum recycled content requirements. The bill was vetoed by the governor due to concerns about its fiscal impact amid the COVID-19 pandemic, but the bill would have required that beverage containers sold in Washington have a minimum of ten percent post-consumer recycled plastic content by 2022, progressively increasing to 25 percent in 2025 and 50 percent in 2030 [100].

While beverage containers are suitable candidates for recycled content minimums, such laws could be expanded to include additional product categories such as plastic bags or other food and consumer goods packaging.

Key considerations for this approach include:

- Which products/materials are appropriate to be covered and on what basis should this determination be made?
- What material-specific targets should be included in legislation and how should these be determined?
- How will recycled content requirements increase over time to ensure continued innovation and development of systems to collect and process material to meet recycled content demand?
- How will enforcement ensure compliance, and what will the penalties be for non-compliance? How will the system be designed to verify the use of recycled content?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

2.1.5 Reusable Product Facilitation

These policy measures seek to support overall reduction of resource consumption and waste generation through reuse of products that would otherwise be recycled or disposed. Reusable items are becoming increasingly common across the United States, with water bottles leading the way. Though brands such as Nalgene have been popular with outdoor enthusiasts for decades, newer startups such as S'well and Hydro Flask have become so trendy they are viewed as status symbols. At the end of 2018, the reusable water bottle market was valued at $8.35 billion, with 3.1 percent year-over-year growth, spurred by concerns over plastic waste [101]. Yeti tumblers and KeepCups are beginning to have a similar impact in the coffee cup market. Additionally, several fast-casual chains, such as Just Salad and Dig, sell and promote the use of proprietary containers to repeat customers for a discount on purchases [102].

However, anecdotal reports indicate that some establishments are refusing to fill reusable containers, citing health codes and concerns. As the reusable market continues to grow, it is imperative that their use is convenient and standardized for consumers. Reusables cannot become widely adopted until health standards and other limiting factors are addressed.

A different approach to reuse is to create refill programs for containers that are collectively owned and property of the state, a non-profit, or a third-party business. Vessel Works, GO Box, and Cup Club are just a few examples of some of the emerging businesses that are offering reusable containers for either coffee or takeout food through rent-return programs [103].

Freiburg, Germany FreiburgCup Program

Program Description

In an attempt to address the growing issue presented by single-use coffee cups, in 2016 the mayor of Freiburg decided to launch the FreiburgCup program. The voluntary program was introduced with three main objectives:

- The promotion of reusable cups
- The reduction of litter
- The promotion of more sustainable consumer behavior

When ordering their coffee, customers pay a refundable deposit of €1 for a reusable cup that can be returned to any participating business (of which there are more than 100) in the city center, who wash and redistribute the cups. Sixty to 70 percent of local coffee shops participate in the FreiburgCup project and the polypropylene cups can be reused up to 400 times [104].

Success

According to a case study by Zero Waste Europe [104], the program has achieved its main objectives. In addition to reducing the amount of litter, the FreiburgCup project increased consumer awareness around the need to reduce the use of single-use cups. There are still challenges to overcome before the program can become mainstream, however. As Zero Waste Europe explains, "consumers' willingness to take part in the program is crucial to its operation, mainly due to the program's voluntary nature. This is an issue because, even though many people are already choosing to switch to sustainable alternatives, a broader behavioral change can be rather hard to achieve, considering the hesitation of the shops to charge their customers for the use of disposable cups while actively promoting the FreiburgCup as a sustainable alternative."

Berkeley Cup Loan Service

Program Description

In September 2019, the City of Berkeley began piloting the first California-based cup rent-return system, engaging in a nine-month pilot project with reusable cup service Vessel [105]. Berkeley's Ecology Center is working with 11 participating businesses, which serve their customers in stainless steel, silicone-lidded cups which are reserved via an online app. Customers use the app to scan a QR code on the cup, which links it to their account. Upon return to the establishment, cups are collected by Vessel, which washes and then returns the cups to the shops for further use.

If a cup is not returned to the establishment within five days, a $15 fine is charged to the user via the app. According to Vessel founder Dagny Tucker, "today we have less than two percent leakage, so really, people are being responsible about dropping it off, and often people just drop it off that same day [106]."

The second phase of this pilot, which began on January 1, 2020, requires the participating establishments to supply exclusively compostable items in their places of business, and charge a $0.25 fee for each non-compostable, disposable cup they sell, as per the city's rules. The fee per cup is reportedly less than the cost of a paper cup and there is no upfront participation fee.

At present, Vessel collaborates with seven different coffee establishments, including a shop at the University of Colorado, Boulder.

Berkeley Single-Use Foodware & Litter Reduction

The recent addition of Chapter 11.64 to Berkeley's Municipal Code has established a roadmap for the future of reusable utensils and foodware in the city. The ordinance was signed into effect in January 2019 and was backed by a "coalition of more than 1,400 local, national, and international organizations participating in the global Break Free from Plastic Movement [107]."

Effective January 1, 2020, all takeout foodware in the city must adhere to standards set by the municipal compost collection programs, and be free of all fluorinated chemicals, save for aluminum that is to be accepted by the city's recycling collection program. Reusable cups provided by customers are also to be accepted, with establishments reserving the right to refuse a reusable container that they deem to be unfit for use, contaminated, cracked, or inappropriate for size.

If no cup is provided, the customer is to be charged $0.25 for every disposable cup provided to them. Anyone that can present a California Special Supplemental Food Program for Women, Infants, and Children (WIC) voucher or card is exempt from this surcharge [108].

Food vendors will have to be responsible for their own dishwashing and sanitization of reusable foodware, in compliance with the California State Health Code. Those without access to dishwashing facilities on-site will be eligible to receive waivers, provided "insurmountable space constraints, undue financial hardship, and/or other extraordinary, insurmountable circumstances" [108]. Technical assistance and mini-grants will also be available to help food vendors transition to reusable foodware.

Berkeley Requirement for Reusable Foodware for Dine-In

Under Berkeley's Single-Use Disposable Foodware and Litter Reduction Ordinance, which took effect on January 1, 2020, only reusable foodware can be used for dine-in service, and all

takeout foodware must be approved as recyclable or compostable in the City's collection programs. Food vendors are also required to charge customers $0.25 for every disposable beverage or food container provided, and disposable compostable straws, stirrers, cup spill plugs, napkins, and utensils for takeout are provided only upon customer request or at a self-serve station [109].

GO Box Pilot in Portland

Founded in 2011, GO Box is a reusable container initiative that involves professional cleaning and sanitization of reusable containers, which are distributed to vendors across Portland, Oregon. GO Box collects and cleans the containers then redistributes them across the vendors to be used again.

In 2019, GO Box was contracted to help run a pilot program for A+E Networks corporate cafeteria in New York City, where employees used an app to sign up for the subscription program for a reusable container [110].

GO Box's polypropylene containers are designed to be used up to a thousand times. To date, the program has helped to eliminate an estimated 226,000 single-use containers and cups across Portland [111].

California Refillable Sanitation Law

There have been several recent efforts to address the health concerns around refillables, most notably, California's AB 619, signed into effect July 12, 2019 [112]. The bill was drafted by Assembly Member David Chiu and sponsored by the Clean Seas Lobbying Coalition. While a previous practice stated that businesses could refill beverage containers given sanitary, contaminant-free conditions for the transfer, no true criteria or description existed that standardized what sanitary meant. It was standard policy to refuse customer-provided containers out of a fear of cross-contamination in the kitchen.

The law dictates that to use reusable containers, each surface must be sanitized or must avoid contact with any serving surface. Any establishment serving food must also create their own policy for prevention of cross-contamination and have this approved by inspectors. The law also establishes qualifications for containers to be considered appropriate for reuse, modeled off federal and state health codes [113] [114].

Applicability to Washington

Amid the current COVID-19 crisis, there is increased uncertainty and perceived risk around reusables, especially for customer-provided containers, and many retail establishments have temporarily stopped allowing them. While there is no evidence that single-use products (which

are often made of plastic) are inherently safer than reusable products, viable reusable program models, at least in the near future, will likely rely on business or third-party sanitization processes to mitigate risks. As the popularity of reusable products grows, Washington should preempt confusion with hygiene practices by defining food safety projects in relation to reusables. Similar to places like Portland, Boulder, and Berkeley, Seattle and other urban areas in Washington could be candidates for piloting localized reusable product programs.

There are currently proposed changes to the Washington state food code (WAC 246-215-03348 Refilling Returnables) which would expand the definition of foods for which consumers could bring their own containers. The law currently only allows consumers to bring their own beverage containers for refilling. The draft changes would allow consumers to bring their own containers for buying and refilling food and beverages that are not yet ready to eat (e.g., pasta, beans, and packaged foods like wrapped candies), as well as prepared foods filled by restaurant and food establishment employees [115]. Though the proposed changes received significant support via the public comment process, the Department of Health (DOH) is still considering the changes.

Reusable products are facilitated by strong regulation and infrastructure. A reusable system may work well with a deposit program that encourages complementary behavior and can be managed by one entity, as in Oregon.

Switches from single-use plastics foodware to other single-use items, even if compostable, should be accompanied by a fee on the alternatives so that there is a real incentive to move to reusable items. The U.K. is currently considering requiring all eat-in restaurants to use reusable foodware; this requirement could come into effect immediately as it is a requirement under the U.K.'s Waste Regulations 2011 for producers of waste to follow the waste management hierarchy. A move to compostable items should only be considered where the infrastructure is in place to process the material and ideally under a program of extended producer responsibility such that there is the necessary investment in the required infrastructure.

Key considerations for the approach include:

- How can objections regarding food safety and hygiene concerns regarding reusable products be addressed and preempted?
- What products/materials are most appropriate to include in reusable programs?
- At what scale can/should reusable programs be efficiently and feasibly operated? Is there a statewide measure that could encourage such programs?
- Is there infrastructure from another program (e.g., a container deposit system) that could be utilized for a reusable program?
- Is funding going to be made available to businesses to support their transition and enable equitable adoption, including by small/disadvantaged businesses?

- What else can/should be done at the state level to support transitioning to reusables?
- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

2.1.6 Multi-faceted Measures

These policy measures seek to address multiple challenges posed by plastic packaging simultaneously, through a combination of tools described in previous sections. The E.U. has chosen a multi-faceted policy approach to address single-use plastics through a combination of product bans, collection targets (to be met through existing or new EPR programs), product redesign mandates, waste reduction measures, product labeling standards, and recycled content requirements. In the U.S., legislative efforts at the federal level and in California to take such an approach for all plastics are ongoing.

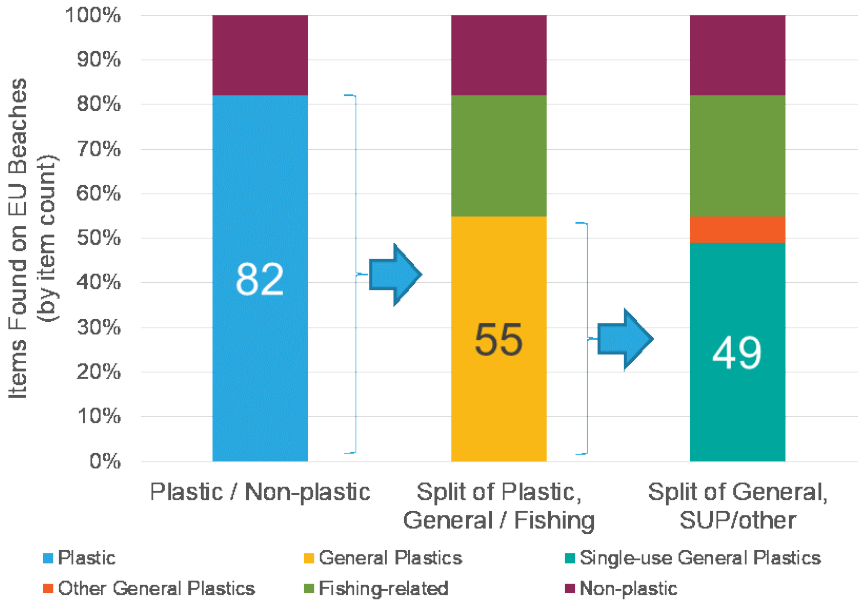
European Union Single-Use Plastics Directive

Program Description

In early 2019, the European Parliament approved legislative measures that are part of the Circular Economy package, including the Single-Use Plastics Directive 2019/904 (SUPD) [116].

- The SUPD targets the ten most common single-use plastic items found as marine pollution (determined by data collected from beach clean-ups) through a variety of policy instruments. This legislation produces E.U.-wide action on single-use plastics, as shown in Figure 3. Eunomia provided much of the analysis to identify priority items, achievable objectives, and possible policy solutions, informed by economic and environmental impact assessments.

Figure 5 Marine Litter Analysis



This analysis was used to determine the most effective method to combat each pollutant. A focused life cycle analysis (LCA) was also completed on the carbon impacts of alternatives. Bans were implemented for single-use plastic items for which alternatives were easily available on the market, including:

- Cotton bud sticks (aka "Q-tip"-type products)
- Cutlery
- Plates
- Straws
- Coffee stirrers
- Sticks for balloons
- All food and beverage containers made of EPS and on all products made of oxo-degradable plastic

A 90 percent collection target for plastic bottles was set for 2029, with an intermediate target of 77 percent by 2025. Plastic bottles will also be required to undergo a re-design to ensure that caps stay connected to bottles. PET bottles must also incorporate 25 percent recycled content by 2025 and all plastic bottles will need to be made of 30 percent recycled content by 2030.

Additional measures were implemented to reduce the consumption of food containers and beverage cups made of plastic and to include specific marking and labeling of certain products [117].

One of the most interesting elements of the Directive is that it requires producers to cover the *necessary* costs of:

- The clean-up of litter (and subsequent transport and treatment of that litter)
- Waste collection of products discarded in public collection systems (including the infrastructure and its operation, as well as subsequent transport and treatment)
- Awareness-raising measures regarding those products
- Certain reporting system costs

The understanding of what "necessary" is and how such costs will be calculated and allocated across producers of different products from cigarettes to chip bags remains to be seen, but it places an emphasis on even those producers of single-use plastics products for which no specific ban or reduction measure was placed to start to internalize the external cost of managing their product when it is littered.

All member states of the E.U. are required to write the measures of the SUPD into law within two years. Each measure has its own set of implementation deadlines, with varying timelines for different groups of member states.

Expected Success

Though it is too early to comment on the success of the SUPD, as measures are still being written into law and implementation is just beginning, there have been some projections made on the impact of the initiatives. Projections indicate that benefits will include:

- Avoidance of the emission of 3.4 million tons of CO_2 equivalent
- Avoidance of environmental damages which would cost the equivalent of €22 billion ($24.6 billion) by 2030
- Saving consumers a projected €6.5 billion ($7.6 billion) [117]

Since this law was modeled after the 2015 Plastic Bags Directive, which has been extremely successful and brought about a rapid shift in consumer behavior, the European Commission expects similar success for the SUPD. It is also likely that given the scope of the law across the E.U., that manufacturers adjusting their product packaging to remain compliant with the regulations will lead to changes across their global supply chain, amplifying the effects beyond Europe.

Unintended Consequences

Unintended consequences of the Directive are now starting to materialize. Producers are either moving away from plastics to alternative materials for single-use items for which, in some cases, the environmental impact has not been assessed; or are testing the definition of plastics which allows for what most would perceive as being plastics potentially falling outside of the definition. For example, the Single-Use Plastic Directive excludes "natural polymers that have not been chemically modified". Exemption for some natural polymers is clearly important, otherwise materials such as cotton and paper could have been inadvertently brought into the scope of the Directive, with wide-ranging unintended consequences.

However, natural polymers would encompass regenerated cellulose-based materials such as viscose and lyocell, often used in nonwoven fibres that can be used in products such as wet wipes and cigarette filters, both of which are intended to be regulated through EPR and other measures under the Directive. A shift from synthetic to regenerated cellulose-based materials would also impact raw material demand, away from primary fossil-based hydrocarbons and toward cellulose, which is typically harvested from hardwoods, softwoods and sometimes bamboo. Issues associated with biodiversity loss, land use competition, water abstraction, and application of chemicals in crop production are highly complex, making simple comparison of very different materials problematic.

While the intention of the Directive was to reduce environmental impact from single-use items, the specific focus on plastics has created a situation where producers are effectively trying to reduce their exposure to regulation and associated costs by shifting to non-plastic or modified-plastic alternatives but not truly addressing the larger issues related to single-use items, waste, and litter.

Applicability to Washington

A multi-faceted approach could address plastic pollution and management in a more comprehensive way but would need to be carefully evaluated for potential unintended consequences.

Key considerations for this approach include:

- How can this type of policy be designed such that new problematic items can be addressed when they arise in the future, or so that such items never make it to market in the first place?
- What might be the unintended environmental and financial consequences of targeting single-use plastics only, rather than all single-use items, if consumers and producers switch to alternative materials with potentially less-understood attributes and/or greater negative impacts?

- Is there evidence that this policy measure successfully helps meet the goal of the legislation to reduce plastic packaging in the waste stream?

2.2 Processing and Supply Chain Technology

There are several technology options for supporting the management of plastic packaging; we discuss three technologies here: two processing technologies—mechanical and chemical recycling—which physically process and transform material, and blockchain, a supply chain technology that can be used in conjunction with various policy approaches to aid with compliance and accountability. There is also research and development to redesign plastic, though it is highly dependent on resin type and application. In general, it is very difficult to introduce new polymers given the strong market hold of incumbents.

2.2.1 Processing Technology

This section of the report focuses on the current state of technologies that exist to manage and physically process collected plastics for recycling. There are several factors that will impact the feasibility of any of the presented technologies being an implementable solution for Washington. These include:

Technology readiness and suitability

- Is the technology working at a commercial scale, and if so, could it be developed in Washington if an appropriate plastic feedstock material is available?
- Does the technology or technology provider have a facility with spare capacity in the vicinity of Washington at which material could be processed?

Feedstock considerations

- What are the minimum tonnage requirements needed for the process to be viable?
- Is the feedstock available, and who owns the feedstock? Would the technology provider have to source the material from multiple sources, or would there be a single contract arrangement? This would be preferable and would be possible for example under a single PRO EPR model (see Section 2.1.3).
- What is the feedstock specification that must be met for the technology to work? For example, a recently published 2020 report [118] stated that:
    - "Higher temperature allows more comprehensive polymer breakdown and higher material purity of the processed material." However, "high operating temperatures result in higher costs and required energy input."
    - "The lower the process temperature of a technology, the more sensitive it is to the quality of the waste." Improving the quality of the input stream requires

additional handling and sorting which, "may result in additional costs other than recovery plant costs and will require more effort around logistics."

- "The sensitivity of different technologies to waste contamination determines the extent of efforts needed around logistics. The more sensitive the technology, the more detailed waste separation is required. A more detailed breakdown of plastic input implies less need for upgrading steps before new plastics can be produced. The possible polymer breakdown is, thus, crucial when assessing the potential contribution of a technology to achieving circular economy targets."

System conditions

- What are the market conditions that will allow new technologies to be financially viable solutions for Washington? This is linked to policy: for example, if specific plastic films are banned from landfill, then this will create a demand for alternative processes. Equally, if EPR policy requires high recycling rates of material, then landfill will not be option, and investment in or use of plastic recycling technologies that can meet the definition of recycling may be possible solutions. The definition of recycling is discussed further below.

Consideration is given below to technology readiness and feedstock requirements. Systems conditions will be considered in the final report with future recommendations.

Mechanical vs. Chemical Recycling

There are two types of plastics recycling:

- **Mechanical recycling:** This is an approach by which waste plastics are recycled into secondary raw materials without altering the basic structure of the material [119].
- **Chemical recycling:** This involves breaking down a plastic polymer into its chemical building blocks, which are then used as raw materials in the manufacture of new polymers or other petrochemical-based materials. According to ISO 15270:2008 (Plastics – Guidelines for the recovery and recycling of plastics waste), the definition of chemical recycling (also called "feedstock recycling") is: "conversion of monomers or production of new raw materials by changing the chemical structure of plastic waste through cracking, gasification of depolymerization, excluding energy recovery and incineration." A number of chemical recycling processes involve depolymerization, which breaks polymers (such as PET) into monomer building blocks (i.e., ethylene glycol) that can be used for repolymerization back into PET. Often other chemical additives are added to create plastic resins with specific material properties [119]. Chemical additives present in plastic are turned into inert char during the depolymerization process.

While there are nearly 150 mechanical recyclers alone in the U.S., for the purposes of this report we have highlighted 52 mechanical and chemical recyclers in North America using innovative

technologies or with specialized capacity for handling plastic material, especially related to plastic packaging. This is not an exhaustive list, however it includes a selection of companies who have received letters of non-objection from the U.S. FDA and can produce post-consumer resin for food contact applications; companies that are vertically integrated and recycle as well as manufacture plastic products; and those with specialized sorting or processing technology that allows them to achieve higher material quality, such as color sorting ability.

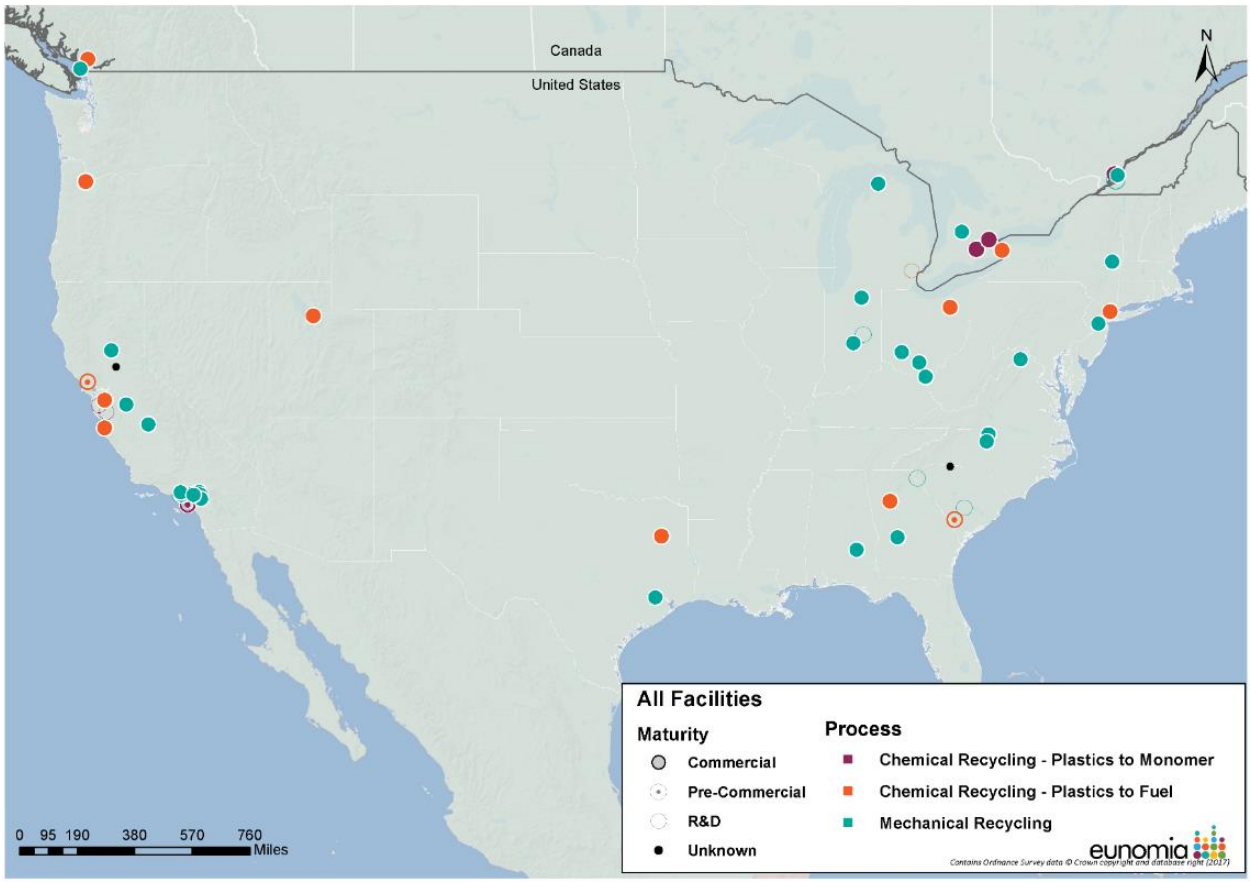
Section 2.2.2 and A.4.1 summarize the mechanical technology companies identified in North America, and Section 0, Appendix 0, and A.1.1 review the chemical recycling processes used by those companies that produce plastics monomers and those that produce a fuel.

Sections 2.2.2 and 0 include the most relevant information from the appendix. The tables in Appendix A.1.0 include the following information for each identified company:

- Company name and location
- Stage of maturity/scale of technology
- Materials managed
- Tonnage range (processing capacity)
- Financial information (this is limited as many of the technologies are at the start up or early commercial stage)
- End products from the process

The map in Figure 6 shows the location of different technologies in the U.S. and Canada and indicates if they are at the commercial, pre-commercial (pilot plant), or R&D stage, and what type of plastics recycling process is being used.

Figure 6 **Location of Identified Mechanical and Chemical Recycling Facilities that are at Stage in the U.S. and Canada**



2.2.2 Mechanical Recycling

This section focuses on companies involved in washing, grinding, extruding, and pelletizing plastic waste. In some cases, the company also sorts mixed plastics into individual plastics first before reprocessing them into a single recycled plastic polymer material. Plastic pellets, also known as pre-production pellets or nurdles, as well as plastic flake, are the building blocks for nearly every plastic product put on the market. Plastic pellets and flake are produced by either petrochemical companies or recyclers and transported to plastic manufacturing facilities where they are melted down and formed into an end product [120]. Unlike glass or aluminum, plastic can only be mechanically recycled a few times before its quality degrades to the point where it must be "downcycled" into a lower value product type.

Mechanical plastics recycling technologies are based on a combination of human-power sortation and automatic sorters interfacing with visual sensing, near infrared (NIR) sensing, and air nozzles to allow various resin compositions to be separated. How the equipment is configured will depend on the specification of the incoming material and the quality of output

needed. MRFs are the first stage of plastics separation. In some cases, MRFs sort plastics into bales of single-resin plastics that meet plastics reprocessors' bale specifications—such as PET bottles, natural HDPE bottles, and colored HDPE specifications—and can be sold and processed directly by mechanical recyclers. In other cases, MRFs sort plastics into mixed-resin bales that require additional separation before they can be mechanically recycled. In general, plastics must be separated by resin before they can be mechanically recycled.

Once plastics have been sorted into single-resin feedstocks, NIR sortation equipment is more extensively used at the plastic reprocessing facility, where there are generally two major stages of the plastics recycling process: whole container processing and flake processing.

Typically, NIR sortation is first used as a first step in whole container processing to eliminate contaminants and improve plastic quality in bale supplies. A grinder or granulator is then used to create flake from whole packages. NIR sortation of flake provides a final quality control step by removing very fine contaminants. Screened flake is then processed into recycled plastic pellets through melting and extrusion of standard or custom formulations.

Of the 33 mechanical plastic recycling facility operators summarized in Appendix A.4.1, only one (Merlin Plastics) processes mixed plastics from residential, single-stream collection at a commercial scale, and one other accepts post-consumer plastics film from MRFs. Both facilities are based in Canada. The majority of the other mechanical recycling companies accept single polymer streams, much of it from pre- or post-commercial or industrial sources, or from DRS programs. Mechanical recyclers that do recycle residentially-sourced materials primarily focus on PET, HDPE/LDPE, with a few also recycling PP. These resins have more reliable market demand for PCR plastic pellets and sufficient volume from residential sources exists to make mechanical recycling viable under current market conditions. There is currently not enough mechanical recycling capacity in the U.S. to process all of the plastic packaging produced (even before considering imported plastic).

The company that is most relevant to Washington due to both its proximity and processing capacity is Merlin Plastics. Merlin Plastics was founded in 1987 and is North America's fourth largest plastic recycler, processing over 300 million pounds of post-consumer and post-industrial plastics each year to produce natural HDPE pellets, colored HPDE pellets, injection pellets, and clear and green PET flakes. Its main facilities are in British Columbia and Alberta and was originally set up to process containers from the provinces' DRS systems. It is also a partner (with Emterra) in ReVital Polymers in Sarnia, Ontario, and has joint ventures for deposit plastics materials in Oregon and California.

Like many other mechanical plastic processors, there is a focus on processing clean material coming from DRS programs. The difference is that, as a result of winning a five-year contract with Recycle BC under the B.C. packaging EPR program, Merlin invested $20 million in

processing equipment and technology to sort the curbside-collected containers, adding an additional capability and involvement in preparing plastic packaging for mechanical recycling.

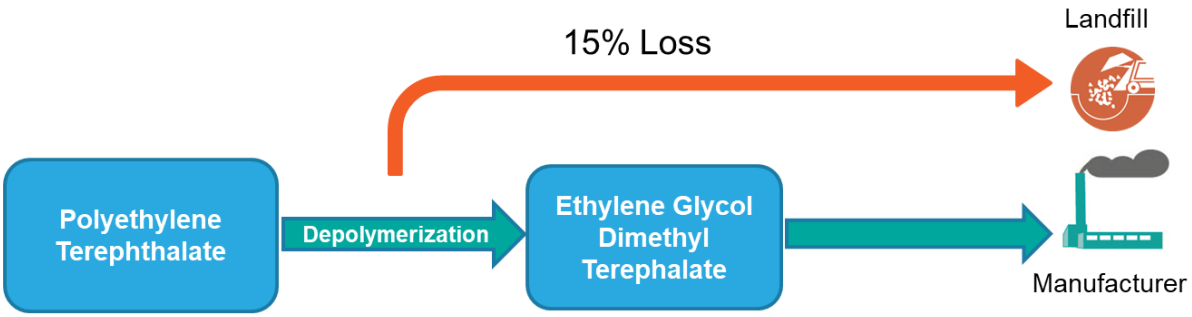
In its most recent post-collection contract process, Recycle BC awarded its new contract for post-collection services to another service provider in late 2019. Without this material supply flowing through its container recycling facility and mechanical recycling facilities in Canada, Merlin could have capacity to process similar partially presorted curbside material from other jurisdictions. Discussions with Merlin suggest that they would also consider developing a plastics recycling facility specifically for Washington if they could secure a 10-year contract [121].

Several companies were also identified that recycle plastic carpet. These companies are based in California, which has a carpet stewardship program. While not plastic packaging itself, carpet production and recycling can be linked to packaging. One company, Circular Polymers, has developed technology to recycle PET carpet made from PET bottles back into pellets that can be used to produce new PET bottles through mechanical and chemical processing.

2.2.3 Chemical Recycling

As stated in Section 2.2, there are two types of chemical recycling processes: one based on the depolymerization of plastic into its constituent monomers, and the other that first turns the plastic into a fuel and then further cracks the fuel into monomers. There is debate about whether polymer-to-fuel chemical recycling can be truly considered recycling rather than waste-to-energy, however we have included it for the sake of completeness. These processes are summarized in Figure 7 and Figure 8 respectively. The process flow diagrams have been developed using information gathered from the technology providers listed Appendix 0 and A.1.1.

Figure 7 Simplified Depolymerization Process for PET



The depolymerization process takes considerably less energy than the pyrolysis/steam cracking process, however, it is limited with respect to what materials it can process. PET is the most common material processed; BP has invested $25 million in a facility in Illinois that will depolymerize black and colored PET food trays and colored bottles.

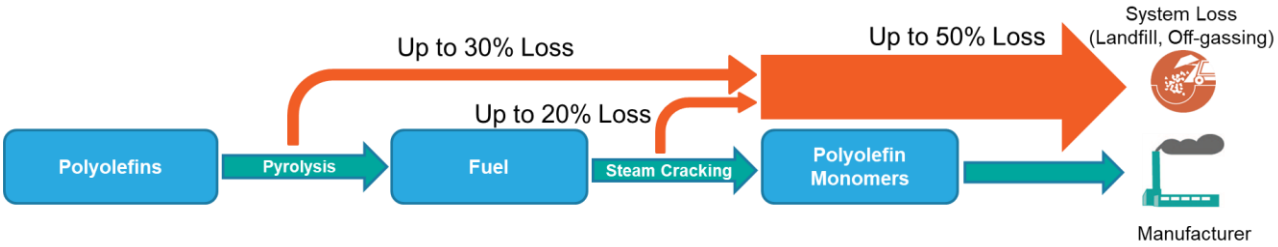
Our technology scan also identified a company called Pyrowave that has a patented Catalytic Microwave Depolymerization process that has the potential to break down EPS into wax and monomers for food grade applications. The company has an R&D facility in Montreal.

Another company of interest is Loop Industries, based in Terrebonne, Quebec, Canada, which uses a patented depolymerization technology to recycle plastic. The company sources its feedstock, PET and polyester fiber from a wide range of sources, including waste from mechanical recyclers, thermoformers, apparel and textile manufacturers, and carpet manufacturers, as well as waste management companies [122]. The company's technology, which can handle both colored and opaque PET and polyester, breaks waste plastic down into its monomers, dimethyl terephthalate (DMT) and monoethylene glycol (MEG), without heat or pressure. The monomers are then purified, removing all coloring, additives, and organic or inorganic impurities. From there, the DMT and MEG are repolymerized into Loop™-branded PET plastic. The output is virgin-quality PET plastic that can be used for FDA approved food-grade plastic packaging.

In May 2019, Loop Industries signed a deal for a $35 million investment, which will help fund its first commercial recycling facility as part of its joint venture with plastics producer Indorama Ventures. The investment will also help fund the pre-revenue company's R&D and operations expenses [123]. The facility, located in Spartanburg, South Carolina, had been expected to produce over 45 million pounds/year of recycled PET (rPET), but leaders of the project are now evaluating options to increase the capacity of the plant to over 88 million pounds and expect a decision to be made by the second quarter of FY2020. The retrofitted plant is anticipated to come online during the latter half of 2020 [123].

In 2018, the company announced a multi-year supply agreement with PepsiCo that will enable the food and beverage giant to purchase production capacity from Loop's U.S. facility. Shortly after, the company also signed a multi-year supply deal with Coca-Cola, under which Loop will supply 100 percent rPET plastic from its Spartanburg facility in the U.S. to authorized Coca-Cola bottlers [124]. Most recently, in March 2020, Loop Industries announced it had entered into a multi-year offtake agreement to supply L'Oreal with rPET resin. Like the Coca-Cola and PepsiCo agreements, the resin will be supplied from the company's joint venture facility in South Carolina [125].

Figure 8 Simplified Pyrolysis and Steam Cracking Process for Polyolefins



Chemical recycling, or conversion of polyolefins (HDPE, LDPE, PE, PP) into a fuel, is not new. It should be noted that there is disagreement about whether polymer-to-fuel chemical recycling can be truly considered recycling rather than waste-to-energy, but we have included it for the sake of completeness. However, the plastics industry has recently begun to examine the different chemical technologies, which include:

- **Chemolysis:** This is the term used to categorize the processes that use chemicals and catalysts (catalysis) to depolymerize or break down plastic polymers into chemical hydrocarbon building blocks. These can then be used in plastics manufacturing or other uses – generally high value chemicals. In this way, recycled hydrocarbons displace the need to make chemicals from virgin fossil raw materials.
- **Pyrolysis:** This is a process whereby heat is used to break down plastics into hydrocarbon building blocks in the absence of air. In some cases the hydrocarbons are reformed into oils, which can be further refined into transportation fuels (which results in the eventual conversion to GHGs as the fuels are burned) or used as feedstock to make other chemicals [119]. Conventional pyrolysis (thermal cracking) is suitable for waste plastics that are difficult to depolymerize, such as multi-layered packaging. The process takes place at moderate to high temperatures and its parameters can be changed to optimize the product yield according to preferences and needs [118]. Plasma pyrolysis, which is suitable for mixed plastic feedstock, integrates the conventional pyrolysis with thermochemical properties of plasma to convert plastic waste into syngas. The process temperatures are very high, and the waste plastics are decomposed into monomers and other smaller hydrocarbons. Another approach to pyrolysis is the use of microwaves as an energy heat source, which involves mixing plastics with a highly microwave-absorbent dielectric material. The heat absorbed from the microwaves is transferred to the plastics by conduction, and the sources of microwave radiation allow very high temperatures and heating rates, allowing for high conversion efficiencies of electrical energy into heat [118].
- **Catalytic Cracking:** Catalytic cracking of plastics uses various chemical catalysts to break plastics into monomers or other chemicals that can be used as plastics manufacturing feedstock or for other high end uses. Adding a catalyst to the pyrolysis process can reduce production costs since they reduce the required process temperature [118].

Adding a catalyst can also increase the yield of products with higher added value. The main difficulty with this technology is that the chloride and nitrogen components present in the waste stream tend to deactivate the catalyst, while the inorganic materials tend to block the catalyst's pores. For this reason, pre-treatment of the waste is often required.

- **Hydrocracking:** This technology involves adding hydrogen to the cracking process, which results in higher product quality. The process takes place at elevated hydrogen pressures and a temperature range from 375 to 500˚C. The biggest challenge to using this technology is the cost of hydrogen [118].
- **Gasification:** Gasification involves heating plastics with air or steam to a gaseous mixture containing carbon dioxide (CO_2), carbon monoxide, hydrogen (collectively syngas), methane, and other light hydrocarbons. This mixture can be reformed into plastics and other chemicals to create products and packaging. One benefit of gasification over pyrolysis is the possibility of utilizing mixtures of different plastic resins, or plastics mixed with other types of feedstock (e.g., biomass) [119].

As of the time of writing this report, only a few methods such as pyrolysis and gasification have reached commercial maturity, though there are broader environmental considerations and issues of scaling with these technologies. Other technologies, like methanolysis, hydrolysis, glycolysis, and hydrogenation are still in the development stages [119].

Converting the fuel to a monomer, although possible, is very energy intensive and expensive which is why no commercial or near-commercial facility was identified. Sixty-five percent of the total process' energy consumption is used in the steam cracking of fuel to create olefins [126]. As shown in Figure 8, there is also significant loss when the process happens in full. It is estimated that 50 percent of the input material will be lost – 30 percent at the pyrolysis stage [127] and then a further 20 percent through the steam cracking process.

From a plastic to fuel perspective, Agilyx is of interest as it has both a mixed-plastics-to-crude (MPC) system plus a polystyrene-to-styrene-monomer (PSM) system. In California, Agilyx partners with waste management company Recology to source polystyrene (PS) collected from a residential recycling program. Agilyx also started sourcing material nationally, from single-use PS food trays from school systems in Florida to municipalities in Canada and more than 300 commercial customers [128]. Agilyx's current facility processes ten tons of PS per day. Agilyx's new PS facilities in California and Chicago will process 50 to 150 tons of PS per day [128]. The Agilyx MPC System is capable of accepting all types of plastic, but there are more favorable resin types and mixes that generate higher oil yields and superior quality end products. The end product is a synthetic crude oil that is sold to existing refineries where it is made into gasoline, diesel fuel, jet fuel, fuel oil, and lubricants.

Klean Industries is a large international plastics recycler. Klean's system uses a continuous liquefaction technology that indirectly heats the plastic waste and a catalytic reaction to generate hydrocarbon gases. These are then cooled and condensed to produce ASTM spec diesel as well as a proprietary blend of heating fuel. The company claims to be able to produce approximately 950 liters of diesel fuel from each ton of waste plastic. It also states that different polymers can be processed together without any sorting and that typical contaminants such as grit, paper, metal, and food residue do not need to be removed prior to treatment. Klean's system is able to accept high loads of PVC and PET along with polyolefin plastics without damaging the reactor. The company's technology originates in Japan and has been in commercial operation for over 20 years [129]. In Canada, Klean has an operating plastic-to-diesel facility in B.C., which processes 100 metric tonnes per day (33,600 tonnes/year) [130]. Klean has over 16 operational plastics recycling facilities around the world include the flagship facility in Japan and 15 active projects for new plastics recycling facilities, including one in Vancouver, Canada, one in Germany, and one in Malta. The company is planning to roll out more facilities in North America and Europe [131].

Finally, Renewlogy, which was founded in 2011 at the Massachusetts Institute of Technology (MIT), uses a proprietary chemical recycling process that converts non-recycled plastic waste back into its basic molecular structure. The company is capable of accepting mixed and dirty plastic feedstock. Renewlogy's large modules, which can be directly installed at waste management sites, process ten tons of plastic waste per day. About 70 to 80 percent of the plastic becomes a liquid fuel product. The company makes diesel, kerosene, and light fuels, and about 20 percent becomes natural gas, which is used to heat the process.

In 2018, Renewlogy successfully completed cold and warm commissioning of a large-scale plastic conversion system in Salt Lake City before transporting it to Chester, Nova Scotia to be used by Canadian waste company Sustane Technologies. The Sustane Technology facility is a 70,000 tons per year mixed waste processing facility that is intended to produce 35,000 tons per year of biomass pellets from the organic and paper fraction of the waste stream, 3.5 million liters per year of diesel fuel from the plastic fraction of the waste stream (using Renewlogy technology), and an aggregate product and recovered metals for recycling. This facility also accepts bags of hard-to-recycle plastics through the Hefty EnergyBag program, which Boise, Idaho, rolled out in 2018. The facility stopped processing EnergyBags in October 2019 and was in the process of installing upgrades through funding from Dow and Reynolds Consumer Products. The facility was expected to start accepting bags again in the first quarter of 2020 [132]. Further details can be found in Appendix A.1.1.

2.2.4 Applicability to Washington

There is already an element of plastics mechanical processing taking place at the single-stream MRFs operating across the state. A similar system in B.C.—where partially processed mixed

plastics and containers are taken to a container processing facility to be further sorted—may be an option, however, the viability of this model is based on:

- The facility processing all non-fiber streams, not just plastic rejects from existing MRFs
- A sufficiently long-term contract (five plus years) for all the material in the state

These factors are only likely to be possible via an EPR program for all packaging, not just plastic.

Plastic to monomer chemical recycling appears an even less viable an option, not least because of the limitations on the type of feedstock – predominately PET. Finally, while conversion of plastics to fuels may have the benefit of replacing non-renewable hydrocarbon-based fuels, the extraction of which will result in a significantly greater GHG impact than fuels produced through chemical recycling, this process cannot be called recycling in the sense that the material does not get made into another product. Future plastic regulation will need to carefully consider the definition of recycling and the impact that definition might have on achieving a circular economy. The current definition of recycling under Chapter 70.95.030 RCW is [133]:

> *"Recycling" means transforming or remanufacturing waste materials into usable or marketable materials for use other than landfill disposal or incineration.*

Recently, the "Break Free from Plastic Pollution Act," HR 5845 was introduced that seeks to implement a nationwide EPR program for packaging, along with additional measures to tackle plastic waste [134]. This draft bill specifically states that the conversion of waste into alternative products such as chemicals, feedstocks, fuels, and energy through pyrolysis, hydropyrolysis, methanolysis, gasification, or enzymatic breakdown is *not* considered recycling.

Providers of both mechanical and chemical processing technology will be drawn to Washington if there is policy requiring recycling of certain materials. This is demonstrated by the number of plastics recyclers that now process carpet in California.

2.2.5 Supply Chain Technology

Blockchain

Blockchain technology, when applied to supply chains – or reverse supply chains, such as for waste management – is used to create an immutable ledger, a complete record of the movement of goods that has been verified at every transfer point, providing greater accountability and transparency. Blockchain is a software program that can be used in combination with RFID or QR code technology to coordinate with physical products. Using blockchain across an industry, such as recycling, can also provide many stakeholders with insight into the location of products and better match up supply of material with the demand of

processors or producers. This can also increase transparency and accountability to ensure residents or governments that materials are being properly recycled by tracking tonnages at every stage of the chain.

Blockchain can also be used to generate smart contracts, which allow multiple parties to enter into a contract and for payment to be released when both sides verify a satisfactory completion of the contract terms. This function can be used along the reverse supply chain to verify recycling transactions without the need for middlemen.

Blockchain can be used in concert with programs such as EPR to ensure compliance from every player within the waste management process, allowing governments or producers to better track their products at end-of-life. The tracked materials must still go on to either a mechanical or chemical recycling facility for processing.

3.0 Task 3B: Costs and Savings to Stakeholders in Existing Product Stewardship Programs

Generally, stewardship and EPR programs move the end-of-life management costs for targeted materials from municipalities and ratepayers/taxpayers to producers and consumers. While this shift is beneficial to taxpayers and to governments, EPR programs nonetheless come with some costs. As described through the case studies on EPR for packaging presented in Section 2.1.3, new systems and investments are required to manage producer obligations. Examples of some of the types expenses that can be incurred through the establishment of EPR include the creation of new organizations such as PROs, reporting and data management systems, or new collection and sorting/reprocessing infrastructure. The sections below detail some of the costs associated with the EPR for packaging programs described in case studies in Section 2.1.3.

3.1 Costs of Packaging Management in EPR Systems

In an EPR system in which producers are required to take financial responsibility and can influence operational management, data can be gathered on the cost of the system both from a collection and processing perspective, for individual materials. This information can then be used to recover system costs from producers using fees based on the actual proportional costs of individual material/packaging types.

Table 3-1 summarizes the total system costs paid by producers under the EPR programs introduced earlier in the report. Note that it is difficult to compare the costs of different systems, even between two Canadian provinces. This is because the cost of the system depends on many factors, including the outcomes that are required to be met, the operational systems established to deliver the outcomes, the geography and demographics of the areas, and waste composition.

Table 3-1 Cost Data Across EPR Programs

Program	Program Cost	Cost per Capita
France (2017) [135]	€665.0 million ($733.7 million USD)	€10 ($11 USD)

Program	Program Cost	Cost per Capita
Germany (2013) [58]	€2.2 billion ($2.4 billion USD)	€24 ($27 USD)
Belgium (2017) [135]	€144.3 million ($159.2 million USD)	€14 ($15 USD)
British Columbia (2018)	$88.7 million CAD ($63.8 million USD)	$19 CAD ($14 USD)
Ontario (2018)	$291.5 million ($209.7 USD)	$20 CAD ($14 USD)

Well-designed EPR systems provide a level of cost transparency that allows system efficiencies and improvements to be identified and made. Some, but not all, packaging EPR systems currently in place have this level of transparency, and efforts to increase transparency and accountability are underway in many jurisdictions.

System costs are recovered from producers using modulated product fees based on the actual proportional costs of individual material/packaging types and, in some cases, using additional bonuses and penalties ("eco-modulation") for certain packaging attributes.

Detailed information on fees for individual material types, including plastic packaging, as of 2020 across several programs is provided in Appendix A.2.0.

Additional initiatives are also ongoing to develop more precise and consistent cost allocation approaches and to facilitate adoption of eco-modulation of fees to better align fee levels with program objectives and circular economy principles.

The Canadian Stewardship Services Alliance (CSSA) recently undertook the material cost differentiation (MCD) project to redefine the methodology used in PPP stewardship programs to determine the relative impacts of material characteristics on the cost of the recycling collection system. Eunomia is advising the European Commission on fee modulation practices across the E.U.

3.2 Municipalities and Households

Under EPR, the total or partial financial responsibility for covering the cost of the system transfers from municipalities and ratepayers/taxpayers to producers and their customers. The level of financial responsibility shifted to producers ranges from 50 percent currently in Ontario to 100 percent in Germany, Belgium, and B.C.

In some programs, municipalities continue to directly deliver or procure services while other jurisdictions transfer recycling collection service delivery entirely to producers.

In many programs—including Recycle BC in British Columbia, where the majority of municipalities have remained involved in service delivery—limited information about the actual costs of service and concerns about fairness of reimbursement levels across jurisdictions have resulted in reimbursements to municipalities at standard benchmark rates agreed to per household based on services provided in line with a service level agreement. Under the B.C. model, payments are higher, for example, in municipalities where household densities are lower, as this condition is acknowledged to lead to higher collection costs compared to municipalities with higher residential density.

Payments are also higher for municipalities that have dual-stream recycling collection, compared to single-stream, as this is recognized as providing downstream processing savings. In some cases, municipalities have reported that these reimbursements are higher than their total costs to provide collection services while other municipalities have reported that the reimbursements do not fully cover their costs.

In all cases, B.C. municipalities operating as contracted service providers commit to passing whatever savings are realized through the reimbursements from Recycle BC on to households, either through direct credits on utility bills or by using the funds to offset costs for other services provided, such as curbside organics collection or waste prevention programs.

3.3 Producers

EPR policies are a means of ensuring that the "polluter pays" principle is applied to waste management. Producers placing packaging on the market are required to register and report their sales in order to determine their regulatory obligations.

Producer costs are likely to include:

- **Producer fees:** These are the fees necessary to cover the cost of the system and will vary by material and the objective of the fee, e.g., does it aim to cover the cost of collection and processing (net of revenue) of the specific material, or does it also encourage producers to use packaging that is easier to recycle or has a reduced carbon impact? Total fees reflect the quantity of material placed on the market.
- **Registration/administration fees**: Producers are sometimes charged fees to cover the administration, auditing, and enforcement of the system by the regulatory authority. For example, in Ontario, producers under an IPR model are required to register with the regulatory authority, RPRA. There is a fee associated with registration which effectively covers the costs of the organization.
- **PRO fees**: These fees are paid by producers if they are required or choose to join a PRO to manage compliance on their behalf.

Producer Fees

Different programs require producers to cover varying proportions of the costs of the collection and processing of packaging material for recycling. Table 3-2 provides a comparison of cost coverage models in the programs outlined in Section 2.1.3.

Table 3-2 Producer Cost Coverage Across EPR Programs

Program	Producer Cost Coverage Proportion
France	80%
Germany	100%
Belgium	100% (does not include coverage for mixed paper)[17]
British Columbia	100%
Ontario	50% (transitioning to 100% starting in 2023 with full cost coverage by end of 2025)

Producer fees are modulated to varying degrees. Modulation can simply reflect the cost of collection and processing net of revenue for individual materials. For instance, fees for producers who place aluminum containers on the market, which are easy to collect and recycle and have a high material market value, will pay lower fees per pound than a producer of a lower value material, such as aseptic cartons. Fees can also be structured to incentivize producers to use materials that are easier to recycle or that have a reduced carbon impact. France's system, for instance, includes bonuses and penalties related to packaging design features, such as awareness-raising logos and paper printed with mineral-based ink.

Until recently, there was no mechanism for modulating fees within Germany's PROs. This changed in 2019 with the update of the Packaging Act, Section 21 of which stipulates that:

> *(1) While determining and calculating participation fees, EPR-Organizations are obligated to formulate new incentives for packaging manufacturers, in order to:*

[17] Of the mixed paper stream, 25% of is estimated to be packaging and 75% is estimated to be printed paper, which is not covered by the EPR program and therefore not subject to reimbursement. However, Fost Plus pays 30% of collection costs for mixed paper because paper packaging is considered a higher volume of the total than printed paper. Revenues from the mixed paper stream are split 75% to municipalities and 25% to Fost Plus.

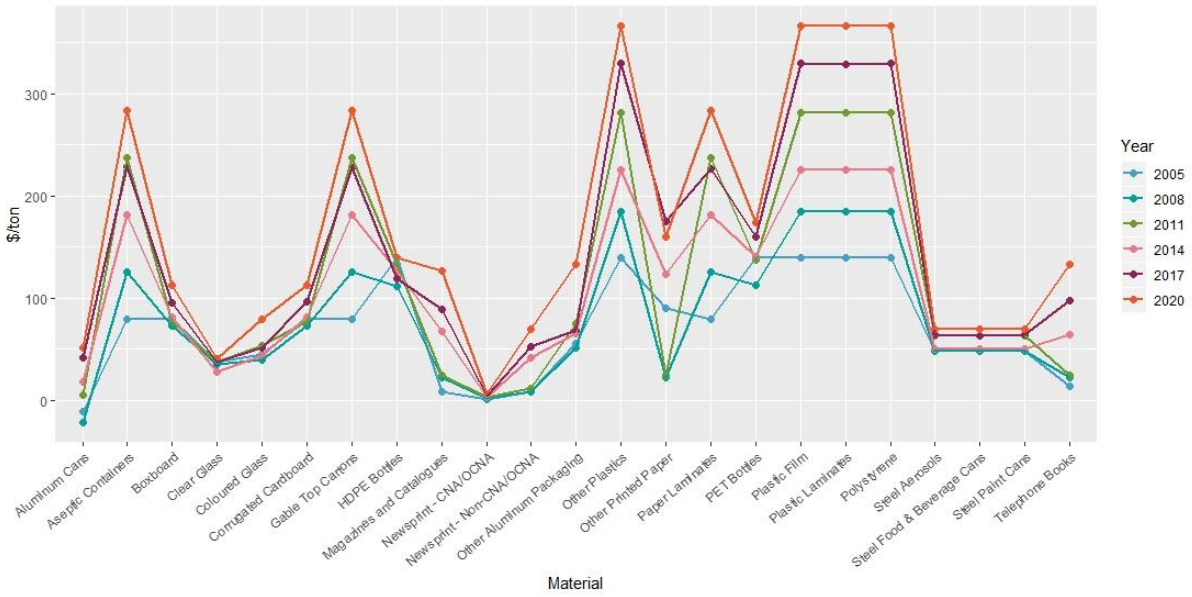
1. *Promote the use of materials and combinations thereof which can be recycled at the highest possible percentage rate, taking into account the practice of sorting and recycling; and*
2. *Promote the use of recycled materials and of renewable raw materials [136].*

Based on these new stipulations, and previous conditions set by earlier versions of the law, those companies that fail to comply with the new regulation face a fine of up to €200,000 [137].

Producer fees will go down when markets for a material are buoyant and will go up when material markets are down, as seen in Ontario in Figure 9. Where producers have operational control, at least over the processing of material, they are better able to manage fluctuations as they have larger volumes for which to negotiate better prices. Individual municipalities do not have the ability to do this.

Detailed information on fees for 2020 across different programs are provided in Appendix A.2.0.

Figure 9 Changes in Producer Fees by Material in Ontario from 2005-2020



Source: Ontario PIM Data, Stewardship Ontario and Eunomia Calculations based on 50% funding

3.4 Regulatory Authority

Where there is a regulatory authority that oversees the system, such as in Ontario, the cost of that regulatory authority organization is paid for through producer registration fees. These fees are most often dependent on the amount of material placed on the market by producers or on their market share.

The regulatory authority must establish processes to verify the data provided by producers to ensure that fees are allocated correctly. This may include audits, for which resources will be needed. Costs can also vary based on the number of producers in the state and the amount of data-sharing between geographically similar EPR programs.

3.5 Other Costs and Savings to Stakeholders

Because existing EPR programs for packaging came into effect at different times under different conditions for recycling service and markets, and different configurations of stakeholders involved in recycling and packaging management prior to the start of EPR programs, there is limited relevant information about the costs and savings to additional stakeholders under EPR programs elsewhere.

The King County Responsible Recycling Task Force recently commissioned a report to examine what a transition to an EPR framework for packaging would look like in Washington State. The report provides further detail on the roles of existing and new stakeholders as well as impacts to them under an implementation model for EPR [3].

4.0 Task 3C: Identify Existing Organizations Capable of Managing Plastic Packaging That Could Be Employed for Use in Developing a Program in the State

Within an EPR framework, an oversight organization is especially important. It ensures that producers and/or PROs are meeting the requirements outlined in legislation in terms of participation, payment, reporting, performance, and compliance. Table 4-1 provides a list of organizations that could play a role, or otherwise provide useful model elements, for a plastic packaging management program in Washington. These organizations may be active in or outside of Washington and may be best suited for either direct involvement in a plastic packaging management program, to serve an advisory role, or as a model when creating a plastics packaging management organization for Washington State.

Table 4-1 Review of Organizations for Plastic Packaging Management

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
Washington-based			
Department of Commerce (Commerce)	Government	Commerce is charged with enhancing and promoting sustainable community and economic vitality in Washington. They administer a portfolio of more than 100 programs and several state boards and commissions, all focused on helping communities achieve positive growth. Key customers include: businesses, local governments, tribes, and community-based organizations. They convene numerous local, state, regional, and federal partners and stakeholders, both public and private.	Commerce could advise on, oversee, or (partially or wholly) administer plastic packaging management functions such as: market development, R&D, grants, loans, and economic development zones, recycled content requirements, etc.
Department of Revenue (DOR)	Government	DOR is tasked with collecting tax dollars that help fund vital public services throughout the state. Currently, the department administers 60 categories of taxes that help fund education, human	DOR could advise on, oversee, or (partially or wholly) administer plastic packaging management functions such as: tracking and reporting, modulated fee assessment, and enforcement.

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
		services, health care, public safety, natural resources, and other services offered to communities.	
Department of Ecology (Ecology)	Government	Ecology is the environmental regulatory agency for the state. The department administers laws and regulations pertaining to the areas of water quality, water rights, and water resources; shoreline management; toxics clean-up; nuclear waste; hazardous waste; and air quality. It also conducts monitoring and scientific assessments.	Ecology could advise on, oversee, (partially or wholly) administer, enforce, and regulate any and all plastic packaging management functions associated with stewardship organization plans and requirements. Ecology already oversees four of the State's existing EPR/product stewardship programs.
Department of Health (DOH), County Public Health Departments (for reusables programs)	Government	Local and state-level health departments oversee rules, regulations, programs, and services to help prevent illness and injury, promote healthy places to live and work, provide education to help people make good health decisions, and ensure the state is prepared for emergencies.	DOH could develop regulations governing reuse and use of durable substitutes for single-use plastic. They could also be charged with enforcement. DOH also already oversees the Safe Medication Return EPR program.
Ag Container Recycling Council (ACRC)	Industry-funded Non-profit	Industry funded, non-profit organization that collects and recycles agricultural	ACRC already facilitates some recycling of ag plastics in Washington, including

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
		crop protection, animal health, and specialty pest control product containers (jugs and drums).	sending some tons for recycling at Oregon-based recycler Agri-Plas Inc., and could play a coordination, infrastructure, or stewardship organization role in statewide agricultural plastics management.
LightRecycle Washington	Industry-managed Non-profit	LightRecycle establishes a system for Washington State to recover mercury-containing lighting, and is operated by PCA Product Stewardship Inc. (which is affiliated with Product Care, described below). PCA is a non-profit industry association, specializing in product stewardship on behalf of the manufacturers, distributors, and retailers of products that are regulated under product stewardship laws.	LightRecycle covers the costs of end-of-life lamp management and establishes a no-cost, drop-off recycling option for covered products. As implemented in WA, the program utilizes a visible-to-consumer Environmental Handling Charge (EHC). The EHC is not a government tax, and is considered part of the product cost and is therefore subject to sales taxes. Sellers have discretion on whether to actively display the EHC or incorporate it into the sales price. The per bulb fee, currently at 95¢/bulb, has been repeatedly increased as sales of mercury-containing lights drop while volumes

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
			returned for recycling have remained steady.
Liquor & Cannabis Control Board	Government	An administrative agency of the State of Washington. The Board is part of the executive branch and reports to the Governor. The Board's primary function is the licensing of on and off premises establishments which sell any type of alcohol, and the enforcement and education of the state's alcohol, tobacco, and cannabis laws.	The Board could be charged with assessing manufacturer obligations, enforcing compliance, mandating recycled content, requiring recovery, specifying labelling, etc.
PaintCare	Industry-funded Non-profit	Non-profit PRO created by the American Coatings Association to administer paint stewardship programs. In states that pass paint stewardship laws, PaintCare establishes drop-off locations where the public can dispose of leftover paint for recycling, reuse, or other appropriate management.	PaintCare serves as a PRO in managing over 10 programs nationwide, including the legislated, soon-to-launch Washington program. This PRO does not address packaging, and the model relies on a retail-applied advanced recovery fee to the customer rather than true EPR. However, manufacturers are involved, and some requirements in the existing legislated plan may be applicable to a plastic packaging management system.

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
Photovoltaic Module Stewardship and Takeback Program	Producer Organization	The program requires manufacturers of solar panels, also known as photovoltaic or "PV" modules, to provide the public a convenient and environmentally sound way to recycle all modules purchased after July 1, 2017. Manufacturers are required to finance the takeback and recycling system at no cost to the owner of the PV module.	Elements of this PRO could be applicable for establishing a plastic packaging PRO, including a producer-directed board, creation of an opt-in standard plan, reporting requirements, etc.
Recycling Development Center	Government	The Recycling Development Center is tasked with facilitating research and development, marketing, and policy analysis to bolster recycling markets and processing in Washington. Initially, the Center will focus on businesses that convert or remanufacture waste into new products, especially mixed waste paper and plastics. They are also partnering with Commerce, which will provide business, marketing, and technical assistance to support the public and private sectors.	This agency could inform, guide, support, or regulate material flow, recycled content, recyclability (prohibit mixed materials), market development, data gathering, measurement, and reporting, etc.

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
Washington Materials Management Financing Authority	Producer Organization	Manufacturer board-directed authority created by state law to handle the collection for recycling of certain electronics in Washington. The Authority follows state law and guidelines as set forth by Ecology to create a standard plan that manufacturers will participate in and finance.	Elements of this PRO, which manages several electronic products in Washington, could be applicable for establishing a plastic packaging PRO, including a producer-directed board, creation of an opt-in standard plan, reporting requirements, etc.
Washington Utilities and Transportation Commission (WUTC)	Government	Three-member commission appointed by the governor. The WUTC ensures investor-owned utility and transportation services are safe, available, reliable and fairly priced. Regulated businesses include solid waste carriers.	This agency could clarify, inform, guide, support, or regulate material flow, data gathering, measurement, and reporting, etc., regarding regulation of residential solid waste collection. This would have implications for plastics management in the state.
Zero Waste Washington (ZWW)	Non-profit	Works to advance producer responsibility policy and programs in Washington. ZWW advocates for products designed and produced to be healthy, safe, and continually recycled and reused.	Though unlikely to assume an official oversight or implementation role as a PRO, this organization could serve as a stakeholder on relevant boards and commissions.

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
Outside Washington			
AMERIPEN	Trade Association Non-profit	Focuses on U.S. public policy for the packaging industry. They advocate on behalf of the entire packaging value chain – from material producers, to brand owners, to recycling partners – before state legislatures, and collaborate with stakeholders to advance the packaging industry's public policy objectives.	This organization could represent an industry sector as part of a stewardship organization or serve on a legislated advisory committee under a stewardship plan.
Association of Plastics Recyclers (APR)	Trade Association Non-profit	APR is the international trade association representing the plastics recycling industry. Membership includes independent recycling companies of all sizes, processing numerous resins, as well as consumer product companies, equipment manufacturers, testing laboratories, organizations, and others committed to the success of plastics recycling. APR works to enhance quality and increase supply through technical resources, testing programs, design	This organization could serve on a legislated advisory committee under a stewardship plan.

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
		solutions, corporate training, regulatory leadership and education programs.	
California Department of Resources Recycling and Recovery (CalRecycle)	Government	Department within the California Environmental Protection Agency. CalRecycle administers and provides oversight for all of California's state-managed non-hazardous waste handling and recycling programs. Known mostly for overseeing beverage container and electronic waste recycling, CalRecycle is also responsible for organics management, used tires, used motor oil, carpet, paint, mattresses, rigid plastic containers, newsprint, construction and demolition debris, medical sharps waste, household hazardous waste, and food scrap composting.	This organization serves as a de facto administrator for stewardship programs. Each product is handled uniquely, with financing structures and industry responsibility varying widely.
Health Products Stewardship Association (HPSA)	Industry Non-profit	HPSA represents producers of consumer health products and pharmaceuticals in Canada. The association was formed by producers to ensure the safe and effective collection and disposal of their products. Members include: branded	The structure of this model could inform mechanisms for including a variety of plastics producers in a Washington system. The varied fee structure could further be adapted to create modulated fees on different packages or materials

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
		drug makers, generic drug makers, and over-the-counter drug makers, all of whom divide financial responsibility based on value of sales or quantity of sales. HPSA fulfils their stewardship obligations in provinces that have EPR regulations regarding consumer health products (CHP). Governed by a board of directors representing companies that produce CHPs, HPSA is a federally registered non-profit organization. It operates collection and disposal programs that focus on prescription drugs, natural health products, over-the-counter medications, and medical sharps waste generated by the public in their homes.	as an incentive for producers to design products that contribute to waste prevention, minimize environmental impact, and facilitate recycling.
Manitoba Framework	N/A	Shared producer responsibility system for managing residential PPP, where producers cover 80 percent of the costs of recycling collection, and municipalities pay the remaining 20 percent. Producers meet their obligation through two stewardship organizations,	This model could provide guidance for both financial structuring of a Washington program, as well as approaches for separating and sharing management of different classes of

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
		one focused on beverage containers – Canadian Beverage Container Recycling Association (CBCRA) – and one focused on all other PPP materials – Multi-Material Stewardship Manitoba (MMSM).	products that may contain plastic packaging.
Product Care	Non-profit	Product Care provides free recycling locations across nine Canadian provinces for consumers to bring products such as paint, household hazardous waste, light bulbs, and alarms.	Product Care offers a fully functioning, multi-product EPR system whose financial and collection structures could be adapted to address plastic packaging flows. Product Care is funded by its membership, a group of more than 700 producers of products that are regulated under an EPR model. Their recycling programs are provided at no cost to consumers, and are funded by the fees Product Care collects from its membership. Monthly reporting is required, based on sales, using an online reporting system. The recycling fee is subject to sales tax, as it is considered to be just another cost of

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
			doing business, and therefore part of the price of designated products.
Recycle BC	Non-profit	Recycle BC (previously known as Multi-Material BC) is a non-profit organization which manages residential PPP recycling in British Columbia. It was launched in 2014, after a 2011 law passed by the MOECCS transferred the cost of recycling from residents to producers. Producers who sell products in B.C. pay fees to Recycle BC for the packaging and paper supplied on a quarterly basis determined by how many kilograms of each material they sold in the province. Items collected are sorted and sold to end-markets for processing into new products.	This comprehensive, comparatively mature EPR model provides options for how municipalities and solid waste/recycling haulers participate in the program.
The Recycling Partnership (TRP)	Non-profit	National non-profit supporting recycling in states, cities and communities across the U.S. They are funded by over 40 leading companies from across several industries. They engage in	TRP provides an example of industry collaboration and shared funding that could inform the creation of a stewardship organization or the development of a financing mechanism.

Organizations	Type of Organization (Government, Non-profit, For profit)	Description/ Background/Context	Aspects/Functions of the Organization That Are Relevant to Plastic Management System in Washington
		contamination reduction campaigns and other education efforts.	
Sustainable Packaging Coalition (SPC)/How2Recycle	Non-profit	SPC is a membership-based collaborative that leverages industry to make packaging more sustainable. SPC brings packaging sustainability stakeholders together to catalyze actionable improvements to packaging systems and lend an authoritative voice on issues related to packaging sustainability. The member-elected Executive Committee advises staff and is comprised of a minimum each of two material manufacturers, converters, and brand owners.	Given their industry expertise, SPC could play a role in informing or developing labelling standards, recycled content credit trading and tracking, etc., either in the development of legislation or as part of a stewardship organization plan.

5.0 Task 3D: Identify Existing Databases of Plastic Packaging Producers That Were Used in Other Product Stewardship Programs

For an EPR system to function properly, it is essential that both producers and the packaging they put on the market are accurately accounted for. This requires a database to be developed and managed by the governing body responsible for the EPR program. There must also be policies requiring producers to register with the agency, with failure to do so resulting in penalties. There are a number of EPR programs for packaging which already have databases of producers and could serve as a useful point of comparison to identify potentially obligated producers if an EPR program were to be implemented in Washington.

In the Canadian provincial stewardship programs for PPP, each program maintains their own list of producers or "stewards", some of which are publicly available. The following four provincial programs also provide this information to the Canadian Stewardship Services Alliance (CSSA), a national non-profit that provides administration and management services to PROs:

- Recycle BC (British Columbia)
- Multi-Material Stewardship Western (Saskatchewan)
- Multi-Material Stewardship Manitoba (Manitoba)
- Stewardship Ontario (Ontario)

Each list can be found on the CSSA website, as well as on the respective websites of each provincial stewardship program. The comprehensive list of packaging producers across the four programs supported by CSSA is included in Appendix A.5.0.

In developing a comprehensive list of obligated producers under an EPR program, industry associations can also be valuable resources for cross-checking the list of producers. Packaging manufacturers are likely to be members of associations that represent industries associated with

plastic packaging such as plastic packaging manufacturers and brand owners. These may include, among others:

- Washington Beverage Association
- Consumer Brands Association (formerly the Grocery Manufacturers Association)
- Society of Consumer Affairs Professionals (SOCAP) Consumer Packaged Goods Industry Community
- American Institute for Packaging and the Environment (AMERIPEN)
- Association for Packaging and Processing
- Food Packaging Coalition
- Consumer Technology Association

In Washington, such organizations could help publicize new producer requirements associated with an EPR program and do outreach to their members. Plastic packaging producers may also already be involved in existing stewardship programs in Washington or nearby states/provinces that could be referred to when developing the database.

Finally, data management is key for a functional and sustainable EPR program. Structuring the enabling legislation to ensure proper reporting and requiring registration from all obligated packaging producers is essential for a well-functioning EPR system.

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APPENDICES

A.1.0 Plastic Packaging Definition

For the purposes of this study, "packaging" means material used for the containment, protection, handling, delivery, or presentation of goods by the producer for the user or consumer, ranging from raw materials to processed goods. Packaging includes, but is not limited to, all of the following:

(A) Sales packaging or primary packaging intended to constitute a sales unit to the consumer at the point of purchase and most closely contains the product, food, or beverage.

(B) Grouped packaging or secondary packaging intended to brand or display the product.

(C) Transport packaging or tertiary packaging intended to protect the product during transport.

The following plastic packaging material definitions used for this study are originally from the Washington 2015-16 Statewide Waste Characterization Study and include the following, except for **PLA compostable packaging (#28):**

17. #1 PETE (Polyethylene terephthalate) Plastic bottles: includes plastic bottles bearing the #1, such as carbonated drink bottles and water bottles.

18. #1 PETE (Polyethylene terephthalate) Plastic non-bottles: includes plastic non-bottle packaging bearing the #1 and would include oven-ready meal trays and other packaging.

19. #2 HDPE (High-density polyethylene) Plastic Natural Bottles: includes milk jugs and water jugs and any natural bottle bearing the #2.

20. #2 HDPE (High-density polyethylene) Plastic Colored Bottles: includes detergent bottles, some hair care product bottles, and any opaque plastic bottle bearing the #2.

21. #2 HDPE (High-density polyethylene) Plastic Jars and Tubs: yogurt and margarine tubs and any packaging jar or tub bearing the #2. This category includes 5-gallon plastic pails (with or without handles) and lids.

22. #3 PVC (Polyvinyl chloride) Plastic Packaging: includes any plastic bottle or container marked with a # 3.

23. #4 LDPE (Low-density polyethylene) Plastic Packaging: includes any plastic bottle or container marked with the #4.

24. #5 PP (Polypropylene) Plastic Packaging: includes any plastic packaging marked with the #5 as well as plastic straws.

25. #6 PS (Polystyrene) Plastic Packaging: includes any plastic packaging marked with the #6 such as compact disc cases, some plastic to-go beverage cups, and any other rigid PS packaging.

26. #7 Other/Unknown Plastic Packaging: includes all non-numbered plastic packaging and any other plastic packaging product not listed in another category.

27. Expanded Polystyrene Packaging: includes packing peanuts, Styrofoam coolers, egg cartons, meat trays, take out containers, and other Styrofoam packaging.

28. PLA (Polylactic Acid) Compostable Packaging: any compostable plastic packaging or food containers made from corn, potato, sugarcane or any other compostable resin. Examples include fast food clamshell containers and beverage cups. This type of plastic is excluded from this study.

29. Plastic Merchandise Bags: will include all grocery, shopping, and merchandise bags.

30. Non-industrial Packaging Film Plastic: includes other types of packaging film such as cling wrap, bread and food bags, and plastic potato chip bags.

31. Industrial Packaging Film Plastic: includes bubble wrap and shrink wrap and any other packaging film used in a typically industrial manner.

32. Flexible Plastic Packaging: means plastic pouches made of thicker, multi-layer flexible material. May have a flat bottom so that package would stand up on its own, but not always. Material is thicker than potato chip bags and frozen vegetable bags. Includes plastic coffee bags like Starbucks and Peet's; Capri Sun pouches; baby food pouches – may have plastic screw top; soup pouches; salad dressing pouches; wine pouches; backpacking meals in pouches; soap refill pouches; laundry detergent pouches; and other similar items.

33. Remainder/Composite Plastic Packaging: other types of packaging that are not one of the above materials and items that are composites of multiple plastics and plastics mixed with other materials. An example of this material type is some bathroom silicone sealant tubes designed to be used with an applicator gun. These tubes frequently have plastic bodies and tips but metal end caps.

A.2.0 Additional Program Information

A.2.1 EPR Program Fee Schedules

The tables below show producer fee schedules from various EPR for packaging programs in Canada and Europe.

Table A 1 Recycle BC Producer Fee Schedule

RECYCLE BC FEE SCHEDULE (CENTS/KG)				
Category	**Material**	**2020 Fee Rates (cents/ kg)**	**2019 Fee Rates (cents/ kg)**	**Variance %**
PRINTED PAPER	Newsprint	16.00	11.00	45.5%
	Magazines and Catalogues	26.00	14.00	85.7%
	Telephone Books	26.00	14.00	85.7%
	Other Printed Paper	26.00	14.00	85.7%
PAPER PACKAGING	Corrugated Cardboard	36.00	25.00	44.0%
	Boxboard	36.00	25.00	44.0%
	Gable Top Cartons	83.00	55.00	50.9%
	Paper Laminates	83.00	55.00	50.9%
	Aseptic Containers	83.00	55.00	50.9%
PLASTICS	PET Containers	77.00	63.00	22.2%
	HDPE Containers	77.00	63.00	22.2%
	Plastic Film	112.00	100.00	12.0%
	Plastic Laminates	141.00	128.00	10.2%
	Polystyrene	112.00	100.00	12.0%
	Other Plastics	112.00	100.00	12.0%
STEEL	Other Steel Packaging	30.00	27.00	11.1%
	Steel Aerosols	30.00	27.00	11.1%
	Steel Paint Cans	30.00	27.00	11.1%
ALUMINUM	Aluminum Food & Milk Containers	56.00	42.00	33.3%
	Other Aluminum Packaging	56.00	42.00	33.3%
GLASS	Clear Glass	17.00	16.00	6.3%
	Coloured Glass	17.00	16.00	6.3%

Source: Recycle BC

Table A 2 Stewardship Ontario Producer Fee Schedule

STEWARDSHIP ONTARIO FEE SCHEDULE (CENTS/KG)				
Category	**Material**	**2020 Fee Rates (cents/ kg)**	**2019 Fee Rates (cents/ kg)**	**Variance %**
PRINTED PAPER	Newsprint - CNA/OCNA	0.63	0.59	6.8%
	Newsprint - Non-CNA/OCNA	6.90	5.98	15.4%
	Magazines and Catalogues	12.70	9.04	40.5%
	Telephone Books	13.25	11.06	19.8%
	Other Printed Paper	16.00	18.45	-13.3%
PAPER PACKAGING	Corrugated Cardboard	11.28	10.13	11.4%
	Boxboard	11.28	10.13	11.4%
	Gable Top Cartons	28.33	22.44	26.2%
	Paper Laminates	28.33	22.44	26.2%
	Aseptic Containers	28.33	22.44	26.2%
PLASTICS	PET Bottles	17.39	19.65	-11.5%
	HDPE Bottles	13.92	13.21	5.4%
	Plastic Film	36.67	33.07	10.9%
	Plastic Laminates	36.67	33.07	10.9%
	Polystyrene	36.67	33.07	10.9%
	Other Plastics	36.67	33.07	10.9%
STEEL	Steel Food & Beverage Cans	6.97	7.10	-1.8%
	Steel Aerosols	6.97	7.10	-1.8%
	Steel Paint Cans	6.97	7.10	-1.8%
ALUMINUM	Aluminum Food & Beverage Cans	5.16	3.68	40.2%
	Other Aluminum Packaging	13.32	7.96	67.3%
GLASS	Clear Glass	4.07	3.80	7.1%
	Coloured Glass	7.95	6.76	17.6%
IN-KIND	In-Kind Amount	$4,860,588	$5,112,007	-4.9%

Source: Stewardship Ontario

Table A 3 Germany's Green Dot 2019 License Fees per Material

MATERIAL	EURO/TON
Glass	1.00
Paper/cardboard	3.00
Tinplate	5.00
Aluminium	13.00
Plastics	17.00
Composite carton	13.00
Miscellaneous Composites	13.00
Organic Materials	2.00

Source: PRO Europe

Table A 4 Producer Fees Under Each of Belgium's PROs in 2019

Material	2019 (€/ton) Fost Plus	2019 (€/ton) VALIPAC
Glass	31.1	14.50
Paper Cardboard	22.3	14.50
Steel	52.9	See metal
Aluminum	33.9	See metal
Metal	N/A	14.50
PET Bottles and flasks	346.3	See plastics
HDPE bottles and flasks	341.8	See plastics
Plastics other	510.3	N/A
Plastics all	N/A	39.50
Building sector plastics	NA	49.50

Material	2019 (€/ton) Fost Plus	2019 (€/ton) VALIPAC
Drinks cartons	354.1	N/A
Wood	N/A	14.50
Textiles	N/A	14.50
Other recyclable materials	N/A	14.50
Non-recyclable materials	See energy from waste and disposed	53.00
Energy from Waste	616.10	N/A
Disposed	781.80	N/A

Source: Fost Plus and VALIPAC

A.2.3 Canadian EPR Programs

The Canadian Stewardship Services Alliance's (CSSA) checklist on reporting requirements for producers in four of the Canadian provincial stewardship programs it supports is presented in Figure A .

Figure A 1 Canadian Stewardship Programs Producer Reporting Checklist

Canadian Stewardship Services Alliance

2020 Ready to Report Checklist – PPP Programs

This checklist summarizes everything packaging and paper product (PPP) Stewards should have on hand when preparing to submit report(s) on the WeRecycle Portal.

- **User ID & Password**
  Registered Stewards will need a User ID and password to log in to the portal. Use the 'Did you forget your password?' link to recover your login information, or contact NSS for assistance. Upon entering your User ID and password, you may be prompted to revise your password to meet our enhanced password security requirements.
- **Understand Your Obligation**
  Know whether your organization is an Obligated Steward or a Voluntary Steward. Steward lists identify how each Steward is registered. Additionally, be aware of any reporting or payment exemptions for which your organization is eligible, or if you qualify for low-volume reporting (Recycle BC & MMSW only).
- **Material List**
  The WeRecycle Material List (formerly known as the National Material List) allows Stewards to report against the very same materials for each of their PPP programs, facilitating data entry and comparing your supplied kg across programs. Stewards can also opt to use the Program Material Lists (formerly known as Provincial Material Lists) to prepare data. Choose the material list that matches what you used to prepare your figures. Selecting the right list will ensure the correct table of materials is presented on the Portal when entering data.
- **Methodology**
  You will need to summarize your methodology in the portal, including information about your data collection process, changes from prior reports, deducted materials and explanations for any significant year-over-year changes in tonnage. Consider drafting this in advance. Stewards reporting deductions will need to provide details in the Deduction Declaration Form.
- **Data Table**
  Create a simple summary table or spreadsheet that shows the material categories you are reporting and the number of kg supplied before entering data in the Portal.
- **Invoice Preferences**
  By default, your organization will be invoiced quarterly for each program you submit reports with. To request annual invoicing, please contact National Steward Services.
- **Brands & Affiliates**
  If you have many brands, you can prepare a list of all brands you are reporting in a spreadsheet (CSV file). This can be uploaded to the Portal as an attachment, rather than typing in each brand manually. A separate CSV file should be created for any affiliates, if applicable.
- **Submission**
  While a Secondary Contact can enter all your data, only the Primary Contact can click 'submit' on a report. Primary Contacts can use the 'Continue Report' tile to review reports prepared by their Secondary Contacts. Secondary Contacts can use the 'email reminder to primary contact' button on the submission page to let them know the report is ready for their review. If you need to change your existing Primary Contact, please complete Form 1 in the Primary Contact Authorization Forms and send it to stewards@cssalliance.ca

The National Steward Services team is available to assist with questions about the checklist or completing reports: stewards@cssalliance.ca or 1-888-950-9549

Stewardship Ontario · Multi-Material Stewardship Western · MMSM Multi-Material Stewardship Manitoba · RECYCLEBC

A.2.4 Ontario

A.2.4.1 Additional Legislation of Note

On November 29, 2018, the new Conservative government's Minister of the Environment, Conservation and Parks presented the government's Made-in-Ontario Environment Plan [138]. This plan essentially superseded the former provincial Liberal government's Waste-Free Ontario Strategy, although the WFOA and the two schedules remain fully in effect. This new plan retained a circular economy perspective and outlines four main areas of environmental action for the province:

- Help protect air, land, and water
- Address litter and reduce waste
- Support Ontarians to do their share in reducing GHGs
- Help communities and families prepare for climate change

In the area of reducing waste (and addressing litter), the most important plan component was reinforcing the commitment to producer responsibility for the waste generated from their products and packaging by moving Ontario's existing waste diversion programs to the producer responsibility model "to provide relief for taxpayers and make producers of packaging and products more efficient by better connecting them with markets that recycle what they produce."

At the end of July 2019, Special Advisor David Lindsay issued a report (requested by the Minister) on Recycling and Plastic Waste called "Renewing the Blue Box: Final Report on the Blue Box Remediation Process." The purpose of the report, which was completed in about a month with active consultation with producers, the Association of Municipalities of Ontario (AMO), and other key stakeholders, was to develop a path for the transition of the Blue Box program to full producer responsibility. Seven key "mediation issues" were identified, areas of consensus/no consensus were noted, and recommendations presented for actions to move towards draft regulations. The key mediation considerations were:

- A measured timeframe for the transition to a new EPR framework of 100 percent producer responsibility for the Blue Box program (from 2019 through 2025)
- Ensuring a common collection system with uninterrupted service during the transition period
- Transitioning municipal assets in a way that municipalities may bid on future services, but producers are free to determine what (public and private) assets are used

- Standardizing what is in the Blue Box – regulations are to establish a common set of materials and set clear diversion goals from landfill
- Determining eligible sources for Blue Box materials, e.g., include multifamily buildings, selected businesses, parks, and other public space, but NOT major ICI sources
- Setting effective design targets, e.g., material-specific targets by category that drive diversion and challenge industry to innovate
- Promoting increased diversion from landfills – materials entering the Blue Box should be reused or recycled; incineration and waste-to-energy should NOT count as diversion (according to the Lindsay report; this is not yet government policy)

A.3.0 Corporate Commitments

Many of the largest consumer packaged goods (CPG) companies, including Coca-Cola, Nestlé, Danone, Mars, PepsiCo, and Unilever have signed on to or made their own plastic reduction and recycled content pledges, some including pacts with Greenpeace. Below are some highlights of a few of these companies' sustainability commitments related to plastic packaging and recycled content.

Unilever

- Pledged to halve the amount of virgin plastic used from 2019 to 2025 [139].
- Committed to collect and process more plastic packaging than they sell by 2025.
- Published "Design for Recyclability" guidelines.

Coca-Cola

- Coca-Cola has decided to report a packaging mix measure that better reflects the actual breakdown of the number of packages they introduce into the marketplace. The new methodology for packaging mix is based on individual units of packaging sold. This means that a twenty-ounce bottle and a two-liter bottle would represent an equal share of packaging mix.
- Pledged to collect 100 percent of its containers for recycling by 2030 [140].
- Committed to make its packaging 100 percent recyclable by 2025.
- Pledged to incorporate 50 percent recycled content by 2030.

PepsiCo

- PepsiCo's 2018 Corporate Sustainability Report indicated that the company is taking steps to phase out the use of harmful plastics in packaging and phasing in the use of aluminum cans [141].
- Pledged to use 25 percent recycled content in plastic packaging and 33 percent rPET in its PET beverage bottles by 2025 [142].
- Committed to making its containers 100 percent recyclable, biodegradable, or compostable.
- Centered its sustainability policy around the United Nations Sustainable Development Goals (SDGs) [141].
- Joined the Ellen MacArthur Foundation's New Plastics Economy Global Commitment.

Nestlé North America

- Nestlé plans to phase out all plastics that are non-recyclable between 2020 and 2025 and roll out alternative packaging materials in partnership with packaging specialists such as Danimer Scientific and PureCycle Technologies. All plastic straws have already been eliminated from Nestlé products, and they plan to incorporate 50 percent recycled content in their PET in the U.S. and 35 percent worldwide by 2025 [143].
- Pledged to reach 25 percent recycled content in the U.S. by 2021 and asserts that all its U.S. packaging portfolio is already 100 percent recyclable [144].

Fiji Water

- Committed to 100 percent rPET in bottles by 2025 and 20 percent in 2020 [145].

Danone

- Danone is currently supporting their own version of a circular economy, with similar numbers and timeframes for their targets (100 percent recyclable or compostable by 2025).
- Danone has begun to adopt EPR and DRS already and claims to want to surpass the targets set by regulators. Their individual portfolio brands have also launched individual sustainability initiatives, such as Evian's partnership with the Ocean Cleanup [146].

While these pledges are voluntary and progress is self-reported, signatories of the Ellen MacArthur Foundation's New Plastics Economy Global Commitment commit to publishing annual data on progress to promote transparency. Top beverage industry companies Coca-Cola, Keurig Dr. Pepper, PepsiCo have also recently launched the "Every Bottle Back" initiative in conjunction with the American Beverage Association, the World Wildlife Fund (WWF), The Recycling Partnership, and Closed Loop Partners. These corporations are pooling $100 million to expand the availability of rPET and transitioning to a reduction in virgin plastics use [141].

Some have reacted with skepticism to these and similar initiatives by industry with criticism that they do not address the root causes of the plastics pollution issue [147]. Others have pointed to unfulfilled pledges made by several of these CPG companies in the past with regard to recycling and recycled content use, and noted the opposition of industry to programs and policies that have been shown to increase recovery and recycling rates, such as DRS [148].

A.4.0 Technology Providers

A.4.1 Mechanical Processors

A summary of mechanical plastics processors is provided in Table A 5 with further detail provided below the table.

Table A 5 Mechanical Plastic Recycling Operators

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
Avangard Innovative Houston, Texas (U.S.); Nevada (exact location not yet released) (U.S.); Mexico	• Commercial • One operational with three further planned	• Baled LDPE film from commercial generators, such as large retailers	• Existing processing facility in Houston handles 48 million lbs. per year. • In 2020, the company is planning to grow exponentially, opening three processing sites. Each of the three will have annual capacities of close to 100 million lbs. [149].	• Each processing plant will cost about $30 million [149].	• High-grade pellet suitable for use in producing new film.

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
AZEK Wilmington, Ohio (U.S.) **[150]**	• Early commercial stage	• Post-consumer and post-industrial PE bottles [151]	• Up to 100 million lbs. per year by 2020	• $25 million recycling plant [152]	• Recycled PE resin is used in the cores of the company's TimberTech PRO and EDGE boards (plastic lumber).
ByFusion Los Angeles, California (U.S.)	• R&D/Early commercial stage	• All types of plastic (#1-7), individually or mixed, clean or contaminated—except for 100% PS (#6) and other foam-based plastics [153].	• Two ByFusion systems: 'Community Blocker' is designed to process up to 30 tons/month (based on 5 days, 8 hours/day), while 'Industrial Blocker', which is engineered for large scale MRFs and municipalities, can process 90+ tons per month [154].	• Machines cost about $350,000 each [155].	• Building material called 'ByBlock'. ByBlocks can be used for: non-load bearing walls, retaining walls, sound walls, privacy fencing, terracing, accent walls, furniture, and more.
B&B Plastics Inc. Headquarters in Rialto, California (U.S.)	• Commercial stage • Multiple facilities	• Post-industrial clean plastic scrap [156],	• Reprocessed 370 million lbs. of plastic, with a total	• No information available	• Multiple commodity and engineering

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
		10% post-consumer and 90% post-industrial [157].	volume of 500 million lbs. 74% of recycling volume was reprocessed in-house [157]		grade resin pellets and flake.
CarbonLITE Headquarters in Los Angeles, California U.S.)	• Commercial stage • Multiple facilities	• Post-consumer PET bottles, HDPE, and PP bottles and thermoforms.	• 300 million lbs. per year [158] projected capacity when all three facilities open. Third facility in Pennsylvania, expected to be fully operational by the first quarter of 2020 [158] with a capacity of 85 million lbs. per year, 14 tons per hour [159].	• Pennsylvania: $80 million [158]. Riverside and Dallas plants carried investments of $60 million and $62 million, respectively [159].	• Bottle-grade PET flake and pellets that can then be used to manufacture new plastic beverage bottles and other products, as well as HDPE and PP pellets.
Circular Polymers Lincoln, California (U.S.)	• Commercial Stage	• Post-consumer carpet	• The facility will process approximately 30 million lbs. per year, with plans to expand further [160]	• In June 2017, the California Alternative Energy and Advanced Transportation Financing	• Nylon 66, Nylon 6, PET, PP, and calcium carbonate which in part is sent to Eastman's chemical

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
				Authority approved sales tax breaks totalling an estimated $636,000 for $7.5 million worth of equipment for the Lincoln plant.	recycling facility in Kingsport. • Circular Polymers has also signed an agreement to supply PP recovered from carpet to PureCycle Technologies [161].
Custom Polymers PET (affiliate of Custom Polymers, Inc. and recently acquired by Indorama Ventures) Athens, Alabama (U.S.)	• Commercial stage	• Post-consumer and post-industrial PET bottles	• Up to 68 million lbs. of PET flake and food-grade pellet per year [162].	• No information available	• Recycled baled staple fiber, PET flake, and post-consumer PET resin for direct food contact. This facility has a letter of non-objection from the FDA.
Ecomelida (U.S. unit of Chinese recycling company Zhangzhou Sanlida Environmental)	• Not yet operational	• Post-consumer PET, PE film, food and beverage cartons including	• No information available on capacity • The facility plans to produce 159 million lbs. per year	• $52 million investment [164]	• Pellets and paper pulp for export to China [150]

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
Orangeburg County, South Carolina (U.S.)		aseptic packages [163]	of recycled plastic pellets (pellet production slated to begin Q4 2020) [163].		
EFS-Plastics Headquarters in Listowel, Ontario (Canada)	• Commercial stage	• Hazelton facility: post-consumer plastic film from MRFs and store take-back programs across North America. • Listowel facility: post-consumer mixed bales (rigids and films) from MRFs across Canada and the U.S. • Third EFS site will process both mixed rigids as well as some film. The	• The Hazlelton facility is processing 34 million lbs./year as of February 2020 [163]. Facility expansion took place in 2019. • Combined, the two EFS-Plastics facilities took in a total of 30,000 tons in 2019 [150].	• Listowel facility: $8,000,000 capital costs [166]	• EFS Listowel plant currently offers roughly 40 pellet grades for a wide range of applications including consumer products, automotive, agricultural, construction and other markets. • Hazelton facility produces a transparent and gray plastic film [165].

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
		facility will extract PET as well as the other PE and PP resins [165].			
Envision Plastics (subsidiary of Consolidated Container Company) Headquarters in Reidsville, North Carolina (U.S.)	• Commercial stage • Multiple facilities	• HDPE bottles and PP bottles and thermoforms	• Two plants recycle 140 - 150 million pounds, or 70,000 to 75,000 tons, of HDPE per year.	• No information available	• Several types of flake and pellets, including food-grade recycled HDPE for food, beverage, personal care, consumer healthcare, and general-purpose industries. The company also produces recycled HDPE sourced from marine environments.
FDS Manufacturing Headquarters in Pomona, California (U.S.)	• Commercial stage	• PP and PE bottles and thermoforms	• No information available	• In 2019, the company was selected to receive $3 million for a	• PE and PP pellets for use in manufacturing angle board,

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
				melt-filtration unit, pelletizer, and extruder to process an additional 2,000 tons per year of PP and PE [167].	bins, pallets and other products.
GDB International Headquarters in New Brunswick, New Jersey (U.S.)	• Commercial stage	• Post-industrial and post-commercial LDPE, LLDPE and HDPE plastic film [168]	• First line has rated capacity of 1,300 lbs. per hour and second line is larger. Third and fourth lines are each rated to produce 3,000 lbs. per hour [168].	• No information available	• Pellets for garbage bags and other plastic film products as well as pipe and irrigation [168].
Geo-Tech Polymers Headquarters in Piketon, Ohio (U.S.) **[169]**	• Early commercial stage	• Post-consumer and post-industrial PET, HDPE, LLDPE, PP, PS and engineered resins	• 20 - 30 million lbs. per year of plastics between its two plants [170].	• To build the Waverly facility, the company received a $460,000 loan from the Pike County (Ohio) Commissioners to help with	• Multiple types of resin pellets

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
				the costs of purchasing and installing equipment at the plant [170].	
Global Plastics Inc. Perris, California (U.S.)	• Commercial stage • Three facilities	• PET bottles	• No information available	• No information available	• PET packaging, sheet, pellets, and flake
Green Tech Solutions (U.S. subsidiary of Tianjin Sheng Xin Non-Financing Guarantee Co) Blacksburg, South Carolina (U.S.) **[150]**	• Unknown	• First phase will focus on processing electronic scrap (primarily CRT devices and copper wires), second phase will process circuit boards and post-industrial and post-consumer plastics. plastics [171].	• Plastics processing line will have a capacity of approximately one million tons per year [171].	• Capital costs: $75 million [172]	• Pellets for export
Klöckner Pentaplast of Canada Inc.	• Commercial stage • Single facility	• Post-consumer PET bottles	• Annual capacity is 36 million lbs. per year [173]	• No information available	• PET flake, film, thermoforms

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
Quebec (Canada)					
KW Plastics Recycling Division (Part of KW Plastics) Troy, Alabama (U.S.)	• Commercial stage • Single facility	• Post-consumer HDPE and PP bottles and thermoforms	• 650 million lbs. in annual production capacity	• No information available	• HDPE and PP pellets
Merlin Plastics Headquarters in Delta, BC (Canada)	• Commercial stage • Multiple facilities	• Post-consumer PET, HDPE, LDPE, PP, PS	• Facility in New Westminster, BC has a sorting capacity of approximately 150 million lbs. per year [174].	• No information available	• HDPE, LDPE, PP pellets, PET pellets and flake
Peninsula Plastics Recycling (subsidiary of Merlin Plastics) Turlock, California (U.S.)	• Commercial stage • One facility	• Post-consumer PET bottles, post-industrial scrap plastics	• Currently taking in about 70 million lbs. and producing nearly 50 million lbs. of PET flake and pellets per year [175]. New sorting line will boost intake capacity by about 40 million lbs. (plus or minus 10%).	• No information available	• PET pellets and flake

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
Petoskey Plastics Petoskey, Michigan (U.S.)	• Commercial stage • Multiple facilities, recycling facility in Hartford City, IN	• Post-consumer LDPE film	• Over 30 million lbs. of post-consumer plastic recycled at their Indiana facility.	• No information available	• GreenPe resin, plastic bags
Plastic Recycling Inc. Headquarters in Indianapolis, Indiana, Multiple production facilities (U.S.)	• Commercial stage	• PP bottles and thermoforms and PS non-bottle rigid plastics and foam	• No information available	• No information available	• PET, HDPE, LDPE, PP, PS and other engineered resin pellets
Polystyvert Montreal, Quebec (Canada)	• Pilot stage	• Post-consumer PS	• Demonstration plant will be able to recycle 600 tonnes a year at a production rate of 275 lbs. per hour.	• Company launched second round of financing which generated USD $11 million in 2018 [176].	• PS pellets
Polywood Headquarters in Syracuse, Indiana (U.S.) **[150]**	• Early commercial stage	• Post-consumer HDPE and mixed plastic bales	• 34 - 40 million lbs. per year (expected to be operating at full capacity in Q1 2022)	• $35 million facility [177]	• PE pellets

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
PreZero U.S., Inc. (a partnership of ACI Plastics and PreZero) Riverside, California and Westminster, South Carolina (U.S.)	• Commercial • Two facilitates near completion (expected 2020)	• Post-commercial and post-industrial LDPE and LLDPE film • Post-consumer PE, HDPE, and PP thermoforms	• California facility, slated for start-up May 1, 2020, will process 12,500 tonnes per year, with room for expansion [163]. • South Carolina facility, also slated for Q2 2020, will process 25,000 tonnes per year [150].	• California plant, totaling 325,000 square feet, cost $80 million [178]. • South Carolina plant will be an expansion to an existing ACI facility. The expansion project costs about $10 million [178].	• HDPE, LDPE, PP pellets
PureCycle Technologies Ironton, Ohio (U.S.)	• Early commercial stage	• Post-consumer PP bottles and thermoforms • As of September 2019, company was focused on recycling carpets, but can accept almost any PP [179].	• Second phase, expected to come online in 2021, will process 19 million lbs. per year of waste PP [180].	• Hanging Rock facility was a $300 million investment [179]	• PP pellets

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
RePET Inc. Chino, California (U.S.)	• Commercial stage • One facility	• Post-consumer PET bottles	• 80 million lbs. per year of PET flake	• No information available	• PET flake
Revolution Plastics Vernon, California (U.S.)	• Commercial stage	• Post-consumer LDPE film and agricultural film	• 150 million lbs. per year [181]	• No information available	• PE film, agricultural film, retail bags and garbage bags
Roplast Industries Oroville, California (U.S.)	• Commercial stage • One facility	• Post-consumer and post-commercial LDPE film	• 7 million lbs. per year [167]	• No information available	• PE pellets for retail and grocery bags [182]
rPlanet Earth Headquarters in Vernon, California (U.S.)	• Early commercial stage	• Post-consumer PET bottles thermoforms	• Front-end sorting system processes nearly 8 tons per hour [183]. • As of Spring 2019, the company had installed and commissioned one full production line and expected to have a second line installed and running at full capacity over the next 2-3 years. Each line will have	• Capital cost: $100 million [184]	• PET bottle preforms, sheet and thermoform packaging

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
			capacity to produce about 80 million lbs. of finished packaging products annually, giving the plant a total production capacity of approximately 180 million lbs. or more per year of post-consumer PET [163].		
Sirmax Anderson, Indiana (U.S.)	• Not yet operational	• PP and PE scrap	• Estimated capacity of 25 million lbs. per year, with possible expansion to 50 million lbs. per year [163].	• Sirmax/SER North America invested $17.7 million in the facility [185].	• PP and engineered resins
Trex Co. Winchester, Virginia and Fernley, Nevada (U.S.)	• Commercial stage	• Post-consumer PE film, bags, and wrap, mostly collected from grocery stores and retailers	• Currently recycles over 800 million lbs. of PE film, wood chips and sawdust annually, and planned expansions will boost capacity to	• Company's newest facility, expected online in Q1 2021, is part of $200 million capital	• Composite lumber

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
			over 1.4 billion lbs. [186].	investment program [187].	
UltrePET Albany, New York (U.S.)	• Commercial stage	• Post-consumer PET bottles and thermoforms and post-industrial PET feedstocks	• No information available	• No information available	• PET pellets and flake
Unifi Greensboro, North Carolina (U.S.)	• Commercial stage	• Post-consumer PET bottles	• No information available	• No information available	• PET pellets and flake, polyester fabric for textiles and apparel
UPT Group Montezuma, Georgia (U.S.)	• Early commercial stage	• Post-consumer and post-industrial LDPE, HDPE, PC, and agricultural plastic [150]	• 24,000 tons/year [150]	• No information available	• Multiple resin type pellets

Avangard Innovative: Avangard Innovative (AI) currently runs a film recycling facility in Houston, Texas, capable of processing 48 million pounds of LDPE film per year. In September 2019, the company said it would open three additional film recycling sites in Texas, Nevada, and Mexico in 2020. Each plant is estimated to cost $30 million, and each would have a capacity of about 100 million pounds per year. The first to come online will be located near Houston [188]. In January 2020, Dow signed a deal to buy recycled PE pellets from AI, allowing Dow to provide recycled content plastic to North American customers for the first time. As part of the exclusive agreement, Dow will combine its virgin PE with AI's post-consumer resin (PCR). Potential end markets for the resulting recycled-content LLDPE and LDPE pellets include garbage bags, shrink wrap, and protective packaging [188].

AZEK: In April 2019, AZEK Building Products, a Chicago-area decking products manufacturer, opened a new $25 million recycling plant in Wilmington, Ohio. Under the TimberTech name, the new facility will produce composite Pro and Edge deck boards, which are both made using 100 percent recycled plastic. The plant processes PE-type plastic, like shampoo bottles, milk jugs, laundry detergent bottles, and plastic wrap [189].

ByFusion: ByFusion is a New York-based startup company that turns plastic waste into construction blocks known as "ByBlocks." ByBlocks are created with the ByFusion Blocker, a recycling machine, which super-heats and compresses any category of unsorted and unwashed plastic trash. ByBlocks can be used for non-load bearing walls, retaining walls, sound walls, privacy fencing, terracing, accent walls, furniture, and more. ByBlocks have already been used in various projects including the construction of retaining walls in New Zealand and California.

According to the company's website, ByBlocks first became available as part of a beta program launch in the U.S. in 2019. National availability is expected by Q2 2020 [154]. The suggested retail price per ByBlock is $1.95 [190].

B&B Plastics Inc: B&B Plastics Inc. has facilities in Riverside, California; Columbus, Ohio; and Tijuana, Mexico. It is a custom compounder of thermoplastics, providing a broad range of products including generic prime, wide spec, custom compounds, re-pelletized, and regrind materials. They service compounding facilities as well as injection molders, film/sheet extruders, thermoformers, blow molders, rotational-molders, pipe/ profile extruders and brokers.

CarbonLITE: CarbonLITE started business in 2011. The company currently has three facilities: one each in Riverside, California; Dallas, Texas; and Reading, Pennsylvania. The Pennsylvania facility is expected to come online in Q1 2020. CarbonLITE processes post-consumer plastic bottles from municipal curbside systems and deposit centers into food-grade pellets. The existing plants process more than two billion plastic bottles annually. End markets include bottle-grade PET resin flakes and pellets that can then be used to manufacture new plastic beverage bottles and other products. CarbonLITE has received a letter of non-objection from the

U.S. FDA and the PET resin offered by CarbonLITE can be used at levels up to 100 percent recycled content in the manufacture of PET bottles and containers for direct contact with all food types, avoiding the need for virgin materials.

CarbonLITE is expanding its U.S. operations by building a third facility in the Lehigh Valley area of Pennsylvania. The decision to build the facility was driven primarily by two of the company's major customers, Nestlé Waters North America – which signed a pre-buy agreement to purchase pellets from CarbonLITE – and Niagara Bottling. CarbonLITE anticipates that the new 200,000-square-foot processing facility will be in full production by early 2020, and will have the ability to recycle over two billion post-consumer bottles a year, producing 85 million pounds of food-grade PET pellets. The facility is being outfitted with a sorting system with optical and robotic equipment from Bulk Handling Systems, a wash line from Sorema, a flake sorting system from Van Dyk/Tomra, and solid state polycondensation equipment for food-grade pellet production from Starlinger. Like its existing facilities, CarbonLITE's Pennsylvania plant will process all plastics into pellets and will not sell any flake. Some of the facility's output will go to thermoform applications, but 90 percent of the pellets will be used by beverage companies. CarbonLITE expects to invest $80 million in the new plant, up from an initial estimate of about $60 million [159].

Circular Polymers: Founded in 2018, Circular Polymers has the capacity to process 30 million pounds of carpet per year. They are the first North American carpet recycler that can recycle PET carpet, which is made from recycled PET bottles, back into pellets that can be used to produce new PET bottles. A rotary impact separator disassembles carpet components then cleans the recovered fiber to maximize yield and produce high quality outputs. They supply nylon 6, nylon 66, PET, PP pellets and flake; and calcium carbonate powder to various industries.

The company has received financial support from both industry and government initiatives. In February 2018, Carpet America Recovery Effort (CARE), the carpet stewardship program, announced it had awarded Circular Polymers a $10,000 grant to help increase carpet recovery. In January 2018, CalRecycle approved a $2 million Recycling Market Development Zone loan for the company. Of that amount, 75 percent was to go toward equipment purchases with the rest going towards working capital and loan closing costs. The cost of the rotary impact separators alone is estimated at more than $2 million total [191]. According to a recent (2019) press release, Circular Polymers will densify the polyester fiber and ship it via rail to Kingsport, where Eastman will use it to feed its "carbon renewal technology." The technology breaks down the plastic into hydrogen and carbon monoxide, which Eastman uses to create chemical intermediate products to be used in a variety of applications [161]. Eastman plans to process up to 50 million pounds of scrap plastic with its carbon renewal technology in 2020. The company uses simple molecules derived from the scrap plastic to make a plastic it calls Trēva.

Custom Polymers PET: Custom Polymers PET is an affiliate company of Custom Polymers, Inc. located in Athens, Alabama. They produce up to 68 million pounds of recycled PET flake and pellets to provide post-consumer resin qualified for direct food contact by the U.S. FDA. It was acquired by international plastics producer Indorama Ventures in 2019 for nearly $30.5 million and represents Indorama's first bale-to-flake recycling and production facility in the U.S. [162] Indorama plans to sell this rPET for use in packaging, especially as demand for more recycled content from consumer brand owners increases [192].

Ecomelida: Ecomelida is the U.S. subsidiary of Zhangzhou Sanlida Environmental Technology Corporation, an importer and recycler of wastepaper and plastic. In 2018, the company announced that it would open a recycling operation in Orangeburg, South Carolina focused on food and beverage cartons. The facility will separate pulp, plastic, and aluminum from soft drink cartons and other products for use in products such as tissue papers [193].

EFS-Plastics: EFS-Plastics has two existing plants, one each in Listowel, Ontario, and Hazelton, Pennsylvania, that process post-consumer plastic to pellets. The company currently offers 40 grades of recycled plastics (each with its own melt, strength, and color attributes), and has color sorting capacity. Primary end markets include consumer products, automotive, agricultural, and construction. The U.S. facility produces transparent and gray plastic film from curbside and store take-back sources. Plastic bags are made back into plastic bags in the U.S. facility. Current and proposed PCR content requirements, especially in California, are growing their business. The company focuses on extracting PE and PP, as well as lower value plastic materials which were traditionally exported to overseas markets. China's import restrictions are the main reason they are considering expansion to the U.S. (or Canadian) west coast. A third facility is also being planned, although no location has been announced.

Envision Plastics: Founded in 2001, Envision produces recycled resin through several steps. The company operates two facilities, one each in Reidsville, North Carolina and Chino, California. The company became the first in the world to produce food-grade PCR HDPE resins when the U.S. FDA approved its food-grade EcoPrime™ recycled resins. Envision has patented its PRISMATM color sorting process, which can identify and sort different shades of plastic. Their two plants recycle between 140 million and 150 million pounds of HDPE per year. The company provides HDPE PCR to the food, beverage, personal care, consumer healthcare and general-purpose industries.

In a new project, Envision Plastics collects and recycles plastic at risk of entering the ocean, a Virginia-based facility processes the material into sheets, and Plastic Printers, a Hastings, Minnesota-based company turns them into business cards made out of the at-risk ocean plastic. To develop the resin line, Envision collects at-risk plastic from countries with higher rates of plastic leakage to the ocean. From June 2017 to May 2018, Envision recycled 5.2 million pounds of plastic recovered from coastal areas. In 2017, the company announced a goal of sourcing 10

million pounds of plastic over the next two years from areas where the material was at risk of entering marine environments [194].

FDS Manufacturing: Established in 1950, FDS Manufacturing is a major west coast manufacturer of industrial and agricultural packaging. In addition to their headquarters and manufacturing facility in Pomona, California, the company has a warehousing facility in Fowler, California. In May 2019, FDS Manufacturing was awarded $2.9 million to develop a process for diverting post-consumer, recycled PP and PE to create compounded masterbatch resin pellets. These resulting pellets will then be used by FDS Manufacturing and other industrial partners to produce commercial products such as pallets, agricultural storage bins, angle boards, and other multi-use products. A projected 4,005 tons of plastic is estimated to be diverted from landfills in this initial pilot study [195].

GDB International: GDB, headquartered in New Brunswick, New Jersey, has recently taken steps to go from collecting, sorting, and trading plastic film to recycling it into pellets. Of the plastics GDB International handles, 99 percent by volume are generated by post-commercial and post-industrial sources. Its plastics recycling business accounts for roughly 25 percent of the company's annual turnover, while plastics represent the largest volume of material in which GDB International trades. The company's New Brunswick plant measures 110,000 square feet. Approximately 60,000 square feet will be used for pellet production, which will be divided among four lines consisting of metal detectors, inline densifiers, vented extruders equipped with automatic screen changers, and underwater pelletizers [168]. GDB has additional warehouses in Nashville, Illinois; South Brunswick, New Jersey; Dayton, Ohio; and Neenah, Wisconsin.

Geo-Tech Polymers: Geo-Tech Polymers has two recycling facilities, one in Piketon, Ohio and one in Waverly, Ohio. Its facility in Waverly can process 20-30 million pounds of plastics per year and focuses on decoated plastics recycling for the retail packaging industry. The company specializes in decoating paints and surface coating from plastics by using chemical processes. Its main feedstocks include post-consumer and post-industrial plastics, including thermoplastic olefins, PC, ABS, PS, PET, HDPE, PP, and LLDPE [169]. In 2015, the company received a letter of non-objection from the U.S. FDA for food-contact packaging market [196].

Global Plastics Inc.: Global Plastics is a vertically integrated feedstock and end product manufacturer making PET packaging, sheet, pellet, and flake. The company operates out of three facilities in Perris, California and has received a letter of non-objection from the U.S. FDA, allowing all of its products to be used in food contact applications. Global obtains and recycles PET bottles from the state's container deposit system.

Green Tech Solutions: Green Tech Solutions, financed by Chinese investment firm Tianjin Sheng Xin Non-Financing Guarantee Co., plans to process hundreds of millions of pounds of scrap plastic per year. Green Tech's plastics processing operation will focus on post-industrial

plastics but will also process some post-consumer e-plastics. It will buy post-industrial PET, HDPE, and PP, and it will purchase engineered plastics such as ABS. The company will shred, wash, and pelletize the plastic at the Green Tech facility. Green Tech operates out of three facilities; the main facility is in Blacksburg, South Carolina, with additional facilities in Wadesboro, North Carolina and Penang, Malaysia.

Klöckner Pentaplast of Canada Inc.: Founded in 1965, the company operates a dedicated PET plastics recycling facility in greater Montreal. The 65,000 square foot facility, which opened in May 2015, processes about 36 million pounds of post-consumer PET from water bottles collected through curbside and DRS in both the U.S. and Canada. Klöckner Pentaplast then employs its proprietary processing methodology to recycle the plastic. Bottles are sorted into clear, green, and other colors, and after grinding and washing, optical and electrostatic sortation methods are used to sort the flakes. PET flake produced by the facility can be used for a variety of products, including blister packs, clamshells, trays, boxes, and other thermoform or print applications for food, health and beauty as well as electronics and other general-purpose consumer and industrial products [173]. They use this feedstock for their SmartCycle Pentafood, Pentaform, and Pentaclear lines of PET films, which contain post-consumer recycled content levels of 25-100%.

KW Plastics Recycling Division: KW Plastics Recycling Division opened in 1992 and is part of the KW Plastics family of companies with over a billion pounds of annual extruder capacity. KW is a major supplier of PCR to CPGs, and specializes in HDPE and PP recycling and recycles HDPE bulky rigid plastics such as laundry baskets, totes, and five-gallon buckets, post-consumer PP bales, and post-consumer and post-industrial flexible PP such as bulk bags and woven and non-woven fiber. They work with MRFs across the country to source bulky rigids and post-consumer PP and supply post-consumer recycled content resin for food packaging. It has received letters of non-objection from the U.S. FDA for post-consumer PP for food contact applications such as food storage containers and single-use food service items like cutlery, cups, and liquid containers [197].

Merlin Plastics: Founded in 1987, Merlin Plastics is located in Delta, BC, Canada and is the headquarters for the Merlin Group of companies. Merlin Plastics has two recycling plants in B.C. (Merlin Plastics, Gifford, and Merlin Plastics, Delta) and one in Alberta. Its affiliated group of companies in Ontario, Oregon, and California process almost 300 million pounds of post-consumer and post-industrial plastics each year. Merlin is the fourth largest plastics recycler in North America. The company produces natural HDPE pellets, colored HPDE pellets, injection pellets, clear, and green PET flakes. It is also a partner with Emterra in ReVital Polymers in Sarnia, Ontario, and has joint ventures for deposit plastics materials in the states of Oregon and California. Merlin Plastics, Gifford is the container sortation plant where the materials from curbside programs in B.C. are sorted into their respective streams. This facility has an annual storing capacity of 150 million pounds and was reportedly installing another mixed plastics

sorting line in 2019 that would increase capacity by 30 million [175]. The Delta facility processes plastic container packaging into recycled pellet and flake. In 2006, Merlin became the first Canadian recycling company to receive a U.S. FDA letter of non-objection for its post-consumer recycled PET to be used for direct contact containers for agricultural use [174].

Peninsula Plastics Recycling: Peninsula Plastics Recycling has a 180,000 square-foot plant that is currently processing 50 million pounds of PET per year. In January 2019, CalRecycle approved $4 million in low-interest loans to Peninsula Plastics. Half of the money is going toward the company's purchase and installation of a line to sort #1-7 plastic bales. The other half will go to buying wet grinders, which will be used in conjunction with the #1-7s line, and a rooftop solar power system. The company's CEO, Tony Moucachen, states that the company is putting in "a significant amount of investment" beyond the CalRecycle loans, though he declined to disclose the amount [175].

End products include food-grade PET flake, pellets, and other food-grade PCR, which are used in a variety of applications including beverage bottles, bottles for home cleaning, shampoo, hand soap, sheet for thermoform trays and clam shells, fiber for polyester carpet, fabric for T-shirts, upholstery and sweaters, fiberfill for sleeping bags, and strapping.

Petoskey Plastics: Petoskey Plastics is a vertically integrated plastic film bag manufacturer that began recycling film in-house in 1978 and post-consumer bags and film in 1991. It has multiple facilities throughout the U.S. and was one of the first companies to use significant amounts of post-consumer resin in their products. Today they recycle post-consumer plastic at their Hartford City, Indiana recycling facility into their GreenPe resin which is then used to make blown film and bag products. Some of their films include up to 70 percent post-consumer recycled content resin sandwiched in a layer between two virgin resin layers [198].

Plastic Recycling, Inc.: Plastic Recycling, Inc. was established in 1988 and provides custom recycled content PS, PP, PE, and other resin pellets. This company has received a letter of non-objection from the U.S. FDA for food contact applications.

Polystyvert: Founded in 2011, Polystyvert is a startup company that makes PS from 100 percent recycled materials. Instead of breaking the polystyrene down, Polystyvert's technology dissolves it in the essential oil cymene. The company's dissolution technology allows the largest contaminants to be removed initially, due to a screening step. During this step, the mixture of dissolved polystyrene and essential oil is poured through a simple mesh that holds back contaminants like paper, tape, cardboard, other plastics, metals [199]. Once dissolved, it can be re-solidified with another solvent, and washed and filtered to remove contaminants before being transformed into polystyrene pellets, which can be turned back into EPS. The company also supplies solvent-containing concentrators to companies that can be placed on-site [200].

The company has a pilot plant in Montreal. To drive the development of its technology forward on a large scale, the company in 2018 signed a cooperation agreement with Total Polymers (a subsidiary of French energy group Total), targeting dissolution and recycling of domestic post-consumer PS [201].

In June 2018, the company opened a demonstration facility in Anjou, Quebec that can process 275 pounds of PS per hour, or 800 tons a year. The company gets its PS from both residential and commercial generators, such as large appliance distributors. As of March 2019, the PS it produces was being sold to a company that manufacturers insulation. At the time, it was also trying to obtain food grade approval from Health Canada and the U.S. FDA in order to make food containers [200]. The company hopes to license its technology to other companies and to build a larger plant in Montreal.

Polywood: Founded in 1990, Polywood manufactures outdoor furniture made from recycled HDPE plastic milk jugs. The company's manufacturing, distributing and plastics processing center is located in Roxboro, North Carolina. Polywood has one other facility. The company has a vertically integrated operation that processes the HDPE milk jugs and manufactures plastic lumber and furniture in the same facility. The company processes about 27 tons or 400,000 post-consumer milk jugs per day at its Syracuse, Indiana facility. In 2018, Polywood invested $35.3 million in a new factory in Roxboro, North Carolina. The new facility will process about 18 tons of post-consumer HDPE per year.

PreZero US, Inc: PreZero US, Inc. is a California-based recycling company. In 2020, the company is opening an LDPE processing plant in Jurupa Valley, California, which will include a 300,000-square foot "environmental campus" with a sorting and plastics processing facility. In addition, the company is opening a mixed rigid plastics processing plant in South Carolina in 2021. Combined, the facilities will have the capacity to process 100,000 tons of postconsumer plastics per year [202].

It accepts A-grade plastic film (material that consists of 95 percent clean, dry, clear, natural LDPE and LLDPE film from store drop-off, post-commercial sources, etc.). Any mix of post-commercial or post-industrial film is acceptable with a minimal amount of HDPE allowed.

B-grade plastic film is also be accepted at the California facility; this consists of 80 percent clear, up to 20 percent colored, clean, natural LDPE and/or LLDPE films. Any mix of post-consumer or post-industrial film is allowed with minimal amounts HDPE or strapping.

The South Carolina facility will accept mixed rigid and bulky rigid plastics (HDPE and PP). These grades primarily consist of non-bottle PE and PP bulky rigid plastic items such as plastic drums, crates, buckets, baskets, toys, refuse totes, and lawn furniture typically collected in a residential recycling MRF [203].

In the years after the facilities start up, PreZero anticipates expanding each to process both mixed rigids and film.

PureCycle Technologies: Founded in 2015, PureCycle Technologies uses a proprietary process, licensed from Procter & Gamble, that removes color, odor, and other contaminants from recycled feedstock to produce a virgin-like PP. The PureCycle process purifies recycled plastics at the molecular level. Since there is no chemical reaction taking place, the polymer molecules remain intact as the impurities are removed through a solvent-based physical separation/purification process.

The company is currently constructing a plant in Lawrence County, Ohio in partnership with Milliken and Co. and Nestlé. Once it is operational, the facility is expected to be able to take post-consumer material from MRFs as well as post-industrial PP. At scale, the plant will have the capacity to process more than 119 million pounds of waste PP each year and produce 105 million pounds of PP resin for use in consumer product applications such as food and beverage packaging, consumer good packaging, automobile interiors, electronics, home furnishings, and many other products. PureCycle has signed contracts with P&G, Milliken, Nestlé, and L'Oreal to produce the plastic [179].

As of March 2019, the company was beginning commissioning of their Feedstock Evaluation Unit, which is a smaller scale of the commercial scale line, in Hanging Rock, Ohio. Phase 2 of PureCycle's plant, which has already been designed, will come online in the summer of 2021. The company is hoping to expand to other cities in the U.S. and Europe in the next few years. PurecCycle is also working toward a letter of non-objection from the U.S. FDA for their recycled PP to be used in food-grade applications [180].

RePET Inc.: RePET was established in 2009 as a CalRecycle certified processor of post-consumer PET bottle waste and produces PET and PP flake of various colors. This company has also received a letter of non-objection from the U.S. FDA.

Revolution Plastics: Revolution Plastics was formed by agricultural plastics reclaimer Encore Recycling and plastics manufacturers Delta Plastics and Command Packaging. With this combination of recycling and manufacturing capability, Revolution is able to close the loop of plastic film recycling. They are a large reclaimer of a hard-to-recycle film and achieve a high percentage of recycled content in the manufacture of new films and plastic bags for retail and refuse.

Roplast Industries: The company's 130,000 square foot manufacturing and corporate office facility is located in Oroville, California. Roplast Industries manufactures custom PE films and bags for markets throughout the U.S. In 2016, Roplast opened its Revolve Recycling Facility. Their aim was to establish a plastic waste recovery stream with their primary sources of

feedstock being plastic film waste generated in their clients' waste streams that are recovered and reprocessed at Revolve and turned into resin pellet feedstock for bag production by Roplast. The company has since established several retail and grocery chain-of-custody programs that allow for circular waste integration (film to film) into their reusable PE bags with partners such as Nike and Columbia Sportswear. In 2020, Roplast will again be expanding its Revolve Recycling line with the addition of an aqueous pre-wash line for increased pellet quality and production volume [182]. Their long-term goal is to be no less than 75 percent self-sustained on a vertically integrated stream of PCR generated by their recycling program through their client partners [182]. In 2019, the company was awarded $2.5 million for a new de-inking system allowing the company to recycle 2,500 more tons per year of LDPE [167].

The City of Anderson is also investing $650,000 in infrastructure, including a rail spur, and is providing $1.5 million in tax increment financing for the project through a bond [185].

rPlanet Earth: rPlanet Earth is a California-based company that recycles PET collected from the state's deposit program and makes pre-forms in its plant for sale to soft drink companies. The company's food-grade packaging facility is located in Vernon, California, which also serves as its headquarters. It plans to build several more similar plants across the U.S. to establish a fully integrated network of packaging manufacturing facilities to reuse post-consumer waste to create rPET products. It uses two main processes: processed and cleaned rPET is conveyed to a sheet extruder, converted into thermoform in a separate machine that presses and molds it into different forms; or rPET is sent directly to an injection molding machine where it is made into preforms for use by beverage/soft drink companies. The facility is designed to process 75 million pounds of PET per year. End markets for plastics include 25 to 100 percent recycled content products including beverage preforms and thermoforms for containers for cosmetics, produce, deli, bakery, and other ready-to-eat foods. Adding a second line to the California plant will double their capacity and make rPlanet the largest food grade recycler of PET in the U.S. The company's long-term plans are to build two or three more facilities for coast-to-coast coverage.

The company has received a variety of financing. In 2016, Citi, MBS Urban Initiatives and New Markets Community Capital provided New Market Tax Credit (NMTC) financing for rPlanet Earth. Financing for the project was structured through the NMTC Program, a federal initiative designed to spur investment in businesses and real estate projects in low-income communities. Citi provided $7.5 million in NMTC allocation and $6.6 million in NMTC equity. New Markets Community Capital provided $8 million of NMTC allocation, and MBS Urban Initiatives provided $5 million of NMTC allocation. Private investors provided the remainder of the capital. In Q4 of 2018, the company also received a $2 million California Climate Investment loan from CalRecycle, as well as a $3 million grant and tax breaks from the State. The Closed Loop Fund, New York, also invested $1.5 million in rPlanet Earth in late 2018 [184].

Sirmax: Sirmax makes compounds based on prime PP and engineering resins for appliance, automotive, power tools, consumer products, and other markets in Anderson, Indiana. A July 2019 news release said that the company will spend almost $18 million to build a new recycling plant in Indiana. The 130,00 square foot plant will be located in Anderson, where Sirmax opened its first U.S. location in 2015 and will open in July or August 2020 [204]. For the new plant, Sirmax bought 35 acres south of its existing 140,000 square foot plant. The new plant is expected to create 38 new jobs by the end of 2022. It will process and pelletize PP and PE scrap. Sirmax will use some of this recycled material to make recycled content compounds. It is receiving more than $2 million in public funding for the new plant, including $1.5 million for developing a brownfield site and $650,000 for infrastructure, including a rail spur and utility expansion. The new plant officially is being built by SER North America LLC, a new company that Sirmax formed after acquiring Italian plastics recycler SER in March. Sirmax's global customers include Fiat Chrysler, Volkswagen, Whirlpool, Bosch, Honeywell, and Ikea. In 2018, Sirmax posted sales of more than €300 million ($334.5 million). The firm claims to be one of the world's largest independent producers of PP compounds for several markets [202].

Trex Company: Trex is one of the largest recyclers of plastic film in North America, diverting more than 400 million pounds of plastic film, bags, and wrap each year and using it to produce outdoor living products such as composite deck lumber. The company currently has two production facilities, one in Winchester, Virginia, and another in Fernley, Nevada. A third facility is also being planned for Virginia. The average 500 square foot composite Trex deck contains 140,000 recycled plastic bags. The company's recycling process involves the following steps: 1. plastic film is cleaned and ground into granules; 2. plastic film granules and sawdust are combined and heated; 3. film/sawdust is mixed to a soft, pliable consistency; 4. the mixture is formed into boards using profile dies, 5. the boards are cooled and cut to length; and 6. finished boards are wrapped and shipped.

Most of the plastic it uses to make its decking products are sourced through a recycling program called NexTrex, which engages nearly 32,000 grocery stores and retailers across the country [187].

In November 2019, Trex announced that it had broken ground on a new manufacturing facility in Frederick County, Virginia. The new facility, which will begin to come online in the first quarter of 2021, is part of a $200 million, multi-year capital investment program that will allow Trex to increase production output. In addition to expanding capacity in Virginia, the company is in the process of installing additional capacity at its Nevada site. The additional lines are expected to come online in the second quarter of 2020 [187].

UltrePET: UltrePET is a recycler of PET and other plastic resins based in Albany, New York. They accept PET bottles from curbside and DRS programs, as well as post-consumer thermoforms and post-industrial feedstocks to produce food grade PET pellets and flake. The company has

received a letter of non-objection from the U.S. FDA. They supply recycled content PET resin to bottle and sheet manufacturers in the northeastern U.S. and Canada [205].

Unifi: Unifi is a vertically integrated company that recycles PET bottles, selling some as PET pellet and flake, as well as incorporating the recycled polyester into its branded fiber products for use in textiles. Their REPREVE polyester performance fiber is used in apparel, automotive, and home fabric applications. They also recently introduced new fibers including TruFlexx, a polyester fabric that can replace spandex, TruClean, a chemical-free, anti-static fiber, and a nylon staple fiber [206]. Unifi also has color sorting capability in its recycling operations.

UPT Group: UPT Group is a China-based company that launched a new startup in Georgia to recycle post-industrial and post-consumer LDPE, HDPE, PC, and agricultural plastic. Their projected capacity is 24,000 tons per year [207], and will manufacture multiple resin type pellets for use by XTJ Plastic Recycling in plastic piping and other products [150].

A.4.2 Chemical Recycling Companies – Plastics to Monomer

Table A 6 details chemical recycling companies that reduce plastics to their monomer. Further information on each is provided below the table.

Table A 6 Chemical Recycling Companies – Plastics to Monomer

Company Name	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
Agilyx Corporation Corporate Headquarters in Tigard, Oregon (U.S.)	• Commercial Stage	• Post-consumer (residential and commercial) PS	• Current facility processes 10 tons of PS per day. New polystyrene facilities in California and Chicago will process 50 to 150 tons of polystyrene per day [208].	• No information available	• Styrene monomer used to remake new PS products
BioCellection Menlo Park, California (U.S.)	• R&D stage	• Post-consumer bottles and thermoforms (PET, PE, PP, PS), film (HDPE, LDPE), and foam (PS)	• Currently able to process 5 lbs. per day • BioCellection is currently scaling up to a processing	• No information available	• Chemicals including succinic acid, glutaric acid, adipic acid, pimelic acid, suberic acid, and azelaic acid. These chemicals can be

Company Name	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
			plant that would have the capacity to recycle 300 tons per year of plastic by 2025. This will serve as their demonstration to then scale to commercial facilities [209].		used to make paints, coatings, automotive parts, apparel, electronics, solvents. and fragrances [210].
GreenMantra Technologies Brantford, Ontario (Canada)	• Early commercial stage	• Post-consumer and post-industrial PS, LDPE, HDPE, PP • Commercial facility is currently focused on PE and PP, demonstration facility is focused on PS [169].	• Existing plant's annual capacity is 5,000 tons per year. Under expansion plans, this will be increased by an additional 2,500 tons per year.	• No information available	• PE and PP additives (sold under the Ceranovus brand name) that can be formulated into specialty chemicals such as synthetic waxes and polymers. These can be used in rubber compounding and asphalt modification for roofing and paving, plastics processing and

Company Name	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
					composites, polymer and rubber compounding, coatings and inks, and other applications.
IBM San Jose, California (U.S.)	• R&D stage	• Post-consumer PET plastics (clear and colored, dirty or clean)	• No information available	• No information available	• PET powder which can be fed directly back into plastic manufacturing machines in order to make new food-grade PET
Loop Industries & Indorama Ventures Headquarters in Terrebonne, Quebec (Canada) **[169]** Joint venture facility in Spartanburg, South Carolina (U.S.)	• Early commercial stage	• Post-consumer and post-industrial PET and polyester fiber of any color, transparency, or condition, including ocean plastics [169].	• Spartanburg plant capacity is 40,000 tons per year [211]	• Spartanburg facility: $35 million [123]	• Monomers, which are filtered, purified, and polymerized to create Loop branded PET resin and polyester fiber suitable for use in food-grade packaging.

Company Name	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
Pyrowave Headquarters in Oakville, Ontario (Canada)	• Early commercial stage	• Post-consumer and post-industrial PS, including EPS and high impact polystyrene (HIPS)	• Current yield can reach up to 90% in monomer production and has a processing capacity ranging from 220 to 440 lbs. hour [212].	• In January 2020, Pyrowave was granted $3.2 M to extend its technology platform of chemical plastic-to-plastic recycling to mixed plastics.	• Waxes and monomers for production of new plastics
Reclaimed EcoEnergy Newport Beach, California (U.S.)	• Pilot stage	• Any organic material source, including PET, HDPE, PVC, LDPE, PP, PS, mixed #3-7 plastics, and multilayer packaging/film	• No information available	• $5-10 million to bring 2-3 commercial units to market [169]	• Process output is pure carbon, which is combined with hydrogen to form pure organic lubricants [169].

Agilyx Corporation: Agilyx has been converting scrap mixed plastics into crude oil since 2005. Agilyx's PSM system yields a styrene oil from waste PS that is ready for refining into new products. The liquid that is produced can be used in pharmaceutical, agricultural, safety, construction, food packaging, durable goods, composites, insulation, and shipping industry products. The MPC system yields a synthetic crude oil which is sold to existing refineries where it is made into products for everyday use such as gasoline, diesel fuel and jet fuel, fuel oil, lubricants, and even transformed back into plastic. Agilyx partners with waste management company Recology to source PS collected from residential recycling programs. Agilyx also started sourcing material nationally, from single-use PS food trays from school systems in Florida to municipalities in Canada and more than 300 commercial customers [128].

In April 2018, Agilyx announced the opening of a commercial polystyrene-scrap-to-styrene-oil chemical recycling plant. The oil is not a fuel but is intended to be reintroduced into the PS production process. Agilyx has also formed joint ventures and off-take agreements with Texas-based AmSty and Ineos Styrolution, which use Agilyx's styrene monomer to make food-grade consumer packaging.

Agilyx has sold its technology to three customers in the United States who operate on a commercial scale utilizing their technology [213].

In November 2018, the company announced a collaborative agreement with Monroe Energy to supply up to 2,500 barrels per day of Agilyx's synthetic crude oil (ASCO) derived from recycled plastics. Monroe will refine the ASCO product into jet fuel for Delta. Agilyx plans to locate a production facility near Monroe's refinery (located just outside of Philadelphia), developing the plant in phases until it reaches a production capacity of 2,500 bbl per day by the end of 2020 [214].

BioCellection: BioCellection was founded in 2015 in Menlo Park, California, where its lab is headquartered. The company uses a selective oxidation process to decompose post-consumer PE (particularly LDPE and HDPE flexible plastics), usually in the form of grocery bags, bubble wrap, food wrap, and packaging, into shorter chain molecules, such as oligomers and dibasic acids. The company's prototype machine does not require plastics to be clean before recycling. The process employs two catalysts, which are both recovered and recycled back into the system. BioCellection's process produces several different kinds of acids, such as succinic acid, glutaric acid, adipic acid, pimelic acid, suberic acid, and azelaic acid, which can be used in products such as solvents and coatings [169]. In 2019, BioCellection moved into a new lab, equipped with technology to double the team's experimental capacity. According to a December 2019 article, BioCellection is opening a processing plant that would have the capacity to recycle 50,000 tons of plastics by 2023. They are also working with other companies to make the technology available in other parts of the world [215], and are partnering with stakeholders including the

cities of San Jose and San Francisco, GreenWaste Recovery, and Recology to scale up operation to demonstrate the practicality of the technology [216].

GreenMantra Technologies: Established in 2010, the company constructed its first demonstration facility in Brantford, Ontario. Thanks to a series of investments by venture capital and funding from both provincial and federal governments, at the end of 2014, Green Mantra Technologies completed construction of a commercial-scale facility, also located in Brantford. The company uses a proprietary thermo-catalytic system and patented process to convert scrap plastics, including hard-to-recycle materials such as grocery bags and film, into polymers and other specialty chemicals. GreenMantra's process breaks some of the bonds to create mid-molecular-weight polymers. The existing plant's annual capacity is 5,500 tons per year. Under expansion plans, this will be increased by an additional 2,750 tons per year. The company produces synthetic waxes that can be used in a number of applications, including asphalt roofing, asphalt roads, polymer processing, and plastic composites. In addition, the company's PE and PP additives can be used in inks, coatings, and other applications as a modifier for resins and polymers.

Since 2014, GreenMantra operates one commercial facility in Brantford, which has three production lines [169]. In 2019, the company began construction of a demonstration plant at its existing manufacturing facility for a technology that converts post-consumer PS into styrenic polymers. The new plant was scheduled to be operational by the end of 2019 [217].

In 2018, Green Mantra announced the development of an allied technology that converts post-consumer PS into unique styrenic polymers. The company began construction of a demonstration plant for this technology in 2018, which is being built at GreenMantra's existing manufacturing complex in Brantford. This facility, which was expected to be operational by the end of 2019, will have an anticipated initial annual capacity of 1,100 tons per year [217].

The Closed Loop Fund invested $3 million to enable GreenMantra to double the capacity of its Brantford manufacturing facility. Sustainable Development Technology Canada (SDTC) also provided $2.2 million in funding to be used toward construction of a demonstration plant that will convert waste polystyrene into modified styrenic polymers for use in inks, foam insulation, and other applications.

IBM: IBM has developed a catalytic chemical process called Volatile Catalyst (VolCat) technology that digests PET plastics into a white powder form which can be fed directly back into plastic manufacturing machines in order to make new products. VolCat begins by heating PET and ethylene glycol in a reactor with the catalyst. After depolymerization is complete, the catalyst is recovered by distillation from the reactor using the heat of reaction. Any type of PET plastic container–clear or colored, dirty or clean–can all be used as feedstock with no preprocessing. VolCat technology separates the contaminants including food residue, glue, dirt, dyes, and

pigments from material that is useable for new PET. The technology is reportedly in the early stage of commercialization.

Loop Industries (joint venture with Indorama Ventures)**:** Founded in 2015, Loop Industries is a company based in Terrebonnne, Quebec, Canada that uses a patented depolymerization technology to recycle plastic. The company sources their feedstock (PET plastic and polyester fiber) from a wide range of sources, including waste from mechanical recyclers, thermoformers, apparel and textile manufacturers and carpet manufacturers, as well as waste management companies [122]. The company's technology, which can handle both colored and opaque PET and polyester, breaks waste plastic down into its monomers—dimethyl terephthalate (DMT) and mono ethylene glycol (MEG) – without heat or pressure. The monomers are then purified, removing all coloring, additives, and organic or inorganic impurities. From there, the DMT and MEG are repolymerized into Loop™ branded PET plastic, a virgin-quality PET plastic that can be used for FDA approved food-grade plastic packaging.

In May 2019, Loop Industries signed a deal for a $35 million investment, which will help fund its first commercial recycling facility, as part of its joint venture with plastics producer Indorama Ventures called Indorama Loop Technologies. The investment will also help fund the pre-revenue company's R&D and operations expenses [123]. The facility, located in Spartanburg, South Carolina, had been expected to produce over 45 million pounds of rPET per year, but leaders of the project are now evaluating options to increase the capacity of the plant to over 88 million pounds and expects a decision to be made by the second quarter of FY2020. The retrofitted plant is anticipated to come online during the latter half of 2020 [123].

In 2018, the company announced a multi-year supply agreement with PepsiCo that will enable the food and beverage giant to purchase production capacity from Loop's U.S. facility. Shortly after, the company also signed a multi-year supply deal with Coca-Cola, under which Loop will supply 100 percent recycled PET plastic from its Spartanburg facility in the U.S. to authorized Coca-Cola bottlers [124]. Most recently, in March 2020, Loop Industries announced it had entered into a multi-year off-take agreement to supply L'Oreal with rPET resin. Like the Coca-Cola and Pepsi Co agreements, the resin is to be supplied from the company's joint venture facility in South Carolina [125].

Pyrowave: Founded 2014, Pyrowave's patented Catalytic Microwave Depolymerization (CMD) technology breaks down plastic products, like EPS cups or food containers, back into their original compounds using small-scale modular units that can treat 400 to 1,200 tons per year on-site. According to one article, the equipment can handle plastics "with or without food contamination [218]." Pyrowave's technology produces end products such as wax and monomers that are purchased by plastic manufacturers for production of new plastics. They can then be sold back to chemical companies that reuse the monomers and waxes for FDA compliant applications. The company is headquartered in Oakville, Ontario and its R&D facility

and pilot plant is in Montreal, Quebec. It is also developing a PS closed loop model that includes adding multiple units to its current facility in Salaberry-de-Valleyfield, Quebec [169]. As of August 2018, the company had invested about $1 million of its $3 million in funding [210].

Reclaimed EcoEnergy: Reclaimed EcoEnergy is a start-up recycling company based in Newport Beach, California, that processes feedstocks into lubricants via a physical process that requires no added heat. The output of the process is pure carbon, which is combined with hydrogen to form pure organic lubricants. The company's technology accepts any organic material sources, including PET, HDPE, PVC, LDPE, PP, PS, mixed #3-7 plastics, and multilayer packaging/film. As of February 2019, Reclaimed Ecoenergy was building out their first commercial project and looking to bring to market small-scale integration with MRF facilities [169].

A.4.3 Chemical Recycling Companies – Plastic to Fuel

Table A 7 contains details of the companies that have plastic to fuel facility in pilot, pre-commercial or commercial stage.

Table A 7 Chemical Recycling Companies – Plastic to Fuel Companies

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
Agilyx Corporation Corporate Headquarters in Tigard, Oregon (U.S.)	• Commercial Stage	• MPC system can accept all types of plastic, but certain more favorable resin types and mixes generate higher oil yields and superior quality end products.	• No information available	• No information available	• End product is a synthetic crude oil that is sold to existing refineries where it is made into gasoline, diesel fuel and jet fuel, fuel oil, and lubricants.
Climax Global Energy Allendale, South Carolina (U.S.) **[169]**	• Pilot stage	• Focus on mixed #3-7 plastics but can accept all types of plastics. Feedstock can be mixed, dirty, wet. • Other feedstocks include used oils, forestry industry	• Pilot demonstration plant could process 3 tons per day.	• No information available	• Synthetic crude oil, transportation fuels, and industrial petrochemicals.

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
		by-products, and biomass.			
Ecofuel Technologies Livonia, Michigan (U.S.)	• R&D stage	• HDPE, LDPE, PP, PS, and mixed plastics	• Modular units can be scaled to handle 200-60,000 lbs. per day of plastics.	• Capital needs: $10 million	• Lubricating fluids, diesel, gasoline, aviation fuel
Fulcrum Bioenergy Pleasanton, California (U.S.)	• Early commercial stage	• Municipal solid waste (MSW) that has been pre-processed to extract commercially recyclable material and inorganic waste	• Once operational, Sierra Biofuels Plant is expected to have a capacity of 175,000 tons per year.	• Gary, Indiana facility is a $600 million project [219].	• Company uses gasification to produce syngas, followed by purification and process to convert syngas into syncrude. Syncrude is upgraded to products such as jet fuel and diesel [169].
Golden Renewable Energy Yonkers, New York (U.S.) **[169]**	• Early commercial stage	• Post-consumer and post-industrial plastics, post-recycled plastics, grades 1-7,	• Zebulon facility has a capacity of 8,000 tons per year, producing 2.0MM gallons of	• No information available	• Liquid fuel with same characteristics of #2 diesel fuel

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
		rigids, plastic film, and bags	recycled diesel per year.		
Klean Industries Vancouver, British Columbia (Canada) **[169]**	• Commercial stage	• Post-consumer and post-industrial PET, HDPE, LDPE, PP, PS, PVC, mixed #3-7 plastics, agricultural plastics, e-waste, etc.	• KleanFuels project in Vancouver, Canada will process 5,000 metric tons/year; GreenFuels in Germany will process over 35,000 metric tons/year; and the facility in Malta (which will incorporate new KleanLoop blockchain technology) will process 20,000 metric tons/year [169].	• No information available	• Refined fuels, recovered carbon black, and noncarbon filler compounds

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
New Hope Energy Tyler, Texas (U.S.)	• Early commercial stage	• All post-consumer and post-industrial waste plastics, including plastics of mixed colors. Prefer HDPE, LDPE, PP, and PS.	• 960 tons per day or 340,000 tons per year at full capacity [220]	• Total plant costs will be less than $150 million.	• Petroleum products, e.g., bunker no. 2 and no. 4, marine gas oil, home heating oil, fuel oil no. 2 and no. 4, naphtha, paraffin, and asphalt
Nexus Fuels Atlanta, Georgia (U.S.) **[169]**	• Early commercial stage	• Post-consumer and post-industrial plastics with preference for feedstock from upstream retail, commercial, agricultural, and industrial sources. System is optimized to accept HDPE, LDPE, PP, and PS and tolerates contaminants.	• 50 tons per day	• No information available	• Virgin plastics (fully circular) as well as high-grade fuels composed of gasoline, kerosene, diesel, heavy oils, and waxes.

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
Plastic2Oil Headquarters in Niagara Falls, New York (U.S.)	• Early commercial stage	• Post-commercial and post-industrial waste plastic including HDPE, LDPE, PP and other plastics. Does not accept PET and PVC.	• No information available	• No information available	• Fuel products including naphtha, fuel no. 2 (such as furnace oil or diesel), and fuel no. 6 (such as heavy fuel for industrial boilers and ships).
Renewlogy Salt Lake City, Utah (U.S.)	• Early Commercial Stage	• Post-consumer waste plastics, including mixed #3-7 plastics	• Large modules process 10 tons per day. Each module is roughly 3,000 sq. ft.	• No information available	• 70-80% of plastics that go through modules become liquid fuel product (diesel, kerosene, and light fuels), 20% becomes natural gas, which is used to heat the process.
Resynergi Santa Rosa, California (U.S.)	• Pilot stage	• Post-consumer HDPE, LDPE, PP, and PS	• Evolucient Continuous Microwave Assisted Pyrolysis (CMAP) system is modular and has	• $2 million per machine [221]	• Majority of what is produced is gasoline (70-75%) and diesel (15- 20%). Exact yield of diesel

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
			per unit capacity to process 1-5 metric tons per day of feedstock [169]		and gas varies with material and operating conditions, but about 1 kg of waste plastic can be turned into 1 liter of fuel. The remaining 5-15% is char and syngas. • Dirty plastics, such as mulch films or plastic with food waste, are converted into biochar, which can be collected and used as fertilizer. • Depending on input material and operating conditions, process can also make chemicals that can be

Company Name, Location	Stage of Maturity	Material Managed	Tonnage Range	Costs	End Products
					turned back into plastics.
RES Polyflow Headquarters in Chagrin Falls, Ohio (U.S.) **[169]**	• Early commercial stage	• Post-consumer and post-industrial PET, HDPE, mixed #3-7 plastics	• Up to 60 tons per day [222]	• No information available	• Naphtha, distillate, and paraffin wax
Sierra Energy Monterey, California (U.S.)	• Early commercial stage	• MSW and biomass, including post-consumer and post-industrial plastics	• Capacity of 22 tons per day [169]	• Capital needs: $30 million [169].	• Syngas that can be upgraded to hydrogen, diesel, and electricity end-products.

Climax Global Energy: Climax Global Energy Inc. is an alternative energy company that converts waste plastics, used oils, forestry industry byproducts, and biomass into synthetic crude oil, transportation fuels, and industrial petrochemicals using microwave energy. According to a recent report, the company completed a pilot demonstration in Allendale, South Carolina with a capacity to process three tons per day and is aiming to establish direct relationships with refineries for the off-take of their output [169].

Ecofuel Technologies Inc.: EcoFuel Technologies was founded in 2012 and is headquartered in Livonia, Michigan. The company focusses on manufacturing portable machines that convert waste plastics, specifically non-reusable, "end-of-life" plastics into diesel fuel. Shortly after forming, EcoFuel Technologies worked with James Holm to pilot a portable machine for installation on a boat. The objective of the pilot project is to pick up plastics in the ocean and convert the plastics to diesel fuel while at sea. EcoFuel Technologies is also partnering with Ocean Guardian and Ocean Recovery Systems to recover plastics from the mid depths of the ocean and convert them to fuel. EcoFuel's plastics-to-fuel units range in sizes capable of handling 200 pounds of plastics per day to multiples of 10,000 pounds per day. The units weigh around 500 pounds and the whole system can fit inside a 20-foot shipping container. Each machine costs between $1.5 million to $2 million [223].

The company has its demonstration unit in Livonia, Michigan. A second unit was sold to a non-profit in Santa Cruz, and a third one is operating in India [169]. In the long term, the company plans to partner with local entities to commercialize the technology and operate worldwide.

Fulcrum Bioenergy: Fulcrum Bioenergy has developed a global platform to produce renewable transportation fuels by building, owning and operating commercial MSW-to-fuel production plants. Company's product off-take customers include Cathay Pacific, United Airlines, Andeavor, BP, and World Fuels Services. Fulcrum's process uses MSW feedstock after it has been processed for conventional recyclables, such as cans, bottles, plastic containers, paper, and cardboard that would otherwise be landfilled. The company's first facility, the Sierra BioFuels Plant near Reno, Nevada, will be one of the U.S.'s first fully operational, commercial-scale MSW-to-renewable fuels production plants. The plant is expected to begin operations in 2020. They are currently advancing on a large development program which includes several plants that in total will produce more than 300 million gallons of transportation fuel each year. These future sites will be located at or near the source of the MSW feedstock that they currently have secured under long-term contracts. Fulcrum has constructed the Feedstock Processing Facility at the plant, which has been operational since 2016. Fulcrum is also building a Centerpoint Biofuels facility in Gary, Indiana. The plant's construction will begin in 2020 and will take approximately 18 to 24 months to complete [224].

Golden Renewable Energy (GRE): Using pyrolysis as its base, GRE has developed and commercialized a proprietary process implemented in its Recycled Fuel Production Unit that

converts mixed waste plastics and other waste materials into commercial fuels. GRE's core business is to own, install, and operate a network of facilities to localize the recycling of waste plastics. GRE is already in operation in North Carolina and is currently developing multiple sites in the U.S. and abroad. GRE's technology is capable of handling various waste streams that are generated by medium to large metropolitan areas and companies producing varied (not mixed) plastics, including: post-consumer plastics, post-industrial plastics, post-recycled plastics, mixed plastics, rigids, and plastic film and bags.

The company currently owns and operates one facility in Zebulon, North Carolina (U.S.) and is developing multiple sites in the U.S. and abroad. As of March 2019, the facility in North Carolina was being converted into an assembly plant to build at least five more units.

Klean Industries: Klean Industries designs and develops facilities that convert waste plastics into oils. According to the company's website, the system uses a continuous liquefaction technology that indirectly heats plastic waste and a catalytic reaction to generate hydrocarbon gases, which are then cooled and condensed to produce ASTM spec diesel as well as a proprietary blend of heating fuel. Its plants can produce approximately 950 liters of diesel fuel from each tonne of waste plastic. The company also claims that different polymers can be processed together without any sorting and that typical contaminants such as grit, paper, metal, and food residue do not need to be removed prior to treatment. Klean's system can accept high loads of PVC and PET along with polyolefin plastics without damaging the reactor. The company's technology originates in Japan and has been in commercial operation for over 20 years [129]. In Canada, Klean has an operating plastic-to-diesel facility in British Columbia, which processes 100 metric tons per day (33,600 tons per year) [225].

Klean has over 16 operational plastics recycling facilities around the world. The Sapporo Plastic Recycling plant in Hokkaido, Japan, which was installed in 1999, was designed as a commercial scale flagship facility. In addition to its existing facilities, Klean has over 15 active projects for new plastics recycling facilities including one in Vancouver, B.C., one in Germany, and one in Malta. The company is planning to roll out more facilities in North America and Europe [169].

New Hope Energy: Founded in 2013, New Hope Energy is a plastic conversion company that uses a patented and proprietary pyrolysis process to convert HDPE, LDPE, PP, PS plastics into a synthetic crude that has the same composition as petroleum crude. The end product can be used interchangeably as crude oil. The process doesn't use water and doesn't create byproducts. In 2008, New Hope Energy commissioned the Trinity Oaks facility in Tyler, Texas. As of March 2019, the company was expanding this facility and was in the initial stages of production and continuing to conduct additional R&D related to technology and product development [169]. At full capacity (expected in 2020), the plant will be capable of processing 960 tons per day or 340,000 tons per year, and produce over 4,500 bbl per day of renewable synthetic fuels and

plastic feedstocks [220]. The process has yet to be fully commercialized beyond the Trinity Oaks plant.

Nexus Fuels: Founded in 2013**,** Nexus Fuels is a commercial-scale waste management and energy production company based in Atlanta that converts waste plastics into feedstocks for plastics production and fuels, which can be converted back to virgin plastics through molecular recycling and refined into a range of products. The company operates a commercial plant scaled rom a successful pilot in Atlanta, Georgia. It has the capacity to process 50 tons of liquid plastic waste each day at its facility and sold 75,000 gallons, or about 2,300 tons, of pyrolysis to global customers so far [226]. In late 2019, Nexus announced that it was providing Shell with liquid feedstock derived from plastic waste [227]. The company recently supplied its first cargo of pyrolysis liquid to Shell's chemical plant in Norco, Louisiana where it was made into chemicals that are the raw materials for everyday products [227].

Plastic2Oil: The company has three operational facilities in the U.S. and it's primary feedstocks include post-commercial and post-industrial waste plastic, including unwashed, unsorted waste plastic, composites, and commingled plastic materials. Optimal plastic feedstock types include HDPE, LDPE, PP, and #7 "other" plastics. After the plastic has been liquified in the pre-melt reactor, it passes through a solids-liquids separator before going into the main reactor, where the liquified plastic hydrocarbons are "cracked" into various shorter hydrocarbon chains and exit in a gaseous state. The processor requires only 4,500 square feet of operating space. It is highly automated with a very low operator to processor ratio and has a modular design, which allows for easy deployment. The conversion ratio for waste plastic into fuel averages 86 percent. End products include a range of liquid fuel products which do not require further refining. No. 6 fuel produced by the Plastic2Oil process is the company's cleanest product. Other products include No. 2 fuel (diesel, petroleum distillate), naphtha, and petcoke (carbon black).

Renewlogy: Renewlogy was founded in 2011 at the Massachusetts Institute of Technology (MIT). Using a proprietary chemical recycling process, Renewlogy converts non-recycled plastic waste back into its basic molecular structure. The company can accept mixed and dirty plastic feedstock. Renewlogy's large modules, which can be directly installed at waste management sites, process 10 tons of plastic waste per day. About 70 to 80 percent of the plastic becomes a liquid fuel product. The company makes diesel, kerosene, and light fuels and about 20 percent of the plastic becomes natural gas, which is used to heat the process.

In 2018, Renewlogy successfully completed cold and warm commissioning of a large-scale plastic conversion system in Salt Lake City before transporting it to Chester, Nova Scotia, to be used by Canadian waste company Sustane Technologies. The Sustane facility is a 70,000-tons-per-year mixed waste processing facility that is intended to produce 35,000 tons per year of biomass pellets from the organic and paper fraction of the waste stream and 3.5 million liters

per year of diesel fuel from the plastic fraction of the waste stream (using Renewlogy technology), an aggregate product, and recovered metals for recycling.

In 2019, Renewlogy was awarded a contract from the City of Phoenix, Arizona to process its mixed #3-7 plastics. The project, "Renew Phoenix", which is a joint venture with Generate Materials Recovery (GMR), involves building a facility to process the materials on the city's Resource Innovation Campus [228]. At full production, the project is expected to divert 10 tons of mixed plastics from landfill per day, equating to 60 barrels of liquid fuel.

Most recently, the company is embarking on a project, sponsored by National Geographic, to target river plastics. This project, which will take place in India, will use reverse vending machines that issue coupons to local collectors in exchange for plastic waste. According to one article, a scaled-down mobile and off-grid version of the system will be able to process one ton of the collected material daily, making diesel products [228]. The company currently has two facilities, including a demonstration facility in Salt Lake City, Utah, and a large-scale facility in Chester, Nova Scotia, Canada.

Renewlogy also has a number of commitments in other cities across North America as well as projects in Asia [169]. In addition to licensing its technology, the company is organizing grassroots efforts to gather and process plastic that is not normally collected for recycling as part of the Hefty Energy Bag Program. Through this program, which started in 2018, residents in a number of U.S. cities (including Boise, Idaho; Omaha, Nebraska; and Lincoln, Nebraska) can put plastics #4-6 in their regular recycling bins using special orange bags, which are then separated at the recycling facility and sent to Renewlogy's Salt Lake City plant for processing [229].

Resynergi: Located in California, the company provides compact and portable systems that convert unrecycled waste plastic into usable fuels and other products. The company is currently operating out of Washington and California. They also have a small-scale mobile ocean litter plastics processing project with the Ocean Legacy Foundation in Vancouver, B.C. The company's Evolucient Continuous Microwave Assisted Pyrolysis (CMAP) system is modular and has a per-unit capacity to process one to five metric tons per day of feedstock [169]. Currently, Resynergi's system can process HDPE, LDPE, PP, and PS. Resynergi portable systems measure 40 feet by 9 feet and are worth about $2 million each. The company claims that each ton of plastic fed into the machine produces about 200 gallons of fuel [221]. Seventy to 75 percent of what is produced is gasoline and 15 to 20 percent is diesel. The remaining 5 to 15 percent is comprised of char and syngas. Depending on the input material and operating conditions, Resynergi's pyrolysis process can also be used to make chemicals that can be turned back into plastics.

In September 2019, Resynergi announced that it was partnering with CannaCraft Inc., a large-scale cannabis manufacturer, to launch a pilot program aimed at converting the plastic

packaging from cannabis products into fuel that will be used to power Kind House Distribution vehicles, CannaCraft's distribution arm [230].

RES Polyflow: Established in 2011, Ohio-based RES Polyflow specializes in handling hard-to-recycle categories of plastic waste, ranging from tires and carpet to mixed plastics. The company's process is optimized for recycling very common but complex materials such as partially filled ink and toner cartridges, contractor buckets with dried paint residue, layered packaging film, and automotive shredder residue. The ability to accept a mixed stream of materials eliminates the need for repeated sorting. For higher volume feedstocks, multiple RES Polyflow process vessels can be installed in parallel with shared feed-in and product removal sub-systems. The company is currently working with an aggregator in Chicago for its feedstock.

RES Polyflow's patented energy recovery technology thermally deconstructs hydrocarbon-based materials and converts it into new molecular structures that can be marketed as transportation fuels as well as feedstocks for new polymer production. The finished product generated by the RES Polyflow process is a light liquid that is marketable to a variety of industries. Known as pygas, this stream is equivalent in quality and consistency to benchmark crude oil and can be tailored to the specific requirement of an off-take customer. Diesel fuel, octane enhancers, and gasoline blend stocks can also be produced.

The company has one demonstration plant that operated in Perry, Ohio and is building a commercial plant incorporating four commercial units in Ashley, Indiana with each conversion vessel having a capacity of 6,000 pounds per hour. The facility in Ashley, Indiana, is being retrofitted to produce 1,600 bbl of diesel fuel and naphtha blend stocks per day [169].

In April 2019, renewable energy development company Brightmark Energy closed a $260 million financing package for the construction of the U.S.' first commercial-scale plastics-to-fuel plant, which will be based in Ashley, Indiana. As part of the financing closure, Brightmark became the controlling owner of RES Polyflow. The Brightmark Energy Ashley Indiana plant will have the annual capacity to process 100,000 tons of plastic into 18 million gallons of low-sulfur diesel and naphtha blend stocks, as well as five million gallons of wax. It is reported that BP will purchase the fuels produced by the facility, which will be distributed in the regional petroleum market. The plant will also produce commercial grade waxes for sale to the industrial wax market, which will be purchased by AM WAX [231].

Sierra Energy: Since 2004, Sierra Energy has focused on the development of FastOx gasification, a technology that turns trash into energy without burning. Sierra Energy's commercial facility is in Monterey County, California (U.S. Army Garrison Fort Hunter Liggett Project). The company continues to advance its technology and test new applications for gasification at the Sierra Energy Research Park in Davis, California [232]. While the combinations of waste types needed to optimize energy production may change, almost any type of waste is acceptable. This

includes: MSW, biomass, auto shredder residue (ASR), railroad ties, medical waste, hazardous waste, tires, construction and demolition waste, industrial waste, and more. The only type of waste not recommend for processing is radioactive waste.

The company has received grants from both the State of California and the U.S. Army. Specifically, the Department of Defense invested $3 million into the project (as part of the U.S. Army's net-zero waste initiative) and the California Energy Commission invested $5 million [233].

A.4.4 Blockchain

End of Waste Foundation*:* End of Waste Foundation (EOW) is a California-based startup launching a blockchain platform that will track material from haulers to MRFs to processors to manufacturers. This will result in a certificate verifying tonnage (valued at $70 per ton), path to recycling, and GHG emissions offset once the loop is complete. Certificates can be purchased or partially funded by generators and others in the value chain. Up to $35 per ton will be shared among each entity involved from haulers to manufacturers. A minimum of $20 will be dedicated to R&D. The remainder stays with EOW as a management fee. EOW is focusing on glass initially and its first official industry partner is Colorado-based Momentum Recycling. Paul Dolan Vineyards and others have also signed on. The Foundation projects it can help achieve a 75 percent glass container recycling rate in the U.S. by 2030 if the concept is successful [234].

Traca: A distributed ledger technology (DLT) based tool for waste supply chain documentation. Traca is currently working with British digital logistics firm Marine Transport International to deploy a blockchain solution for recycling waste. Recycling companies can share forms and data quickly and securely with producers, regulators, and end destinations, increasing efficiency and saving money and time for the stakeholders across the supply chain.

Treum: Treum specializes in blockchain-based supply chain solutions that help build trust between businesses and customers. In addition to the traceability and transparency inherent in their solutions, Treum has the functionality to allow organizations to the ability to tokenize non-fungible assets and allow them to be held, purchased, exchanged, and traded [235].

A.5.0 CSSA Producer List

Legend:
R = Resident Steward
V= Voluntary Steward (Non-resident)

About This List (Disclaimer):
This list represents all businesses that have registered with either Recycle BC, MMSW, MMSM, or Stewardship Ontario, whether resident or voluntary. Stewards should also rely on their own vendor records to determine if their suppliers are resident in an applicable province.

Date of Issue: Jan 16, 2020

Table A 8 CSSA Producer List

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
0881380 BC LTD	R			
0976288 B.C. LTD.	R			
1004841 Ontario Ltd				R
1147785 Ontario Ltd.				R
1377041 Ontario Inc.				R
1461043 Ontario Ltd. o/a NUVO Iron				R
149563 Ontario Inc.				R
1526220 Ontario Inc. dba Dai Jung				R
2 Ameriks Inc.	V			V

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
2001 Audio Video				R
2062233 Ontario Inc o/a ManleySales				R
2179825 Ontario Inc				R
2645278 Ontario Inc.	R		R	R
3M Canada Company	R	R	R	R
407ETR Concession Company Ltd.				R
429149 BC lts dba Quilts Etc			R	
4898789 Manitoba Ltd.			R	
7-Eleven Canada, Inc.	R	R	R	R
9371427 Canada Inc.	R	R	R	R
991909 Ontario Inc.				R
A&W Food Services of Canada Inc.	R	R	R	R
A. Bosa & Co. Ltd.	R			
A. LASSONDE INC.	R	V	V	R
A.E. Mckenzie Co ULC	R	V	R	R
A.J. Floral Wholesale	R			
A.M. Jensen Ltd & Wilton Cheese				R
A.W. Jantzi & Sons Ltd.				R
AA Pharma Inc.	V	V	V	R
ABB Electrification Canada ULC				R
Abbott Laboratories Co, c/o	R		R	R
Abbott Laboratories Co.	R	V	V	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Abbott of England				R
AbbVie Corporation	R		V	R
Absorbent Products Ltd	R			
Abundance Naturally				R
Accent-Fairchild Factory Group				R
Access Credit Union			R	
ACCO Brands Canada LP dba HILROY			V	R
Acer America Corporation	R	V	V	R
ACH Food Companies Canada	V	V	R	R
ACI Brands Inc				R
Acme United Limited	V			R
Active Green + Ross Tire &				R
Activision Canada Inc.				R
Acuity Brands				R
Acushnet Canada Inc	R	R	R	R
Adenat Inc				R
Adera Development Corporation	R			
Adidas Canada Limited	R	R	R	R
ADONIS GROUP Inc.				R
Aerus Canada Inc.				R
Affinity Credit Union		R		
African Lion Safari & Game Farm				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
AG Professional Hair Care Products	R			
AGF Management Limited	R		R	R
AgReliant Genetics Inc.				R
Agronomy Company of Canada Ltd.				R
Agropur Coopérative	R		R	R
Air Canada Vacations (Touram)	R		R	R
Air King Limited				R
Airway Surgical Appliances Ltd	V	V	V	R
Alasko Foods Inc.	V			R
Alcon Canada Inc.	V	V	V	R
Aldergrove Credit Union	R			
Aldershot Greenhouses LTD				R
Alectra Utilities Corporation				R
Alexanian Flooring Limited				R
Algoma Orchards Ltd				R
Algonquin College of Applied Arts &				R
ALIMENTS FONTAINE SANTE INC				R
ALIMENTS OUIMET-CORDON BLEU INC				R
A-LINE ATLANTIC INC				R
All Treat Farms Ltd				R
Allan Byers Equipment Limited				R
Allegion Canada Inc				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Allergan, Inc. (Canada)	R	R	V	R
Alliance Agri-Turf Inc.				R
Alliance Mercantile Inc.	R			R
Alpine Credits Limited	R			
Altex Inc.				R
Althon Inc.				R
AluminArt Products Ltd				R
Amazon Canada Fulfilment Services,	R			R
Amco Produce Inc.				R
Amer Sports Canada Inc	R			R
American Eagle Canada Inc	R	R	R	R
American Nutrition Inc.				R
Ameriwood Industries Inc.				R
Amex Bank of Canada				R
AMG Medical Inc.	R			
Amlite Lighting				R
AMRE SUPPLY (ONTARIO) LIMITED				R
Amsoil Inc.				R
Amway Canada Corporation	V	V	V	R
Andersen's Nursery Ltd	R			
Anderson Watts Ltd.	R	V	R	R
Andrew Hendriks & Sons Greenhouses				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Andrew Peller Ltd	R			
Angel Seafoods Ltd	R			
Anglo Oriental limited				R
Angus Inc.				R
Anitas Organic Grain & Flour Mill	R			
Ann Canada Inc.	R			R
Ann-Louise Jewellers Ltd.	R			
Anytime Fitness, LLC			R	R
AO Smith Enterprises Ltd.				R
Apex Branded Solutions Inc	V		V	R
Aphria Inc.	R			R
APO Products Ltd.				R
Apotex Inc.	R	R	R	R
Apple Canada Inc.	R	R	R	R
Appleshore Restaurants Inc.				R
Aquaterra Corporation Inc				R
Aquilini Development and Const.	R			
Aralez Pharmaceutical Canada Inc.				R
Arbor Memorial Services				R
Arby's Restaurant Group Inc	R	R	R	R
ArcelorMittal Dofasco				R
Arch Chemicals Inc.			V	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Arc'teryx Equipment	R			R
Arctic Glacier Canada Inc.			R	R
Arden Holdings Inc.	R	R	R	R
Aritzia LP	R		R	R
Arla Foods Inc	R	V	V	R
Arlo Technologies Canada Limited	R			
Armacell Canada Inc.	V	V		R
Armstrong Milling Company				R
Army & Navy Dept. Store Ltd.	R			
ARRIS Canada				R
Art Knapp	R			
ARYZTA Limited				R
ARYZTA Ltd (Gourmet Bake Inc).	R			
Ascensia Diabetes Care Canada Inc.	R	R	R	R
Ash Apiaries Ltd			R	
Askew's Food Service Ltd	R			
Askew's Foods (Sicamous) Ltd	R			
ASM Canada - Sales & Logistics Solu	R			R
ASM Canada Inc	R	V	V	R
Assiniboine Credit Union			R	
Associated National Brokerage Inc.	V	V	V	R
Associated Veterinary Purchasing	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
ASTELLAS PHARMA CANADA INC				R
AstraZeneca Canada Inc.	V	R	R	R
ATKINS NUTRITIONALS INC.	R	V	V	R
Atlantia	R			
Atlantic Packaging Products Ltd				R
Atlantic Promotions Inc				R
Atlas Graham Industries Company			R	
ATRON ELECTRO INDUSTRIES INC.	V	V	V	R
Aurora Cannabis Enterprises Inc.	R	R		R
Aurora Importing & Distributing	V			R
Auto Control Medical	V		V	R
Avalon Dairy Ltd	R			
Avaria Health & Beauty Corp				R
Aviso Wealth	R		R	R
Aviva Canada Inc.	R		R	R
Avondale Stores Limited				R
AW Holdings Corp	R	R	R	R
AWC Canada LLC				R
AZ Trading Co. Ltd.	R			
Azuma Foods (Canada) Co., Ltd.	R			R
B & G Foods Canada, ULC	V	V	R	R
B.Y. Group Ltd.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Bad Boy Furniture Warehouse Ltd.				R
BAG TO EARTH INC	R			R
Baird MacGregor Insurance Brokers				R
BakeMark Canada	R		R	R
BalancePlus Sliders Inc.				R
Ball, Bounce and Sport (Canada) Inc				R
Ballantry Homes				R
Bank of Montreal	R	R	R	R
Bank of Nova Scotia	R	R	R	R
Bardon Supplies Limited				R
Barouh Eaton Canada Ltd.				R
BARRYMORE FURNITURE CO.				R
Bartim Industries Limited				R
Basalite Concrete Products	R			
Basics Office Products Ltd.	R			R
Baskits Inc.				R
Bass Pro Canada ULC	R			R
Bath and Body Works (Canada) Corp	R	R	R	R
Bath Fitter Distribution Inc.				R
Bausch Health, Canada Inc.	V	V	V	R
Baxter Corporation				R
Bayard Canada	V	V	V	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Bayer Inc	R	R	R	R
Baywood paper ULC				R
BC Assessment	R			
BC Fresh Vegetables Inc.	R			
BC Housing	R			
BC Hydro	R			
BC Lions Football Club Inc.	R			
BC MOE	R			
BC Transit	R			
BC Tree Fruits Cooperative	R			
BD Canada Ltd	R	R	R	R
Beachcomber Hot Tubs Inc	R			R
BEAN SPROUT KING	R			
Bearskin Airlines				R
Beausejour Tire Ltd.			R	
Beauty Systems Group (Canada) Inc.	R	R	R	R
BeaverTails Canada Inc.	R			R
Becton Dickinson Canada Inc	R		R	R
Bed Bath & Beyond Canada L.P.	R	R	R	R
Beddington's Bed & Bath				R
Bee Maid Honey Limited			R	
Behr Process Canada Ltd				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Behr Process Canada Ltd.	R			
Beiersdorf Canada Inc	V	V	V	R
Belcam Inc	V	V	V	V
Belich's Market Ltd.	R			
Bell Administration	R	R	R	R
Bell Billing	R	R	R	R
Bell Lifestyle Products Inc				R
Bell Marketing	R	R	R	R
Bell Mobility	R	R	R	R
Bell Residential Services	R	R	R	R
Bellisio Food Canada	V	V	V	R
Belmont Meat Products Ltd.	R			R
Benjamin Moore & Co., Limited	R	R	R	R
BenQ Canada Corp	R			R
Bentley Leathers Inc.			R	R
Bento Nouveau	R		R	R
Bergen Farms Berries Ltd	R			
Bernardin Ltd				R
Best Buy Canada Ltd	R	R	R	R
Bevo Farms Ltd.	R			
BG Health Group Inc.	R			
BGP Pharma ULC	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
BIC INC.	R	V	V	R
Big Mountain Foods	R			
Bioforce Canada Inc.	V	V	V	V
Biogen Canada Inc.				R
Birks Group Inc.	R		R	R
Biscuits Leclerc Ltee				R
Bissell Canada Corporation			V	R
BK Canada Service ULC	R	R	R	R
Blanco Canada Inc.				R
Blenz the Canadian Coffee Company	R			
Blinds To Go Inc.				R
Blissco Holdings Ltd	R			
Blistex Ltd	V	V	V	R
Bloomstar Bouquet	R			R
Blue Jays Holdco				R
Blue Line Distributing of Canada				R
Blue Ruby Jewellery	R			
BlueShore Financial	R			
Bluewater Power Distribution Corp				R
BMS Enterprises				R
BMW Canada Inc.	R		R	R
Boathouse Row Hamilton Inc-o/a	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
BOATsmart! Canada				R
Bob Bannerman Motors Limited				R
Body Plus Nutritional Products Inc.	R			R
Boehringer Ingelheim Canada Ltd.	R	R	R	R
Boiron Canada Inc.	V			
Bolt Mobile		R		
Bonchaz Bakery Cafe Inc.	R			
Bonduelle Canada Inc	R			R
Bonnie Togs				R
Borgfeldt (Canada) Limited			R	R
BOSE LIMITED	R	V	V	R
Boshart Industries Inc.	V			
Boston Pizza International Inc.	R	R	R	R
Botanical PaperWorks Inc.			R	
Bothwell Cheese Inc.			R	
Boucher & Jones Inc.				R
Boulangerie Vachon Inc.	V	V	V	R
Boutique La Vie en Rose	R	R	R	R
Boys'Co	R			
Bradford Greenhouses Limited				R
Bradley Air Services Limited				R
Brandon Bearing Ag &			R	

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Brandon Photographics foto source			R	
Brandon University			R	
BRANDS UNLIMITED TRADING INC	V			
Branthaven Homes 2000 Inc				R
Brar Natural Flour Milling BC Inc.	R			
Brazilian Canadian Coffee Co. Ltd				R
Breka Bakery & Cafe Inc	R			
Bremner Foods Ltd	R			
Brentwood Classics Ltd.				R
Breville Canada L.P.	R	V	R	R
BRG Sports				R
Bridgestone Firestone Canada Inc				R
Briggs & Stratton Canada Inc.				R
Brigham Enterprises Inc				R
Bristol Myers Squibb Canada Co	R	R	R	R
British Columbia Automobile Associa	R			
British Columbia Ferry	R			
British Columbia Lottery Corporatio	R			
British Columbia Pension Corporatio	R			
Brock University				R
Brockmann's Chocolate	R			
Bron and Sons Nursery Inc	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Brother Intl Corp (Canada) Ltee			R	R
Browns Restaurant Group	R	R	R	R
Browns Shoes Inc.	R		R	R
BRT Group of Companies				R
Brum's Dairy Ltd.				R
BSH Home Appliances Ltd.	R		R	R
BSN Medical Inc		V	R	R
Buckwold Western Ltd.			R	
Budd Stores Co Ltd				R
Buddy's Kitchen, Inc.	R			
Build-A-Bear Workshop Inc.	R		R	R
Building Products of Canada Corp				R
Bulk Barn Foods Limited	R	R	R	R
Bulkley Valley Credit Union	R			
Bulova Watch Company Limited				R
Burberry Canada Inc.	R			R
Burgham Sales Ltd.				R
Burlington Hydro Inc.				R
Burnaby Lake Greenhouses	R			
Burnbrae Farms Ltd.	R		R	R
Bush Brothers & Company	V	V	V	R
Bushnell Corporation				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Busy Bee Tools				R
Buy-Low Foods LP	R	V		
B-W Feed & Seed Ltd.				R
Bylands Nurseries Ltd.	R			
C & C Growers Inc	R			
C&E Overseas Ltd.	R			R
C. B. Powell Limited	V	V	V	R
C.W.Shasky & Associates				R
CAA Club Group				R
CAA Manitoba			R	
CAA Saskatchewan		R		
Cabela's Retail Canada Inc.	R	R	R	R
Cactus Club Cafe	R	R		
Caframo Limited				R
Calendar Club of Canada Inc	R	V	R	R
Caleres Canada Inc.				R
California Innovations				R
Calkins & Burke Ltd.	R		V	
Campbell's Company of Canada	V	V	V	R
Canada Bread Company, Limited	R	R	R	R
Canada Cutlery Inc				R
Canada Dry Mott's Inc	R	V	V	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Canada GardenWorks Ltd	R			
Canada Garlic Importing Inc.				R
Canada Wide Media Limited	R			
Canadelle Limited Partnership	V		V	R
Canadian Cartographics Corporation				R
Canadian Choice Wholesalers	R			
Canadian Drapery Hardware Ltd				R
Canadian Geographic Enterprises	V	V	R	R
Canadian Hickory Farms Ltd				R
CANADIAN HOME PUBLISHERS	R			R
Canadian Medical Association				R
CANADIAN POSTERS INTERNATIONAL				R
Canadian Thermos Products Inc	V	V	V	R
Canadian Tire Corporation LTD	R	R	R	R
Canadian Valley Growers Ltd.	R			
CANADIAN WESTERN BANK GROUP	R	R	R	
Canadian Woodworking/Sawdust Media	V	V	V	R
Canafric Inc.				R
Canaren Inc.				R
Canarm Ltd.				R
Can-Cell Industries Inc.			R	
Canda Six Fortune Enterprise Co.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
CANDA SIX FORTUNE ENTERPRISE CO. LT	R			
CanMar Foods Ltd.	V			
Cannor Nurseries Ltd.	R			
Canon Canada Inc	R	V	R	R
Canpressco Products	V			
CanPrev Natural Health Products Ltd				R
Can-Rad Beauty Limited			R	R
CanRoof Corporation				R
Canterbury Coffee Corporation	R	V	V	
Canus Goat's Milk Skin Care Product	V	V		V
Capespan North America				V
Capilano Suspension Bridge Ltd	R			
Capital One Bank	R	V	V	R
Caplan Industries Inc	R			R
Card Health Care	V	V		R
Cardinal Meat Specialist Limited	R			R
CARDONE Industries Inc.				R
Care Holdings Inc.	R	V	V	R
Carillon Decorative Products Inc				R
Carleton University				R
Carlson Wagonlit Travel			R	R
Carlton Cards Limited	R		V	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Carpathia Credit Union			R	
Carquest Canada Ltd				R
CASA CUBANA/SPIKE MARKS INC.	R		R	
CASCADES GROUPE TISSU			R	R
Cascades Tissue Group				R
Cascades Tissue Group	V			
CASIO CANADA LTD				R
Casper Sleep, Inc.				R
Castle Cheese (West) Inc.	R			
Castlegate Logistics Canada Inc.	R			R
Catalina Lighting Canada				R
Catelli Foods Corporation	R	V	V	R
Caulfeild Apparel Group Ltd.				R
Cavendish Farms	R			R
Cawston Cold Storage Ltd.	R			
Cayne's Super Housewares				R
CCL Industries, Inc.				R
CDREM Group Inc.				R
CDSPI				R
CDW Canada Inc.				R
Celgene			R	R
Centennial College Appl Arts				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Centennial Food Service	R			
Centoco Plastics Limited				R
Central 1 Credit Union				R
Central Beauty Supply Ltd.				R
Central Lumber Limited				R
Centura Brands Inc	V	V		R
Century 21 Canada LP	R			
Ceratec inc.			R	R
Certainteed Canada Inc	R	V	R	R
CFM Greenway Home Products				R
CGC Inc.				R
Chairman's Brands		R	R	R
Champ's Mushrooms Inc	R			
CHANEL Inc	R	V	R	R
Charlescraft Partnership				R
Charm Jewelry Limited	R	R	R	R
Chartered Professional Accountants				R
Chartwell Industries (Canada) Ltd.				R
Chatters Limited Partnership	R	R	R	R
Checkers Cleaning Supply				R
Chefs Plate Inc.	R			R
CHELTEN HOUSE PRODUCTS, INC	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Chenchiam, Inc.	R			
CHERISON ENTERPRISES INC.				R
Cherry Hill Coffee	R			
Chicken Chef Canada Ltd.			R	
Chicken Delight of Canada Ltd			R	
Chiovitti Banana Co., Ltd.				R
CHO AMERICA	V	V	V	V
Choice Hotels Canada Inc	R			
Choices Markets	R			
Chudleigh's Ltd.				R
Church & Dwight Canada	V	V	V	R
CIBC Head Office - 09902	R	R	R	R
Cinema 1 Inc				R
Cineplex Entertainment Ltd Part	R	R	R	R
CinnabarValley Farms Ltd	R			
Cinnagard Inc				R
Cinnzeo	R			
Cintex International Cda Ltd				R
Citi Cards Canada, Inc				R
Citizen Watch Company Of Canada				R
City Bread Co Ltd			R	
City of Barrie				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
City of Elliot Lake				R
City of Greater Sudbury				R
City of Hamilton				R
City of London				R
City of Regina		R		
City of Saskatoon		R		
CITY OF WINDSOR				R
CKF Inc.	R	V	R	R
Claire's Stores Canada Corp.	R	R	R	R
Claridge Community Newspapers Ltd.				R
Clarins Canada Inc	V		R	R
Clean Life Sciences	R			
Clearview Horticultural Products	R			
Clover Leaf Cheese Ltd.	V			
Clover Leaf Seafoods Company	R	V	V	R
Cloverdale Paint Inc.	R		R	R
CN Tower				R
Coach Stores Canada Corporation	R			R
Coach Stores Canada, Inc	R		R	R
Coalision Inc.	R	R	V	R
Coast Capital Savings Credit Union	R			
Coastal Community Credit Union	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
COATS & CLARK CANADA INC.	V	V	V	R
Coca-Cola Canada Bottling Limited	R	R	V	R
Cogeco Connexion Inc.				R
Colasanti Farms Ltd				R
Colgate-Palmolive Canada Inc	V	V	V	R
College of Licensed Practical			R	
Coloplast Canada Corporation			R	
Columbia Sportswear Canada LP	R			R
Comag Marketing Group				R
Combined Insurance Co of America		R	R	R
Comet Strip Ent. Ltd.			V	
Commercial Bakeries Corp				R
Commonwealth Home Fashions Inc	V	V	V	R
Community Savings Credit Union	R			
Compass Credit Union Ltd.			R	
Compass Minerals Canada Corp.		R	R	R
ConAgra Foods Canada Inc.	R	R	R	R
Conair Consumer Products Inc	R		V	R
Concentra Bank		R	R	R
Concord Premium Meats Ltd.	R			R
Concord Sales Ltd	R			
Conestoga College ITAL				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Conexus Credit Union 2006		R		
Confederation College				R
Conglom Inc.	R	V	V	R
Connoisseur's Kitchen Inc.	R			
Conros Corporation				R
Continental Cosmetics Ltd				R
Continental Imports Limited				R
ContiTech Canada, Inc				R
Cooper Industries Canada				R
Coppa's Fresh Market				R
Copperside Foods Ltd.	R			
Corel Corporation				R
Corelle Brands (Canada) Inc.	V			R
Corinthian Distributors Ltd.	R			
Cornerstone Credit Union		R		
Cosmo Communications				R
Cosmo Music Co. Ltd				R
Costco Wholesale Canada Ltd.	R	R	R	R
Cottage Life Media	R			R
Cougar Shoes Inc				R
CounselTron Ltd.	V		V	R
Country Home Candle Co. Inc.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Countryside Farms Ltd	V	V	V	V
County of Oxford				R
CR Plastic Products Inc				R
Crate and Barrel Canada Inc.	R			R
Crate Designs Ltd.				R
Crayola Canada	V	V	V	R
CRE CANADA INC.				R
Create A Treat Ltd				R
Credit Suisse Securities (Canada),				R
Creekside Custom Foods	R			
Crofters Food Ltd.	V			R
Cronos Group Inc.	R			R
Crosby Molasses Co Ltd	V			
Crossroads Credit Union		R		
Crosstown Civic Credit Union			R	
CSM City Sheet Metal Co Ltd			R	
CTG Brands Inc.	R			R
Cuddle Down Products Ltd.				R
Curry's Art Store Ltd.				R
Curtis International Ltd	V	V	V	R
Curtis Investments Ltd.			R	
Custom Building Products	R			R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Custom Leather Canada Limited				R
Cutler Forest Products				R
Cypress Credit Union Limited		R		
D & H Canada ULC	R			R
D & L Sales Ltd				R
D Dutchmen Dairy Ltd.	R			
D V I Lighting Inc				R
D&G Laboratories Inc.	V	V		R
D&M Canada Inc				R
D.O.T. Furniture Limited				R
D+H				R
Dainty Foods				R
Dairy Farmers of Ontario				R
Dairy Queen Canada Inc.	R	R	R	R
Dakota Trading Corporation	V			
Danby Products Ltd	V	V	V	R
Dan-D Foods Ltd	R			
Daniel Le Chocolat Belge	R			
DaNone Inc	R	R	V	R
DAP Canada	V	V	V	R
Dare Foods Limited	R	R	V	R
Dare Products Inc			V	

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Dart Canada Inc.	R			R
Darvonda Nurseries Ltd.	R			
Dashwood Industries Ltd.				R
Dauphin Herald			R	
Dauphin Plains Credit Union			R	
David Chapman's Ice Cream Ltd.	V	V	R	R
David Oppenheimer & Associates Gene	R	V	V	R
DAVIDsTEA Inc	R	R	R	R
Daybreak Farms	R			
DB Canadian Franchising ULC	R			R
DeBest Gourmet Food Products				R
DeFehr Furniture (2009) Ltd			R	
Delca Enterprises Ltd	R			
Dell Canada Inc.	R	R	R	R
Denise & Company				R
Derlea Brand Foods Inc.				R
Dermalogica (Canada) Ltd.	R		R	R
Desert Spring Eco-Products Ltd.				R
Desjardins Financial Security				R
Devonshire Industries	V	V	V	V
DeVry Greenhouses Ltd.	R			
Dexcom Inc.	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
DGM SALES LIMITED				R
Diamond North Credit Union		R		
Diana Dolls Fashions Inc.				R
Diana's Seafood Delight Inc	R			R
Dimpflmeier Bakery Limited				R
Direct Energy				R
Direct Response Media Group Inc.				R
Direct Target Promotions				R
Direct Value Wholesale	R			
Directions East Trading Ltd				R
Directplus Foodgroup	R	R	R	R
DirectWest		R		
Discovery Islands Organics Ltd.	R			
Disney Store Canada Inc.	R		R	R
Distinctive Appliances Inc				R
Diva International Inc	V		V	R
Dixon Ticonderoga Inc.	V		V	R
D-Link Canada Inc.				R
DM Cakes Etc	R			
Dole Packaged Foods Company	V	V	V	R
Dollar Tree Stores Canada	R	R	R	R
Dollarama L.P.	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
DOM International Ltd.	V			R
Dominican College of Philosophy &				R
Domino's Pizza LLC	R	R	R	R
Domtar Inc	R	R	R	R
Donald's Fine Foods	R			
Donmar Foods Incorporated				R
Dorel Industries Inc -				R
Dormer Laboratories Inc.				R
Dorplex Industries Limited				R
Double Happiness Foods (2007) Ltd.	R			
Dovre Import & Export Ltd	R			
Downtown Camera Ltd.				R
Dr. Oetker Canada Ltd	R	V	V	R
Dufflet Pastries				R
Dundas Jafine Inc.				R
Dundee Corporation				R
Dundee Precious Metals Inc.				R
Dundee Securities Corporation				R
Dunn-Rite Food Products Ltd.			R	
Duracell Canada Inc.	V	V	V	R
Duraflame	V			
Dural, Division of Multibond Inc.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Durham College and UOIT				R
Dusos Fresh Pasta	R			
Duststop Air Filters Inc	V	V	V	R
Dyaco Canada Inc.				R
Dynamic Paint Products Inc	R		R	R
Dyson Canada LTD.	R	V	R	R
E Excel Canada LLC				R
E.D. Smith Foods, Ltd	V	V	R	R
E.I. du Pont Canada Company			R	R
Earnest Ice Cream Ltd	R			
Earth's Own Food Company Inc.	R			R
Earthfresh Foods Corp				R
East 40 Packers Ltd			R	
East Kootenay Community Credit Unio	R			
Easy Heat Ltd			V	
Eat Well Ethnic Foods Inc.	R			
Eataly Toronto LP				R
Eatmore Sprouts & Greens Ltd.	R			
Eaton Industries (Canada) Company				R
Ebel Quarries Inc.				R
ECCO Shoes Canada Inc.	R			R
Ecotrend Ecologics	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Ed Mirvish Enterprises Limited				R
Ed Sobkowich Greenhouses Ltd				R
Eddie Bauer of Canada Corporation	R	R	R	R
Eddie Bauer of Canada Corporation	R			
Eddi's Wholesale Garden Supplies Lt	R			
Edgewell Personal Care Canada ULC	R	V	V	R
Edma Marketing Ltd	V			
Edo Japan Restaurants	R	R	R	R
EDOKO FOOD IMPORTERS LTD	R			
Educator Supplies Limited			R	R
Educators Financial Group Inc				R
Elco Fine Foods Ltd	R			R
Electrolux Major Appliances Canada	R	V	R	R
Electronic Arts				R
Electronic Boutique Canada	R	R	R	R
Elexicon Corporation				R
Eli Lilly Canada Inc.	R	V	V	R
Elias Honey Ltd	R			
Elite Industries Inc				R
Elite Linen Inc.	R			
Elizabeth Arden (Canada) Ltd	V	V	V	R
Elman's Food Products Ltd.			R	

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
EMD SeroNo Canada Inc.				R
Emerson Electric Canada Ltd	R	R	R	R
Empack A Div. of Emu Polish				R
Emperor Specialty Foods Ltd.	R			
Empire Cheese & Butter Co-operative				R
Enbridge Gas Inc.				R
Encorp Pacific Canada	R			
Endy Canada Inc.	R	R	R	R
Endymion Holdings	R			
Enerex Botanicals Ltd.	R			
Energizer Canada Inc				R
Enesco Canada Corporation				R
Engineered Products Canada Limited				R
English Bay Batter L.P.	R			R
English Bay Blending	R			
Entegra Credit Union Ltd			R	
Entertainment One Limited Partnersh				R
Envirogard Products Limited	V	V	V	R
Epson Canada Limited				R
Equifax Canada Inc.				R
Equilibrium Foods Inc.				R
Erie Meat Products				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
ESKA Inc.				R
ESM Farm Equipment Ltd.				R
Essex Topcrop Sales Limited				R
Essilor Group Canada, Inc.	R	R	R	R
EssilorLuxottica Canada Inc.	R	R	R	R
Essity Canada Inc.				R
ESTED INDUSTRIES	V	V	V	V
Estee Lauder Cosmetics Ltd.	R	V	R	R
Ethan Allen (Canada) Inc.				R
Eurofase Inc.				R
European & Co. Inc.				R
European Creations	R			
Evergreen Liquid Plant Food				R
Everik International Inc				R
Everyware Global Inc.	V	V	V	R
Evolution Lighting Canada Inc.,				R
Exceldor Foods Ltd				R
Excelsior Foods Inc.				R
Exemplar Horticulture Ltd.	R			
Expedia CruiseShip Centers	R			
Export Packers Company Ltd.	R	V	V	R
Expresco Foods Inc.	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
F.G. Lister & Co. Limited				R
Fabricland Distributors Inc				R
Fabricland Midwest Limited		R	R	
FABRICLAND PACIFIC LTD	R			
Fairfield Tree Nurseries Inc.	R			
Fairmont Hotels & Resorts				R
Fairstone Financial Inc.	R	R	R	R
FAIRWAY MARKETS	R			
FAIRWEATHER LTD.	R		R	R
FaithLife Financial			R	R
Falesca Importing Ltd.	R			
Falkland Store Ltd.	R			
Fancy That Group				R
Fanshawe College of Applied Arts &				R
Farafena Direct Health	R			
Farleyco Marketing Inc.				R
Farm Boy Company Inc.				R
Farm Credit Canada	R	R	R	
FARQUHAR DAIRIES LTD.				R
FCA Canada Inc.	R	R	R	R
Featherlite Industries Ltd				R
Feature Foods International	V	V	V	

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
FEDERAL-MOGUL CANADA LTD				R
Federated Cooperatives Ltd	R	R	R	
Federated Insurance Co of Canada			R	R
Fédération des caisses Desjardins	V	V	R	R
Fehrkon Enterprises Ltd.	R			
Fellowes Canada Ltd.	V	V	V	R
Fernco Connectors LTD.				R
Ferraz Shawmut Company				R
Ferrero Canada Ltd.	V	V	V	R
Ferring Inc	V	V	V	R
FGC Foods	R			
FGI World				R
FGX Canada Corp	R		R	R
FHC Enterprises LTD	R			
FIJI Water Canada Ltd	V			R
Fine Choice Foods Ltd.	R	V	V	V
Finica Food Specialties Ltd.				R
First Alert Canada				R
First Asset Funds Inc.				R
First Credit Union	R			
First West Credit Union	R			
Fisher & Paykel Appliances Canada,				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Fiskars Canada, Inc.				R
Fit Foods Ltd	R			
Five Guys Franchisor, LLC	R	R	R	R
Fix Auto Canada Inc.	R		R	R
Flags Unlimited				R
Flaman Fitness BC Limited	R			
Flight Centre Travel Group (Canada)	R		R	R
Flora Manufacturing & Distributing	R			R
Florists Supply Inc.	R			
Foamco Industries Corporation				R
FOAMITE INDUSTRIES INC.				R
Fok's Trading (Canada) Ltd.	R			
Foley#s Candies Limited Partnership	R			
Fonora Textile Inc.			V	
Food First Enterprises Ltd.	R			
Food Source Company				R
Foot Locker	R	R	R	R
Foothills Creamery Ltd.	R			
Footprint Products Limited				R
Ford Motor Co of Canada Ltd	R	R	R	R
Foremost International Ltd.				R
Forever XXI, ULC	R		R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Formula Brand Inc.				R
Fort Frances Times Limited				R
Fort NelsonPharmacy	R			
FortisBC Energy Inc.	R			
Fossil Canada	R			R
Fox Run Canada Corp.		V	V	R
FP Canadian Newspapers			R	
FPI Fireplace Products Int'l Ltd				R
FRAM Group (Canada) Inc.				R
Frank T. Ross & Sons	V	V		R
Franke Kindred Canada Ltd				R
Franklin Electric Co Inc.			R	
Franklin Templeton Investments			R	R
Fraser Valley Duck and Goose	R			
Fraserland Organics Inc	R			
Free Daily News Group Inc				R
Freedom Mobile Inc.	R			R
FreeFall Literary Society of Calgar	V			
Freeman Formalwear Ltd				R
Freeman Industries Inc.			V	R
French Connection (Canada)				R
FRESH DIRECT PRODUCE LTD	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Fresh Hemp Foods Ltd.	V	V	R	R
Fresh Is Best Salsa Company Inc	R			
Fresh Selections Inc				R
Freshousefoods	V		V	R
FRESHPACK OKANAGAN FRUIT LTD	R			
Freshpoint Vancouver, Ltd.	R			
Freud Canada, Inc.	V	V	V	R
FREUDENBERG HOUSEHOLD PRODUCTS	V	V	V	V
Freybe Gourmet Foods	R			
Frito Lay Canada	R	R	V	R
Frobisher International Enterprise	R			
Fromagerie St-Albert				R
Fruit of the Loom Inc.				R
Fruiticana Produce Ltd.	R			
Fruits & Passion Boutiques Inc.	R			R
Fujifilm Canada Inc	R	V	R	R
FUKUDA TRADING CO. LTD	R			
Fusion Products Ltd				R
Future Harvest Development Ltd.	R			
G. Brandt Meat Packers Ltd.				R
G.F. Thompson Co. Ltd.				R
GAGAN FOODS INTERNATIONAL LTD	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Galanz Canada				R
Galati Market Fresh				R
Galderma Canada Inc.	R	R	R	R
Galleria Supermarket				R
Gambles Ontario Produce Inc				R
GaNong Bros., Limited				R
Ganz				R
Gap Canada	R	R	R	R
Garant GP	V	V	V	R
Gardein Protein International	R			
Gardena Canada Ltd	V		V	R
Gates Canada Inc	R		R	R
Gateway Casinos	R			
Gatto Flowers Distributing Inc.				R
Gay Lea Foods Co-operative Limited	V	V	R	R
GazMetro				R
GB Micro Electronics Inc.	R			R
GCO Canada Inc.	R	R	R	R
GE Lighting				R
General Mills Canada Corporation	V	V	R	R
General Motors of Canada Company -	R	R	R	R
GENERAL NUTRITION CENTRES	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Gentec International				R
Gentek Marketing Inc.				R
Genuine Health Inc	R			R
Genuine Supply Source Inc.				R
George Brown College				R
George N. Jackson Limited			R	R
George Sant & Sons Ltd				R
George's Cream Inc.	V			
Georgia Main Food Group	R			
Georgian College of Applied Arts &				R
Georgia-Pacific Canada	R		R	R
GEOX Canada Inc	R			R
Gertex Hosiery Inc.				R
Gesco Industries				R
GH International Sealant ULC				R
Giant Tiger Stores Limited				R
Gibbs Nortac Industries Ltd.	R			
Gibson's Cleaners Co. Limited				R
Gildan Apparel (Canada) LP	R			R
Gilead Sciences Canada Inc.				R
Ginger Beef Choice Ltd.	V		V	
Giorgio Armani Corporation Canada	R			R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Give and Go Prepared Foods Corp	V		V	R
Gizella Pastry ltd	R			
Glacier Media Group			R	
Glaswegian Enterprises Inc.	R			
GlaxoSmithKline Consumer Healthcare	R	R	R	R
GlaxoSmithKline Inc.	R	V	R	R
Glen Dimplex Americas Ltd.				R
Glentel Inc.	R		R	R
Global Citrus Group Inc.	R			R
Global Trading Network Ltd.	R			
Global Upholstery Co. Inc.	R		R	R
Globe Electric Company Inc.				R
Glory Juice Co.	R			
Glutenull Bakery	R			
Glyn Walters Holdings Inc.				R
Godiva Chocolatier of Canada Ltd				R
GOJO Canada	V	V	V	R
Golden Boy Foods Ltd	R			
Golden Valley Foods Ltd.	R			
Golf Town Limited	R	R	R	R
Goodfellow Inc.	R		R	R
GoodLife Fitness	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Goodyear Canada Inc.				R
Google Canada Corporation				R
Gore Mutual Insurance Company				R
Gourmet Trading Co.				R
Government of Ontario				R
Grace Foods Canada Inc				R
GRACIOUS LIVING INC - Royal Grp				R
GRAFTON APPAREL LTD	R	R	R	R
Granny's Poultry Cooperative			R	
Grass Root Dairies	R			
Gray Ridge Eggs Inc				R
Great Canadian Dollar Store (1993)	R			
Great Canadian Gaming Corporation	R			R
Great Gulf Homes				R
Great Lakes Copper Inc.				R
Great Lakes New Holland Inc				R
Great Western Brewing Company		R	R	
Greater Sudbury Hydro Plus Inc.				R
Greater Vancouver Community Credit	R			
Greaves Jams & Marmalades Ltd.				R
Gredico Footwear Limited				R
Green Planet Wholesale	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Green Shield Canada	R			R
Greenfield Produce Ltd.	R			
Greenhawk Inc.				R
Greenhouse Delight Foods Inc.	R			
Greenpark Homes				R
Greenstar Plant Products Inc.	R			
Greetalia Food Products Inc.			R	
Groupe Dynamite Inc.	R		R	R
Groupe Jean Coutu (PJC) Inc				R
Groupe Marcelle Inc	V	V	V	R
Groupe Seb Canada	V	V	V	R
GS Distribution Inc.				R
GS FOOD LTD.	R			
Guess? Canada Corporation	R		R	R
Gulf & Fraser Fishermen's Credit Un	R			
Gunther Mele Limited				R
H&M Hennes & Mauritz Inc	R			R
H&R BLOCK CANADA, INC.	R	R	R	R
H. A. Kidd and Company Limited	R		R	R
Haggar Canada Co				R
Hain Celestial Canada ULC	R	V	V	R
Hakim Optical Laboratory Limited				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Hall Telecommunications Supply				R
Hallmark Canada	R	R	R	R
Hallmark Poultry Processors Ltd	R			
Hamilton Beach Brands Canada Inc	V	V	V	R
Hamilton Conservation Authority				R
Han Ka Export-Import ltd.	R			
Hana Foods Inc	R			
Hanahreum Mart Inc	R			
Handi Foods Ltd a/o Mediterranean				R
Hansco Distributors Inc.				R
HapiFoods Group Inc.	R			
Happy Days Dairies Ltd.	R			
Happy Planet Foods Inc.	R			
Hardy Sales Ltd.	R			
Harlan Fairbanks, a div of PBOLP	R	R	R	R
Harlequin Enterprises Ltd.				R
HARLEY-DAVIDSON CANADA LP	R			R
Harmonic Arts Botanical Dispensary	R			
Harmony Organic Dairy Products Inc.				R
Harper's Gardening Centre				R
Harrow News				R
Harry Rosen Inc.	R		R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Hartz Canada, Inc.	R	V	V	R
Harvest Meats (Div of Premium Brand	R	R		
Hasbro Canada Corporation	V	V	V	R
Hauser Industries Inc.				R
Havana House Cigar & Tobacco				R
Heidelberg Foods Ltd.				R
Helen of Troy Inc	V	V	V	R
HelloFresh Canada Inc.	R			R
Henkel Canada Corp - Consumer	R	V	V	R
Henkel Canada Corporation	V	V	V	R
Henry Company Canada, Inc				R
Henry's Cameras			R	R
Herbal One International Inc				R
Heritage Credit Union	R			
Hermes Bakery				R
Hermes Canada Inc.	R			R
Hershey Canada Inc.	R	R	R	R
Hester Creek Estate Winery Ltd.	R			
Hewitt's Dairy Limited				R
Hexo Operations Inc.	R			R
Heys International Ltd				R
HFC Prestige International	R			R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
High Liner Foods Inc.	R	V	V	R
Highfield Holdings				R
Highland Farms Inc.				R
HIGHLAND PACKERS LIMITED				R
Highline Mushrooms West Limited	R			
Highline Produce Limited				R
HILARY'S SALESMASTER INC	V		V	
Hill Times Publishing Inc				R
Hills Foods Ltd	R			
Hill's Pet Nutrition Canada Inc.	R	R	R	R
Hillside Cellars Winery Ltd.	R			
Hisense Canada Co., Ltd.				R
Hitfar Concepts	R	V	R	R
HOFFMANN-LA ROCHE LIMITED	R		V	R
Holland Imports Inc.	R			R
Holland Park Garden Gallery				R
Holt Renfrew & Co., Limited	R			R
Home & Leisure Group Ltd.	V	V	V	R
Home Depot of Canada Inc.	R	R	R	R
Home Hardware Stores Limited	R	R	R	R
HoMedics Group Canada Co	V			R
Homes for Sale Magazine Ltd				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Honda Canada Inc	R	V	V	R
Honeydew International Inc.				R
Honeywell				R
Hopkins Canada, Inc.				R
Horizon Credit Union		R		
Horizon Distributors Ltd	R			
Hormel Foods Corporation				R
Houweling's Tomatoes	R			
HP Canada Co.	R	R	R	R
HP Hood LLC	R			
HQ Fine Foods	V			
HSBC Bank Canada	R	R	R	R
HUB International Canada West ULC	R			
Hub International Limited				R
Hubbell Canada LP			R	R
Hudson's Bay Company	R	R	R	R
Huer Foods Inc	R		V	
Hugo Boss Canada Inc. COO Americas,				R
Humber College Institute of				R
Humber Nurseries Ltd. - Humber				R
Hunter Douglas Canada Ltd Part	R	R	R	R
Husky Food Importers&Distributors				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Husqvarna Canada Corp.	R		R	R
Hydro One Networks Inc				R
Hydro Ottawa Holding				R
Hy's Steakhouse Cocktail Bar			R	
Hyundai Auto Canada Corp.	R	R	R	R
ICBC	R			
Ice River Springs Water Co. Inc.				R
Icebreaker Merino Clothing Inc.	R			R
I-D Foods Corporation	R			R
Ideal Industries				R
Ideal Security Inc.	V	V	V	R
Idelle Labs, Ltd.	V	V	V	R
Ifastgroupe Distribution, a			R	
IKEA Canada Ltd Partnership	R	V	R	R
IKEA Supply AG	V	V	R	R
IKO Industries Ltd.				R
illy Espresso Canada	R			
Illy Espresso Canada Inc.				R
Images 2000 Inc.				R
Imperial Manufacturing Group				R
Imperial Tobacco Canada ltd	R	R	R	R
Indianlife Food Corporation	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Indigo Books & Music Inc.	R	R	R	R
Industrial Alliance Insurance &				R
Inform Brokerage Inc.			R	R
Ingram Micro Inc.	R			R
Inline Nurseries 2010 inc	R			
Inno Foods Inc.	R			V
Innovation Credit Union		R		
INNOVATIVE TECHNOLOGY	R			
Inovata Foods Corp.	V			
Intact Insurance	R		R	
Intact Insurance Company				R
Integrated Appliances Ltd				R
Integris Credit Union	R			
Intercity Packers Ltd.	R			
Interior Savings Credit Union	R			
International Cheese Company Ltd.				R
international Cosmeticare Inc.	R			
International Graphics ULC				R
International Playing Card Co Ltd				R
International Showcase Associates				R
Internet Based Learning Ltd.				R
Intertape Polymer Inc.	R	V	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Intervet Canada Corp.	R		R	R
Intrigue wines Ltd	R			
INTS IT'S NOT THE SAME CANADA LTD				R
Invesco Canada Ltd.	R		R	R
Investors Group Financial Services	R	R	R	R
Iovate Health Sciences Intl Inc				R
IPD Canada Inc	V			
IPEX Electrical Inc.			R	
IPEX Inc			R	R
Ippolito Fruit & Produce Ltd				R
Irving Consumer Products Limited	V	V	V	R
Island Farmhouse Poultry Ltd	R			
Island Independent Buying Group	R			
Islandway Sorbet Canada	V			
Italpasta Limited	R			R
ITN Food Corporation				R
ITW Construction Products				R
ITW Permatex Canada,	V	V	V	R
J M (Canada) Inc.				R
J. Rabba Company Ltd.				R
J.E. Russell Produce Ltd.				R
J.L. FREEMAN S.E.C.	V			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Jaguar Land Rover Canada ULC				R
Jam Industries, Ltd	R			
Jamieson Laboratories Ltd	V	V	V	R
Jamieson's Pet Food Distributors Lt	R			
Jan K. Overweel Limited	R		V	R
Janes Family Foods-Sofina Foods Inc	R			R
Jannex Enterprises (1980) Ltd.				R
Janome Sewing Machine Co., (Canada)	R			R
Janssen Inc.	V	V	V	R
JANZEN'S PHARMACY				R
Jascor Housewares Inc.	V	V	V	R
JD Farms 2010 Ltd	R			
JD Sweid Foods (2013) Ltd.	R	V	V	R
Jeffery's Greenhouses Plant II Ltd				R
JELD-WEN of Canada		R	R	R
Jet Group	R			R
JET TRADING CO., LTD	R			
JFC International, Inc	R			R
Jimmy the Greek Inc.				R
Jiva Manufacturing	R			
JJ Bean Inc.	R			R
JNK FOOD MANAGEMENT LTD	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Jockey Canada Company				R
John Brooks Company Limited				R
John Deere Canada ULC	R	R	V	R
John G. Hofland Ltd.				R
Johns Manville Canada	R		R	R
Johnson & Johnson Inc	V	V	V	R
Johnson & Johnson VisionCare, Inc.	R	V	R	R
Johnson Level and Tools Inc.	V	V	V	V
Johnston Drug Wholesale Ltd	R			
Johnston's Butcher Shop Ltd	R			
Johnvince Foods	V			R
Joseph Brant Memorial Hospital				R
Jo-Van Distributors Inc.				R
Joylypso Inc				R
JTI-Macdonald Corp	R		R	R
JVCKENWOOD Canada Inc.				R
JYSK Linen 'N Furniture Inc.	R	R	R	R
K+S Windsor Salt LTD	V	R	V	R
K2 CORPORATION OF CANADA				R
Kal Tire	R		R	R
KAO Canada Inc. (Jergens	R	V	V	R
Karcher North America Inc				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Kasseler Food Products Inc.				R
KATE SPADE CANADA INC	R			R
Kawartha Dairy Limited				R
Kaycan Ltd	R	R	R	R
Kaz Canada, Inc.	V	V	V	R
KEB Hana Bank Canada	R			R
Keen Canada Outdoor, ULC				R
Kellogg Canada Inc	V	V	R	R
Kenilworth Media Inc.				R
Ken's Foods Inc	V	V	V	R
KENTUCKY FRIED CHICKEN CANADA CO	R	R	R	R
Kernels Popcorn Limited	R	R	R	R
Kerr Bros. Limited	R			R
Kerrisdale Cameras Ltd.	R			
Kerrisdale Pharmacy	R			
Keurig Canada Inc.	R	R	R	R
Keybrand Foods,a div of Freshstone				R
Kia Canada Inc	R	R	R	R
Kicking Horse Coffee Col Ltd.	R			V
Kidcentral Supply				R
Kidde Canada Inc	V	V	V	R
Kiddytown Ltd.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
KIK Holdco Company Inc				R
Kimberly-Clark Inc.	R	R	R	R
Kingsway Chocolate Company Limited				R
Kisko Products Inc				R
Kitchen Craft Cabinetry	R	R	R	R
Kitchen Stuff Plus				R
Kitchening & Co. Fine Foods Ltd.	R			
KLASSEN BRONZE LTD.				R
Kleen Flo Tumbler Ind. Ltd.	V	V	V	R
Klondike Sterling Glove Corp			R	
Knape & Vogt Canada Inc.	V	V	V	R
Knowledge Network Corporation	R			
Kobo Inc				R
Kodak Alaris Operations Canada Inc.				R
Kodak Canada ULC	R		R	R
Kohl & Frisch Limited	R	R	R	R
Kohler Canada Co.				R
Koki Holdings Canada Co.	R			R
Koolatron Corp			R	
Kootenay Savings Credit Union	R			
Kooy Brothers				R
Korhani of Canada Inc.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Korson Furniture Ltd				R
Korzite Coatings Inc.				R
KPM Industries Ltd.				R
Kraft Heinz Canada ULC	R	V	R	R
KriNos Foods Canada Ltd	R			R
Kroeger Inc				R
Krown Imports	R			
Kruger Products L.P.	R	R	R	R
Kumon Canada Inc.	R			R
KWIK MIX Materials Ltd				R
La Cie McCormick Canada Co.	R	V	V	R
La Cite Collegiale				R
La Grotta Del Formaggio	R			
La Maison Simons Inc.	R			R
La Petite Bretonne Distribution Inc				R
La Senza Canada, Inc			R	R
Labatt Brewing Company		R	R	R
Lacoste Garden Centre Inc.			R	
Lady York Holdings Ltd.				R
Lafarge Canada Inc. - Woodstock				R
Lake Breeze Vineyards	R			
Lake View Credit Union	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Lakehead University				R
Lakeland Flowers Ltd	R			
Lakeside Produce Inc				R
Lambton College				R
Landmark Medical Systems Inc	V	V	V	R
Lanthier Bakery Ltd				R
Lantic Inc				R
Lantic Inc. Vancouver Refinery	R			
LaSalle College Vancouver	R			
Laser Sales Inc				R
Laticrete International Inc				R
Laura Secord				R
Laurentian Publishing Limited				R
Laurentian University				R
LAVO				R
Lawrason's Inc				R
Lawrence Meat Packing	R			
Lawyers' Professional Indemnity Co.			R	R
La-Z-Boy Canada Limited	R		R	R
LB Maple Treat Corp.	R			
LCBO				R
Le Chateau Inc.	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
LE CREUSET CANADA INC.				R
Le Kiu Importing Co. Ltd	R			
Leda Health Innovations Inc.	V	V		R
LeDroit				R
LEDVANCE LTD./LTEE	R		R	R
Lee Valley Tools Ltd.	R	R	R	R
Lee's Food Products Limited	V			R
Leese Enterprises	V	V	V	R
Left Coast Naturals	R			
LEGO Canada Inc	R	V	R	R
Leis Pet Distributing Inc.				R
Lekker Foods Distribution Ltd	R			
Lenbrook Industries Limited				R
Lennox International	R	R	R	R
Lenovo (Canada) Inc.	R	V	R	R
Len's Mill Store				R
Leo Pharma Inc	R	R	R	R
Leons Furniture Ltd.	R	R	R	R
Les Chocolats Vadeboncoeur Inc.	V			
Les Croisssants d'Olivier Ltd.	R			
Les Ruchers Promiel inc.	V			V
Lesaffre Yeast Corporation	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Level Ground Trading	R			
Levi Strauss & Co. (Canada) Inc.				R
Leviton Manufacturing of Canada ULC				R
Lexmark Canada Inc.				R
LG Electronics Canada Inc	R	V	V	R
Liberty Wine Merchants	R			
Libra National The Rice People	R			
Life Science Nutritionals	V	V		R
Lifeco Split Corp.				R
LifeScan Canada ULC	R	R	R	R
Lifestyle Markets	R			
Life-Time Sales Ltd.	V			
Lilydale-Sofina Foods Inc.	R	R	V	R
Lincoln Electric Co of Canada LP				R
Lindt & Sprungli (Canada) Inc.	R	V	V	R
Linen Chest (Phase II) Inc.				R
Lion Rampant Imports				R
LITELINE CORPORATION				R
Little Caesar of Canada Inc.	R	R	R	R
Little Critters Pet Shops Inc.				R
Little Kickers Canada Franchising			R	R
LITTLE QUALICUM CHEESEWORKS	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Little Short Stop Stores Ltd				R
Lixil Canada Inc.	R	V	R	R
Loblaw Companies Limited	R	R	R	R
L'Occitane Canada	R		R	R
London Drugs Limited	R	R	R	
London Hydro				R
Long & McQuade	R	R	R	R
Longo Brothers Fruit Markets Inc.				R
Lontours Canada				R
Lordco Parts LTD	R			
L'Oreal Canada Inc.	R	R	R	R
Lorex Canada Inc				R
Lounsbury Foods Limited				R
Lovell Drugs Ltd				R
Lowcost Western Pharmacy #1 & #2	R			
Lowes Canada	R	R	R	R
Loxcreen Canada				R
Loyalist College				R
LoyaltyOne, Co.	R			R
LSI Enterprises Canada ULC	V	V	R	R
Lu & Sons Enterprise Ltd.	R			
Lucky Brand Dungarees Canada Inc.	R		R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Lululemon Athletica	R	R	R	R
Lundberg Family Farms	R			
Lush Handmade Cosmetics Ltd.	R	R	R	R
Lutron Electronics Canada, Inc.				R
LVMH Fragrance Brands Canada Ltd.				R
M&M Meat Shops Ltd.	R	R	R	R
Mac's Convenience Store				R
MacDougall, MacDougall & MacTier				R
Macgregors Meats and Seafood Ltd	V	V	V	R
Mackenzie Financial Corp.				R
Macs Convenience Stores Inc.	R	R	R	
Maddies Natural Pet Products Ltd	R			
Made In Japan Teriyaki Experience				R
Magnotta Winery				R
Magtar Sales Inc.	V	V	V	R
Mainline Fashions Inc.				R
Maison De La Pomme				R
Makita Canada Inc.	R	R	R	R
Mandarin Restaurant Franchise Corp				R
Manitoba Hydro			R	
Manitoba Liquor and Lottery Corp.			R	
Manitoba Public Insurance			R	

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Manitou Investment Management Ltd.				R
MANNARICH FOOD INC.				R
Manoucher Food & Co.				R
Manulife Financial	R	R	R	R
MAPEI INC				R
MAPEI Inc.	R			
Maple Dale Cheese Inc				R
Maple Hill Farms	R			
Maple Leaf Foods Inc	R	R	R	R
Maple Lodge Farms Ltd				R
Marathon Management Co				R
Marble Slab Creamery	R		R	R
Marc Anthony Cosmetics Ltd	V	V	V	R
Maricann Inc.				R
Mario's Gelati Ltd.	R			
Maritime Travel Inc	R			
Mark Anthony Group Inc.	R		R	
Mark-Crest Foods Ltd	R			
Marlane Enterprises Ltd	R			
Maroline Distributing				R
Mars Canada Inc	R	R	R	R
Marshall Ventilated Mattress				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Martin Mills Inc				R
Martin's Family Fruit Farm Ltd				R
Mary Brown's Inc	R		R	R
Mary Kay Cosmetics Ltd.	R	V	V	R
Mary Maxim Inc				R
Masco Canada Limited	R	V	V	R
Masonite Canada				R
Mason's Masonry Supply Ltd.				R
Massage Addict Incorporated			R	R
Massimo Dutti Canada Inc	R			R
Master Halco Corp	R			R
Master Lock Company	V	V	V	R
Mastermind LP				R
Mather & Bell Pharmacy Ltd				R
Mattel Canada Inc	V	V	V	R
Maurices Canada Stores, Ltd.		R	R	R
Max Voets Coffee Roasting LTD	R			
Maxill Inc.				R
Mazda Canada Inc.	R			R
MC COMMERCIAL INC.	R	V	R	R
MCAN Mortgage Corporation				R
McCain Foods Canada	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
McCarthy and Sons	V		V	
McCaughey Consumer Products	V	V	V	R
McCordick Glove & Safety Inc.				R
McDermid Paper Converters Limited				R
McDonald's Pharmacy				R
McDonald's Restaurants of Canada	R	R	R	R
McGregor Industries Inc.				R
McKechnie Pharmacy Ltd				R
Mckesson Canada	R	R	R	R
McLean Budden Limited				R
McMaster University				R
McTaggarts				R
MD Financial Management Inc.	R	R	R	R
MDG Computers				R
Mead Johnson Nutrition (Canada) Co.	R	R	R	R
Meadow Valley Meats	R			
Meadowfresh Dairy Corp	R			
Medela Canada Inc	R			R
Medexus Inc.				R
Media Classified			R	R
Me-Dian Credit Union			R	
Medias Transcontinental SENC				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Medical Centre Pharmacy				R
Medical Pharmacies Group Limited				R
Medisca Pharmaceutique	R			
MedTech Products Inc.	R	V	V	R
Medtronic Canada ULC				R
Meilleures Marques Ltée				V
Melitta Canada Inc.	V	V		R
Melmart Distributors Inc.				R
Melnex Enterprises Ltd.			R	
Member Savings Credit Union				R
Mendocino				R
Me-n-Ed's Enterprises Ltd	R			
Menkes Developments Inc				R
Merangue International Limited	V	V	V	R
Mercedes-Benz Canada Inc.	R	R	R	R
Merck Canada Inc.	R	R	R	R
Meridian Credit Union				R
Meridian Farm Market Ltd.	R			
Meridian Meats & Seafood Ltd	R			
Merit Travel Group Inc.	R			R
Merus Labs International Inc.				R
Merx Inc.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Merz Pharma Canada				R
Metagenics Canada Inc				R
Methapharm Inc.				R
Metro Centre Ltd.			R	
METRO Ontario Inc				R
Metroland Media Group Ltd				R
Metroland Media West Group Ltd				R
Mexycan Trading (1992) Inc	R			
MGA ENTERTAINMENT (CANADA) COMPANY				R
Michael Hill Jeweller (Canada) Ltd	R		R	R
Michaels Stores, Inc.	R	R	R	R
Microsoft Corp.	R	R	R	R
Microsoft Mobile Canada Inc.				R
Midas Canada Inc.			R	R
MIDDLEFIELD GROUP				R
Miele Ltd.	R			R
Ming Pao Newspapers (Canada) Ltd.				R
Minit-Tune International Corp	R			
Mint Pharmaceuticals INC	R		R	R
Minter Country Garden	R			
Minto Corporate Services Inc				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Mirolin Industries				R
Misty Mountain Industries Ltd.	R			
Mitsubishi Motor Sales of Canada, I	R		R	R
Mitten Inc.			R	
Mizkan America				R
MizuNo Canada Inc.				R
Modern Dog Inc	R			
Moen	R	V	V	R
MOHAWK COLLEGE				R
MOLINAROS FINE ITALIAN FOODS LTD.	V	V	V	R
Molisana Imports Inc.				R
Molson Coors Canada	R	R	R	R
MONARCH AND MISFITS			R	R
Monarch Industries Limited			R	
Monarch Oil (Kitchener) Limited				R
Moncler Canada Ltd				R
Mondelez Canada Inc	V	V	V	R
Moores Retail Group Inc.				R
Morgan Williams West	R	V		
Morinda Canada Co	V	V		
MORRIS NATIONAL INC.	R		V	R
Morton-Parker Limited				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Mother Parkers Tea & Coffee Inc.	R		R	R
Motorcade Industries Inc.				R
Motorola Mobility LLC				R
Mouat's Trading Co Ltd	R			
Mountain Equipment Co-op	R		R	R
Movado Group of Canada Inc				R
Moxie's Classic Grill			R	
Moxie's Restaurants, L.P.				R
Mr. Lube Canada LP	R	R	R	R
Mr. Mikes Restaurants Corporation	R	R	R	R
Mrs. Tiggy Winkles				R
MTD Products Limited	V	V	V	R
MTF Mainland Distributors	R			
MTI - MOBILTECH INTERNATIONAL INC	R			
MTS Inc.			R	
MTY Tiki Ming Enterprises	R	R	R	R
MUFG Bank, Ltd.				R
MUJI Canada Limited	R			R
Multy Home LP				R
Municipality of Red Lake				R
Municipality of the County of Brant				R
Murchie's Tea & Coffee (2007) Ltd.	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Mylan Pharmaceuticals ULC	R	V	R	R
Mylex Ltd				R
N. Tepperman Limited				R
Nadel Enterprises Inc.				R
NATIONAL BANK OF CANADA	R	R	R	R
National Importers Canada ltd.	R			R
National Money Mart Company				R
National Post Inc, Div of				R
National Presto Industries Inc				R
National Smokeless Tobacco Co. Ltd.	R	R	V	
Natural Bakery Ltd.			R	
Natural Factors Nutritional	R			R
Natural Pastures Cheese Co. Ltd.	R			
Naturally Homegrown Foods Ltd.	R			
Naturally Splendid Ltd.	R			
Nature's Aid Inc.				R
Nature's Fare Markets	R			
Nature's Path Food Inc.	R			R
Nature's Sunshine Products			R	R
Natures Touch Frozen Food Inc				V
Nature's Way Of Canada Ltd	R	V		R
Natursource Inc.	V			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Nautilus Lifeline Ltd	R			
NCI Canada Inc.				R
Neal Brothers Inc.				R
Neatfreak Group Inc	V	V	V	R
Nehemiah Manufacturing Company	V	V	V	R
Nelson & District Credit Union	R			
Nemcor Inc.	V	V	V	R
Nespresso Canada	R	V	V	R
Nestle Canada Inc.	R	V	V	R
Nestle Purina PetCare	R	R	R	R
Nestle Waters Canada	R	V	V	R
New Balance Canada				R
NEW WORLD DISTRIBUTORS	R			
NEW WORLD IMPORTS LTD.	R			
New Zealand Lamb Company Ltd	R			R
Newell Brands Canada ULC	V	V	V	R
NewGrowth Corp.				R
News Marketing Canada Corp				R
Niagara Protective Coatings				R
NII Northern International Inc.	R	V	R	R
Nike Canada	R		R	R
NIKON CANADA INC	R			R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Nine West Canada, LP	R			R
Nintendo of Canada	R			R
Nipissing University				R
Nissan Canada Inc.	R		R	R
Nissin Foods (USA) Co Inc	V	V	V	R
Niverville Credit Union			R	
Nongshim America, Inc	R			
Norcraft Canada Corporation			R	
Nordic Nurseries Ltd	R			
Nordstrom Canada Retail Inc.	R			R
Normark Inc.				R
Normerica Inc	V	V	V	R
Nortesco Inc.				R
North American Lumber Limited				R
North American Produce Sales	R			
North Peace Savings and Credit Unio	R			
Northbridge Financial Corp				R
Northern Gold Foods Ltd.	R			
Northern Lights College	R			
Northern Reflections Ltd			R	R
Northern Savings Credit Union	R			
Northland Properties Corporation	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Northwest Food Products Ltd	R			
Norwall Group Inc.				R
Norwex Canada Inc			R	
Notre Dame Creamery Ltd.			R	
Nour Trading House Inc				R
Novanni Stainless Inc				R
Novartis Pharmaceuticals Canada	R	R	R	R
Noventis Credit Union Ltd.			R	
Novo Nordisk Canada Inc.	R	R	R	R
Now Communications Inc.				R
NSC Minerals Ltd		R	V	
Nu Skin Canada Inc				R
Nu Stream Realty Inc.	R			
Nufora Foods Inc	R			
Nurise Sales and Marketing				R
Nutri-Chem Pharmacy Ltd.				R
Nutricia North America Canada Inc.	V			R
Nutrition House Canada Inc.				R
Nuts to You Nut Butter Inc				R
Nygard International			R	R
O.C. Tanner Recognition Co Ltd	R			R
Oakville Hydro Corporation				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Oakville Stamping & Bending Ltd				R
Oatey Canada	V			R
Oberto Snacks Inc.	R			
Obsidian Group Inc.			R	R
OCAD University				R
Ocean Brands GP	R	V	V	R
Ocean Spray International Inc				R
Oil Changers				R
OK Tire Stores Inc	R			
Okanagan Grown Produce Ltd	R			
Old Dutch Foods Ltd				R
Old Dutch Foods Ltd.	R	R	R	R
Olsen Fashion Canada Inc	R		R	R
Olymel S.E.C.	R	V	V	R
Omega Alpha Pharmaceuticals Inc				R
Omega Food Importers Co Ltd				R
Omega Nutrition Canada, Inc.	R	V		V
Omer DeSerres Inc.	R			R
OMG's Candy			R	
Omron Healthcare Canada	V			R
onosgreenhouses ltd	R			
Ontario Cannabis Store				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Ontario College Application				R
Ontario College of Teachers				R
Ontario Gas Barbeque				R
Ontario Lottery & Gaming Corp				R
Ontario Natural Food Company Inc.				R
Ontario Pride Eggs Inc				R
Ontario Seed Co. Ltd.				R
Ontario Truss & Wall				R
Ontario Universities' Application				R
Onward Manufacturing Company				R
OPA! Souvlaki Franchise Group Inc.			R	R
Open Access Limited				R
Optimum Frontier Insurance Company				R
Opus Framing Ltd	R			
Orca Specialty Foods Ltd	R			
Oregon Distribution Ltd.				R
Organic Meadow Limited Partnership				R
Organika Health Products Inc	R			R
Origin Organic Farms Inc.	R			
Osram Ltd/Ltee				R
Ottawa Citizen				R
Ottawa Fasteners Supply				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Ottawa Fibre L.P.				R
OVE Decors ULC	R			
Overwater Limited				R
Owens Corning Insulating Systems				R
Oxford Learning Centres, Inc.			R	R
Ozawa Canada Inc.				R
Ozery's Pita Break				R
P K Douglass Inc.				R
P Ravensbergen & Sons Ltd				R
P&H Milling Group - Saskatoon		R		
Pace Processing & Product Developme	R			
Pacific Blue Cross / BC Life	R			
Pacific Salmon Industries Inc.	R			V
Page One Publishing Inc	R			
Paintline Products Inc.				R
PAJ Canada Company				R
Paladin Labs Inc	R	R	V	R
Pan American Nursery Products Inc.		V	V	R
Pan Pacific Pet Limited	R			
Panago Pizza Inc.	R	R		R
Panasonic Canada Inc.	V	V	V	R
Pandora Jewelry LTD	R		R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Paradise Island Foods Inc.	R			
Paramount Franchise Group Inc.				R
Parfums Christian Dior Canada Inc				R
Parissa Laboratories Inc.	R			
Parkers Cleaners				R
Parkland Fuel Corporation				R
Parmalat Dairy & Bakery Inc	R	R	R	R
Paron Cheese Company Limited				R
Parrish & Heimbecker, Limited			R	
Party City Canada Inc.	R	R		R
Partylite Gifts Ltd.				R
Pascoe Canada				R
Paul Kelly (1993) Limited				R
Payless Shoesource Worldwide, Inc.	R	R	R	R
PBF Pita Bread Factory Ltd	R			
PCM CANADA				R
Peachtree Marketing Inc.	V			R
Peak of the Market			R	
Peavey Industries LP	R	R	R	
Peg Perego Canada Inc.				R
Penguin Meat Supply Ltd.	R			
Penncorp Life Insurance Company			R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Pentel Stationery of Canada Limited				R
Pepsi-QTG Canada,	R	R	R	R
Perfect Plastics Inc.	R			
Perfect Pop	R			
Perfetti VanMelle Canada Ltd	V	V	V	R
Pestell Pet Products	V	V	V	R
Pet Valu Canada Inc.		R	R	R
Pet Valu Canada Inc. dba Bosleys	R			
Peterborough Utilities Services				R
PETM Canada Corporation	R	R	R	R
PF Consumer Healthcare Canada ULC	R	R	V	R
Pfizer Canada Inc	V	V	V	R
PH Canada Company	R	R	R	R
Pharmasave Drugs (National) Ltd.	R			
Pharmasave Drugs (Ontario) Ltd.				R
PHARMASAVE DRUGS CENTRAL LTD		R	R	
Pharmasave Drugs Pacific Ltd.	R			
Pharmascience Inc	R	V	R	
Pharmascience Inc.				R
PHILIPS ELECTRONICS LTD.	R			R
Phoenicia Group Inc				R
Pier 1 Imports	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Pierre Fabre DermoCosmétique Canada	V	V		V
Piidea Canada Ltd	V		V	R
Piller's Fine Foods	R	V	V	R
PILOT PLUMBING PRODUCTS CIN.				R
Pine House Bakery Enterprises Ltd.	R			
Pink Triangle Press				R
Pinnacle Foods Canada Corporation				R
Pinty's Delicious Foods Inc				R
Pioneer Meat Ltd.			R	
Pita Land Inc.				R
Pita Pit Limited			R	R
Pizza Nova Take Out Ltd.				R
Pizza Pizza Limited	R	R	R	R
Pizzaville Inc.				R
PJ Food Service, Inc.	R		R	R
Plainsview Credit Union		R		
Plant World Limited				R
PlantBest, Inc.				R
PLANTRONICS	R			R
Plasti-Fab Ltd.	R	R	R	R
Plasti-Kote,				R
Platinum Naturals Ltd.	R			R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Player One Amusement Group Inc				R
Playmobil Canada Inc.				R
Playwell Enterprises Ltd				R
Polar Bear Rubber Ltd			R	
Polyethics Industries Inc.				R
Polygon Realty Ltd.	R			
Polywest Ltd			R	
Popchips Inc				R
Popeyes	R	R	R	R
Porsche Cars Canada Ltd	R		R	R
Ports International Retail Corporat				R
Port-Style Enterprises				R
Post City Magazines Inc				R
Post Foods Canada, Inc.	V	V	V	R
Potters Farm & Nursery Inc.	R			
Power Battery Sales Ltd	R	R	R	R
POWERNODE COMPUTER INC.				R
PPG Architectural Coatings Canada	R	R	R	R
PPN Limited Partnership	R			
Prabu Foods Inc	R			
Prairie Centre CreditUnion(2006)Ltd		R		
Prairie Fire Press, Inc.			R	

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Prairie Flour Mills Ltd.			R	
Prairie Naturals	R			
Prairie Pride Natural Foods		R		
Prelam Enterprises Ltd.	V			
PREMIER BRANDS,				R
Premier Brands, Ltd. Importers				R
Premier Gift Ltd				R
Premier Horticulture Ltee				R
Premier Kosher Inc.				R
Premier Printing Ltd.			R	
Premier Tech Home & Garden Inc.	R	V	V	R
Premium Brands Bakery Group	R			
Prestilux Inc.	R		R	R
Prestone Canada				R
Primerica Financial Services	R	R	R	R
Primo Foods Inc.	V			R
Primolio Sales Inc.	V			V
Primus Management ULC				R
Princess Auto	R	R	R	R
Private Brands Consortium	R	V	V	R
Pro Organics	R			
Procter & Gamble Inc.	R	V	V	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Prospera Credit Union	R			
Province of British Columbia	R			
Prym Consumer Canada Inc	V		V	
PSC Natural Foods	R			
PSC-Power Source Canada Ltd.				R
PTI Foods	V	V	V	R
Puig Canada Inc.				R
punjab milk foods inc	R			
Purdue Pharma				R
Pure Integrative Pharmacy	R			
Puresource Corporation	R		R	R
Purica	R			
Purity Life Health Products Limited	R		V	R
Purolator				R
Purple Springs Nursery Inc	R			
Pusateri's Limited				R
PVH Canada, Inc.	R		R	R
PYA Importer Ltd				R
QLO Management Inc.				R
Quails' Gate Vineyards Estate	R			
Quality Foods	R			
Queen's University				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Quesada Franchising of Canada Corp			R	R
Quest Brands Inc.				R
Quickie Convenience Store Corp				R
Quickstyle Industries Inc.				R
Quikrete Canada Holdings, Limited	R		R	R
QuizNos Canada Restaurant Company	R	R	R	R
R Denninger Limited				R
Raber Glove Manufacturing Company			R	
Radiator Specialty Co of Canada			V	R
Radio Systems Corporation				R
Radioworld Inc				R
Radius Credit Union Limited		R		
Rainbow Greenhouses Inc.	R			
Rainbow Trailers Inc			R	
Ralph Lauren	R			R
Ranbaxy Pharmaceuticals Inc				R
Ranka Enterprises Ltd				R
Rawlings Canada				R
RB Health (Canada) Inc.	R	R	R	R
RBC Financial Group	R	R	R	R
RC Purdy Chocolates Ltd	R		R	R
Recipe Unlimited Corporation	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Reckitt Benckiser (Canada) Inc	R	R	V	R
Recochem Inc.	R	V	V	R
Red Apple Stores Inc.	R	R	R	R
Red Barn Market	R			
Red Bull Canada Ltd	R	V	R	R
Red River Soils			R	
Redpath Sugar Ltd				R
Redstone Food Consultants Limited				R
Refresco Canada Inc	R		V	R
Regal Confections Inc.	R	R	R	R
Region of Durham				R
Region of Niagara				R
Regional Municipality of York				R
Regis Holdings (Canada) Ltd.	R			R
REHA Enterprises Ltd.	V	V	V	R
REID'S DAIRY COMPANY LIMITED				R
Reinhart Foods Ltd	V	V	V	R
Reitmans (Canada) Limited	R	R	R	R
Remenyi House of Music				R
Remington Medical Equipment Ltd.				R
Renfro Canada Corp.	V			R
Renin Canada Corp				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Renova-Fábrica de Papel do Almonda	V	V	V	R
Resers Fine Foods	V	V	V	R
Responsive Brands Inc.			R	R
Restoration Hardware				R
Restwell Sleep Products	R			
Revlon Canada Inc.	R	V	V	R
Rexall Pharmacy Group Ltd.	R	R	R	R
Reynolds Consumer Products Canada I	V	V	V	R
RF Franchising Inc.	R			
Rheem Canada Ltd.				R
Rich Brands Canada Inc				R
RICHARDSON OILSEED	R	V	R	R
Richelieu Hardware Ltd.	V	R	R	R
Richmond Nursery Strawberry Farm				R
Richter International				R
Rip Curl Canada	R			
Ripley's Aquarium of Canada LP				R
Rita D Inc		V	V	
Riverside Natural Foods Ltd	V	V	V	R
Road 13 Vineyards	R			
Robert Bosch Inc.	V	V	R	R
Roberts Company Canada				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Roche Diabetes Care	R	V	V	R
ROGERS' CHOCOLATES LTD	R			
Rogers Communications Canada Inc	R	R	R	R
Rogers Foods Ltd.	R			
Rogers Media Inc (Shopping Channel)	R			R
Rokan Laminating Co. Ltd				R
Roland Canada Ltd.	R			R
Rolex Canada Ltd.				R
Rolf C. Hagen Inc.	R			R
Rollover Premium Pet Food Ltd	V			
Roman Cheese Products Ltd				R
Romarah				R
Ron White Shoes Inc				R
RONA inc./Ace Canada	R	R	R	R
Ronsons Shoe Stores Ltd.	R			
Roots Canada Ltd.	R		R	R
Roots Organic Inc.	R			
Rose Textiles				R
Rosenort Credit Union			R	
Rossdown Natural Foods Ltd	R			
Rothesay Holdings Ltd.(dba Church's	R			
Rothmans, Benson & Hedges Inc.	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Roxul Inc				R
Royal & SunAlliance Canada				R
Royal Adhesives & Sealants Canada				R
Royal BC Museum	R			
Royal Canin Canada Company Inc	R		R	R
Royal Distributing Inc				R
Royalpark Homes				R
RTS Companies Inc.				R
Rubicon Food Products				R
Rubicon Pharmacies		R	R	
Rubie's Costumes Company	V			R
Rumble Nutrition Ltd.	R			
Running Room Canada Inc.	R		R	R
Rust-Oleum Consumer Brands Canada				R
RW Consumer Products	V	V	R	V
Ryerson University				R
S & F Food Importers				R
S Boudrias Inc	V			V
S.C. Johnson & Son Ltd.	V	V	V	R
S.H. Krikorian & Co. Ltd.				R
S/M Enterprises				R
Sabatini U. Gourmet Foods				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
SAFDIE & CO INC.	V			R
Sail Outdoors Inc.				R
Saint Germain Bakery	R			
Saje Natural Business Inc.	R		R	R
Salco Footwear Ind. Ltd.				R
Salisbury House of Canada LTD.			R	
Salmo Drugs Ltd.	R			
Salt Spring Coffee	R			
Salton Appliances (1985) Corp	V	V	V	R
Samko Sales				R
Samsonite Canada Inc	R		R	R
Samsung Electronics Canada Inc	R			R
Samtack Inc	V			R
San Remo Food importers Ltd.	R			
Sanders Pro Distributors				R
Sanofi Consumer Health	R	V	R	R
Sanofi-Aventis Inc	R	R	R	R
Santa Lucia Pizza (Winnipeg) Ltd.			R	
Santa Maria-Sofina Foods Inc	R			R
Santas Choice Inc				R
Santevia Water Systems Inc.	R			
Saputo Dairy Products Canada G.P.	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Sardo Foods Inc				R
SASCU Financial Group	R			
Sask Liquor and Gaming Authority		R		
SaskEnergy/TransGas		R		
SaskGaming		R		
SaskPower		R		
SaskTel		R		
Savage Arms (Canada) Inc.				R
Save on Foods	R	R	R	
SBI Canada Bank	R			
SCANDINAVIAN TOBACCO GROUP CANADA	V		V	
Scapa Tapes North America Ltd.				R
Scentuals Body Care From Nature	R			
Scepter Corporation				R
Schaaf Foods Inc.				R
Schenck Farms & Greenhouses Ltd				R
Schleese Saddlery Service Ltd.				R
Schneider Electric Canada				R
SCITI Trust				R
Scotia Managed Companies				R
SCOTLAND AGROMART LTD				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Scott Plastics Ltd	R			
Scott-Bathgate Ltd	R		R	
Scotts Canada Ltd.	R	V	R	R
Scythes Grp of Companies				R
Seacorp Imports Inc				R
Sealy Canada Limited				R
Searle Greenhouses Ltd			R	
SEI Investments Canada Company				R
SEIKO HONG KONG LIMITED CB				R
Select Brand Distributor's Inc.	R			R
Select Food Products Limited				R
Select Food Services Inc.				R
Select Ready Foods Inc.	V		V	
Selkirk Canada				R
Seneca College Of Applied Arts				R
Sensible Life Products				R
Seoul Trading Corporation	R			
Sephora	R	R	R	R
SERENA FASHIONS LTD	R			
Serious Coffee	R			
Seroyal International Inc				R
Serta Division,	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
ServiceMaster of Canada Ltd.			R	R
Servier Canada				R
Sescolite Lighting				R
Seven Seas Fish Co. Ltd.	R			
SFP CANADA LTD	R		R	R
SGI		R		
SHAC Environmental Products Inc.	V	V		
Shafer-Haggart Ltd.	R			R
Shah Trading Company Limited				R
Shaklee Canada Inc.	V	V	V	R
SharkNinja Operating LLC				R
Sharons Credit Union	R			
Sharp Electronics of Canada Ltd	R	R	R	R
Sharples Greenhouses Corporation				R
Shasha Bread Co. Inc				R
Shaw Cablesystems G.P.	R	R	R	R
Shaw Festival Theatre Company				R
Shell Canada Products	R	R	R	R
Shepherd Hardware Product Ltd				R
Sheridan College				R
Sheridan Nurseries Ltd.				R
Sheung Kee Trading Co. Inc.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Shigs Enterprises Limited	R			
SHIMANO CANADA LTD.				R
Shirra Panwest	V			
Shiseido (Canada) Inc	V	V	R	R
Shop-Vac of Canada Ltd.	V	V	V	R
Shurtape Technologies Co				R
Siegel's Bagels (2007) Limited	R			
Siemens Canada Limited			R	R
Signature Aluminum Canada Inc				R
Signify Canada Limited	R			R
SILVA CUSTOM FURNITURE				R
Simcoe-York Printing & Publishing				R
Simmons Canada Inc.	R	R	R	R
Simply Computing Inc.	R			
Simply Delicious	R			
Simpson Strong-Tie Canada	R		R	R
Sinclair Pharmacy				R
Sing Tao Newspapers (Canada 1988)				R
SIPKENS NURSERIES LTD				R
Sirius XM Canada Inc.				R
SISU Inc.	R			
Siwin Foods Ltd.	V	V	V	V

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Sixty Split Corp.				R
SK Ministry of Environment		R		
Skechers USA Canada Inc	R	R	R	R
Skican Limited				R
Skilcor Food Products Ltd.	R			R
Skotidakis				R
Sky Blue Water Inc.			R	
Sleeman Breweries Ltd		R		
Sleep Country Canada Inc.	R	R	R	R
SMB MFG. INC.				R
Smucker Foods of Canada Co	R	R	V	R
Snap-on Tools of Canada	R	R	R	R
Snow Cap Enterprises	R			
Snowcrest Foods Ltd.	R			
SNP Split Corp.				R
Sobeys	R	R	R	R
SodaStream Canada Ltd.	V	R	R	R
Sofina Foods Inc	R		R	R
SoftMoc Inc.	R	R	R	
Soft-Moc Inc.				R
Sol Cuisine				R
Solmon Rothbart Goodman LLP				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Solutions 2 GO Inc.	R	V	V	R
SONNYSIDE FLOWERS LTD.				R
Sonray Sales Ltd.	R			
Sony Electronics	R	V	R	R
Sony Interactive Entertainment Cana	V	V	V	R
Sony Pictures Home Entertainment				R
Soo Jerky Ltd	R			
Soo Mill and Lumber Company Limited				R
Sopar International	R			R
Soprema Canada Inc.	R	R	R	R
South St. Burger Co.				R
Southwire Canada Company				R
Spectrum Brands Canada, Inc.	R	R	R	R
Spectrum Educational Supplies Ltd				R
Speedimpex Canada Inc				R
Spencer Gifts (Canada) Inc.	R		R	R
Spicers Canada ULC	R		R	R
Spin Master Ltd	R	V		R
SPINRITE LP				R
Spirito Italia SRL Inc				R
Sporting Life Inc.				R
Sports Art Collection				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Sprague Foods Limited				R
Springer's Meats Inc.				R
Springridge Farm				R
Springs Canada Inc.				R
Sprott Shaw (CIBT Ed Group)	R			
St. David's Hydroponics Ltd.				R
St. John Knits, Inc.	R			
St. Joseph Media Inc	R	V	R	R
St. Lawrence College of Applied				R
St.Joseph's Health Care London				R
St.Louis Franchise Limited				R
Staedtler-Mars Limited				R
STANDARD PRODUCTS INC.	R			R
Stanfield's Ltd.				R
Stanley Black & Decker - CDIY Canad	R	R	V	R
Staples Canada	R	R	R	R
Star Marketing Ltd.	R			
Star Produce	R	V	R	
Star Tile Centre Limited				R
Starbucks Coffee Canada, Inc.	R	R	R	R
Steinbach Credit Union			R	
Stella Pharmaceutical Canada Inc.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Sterling Marking Products Inc.				R
Stevens Omni Inc.				R
Stihl Limited	R			R
Stokes Inc.				R
Stokes Seeds Ltd				R
Stoltz Sales & Service (Elmira) Ltd				R
Stone Tile International, Inc.				R
Stoneridge Cycle Ltd				R
Stong's Markets Limited Partnership	R			
Storck Canada Inc.	R		V	R
Storex Industries	V		V	
Stratford Festival of Canada				R
Strathbridge Asset Management Inc.				R
Strathclair Credit Union Ltd.			R	
Streef Produce Ltd.				R
Stride Credit Union Ltd			R	
Structube Ltd				R
Subaru Canada, Inc.	R	V	R	R
Subway Franchise Systems Canada,Ltd	R	R	R	R
Summerland & District Credit Union	R			
Summerland Medicine Centre	R			
Summerland Sweets Ltd	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Summit Specialty Foods Ltd.	R			
Sun & Snow Enterprises Ltd.			R	
Sun Gro Horticulture	R		R	R
Sun Life Assurance Co of Canada	R	R	R	R
Sun Media			R	R
Sun Rich Fresh Foods Inc.	R			
Sun Valley Fine Foods				R
Sunbeam Corporation Canada Limited	R	V	V	R
Sunblaster Holdings ULC	R			
Sunchef Foods				V
Suncoat Products inc.				R
Suncor Energy Products Partnership	R	V	V	R
Sunglo Products Inc.				R
Sun-Maid Growers of California	V	V	V	R
Sunny Crunch Foods Ltd				R
Sunny Delight Beverages Co				R
Sunovion Pharmaceuticals Canada Inc	V			R
SUNPAN TRADING & IMPORTING INC.				R
Sunrise Credit Union Ltd.			R	
Sunrise Markets Inc. dba Sunrise So	R		V	
Sunrise Poultry Processors Ltd	R			
Sunrise Soya Foods (Toronto)				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Sun-Rype Products Ltd.	R	V	V	R
Sunshine Coast Credit Union	R			
Sunshine Market	R			
Sunstar Americas Inc	R	V	V	R
Sunwing Vacations Inc.	R	R	R	R
Superclub Videotron Canada Inc				R
Superior Communications Inc				R
Superior Harvest Foods Inc.			R	
Superior Natural ULC	R			
Supplierpipeline				R
Supreme Internatinal Co. Canada				R
Surati Sweet Mart Limited				R
Surrey Drug Mart				R
Surrey Meat Packers Ltd.	R			
Sustainable Produce Urban Delivery	R			
Sutton Group Realty Services	R			
Suzuki Canada Inc.	R		R	R
SUZY SHIER	R	R	R	R
Swan Products Canada Ltd				R
Swan River Star and Times			R	
Swan Valley Credit Union Ltd.			R	
SWAROVSKI CANADA LTD	R	V	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Swimco			R	
Swissmar Ltd				R
Synergy Credit Union		R		
Synnex Canada Limited	R		R	R
T&T Supermarket Inc				R
T&T Supermarket Inc.	R			
T.S.Simms and Co. Ltd			V	
Tai Foong International Ltd.				R
Tai Lung (Canada) Ltd.				R
Taiga Building Products				R
Take Two Interactive Canada Inc				R
Takeda Canada Inc.	R	R	R	R
Talbots Canada Corporation	R			R
TallGrass Natural Health Ltd.	R			
Tangerine Bank				R
Taplow Ventures Ltd	R			
Targus Canada Ltd.	R	V	V	R
Taro Pharmaceuticals Inc.	R	R	R	R
Tartine Tarts Inc.	R			
Taste of Nature Foods Inc				R
Tasty Chip Steak Products Ltd				R
Tasty Selections				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Tata Global Beverages Canada Inc	V	V	V	R
TAYMOR INDUSTRIES LTD.	R	V	V	R
TB Canada Company	R	R	R	R
T-Brothers Food & Trading Ltd	R			
TCT Mobile Overseas Limited				V
TDK Resource Fund				R
Tech Data Canada Corporation	R			
Techtronic Industries Canada Ltd				R
Tele-mobile Telus Mobility	R	R	R	R
Temiskaming Printing Co Ltd				R
Tempur Canada/Lite Generations				R
Tender Corporation	V	V	V	R
TENDERTYME				R
Terra Breads Retail Inc	R			
Terra Greenhouses				R
Terra International Food Inc.	R			
TerraLink Horticulture Inc.	R			
Terroni Inc.				R
Teva Canada Limited	R	R	V	R
Texas Instruments Canada Ltd	V			R
TFB & Associates Limited	V		V	R
TFI Foods Ltd	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Thai United Food Trading Ltd.	R			
Thamesville Herald				R
Thane Direct (Canada) Inc.				R
The Accolade Group				R
The Aldo Group Inc.	R	R	R	R
The Answer Garden Products Ltd.	R			
The Aylmer Express Limited				R
The Body Shop Canada Limited	R	R	R	R
The Bradford Group				R
The Brick Warehouse Corporation	R	R	R	R
The Canadian Jewish News				R
The Central Drug Stores Ltd.	R			
The Chamberlain Group, Inc.			V	R
The Chesterfield Shop Ltd.				R
The Children's Place	R			
The Chronicle-Journal				R
The Cider Keg				R
The City of Thunder Bay				R
The Clark Companies	R		R	R
The Clorox Company of Canada Ltd.	V	V	V	R
The Co-operators	R	R	R	R
The Cora Franchise Group Inc.	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
The CUMIS Group Limited				R
The Dominion of Canada General	R		R	R
The Dow Chemical Company				R
The Dufresne Group			R	
The Economical Insurance Group	R			R
The Empire Life Insurance Company	R	R	R	R
The Equitable Trust Company				R
The Fern Group Limited				R
The Flower Factory			R	
The Garden Basket Food Markets Inc.				R
The Genuine Canadian Corp.	R	R	R	R
The Globe and Mail			V	R
The Great Canadian Bagel, Ltd.				R
The Great-West Life Assurance Co	R	R	R	R
The Hardwood Flooring Store Ltd.				R
The Hillman Group Canada ULC	R		R	R
The INDEKA Group				R
The Innovak Group inc	V	V	V	V
The Juice Plus Company Canada Inc.				R
The Mentholatum Co of Canada Ltd.	V	V	V	R
The Mibro Group				R
The Minute Maid Company Canada Inc.	R	R	V	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
The Niagara Parks Commission				R
The North West Company		R	R	R
The Oak Grove Cheese Factory Ltd				R
The Ontario Glove Mfg Co Ltd.				R
The Original Cakerie Ltd	R			
The Pampered Chef Canada Corp.	V	V	V	R
The Pepsi Bottling Group	R	R	R	R
The Pottery Supply House				R
The Produce Terminal	R			
The Reader's Digest Association				R
The Second Cup Coffee Co.	R	R	R	R
The Sherwin-Williams Company	R	R	R	R
The Sleep Factory				R
The Source (Bell) Electronics Inc.	R	R	R	R
The stephen Group Inc			R	
The Stitch It, Canada's Taylor Inc			R	R
The Stone Crock Inc				R
The Swatch Group Canada Ltd.				R
THE TORONTO-DOMINION BANK	R	R	R	R
The University Of Western Ontario				R
The Village Cheese Company	R			
The Wellington Advertiser				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
The Westin Harbour Castle Hotel				R
The Windsor Star,				R
The Yankee Candle Company Inc.				R
Thermor Ltd.	R			R
Thetford/Norcold				R
Thinaddictives Inc.	V	V	V	V
Things Engraved Inc.	R		R	R
Thirty-Five Split Corp.				R
Thoi Bao Inc.				R
THOMAS & BETTS LIMITED	R	V	R	
Thomas Fresh Inc.	R	R		
Thomas Haas Chocolates & Patisserie	R			
Thomas, Large & Singer Inc.	V	V	V	R
THRIFTYS INC. (2005)	R	R	R	R
Ti Foods				R
Ticketmaster Canada	R			
Tiffany & Co. Canada	R			R
Tilley Endurables Inc				R
Tim Hortons Advertising and Promo	R	R	R	R
Timex Group Canada Inc	R		V	R
TMF	R			R
TNT THE NEW TREND				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Tomato King (2010) Inc.				R
Tomauri Inc.				R
Tommy Bahama Canada ULC	R			R
TOMY Canada Limited				R
ToolTown Inc.			R	
Tootsi Impex	V			V
Tootsie Roll of Canada Ltd				R
Top Food Distributors Inc.				R
Topper's Franchising Company Inc				R
Toppits Foods Ltd.	R			R
TOPS Products Canada	R		R	R
Top-Valu Food Products Ltd.	R			
Torlys Inc.				R
Toronto Barber & Beauty Supply				R
Toronto Hydro-Electric System Ltd				R
Toronto Star Newspapers Ltd.				R
Toshiba of Canada Ltd				R
Totes-Isotoner Canada Ltd	V			R
Tournament Sports Marketing Inc				R
Town Shoes Limited	R	R	R	R
Toyo Importing Co. Ltd.	R			
Toyota Canada Inc	R	R	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Toys 'R' Us Canada Ltd.	R	R	R	R
Trademango Solutions Inc.	R			
Trail Appliances	R			
Trainers Choice	V	V	V	
Transamerica Life Canada				R
TransCold Distribution Ltd (BC)	R			
TransLink	R			
Transportation Investment Corporati	R			
Travel Trust International				R
Travelbrands Inc.				R
Travelway Group International Inc.				R
Tree of Life Canada Inc	R			R
Trends	R			
Trent University				R
Trenton Distributors Limited				R
Tri-Group Management				R
Trimax Sports Inc.	R			
Trodat Marking Canada				R
Trophy Foods Inc.				R
Trouw Nutrition Canada Inc	R		R	R
Tru Value Food Centre Ltd	R			
Trudell Medical International		V	V	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
True North Chevrolet				R
True Science Holdings, LLC				R
True World Foods, Inc. of Canada	R			
TSC Stores LP				R
TT Group Limited	R			R
Tupperware Canada Inc.				R
TVA Publications Inc	V	V	V	R
Tweed Inc.			R	R
Tween Brands Canada Stores Ltd.	R	R	R	R
Twentieth Century Fox Home				R
Twinings North America	V	V	V	
Tyson Foods Canada Inc.			R	R
UAP INC	R	R	R	R
Uline Canada Corporation	R			R
Ultima Foods Inc	R		V	R
Ultramatic Sleep of Canada Inc.				R
Umbra Ltd				R
UNFI Canada Inc. (Central)	R	V	V	R
Unica Insurance Inc				R
Unico Inc.	R			R
Unilever Canada Inc.	R	V	V	R
Union Electric Lighting Co Ltd.				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
uniPHARM Wholesale Drugs Ltd.	R			
Unique Party Favors				R
Uni-Select Eastern Inc.				R
Uni-Select Prairies Inc.			R	
Unitron Hearing Limited				R
Universal Music Canada Inc.				R
Universal Studios Canada Inc				R
Université de Hearst				R
Universities Canada				R
University of Guelph				R
University of Ottawa				R
University of St. Michael's College				R
University of Toronto				R
University of Waterloo				R
University of Windsor				R
UNO Foods Inc	R			
Upfield Canada Inc.	R	V	V	R
Upper Canada Soap & Candle				R
Urban Barn	R	R	R	R
Urban Harvest Organic Delivery	R			
URBN Inc	R			
US Cotton	V			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
USANA CANADA	R			R
USP Canada Inc.	R	V	R	R
Utilities Kingston				R
Utility Corp.				R
Uvalux International Inc.				R
V Kraus Nurseries Limited				R
V.I.P. Soap Products Ltd	R			
Valassis Canada Inc				R
Valleybrook Gardens (Ont.) Ltd				R
Valleybrook Gardens Ltd.	R			
Value Village Stores	R			
Valvoline Canada			R	R
Van de Water-Raymond 1960 Ltd				R
Van Noort Bulb Co. Ltd.	R			
Vanbelle Nursery	R			
VANCAST INVESTMENTS LTD.	R			
Vancouver City Savings Credit Union	R			
Vancouver Community College	R			
Vancouver Giants	R			
Vancouver Island Farm Products	R			
Vandermeer Nursery Ltd				R
Vanderveen's Greenhouses Ltd.			R	

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Vanguard Credit Union			R	
VantageOne Credit Union	R			
Vaughn Custom Sports Canada Ltd				R
Vector Marketing Canada Corporation	R			
Vegfresh Inc.				R
Velux Canada Inc	R			R
Venturer Electronics Inc.				R
Veritiv Canada, Inc.			R	R
Veterinary Healthcare Solutions				R
Vetoquinol N.-A. Inc.	R		R	R
VF Outdoor Canada, Co.	R		R	R
Vibrant Health Products Inc.	R			
Victorian Epicure Inc	R			R
ViewSonic Corporate Headquarters			R	R
Village Farms Canada LP	R			
Villeroy & Boch Tableware Ltd.				R
Vineland Growers Co-Operative Ltd				R
Vintage Brands Limited	V	V	V	R
Virbac Canada, Inc.	R		R	R
Visage Cosmetics Ltd				R
Visions Electronics	R	R	R	R
Vita Health Products Inc.	V	V	R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Vitafoam Products Canada Limited				R
Vitto Brand Foods Limited				R
Vivere Ltd				R
Volkswagen Group Canada Inc.	R	R	R	R
Volvo Cars of Canada Corp.				R
Voortman Cookies Limited	R		R	R
VTech Technologies Canada Ltd	R			R
W. B. Hamilton Shoes (1860) Ltd.				R
W. Ralston (Canada) Inc.	R	V	R	R
W.H. Escott Co. Ltd.			R	
W.J. HEASLIP LTD				R
W.T. Lynch Foods Limited	R		R	R
Wahl Canada Inc.	V	V		R
Wakefield Canada Inc	V	R	R	R
Wallenstein Equipments Inc				R
Wal-Mart Canada Corp.	R	R	R	R
Walt's Pharmacy Limited				R
Warehouse One Clothing Ltd.	R	R	R	R
Warehouse Trading Inc.				R
Warner Home Entertainment Canada				R
Warner Music Canada Co.				R
Wasip Ltd				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
WATCH TOWER SOCIETY OF CANADA				R
Water Pik Inc	V	V	V	R
Waterline Products Co. Limited				R
Waterloo North Hydro Inc.				R
Watson Gloves (John Watson Limited)	R			
Watts Water Technologies				R
Wawanesa Mutual Insurance Company	R	R	R	R
WD-40 Company (Canada) Ltd.	R			R
Weddel Limited	R	V	V	R
Wedderspoon Organic Inc.	R			
Wellbond Import Export Inc.				R
Wells Fargo Financial Corp Canada			R	R
Wendy's Restaurants of Canada Inc.	R	R	R	R
West Coast Floral Growers & Distrib	R			
West Coast Toy Ltd.	R			
West Coast Wild Foods Ltd	R			
West End Coffee Roasters	R			
West Park Healthcare Centre				R
Westbank Projects Corp.	R			
Westbrook Floral Ltd.				R
Western Drug Distribution Center Lt			R	
Western Foods	R			

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Western Rice Mills Ltd	R			
Westex International Ltd				R
Westland Insurance Group Ltd.	R			
Westminster Savings Credit Union	R			
Weston Foods (Canada) Inc	R	R	R	R
Westpoint Distributors Ltd.	R			
Weyburn Credit Union Ltd.		R		
Whalen LLC	R			R
Whirlpool Canada LP	R	R	R	R
Whistler Blackcomb	R			
White Spot Limited	R			
Whole Foods Market	R			
Whole Foods Market Canada Inc				R
Wholesome Harvest Baking Ltd.				R
Wilfrid Laurier University				R
William Ashley China Corporation				R
Williams Lake and District Credit U	R			
Williams Sonoma Canada Inc	R			R
Willow Point Pharmasave #1106	R			
Wilton Brands LLC			V	R
Windset Farms	R			
Wing Hing Lung Limited				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
WINGTAT GAME BIRD PACKERS INC	R			
Winkler Canvas Ltd.			R	
Winkler Meats Ltd.			R	
Winmark Corporation	R	R	R	R
Winnable Enterprise Co. Ltd.	V	V	V	R
Winners Merchants International L.P	R	R	R	R
Winnipeg Outfitters Inc			R	
Winnipeg Pants & Sportswear			R	
Winnipeg Police Credit Union			R	
Wismettac Asian Foods Inc.	R			R
Witteveen Meats Ltd				R
WN Pharmaceuticals Ltd.	R	V	V	R
Wolverine World Wide Canada ULC				R
Woodstream Canada Corporation				R
WorkSafeBC	R			
World of Water Int'l Ltd.			R	
World's Finest Chocolate Canada Co				R
WrapZone Restaurants	R			
Wrigley Canada	R	R	V	R
WW Canada, Ltd	R	V	R	R
WWRD Canada, Inc				R
Xerox Canada Ltd.	R		R	R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Yamaha Canada Music Ltd.	R	R		R
Yamaha Motor Canada Ltd.	R			R
Yellow Pages Digital	R		R	R
YM INC. (SALES)	R	R	R	R
York Barbell Co. Ltd.				R
York University				R
Young & Young Trading Co.				R
Young Living Canada ULC				R
Young Sod Farms Inc.				R
Your Dollar Store With More Inc.	R	R	R	R
Yves Rocher North America Inc				R
Zale Canada	R	R	R	R
Zara Canada Inc.	R			R
Zara Home Inc	R			R
Zarky's Fine Foods Ltd.				R
Zavida Coffee	V	V	V	R
Zebra Pen Canada Corp.				R
Zenabis Ltd.	R			
Zinetti Food Products Ltd	R	V	V	
Zodiac Pool Care Canada Ltd				R
Zoetis Canada Inc	R		R	R
ZoomerMedia Limited				R

Company Name	Recycle BC	MMSW	MMSM	ON Blue Box
Zwilling J.A. Henckels Canada Ltd.	R		R	R

A.6.0 Plastic Packaging Study Scope of Work

APPENDIX A
STATEMENT OF WORK AND DELIVERABLES

Introduction

The 2019 Washington State Legislature found that unwanted products should be managed with priority on prevention and reduction, followed by recycling and reuse, before energy recovery or landfilling. The Legislature also found that producers of plastic packaging should consider design and management of their packaging in order to reduce environmental impacts. With these findings, Chapter 70.380 RCW Plastic Packaging—Evaluation and Assessment directs Ecology to identify options to reduce plastic packaging in the waste stream that are capable of being established and implemented by January 1, 2022.

As directed in Chapter 70.380 RCW, Ecology is hiring the Contractor to conduct a study of the impacts of plastic packaging in Washington. In this study, within the project schedule and available resources and data as outlined or amended by mutual agreement, the CONTRACTOR will:

- Include consultation with producers, providers of solid waste management services, and stakeholders.
- Assess the amount and types of plastic packaging currently produced in or coming into the state.
- Assess the full cost of managing plastic packaging waste including costs to ratepayers, business, local governments, and others.
- Assess the final disposition of plastic packaging sold into the state.
- Assess costs and savings to all stakeholders in existing product stewardship programs for plastic packaging where they have been implemented including where available the specific costs for the management of plastic packaging.
- Assess the infrastructure needs to manage plastic packaging.
- Assess the contamination and sorting issues facing the plastic packaging recycling stream.
- Assess existing organizations and databases for managing plastic packaging that could be employed for use in developing a program in the state.
- Compile a list of the programs and activities in the state currently managing plastic packaging, including end-of-life management and litter and contamination cleanup.
- Compile a list of existing studies of the final disposition of plastic packaging and materials recovery facilities' residual composition including data on cross-contamination of other recyclables, contamination in compost, and brand data in litter when available.
- Review and identify businesses in Washington that use recycled plastic material as feedstock or components of products.
- Review of industry and domestic or international efforts and innovations to reduce, reuse, recycle, chemically recycle plastic packaging, including technologies such as pyrolysis and gasification processes to divert recoverable materials away from landfills and into valuable raw, intermediate, and final products.
- Provide sources of information, including peer reviewed science, relied upon in the development of the report or assessment must be cited.

The CONTRACTOR report must include recommendations, consistent with the federal Food, Drug, and Cosmetic Act, to meet the goals of reducing plastic packaging through industry initiative and product stewardship to:

- Achieve 100 percent recyclable, reusable, or compostable packaging in all goods sold in Washington by January 1, 2025.
- Achieve at least 20 percent postconsumer recycled content in packaging by January 1, 2025.
- Reduce plastic packaging when possible, optimizing the use to meet the need.

In coordination with Ecology, the CONTRACTOR will conduct all aspects of research and work as defined in Chapter 70.380 RCW Plastic Packaging—Evaluation and Assessment. This includes coordinating engagement with interested Washington, national and international stakeholders.

The ultimate goals of the contract are to:

a. Meet the requirements of Chapter 70.380 RCW.

b. Engage interested stakeholders in a consultative process to inform options to reduce plastic packaging in the waste stream.

c. Draft a report that evaluates and assesses the amount and types of plastic packaging sold into the state as well as the management, disposal and clean-up of plastic packaging.

d. Provide recommendations for options to reduce plastic packaging in the waste stream through industry initiative or product stewardship or both, that are capable of being implemented by January 2022 for Ecology to submit to the Legislature by October 2020.

The source of funds for this Contract is the Waste Reduction, Recycling, and Litter Control Account and may include other available funding sources as well.

Applicable Documents

Chapter 70.95 RCW is the guiding statute for solid waste management in Washington. Under this statute, waste reduction is stated as a fundamental strategy of solid waste management and it is necessary to change manufacturing and purchasing practices and waste generation behaviors to reduce the amount of waste that becomes a governmental responsibility. In 2019 the legislature passed Chapter 70.380 RCW Plastic Packaging—Evaluation and Assessment. This is the main law this contract is to implement.

Other reference documents include:

- *Engrossed Second Substitute Senate Bill 5397*
- *Senate Bill 5397 (original bill)*
- *Product Stewardship Institute's Packaging EPR Toolkit*
- *Canadian Council of Ministers of the Environment: Strategy On Zero Plastic Waste*
- *Publications from The New Plastics Economy*
- *Analyzing Product Stewardship Policies for Packaging and Printed Paper in Washington State*
- *Packaging and Paper Product Extended Producer Responsibility Plan*
- *Oregon DEQ Plastics Recovery Assessment Project*

Requirements and tasks

CONTRACTOR shall hold a project kick off meeting, as directed by Ecology via phone, skype, teleconference or webinar with Ecology staff within 2 weeks of contract execution. Date of meeting may be amended upon mutual agreement of both parties.

Meetings with Ecology may be conducted via phone, skype, teleconference or webinar (as directed by Ecology, per meeting).

In coordination with Ecology, the CONTRACTOR will conduct all aspects of research as defined in Chapter 70.380 RCW and will assure completion of the following tasks:

Task 1: Research and compile data on plastic packaging in Washington

a. Assess the amount and types of plastic packaging currently produced or coming into the state by category, with the greatest specificity that is available.

   Wherever possible, categories will distinguish between the following attributes:

   - Type – Bottles, non-bottle rigid packaging, film, other
   - Resin – PET, HDPE, LDPE, PP, PS, other
   - Color – natural/translucent, colored
   - Other – multi-material, typically soiled

b. Compile existing available data on all programs, activities and entities that currently manage plastic packaging in Washington State including all documented:

   - Recycling services, MRFs and plastic processors
   - End-of-life management including landfill disposal and incineration
   - Litter cleanup
   - Contamination cleanup[1]

c. Assess the quantities and final disposition of all plastic packaging sold or entering into the state. This can include the following at a minimum, if available:

   - End markets for specific resins
   - Disposal locations
   - Litter
   - Contamination in other recyclables
   - Contamination at organics processing facilities and in compost
   - Other disposition

d. Research existing studies and sources of data, with a preference for Washington-based data, on plastic packaging contamination including:

   - Composition and amount of plastic packaging in residuals from material recovery facilities (MRFs)
   - Data on cross-contamination of plastic packaging in other recyclable commodities
   - Data on plastic packaging contamination in compost
   - Data on brand-specific plastic packaging identified in litter

e. Estimate the full cost of managing plastic packaging materials, including consideration given to costs that are determined by volume or weight. Define rationale for why providing costs by volume or weight:

   - Ratepayers

[1] For the purposes of this study, Ecology defines *contamination cleanup* as reducing plastics contamination in recycling streams. For example, optimizing recycling processing facilities to more effectively produce marketable commodities.

- Producers
- Solid waste handling companies
- Local governments
- Other businesses
- Other impacted stakeholders

f. Assess the infrastructure necessary for the complete management of plastic packaging in the state according to the waste management hierarchy. This may include:
   - Methods to reduce the amount of plastics used
   - Need for a plastic recovery facility (PRF)
   - Need for a secondary material recovery facility (secondary MRF)
   - Need for a plastic processing facility (that makes pellets) or chemical recycling facility, etc.
   - Depot and/or drop off systems to supplement curbside collection
   - Need for changes to existing curbside programs (materials accepted, collection frequency, collection methods etc.)

g. Assess the contamination and sorting issues facing the current plastic packaging recycling system. This will include drawing on the results from subtasks 1c and 1d, contamination and sorting issues currently facing Washington's recycling system, such as:
   a. The specific types of materials causing the most significant concerns,
   b. The primary drivers of these issues as they relate to plastic packaging,
   c. The losses (financial and material) estimated to be resulting,
   d. Actions identified in prior research to address these issues, and
   e. Policies that might connect to these actions.

Deliverables: Written report compiling all Task 1 findings. Per SB 5397, all data sources, peer-reviewed research, and assumptions will be documented for reference.

Due date: CONTRACTOR will submit the draft Task 1 deliverable by May 15, 2020.

Task 2: Assess businesses using or capable of using post-consumer recycled plastic packaging in Washington

Review and identify businesses in Washington that:

a. Use post-consumer recycled plastic packaging as a feedstock or component of a product produced by the company. Identify what plastic resins are used, if available
b. Use pre-consumer and/or post-industrial, or other recycled plastic packaging
c. Could potentially use post-consumer plastic packaging

Deliverables: Assessment of all businesses in Washington that use post-consumer recycled content plastic packaging material, use other recycled plastic materials, or could use post-consumer recycled content plastic packaging material. The deliverable will be in a cross tabular format that also tracks resin type, origin of material, product sector, and tons/year of potential use, based on available information. Suggestions by those companies interviewed on the barriers to higher recycled content incorporation (cost, lack of quality, lack of supply, consumer acceptance, health and safety standards, etc.) will be identified in the project report.

Due date: CONTRACTOR will submit the draft Task 2 deliverable by April 30, 2020.

Task 3: Research successful plastic packaging management programs and innovations

a. Conduct a review of industry and other domestic or international efforts and innovations to reduce, reuse, recycle, or otherwise successfully manage plastics and plastic packaging. This may include:
    - Extended producer responsibility systems
    - Chemical recycling facilities, pyrolysis and gasification processes to divert recoverable polymers
    - Utilizing recycled content in plastic packaging
    - Other innovative programs, systems, or technologies to manage plastics or to divert recoverable polymers and other materials away from landfills and into valuable raw, intermediate, and final products
b. Identify costs and savings to stakeholders in existing product stewardship programs where they have been implemented including, where available, the specific costs for the management of plastic packaging.
c. Identify existing organizations[2] capable of managing plastic packaging that could be employed for use in developing a program in the state.
d. Identify existing databases of plastic packaging producers that were used in other product stewardship programs.

Deliverables: CONTRACTOR will deliver a compilation and summary of information detailed in the task. This will include organizing findings and analysis in case studies. The review will summarize examples of best management practices and the best case studies describing how efforts and innovations are being applied to effectively manage plastics and plastic packaging.

Due date: CONTRACTOR will submit the draft Task 3 deliverable by March 31, 2020.

Task 4: Conduct Stakeholder Consultations

[2] For the purposes of this study, *organizations* include businesses, producer responsibility organizations, non-profit organizations, and trade organizations.

a. CONTRACTOR will work with Ecology staff to identify key stakeholders, consult with them on the research and findings, gather information, keep them informed, and provide opportunities for feedback in the development of the final recommendations.

   - Stakeholders include packaging producers and manufacturers, consumer goods companies, solid waste management services and collection companies, recycling facilities, plastic recyclers, non-profit environmental groups, litter and marine debris clean-up programs, local government solid waste or recycling personnel, Ecology management, other state agencies, legislators, and other interested parties.

b. CONTRACTOR will conduct a consultative process with interested stakeholders, to gather data and get input and feedback as the CONTRACTOR develops options to reduce plastic packaging in the waste stream.

c. At a minimum, in a consultative process:

   - Stakeholders may provide information and data needed to inform the research;
   - Stakeholders are provided with effective and timely notice of consultation opportunities;
   - Stakeholders can periodically see draft findings and recommendations in order to determine the implications to their interests;
   - Stakeholders are provided with sufficient time to respond to draft documents;
   - CONTRACTOR will provide a comment summary and a brief statement of how the comments were used. All comments will be collected and posted on the website.
   - Proceedings and results of activities that are part of the consultation process are properly documented and available for public review.

Deliverables: CONTRACTOR will deliver:

- A documented summary of proposed consultative process
- List of stakeholders
- Stakeholder comments and responses to be published on a designated website[3] for public viewing
- Summary document of the consultative process and findings

Due dates: CONTRACTOR will submit stakeholder consultative process outline with dates within one week of kick-off meeting. Stakeholder process will be held throughout project, January-June 2020.

Task 5: Report with findings and draft recommendations to meet plastic reduction goals, and options for legislative consideration.

a. Make recommendations to meet the goals to:

[3] Ecology-hosted website.

- Achieve one hundred percent recyclable, reusable, or compostable packaging in all goods with plastic packaging that are sold in Washington by January 1, 2025.
- Achieve at least twenty percent postconsumer recycled content in plastic packaging by January 1, 2025.
- Reduce plastic packaging when possible optimizing the use to meet the need.
- In developing these recommendations, ensure consistency with federal food, drug and cosmetic act (21 U.S.C. Sec. 301 et. seq.)

Considerations when making the recommendations:

- Implications and reality of meeting the above goals, including the needed system to support recycling and composting this much packaging.
- If possible, to reduce the impacts of plastic packaging in the waste stream.
- Identify recommended infrastructure necessary for the complete management of plastic packaging in the state according to the waste management hierarchy.
- Detail regulatory changes that would be required to achieve any of the recommendations. This may include regulatory changes pertaining to the following:
  - Utilities and Transportation Commission-governed waste systems
  - Local recycling contract systems
  - Statute and rule updates including RCW 81.77, RCW 70.95, WAC 480-70, WAC 173-350

b. Identify legislative options to meet plastic packaging goals that are capable of being established and implemented by January 1, 2022, as well as within 2-5 years.
   - The options must include expected estimated costs and benefits of the proposal to state and local government agencies to administer and enforce the rule, and to private persons or businesses by category of the type of person or business affected.

Deliverables: The CONTRACTOR will work with Ecology to develop a report outline and two report drafts documenting the results and recommendations from the entire study. Each round includes one round of consolidated edits from Ecology. The report will include:

a. Summary of the study findings from all tasks.

b. Recommendations to meet the goals of reducing plastics packaging through industry initiative and plastic product stewardship.

c. Options for legislative consideration to meet the plastic packaging reduction goals that can be established and implemented by January 2022, or if that timeline is deemed not possible, recommendations that could be established and implemented within 2-5 years.

d. Citations of the sources of information including any sources of peer-reviewed science.

e. Up to three verbal presentations on findings and recommendations for each task to Ecology and interested stakeholders.

Due Date: CONTRACTOR will deliver all final products and deliverables to Ecology by September 1, 2020. There will be two draft cycles allowing Ecology two weeks to review in each cycle. The first draft

will be delivered by July 14, 2020 and the second draft by August 14, 2020. Up to three verbal presentations may be given by December 31, 2020.

Task 6: Project Management

The Contractor must remain in close contact with the Ecology project manager, such as weekly calls, to report progress on the work plan, the status of the budget, update the work plan as necessary, and otherwise get input and approval. All invoices must be accompanied by detailed reports documenting expenditures, by task, and highlighting activities accomplished during the billing period.

Deliverables: CONTRACTOR will deliver kick-off meeting agenda and notes, call agendas and notes, monthly invoices and progress reports.

Due Date: CONTRACTOR will provide deliverables to Ecology as follows:

- Kick-off meeting: CONTRACTOR to submit agenda one week prior to meeting and notes one week after meeting.
- Regular check-in calls: CONTRACTOR to submit agenda 2-3 days prior to each call and notes 2-3 business days after each call.
- Monthly reporting: CONTRACTOR to submit invoice and progress report, itemized by task, by the 10th of the following month. Each invoice and progress report shall identify budget by task, amount spent per task, remaining balance by task. Any preapproved travel expenses shall be itemized by task.

Due dates may be revised, with Ecology preapproval, as long as it does not exceed the Period of Performance end date. To extend the Period of Performance end date, requires an executed amendment between the parties.

All products/reports submitted must be compatible with agency software and equipment. Ecology reserves the right to request additional reports relating to various aspects of the project. CONTRACTOR and Ecology will negotiate additional budget and schedule if additional reports are requested.

DOCUMENT ACCESSIBILITY REQUIREMENTS

ECOLOGY has identified those documents intended to be published, posted, or hosted on ECOLOGY's public web site, namely, the final report and presentation materials. The CONTRACTOR shall provide these documents in both their "native format" (such as Word, Excel, or PowerPoint) and in PDF format (latest version of Adobe Acrobat Pro or compatible). The CONTRACTOR shall run the PDF Accessibility Checker's report and provide the report with the delivered documents. The PDF documents must satisfactorily pass the Adobe Acrobat Pro Accessibility Checker (Full Check). ECOLOGY will review the PDF Accessibility results and may request the CONTRACTOR remedy any known issues. ECOLOGY reserves the right to perform independent testing to validate accessibility and may require the CONTRACTOR remedy any identified issues before acceptance of the documents. For assistance concerning accessibility, visit Washington State Office of the Chief Information Officer, OCIO Policy no. 188, Accessibility (https://ocio.wa.gov/policy/accessibility).