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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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.

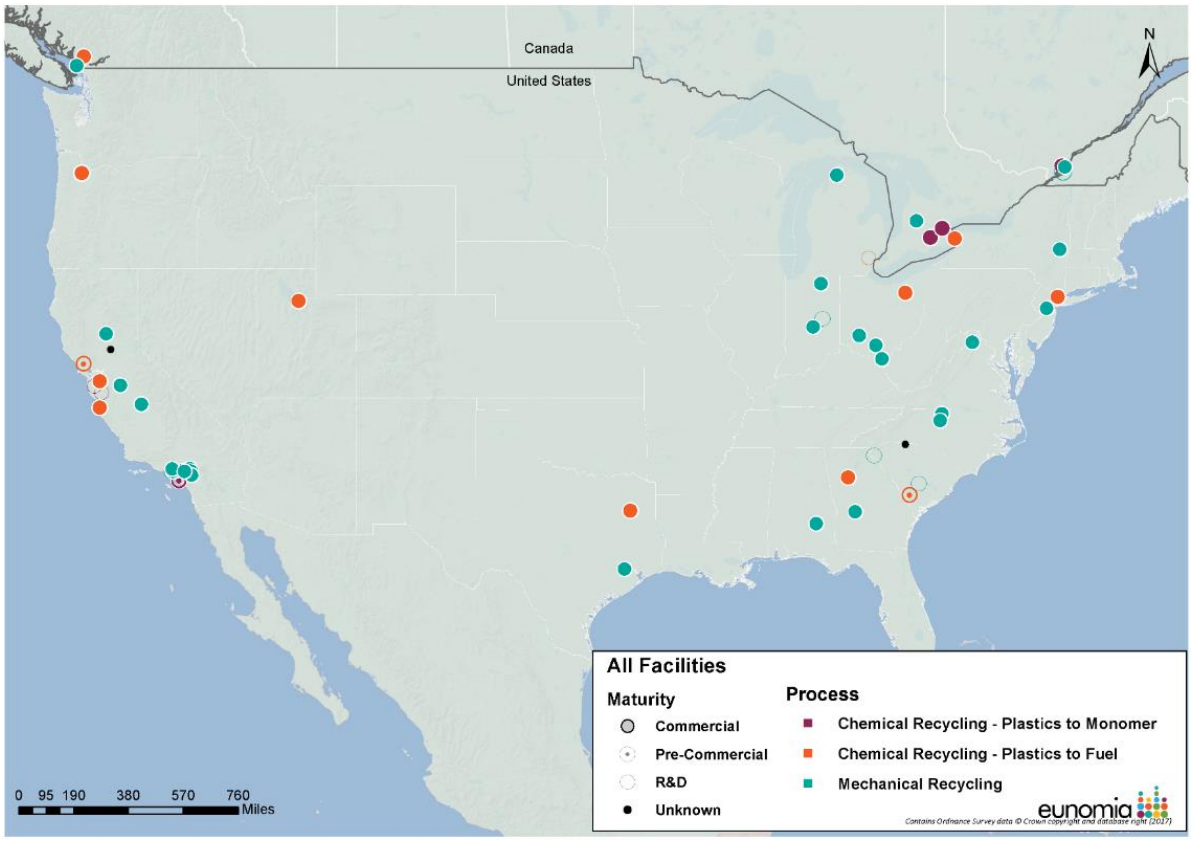
Processing and Supply Chain Technology

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.