PRFLEX

Optimizing the Recycling System for Flexible Plastic Packaging in Canada

WHITE PAPER

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CANADA PLASTICS PACT

CHEMISTRY INDUSTRY ASSOCIATION OF CANADA

circular materials

GAPC CPT

Éco Entreprises Québec

RECYCLEBC

Film & Flexibles Recycling Coalition
THE RECYCLING PARTNERSHIP

Context & Objectives

Flexible plastic packaging (FPP) is one of the most prevalent forms of packaging used for consumer goods: it represents 47% of the plastic packaging put on the Canadian market[1] and is estimated to grow at 4.2% year-over-year[2]. It is recognized for its light weight, durability, versatility, effective extension of food shelf-life, and resource efficiency – thereby offering sustainability advantages, including climate benefits. However, its lightness and wide range of designs, which may include multiple resins and other materials, induce collection, sortation, and recycling infrastructure challenges that need to be addressed to improve its recyclability and end of life.

These challenges are top of mind for governments and all members of the packaging value chain. At the federal level, FPP is notably highlighted as a subjected packaging type in Environment and Climate Change Canada's proposed regulatory framework for recycled content and labelling rules for plastics[3].

Through their EPR regulation, provinces are also setting ambitious recycling rate targets for FPP (e.g. 40% by 2027 in Quebec[4] , and 25% by 2026 in Ontario[5]). Furthermore, the recyclability of films and flexibles is a top priority for brand owners, retailers and manufacturers, as seen in voluntary initiatives such as the Canada Plastics Pact's five-year Roadmap for Flexible Plastic Packaging[6] to advance a more circular economy for FPP.

In this context, the Canada Plastics Pact (CPP), the Chemistry Industry Association of Canada (CIAC), Circular Materials, the Circular Plastics Taskforce (CPT), Éco Entreprises Québec (ÉEQ), Recycle BC and The Recycling Partnership's Film and Flexibles Recycling Coalition joined forces to launch PRFLEX, an unprecedented collaboration aimed at improving the recovery and recycling rates of flexible plastics and films collected from Canadian households.

[1] Canada Plastic Pact (2023). Advancing Circular Economy for Flexible Plastic Packaging in Canada – 5 year roadmap. Available at www.plasticspact.ca/wp-content/uploads/2023/09/Roadmap-Advancing-a-Circular-Economy-for-Flexible-Plastic-Packaging.pdf.

[2] Allied Market Research (2022). Flexible Paper Packaging Market - By Type (Pouches, Shrink Sleeves, Roll Stock, Wraps), By End-use (Food and Beverage, Retail and Consumer Goods, Pharmaceuticals and Healthcare, Personal Care) & Forecast, 2023 – 2032.

[3] Environment and Climate Change Canada (2023). Recycled content and labelling rules for plastics: Regulatory Framework Paper. Available at www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/recycled-content-labelling-rules-plastics.html.

To inform how to improve the overall system, the first undertaking of the PRFLEX initiative was to perform a foundational study on the current state of FPP recycling in Canada.

This research had three main objectives

03

Gathering baseline data

to determine the percentage of FPP currently being collected, sorted and recycled, according to format and type, in each province.

Identifying infrastructure gaps

in material recovery facilities (MRFs) and at reclaimers.

Proposing new technologies

and optimizing processes to increase capture rates, improve sorting and produce higher quality post-consumer recycled resins.

To lead this study, the PRFLEX partners contracted NovAxia, a well-recognized consulting firm that specializes in process optimization, materials recovery facility (MRF) operations and recyclability. Between March and June 2023, the research consisted of collating existing data from studies conducted by municipal and provincial organizations, producer responsibility organizations (PROs) and MRFs, conducting waste audits, discussions with industry stakeholders, and carrying out site visits at MRFs and reclaimers across Canada.

This White Paper presents an abbreviated version of the findings and recommendations of this study. **For a more in-depth analysis, the complete technical report prepared by NovAxia can be found here.**

[4] Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (2023). Règlement portant sur un système de collecte sélective de certaines matières résiduelles.

[5] Ministry of the Environment Conservation and Parks (2023). Resource Recovery and Circular Economy Act, 2016, O. Reg. 391/21: BLUE BOX.

[6] Canada Plastic Pact (2023). Advancing Circular Economy for Flexible Plastic Packaging in Canada – 5 year roadmap. Available at www.plasticspact.ca/wp-content/uploads/2023/09/Roadmap-Advancing-a-Circular-Economy-for-Flexible-Plastic-Packaging.pdf.

The Current State of Flexible Plastic Packaging Recycling in Canada

As per data gathered by the project team, the residential sector in Canada generates between 270 000 and 350 000 metric tonnes per year (TPY)[7] of FPP waste, of which only only 3% to 4% is recycled. The quantity collected curbside and through depots is estimated at roughly 46 000 to 59 000 TPY, or around 17%. This overall low performance can be explained in part by the fact that most Canadian municipalities only accept polyethylene-based films and flexibles (e.g. bread bags and overwrap) in the curbside recycling stream, while others, such as Ottawa, Winnipeg, and London, don't accept any FPP at all. Only British Columbia, through the Recycle BC residential packaging and paper products EPR program, proactively accepts all types of FPP at depots.

There is a significant gap between the performance of the current system and the various recycling targets, both voluntary and imposed by regulations. Achieving these targets must begin with a substantial increase in the collection rate, which can only be achieved by expanding curbside collection to all types of FPP across the country and implementing better ICI collection.

270 000 to 350 000[7]

TPY generated

46 000 to 59 000

TPY collected

3% to 4%

recycling rate

FINDING #1

Without accepting all FPP in the curbside collection systems, it will be very difficult to reach the ambitious voluntary and regulatory performance targets.

[7] Based on waste composition audits performed in the different provinces of Canada. Data should be taken with caution, as values obtained could be overestimated due to methodology (e.g. number of samples, potential integration of small ICI, and moisture level). See Appendix A of the technical report for data limitations.

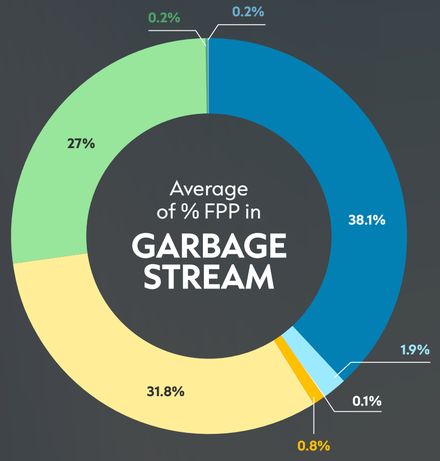
Flexible plastic packaging is also heavily used in the **industrial, commercial, and institutional (ICI)** sector; however, data is scarce on both volume and composition. To better estimate the amount of material generated, the project team performed a literature review and carried out interviews with several manufacturers and generators of ICI FPP. The results demonstrated that retail, trade, manufacturing, and construction are the largest contributing sectors. The agricultural, food service and health sectors are also of interest due to their distinctive nature.

Industry players confirmed that collection streams dedicated solely for FPP in the ICI sector are not widespread, and the majority of collected FPP is currently mixed with other materials and sent for sorting at MRFs or directly to reclaimers. FPP from the ICI sector represents an untapped potential of readily available material that is usually clean and primarily made of a single resin (usually LDPE) and would benefit from upstream segregation to enhance its value.

FINDING #2

The ICI sector represents an untapped feedstock of high-quality and valuable FPP.

Composition, Size and Print Coverage of Residential FPP in Canada



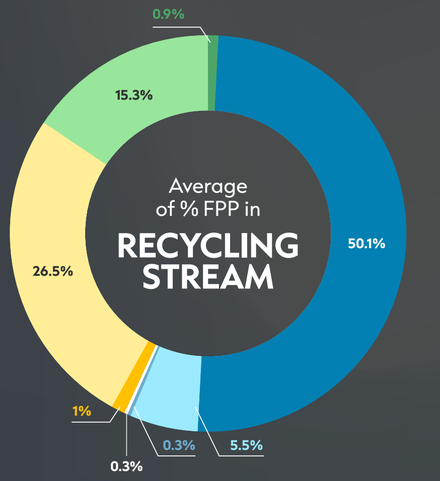


Figure 1: Average proportion of each resin for FPP in the garbage and recycling streams

To design a more optimal recycling system for films and flexibles, it is essential to get a more detailed understanding of the composition, size and print coverage of the FPP waste being generated in Canada. To do so, more refined waste audits were conducted to complement existing data sources, such as provincewide characterization studies.

Figure 1 presents the average proportion of each FPP type in both the disposal and recycling streams. In both cases, mono polyethylene (monoPE) and Other FPP make for the majority of FPP generated in the residential sector. The monoPE proportion is similar to other jurisdictions (between 40% and 50%), thereby giving confidence in the data. However, the proportion of mono polypropylene (monoPP) and mono polyethylene terephthalate (monoPET) differs from what was observed in other jurisdictions or from industry knowledge, and thus should be investigated further.

The Other FPP category accounts for approximately 30% of the total FPP put on the market. This category encompasses a large variety of different multimaterial structures, which can contain barrier layers such as nylon, PVDC, EVOH and aluminium. The variability of these structures, which is mostly due to the wide range of requirements for protection and shelf-life of the different packaged products, makes both the sorting and recycling of FPP more complex.

MonoPE
MonoPP
MonoPVC
Other FPP
Degradable resins
MonoPET
Non-PPP flexible
< 5 cm

FINDING #3

There is a significant variety of FPP on the market (resin type, structures, barriers, additives, etc.) which adds complexity to the recycling value chain.

Size is also an important criterion when designing sorting systems, notably to avoid reducing the performance of optical sorters due to overlapping of materials. The study therefore included a size analysis of the generated FPP waste: less than 1% of FPP were under 5 centimeters (2 inches), while the remaining FPP is equally divided between under and over A4/Letter format size ***(Figure 2)***.

Finally, print coverage is an important consideration for reclaimers, as end uses are different for both clear and for coloured resins. Print coverage is also key for sorting technologies that are embedded in packaging design, such as digital watermarking. As seen in ***Figure 3***, 60% or more of all FPP are printed, with the majority having over 50% print coverage. While the results of this characterization study provide valuable insights, these are limited both in scope and reliability and the results should be used with caution. In short, there remains a lack of reliable data on the volume of FPP considered as mono-material or multi-material, as well as on which types of packaging have problematic barriers, as this data is not currently captured by the producer declarations to the various EPR programs. This lack of reliable data is a major obstacle to guiding investment at both MRFs and reclaimers.

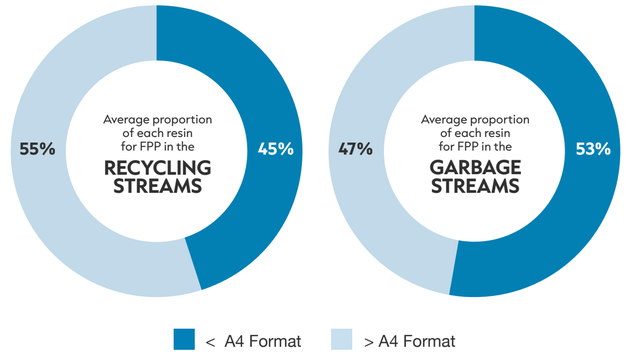


Figure 2: Average proportion of each resin for FPP in the garbage and recycling streams

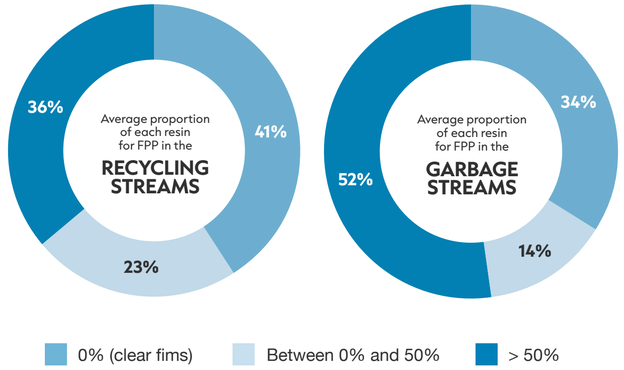


Figure 3: Average proportion of each resin for FPP in the garbage and recycling streams

FINDING #4

There is a lack of reliable and granular data on FPP composition and volume, which hinders decision-making.

Sorting of FPP in MRFs

The main mission of a MRF is to separate mixed recyclable materials according to criteria established by reclaimers. The nature of its activities and the expansion of sorting efforts are therefore directly influenced by the stability of demand and by the price of a material (revenue versus operating cost). From this perspective, the sorting of FPP, which is both costly and brings in low revenue, has not been a focus. The aim is rather to actively remove FPP from the flows in order to improve the quality of the bales of other sorted materials that will be marketed (e.g. mixed paper).

Sorting is thus not centered on the production of FPP bales free of contamination, which is what reclaimers are asking for, resulting in FPP bales with low marketability. This explains why 72% of the collected FPP nationwide is sent for disposal and 28% is sorted to bales, with only 62% of these bales being sold, mostly overseas. Although the implementation of EPR programs across Canada will help shift the focus from monetary aspects to sorting performance, FPP will remain a difficult material to sort.

Industrial visits and interviews carried out for this study demonstrated an almost uniform inability across Canadian MRFs to effectively sort FPP at present

This is especially true for single stream MRFs, who require more sorting stations and equipment to capture the FPP that can find its way into every material line.

Figure 4 shows a generic representation of the sorting process for single stream collection, with manual or automated sorting stations dedicated to the removal of FPP. At pre-sort, materials commingled in recycling bags are often released, and employees remove the large FPP before they reach subsequent separators. The majority of FPP is then directed to the 2D fibre stream given their light weight and flat bodies, but some bags are still drawn into the flow of containers, which forces operators to assign manual or automated sorters to several control stations.

This process is both labour and equipment intensive, which makes sorting FPP among the most expensive activities in a single-stream MRF. Based on the financial information shared by operators on single stream MRF operations, the cost of sorting FPP varies from $488/tonne, in the case of a large capacity facility (>50,000 TPY), to $738/tonne, for a medium capacity facility (30,000 to 50,000 TPY), excluding costs or revenues related to the marketing, recovery, or disposal of these materials.

FINDING #5

Loose FPP represents one of the most challenging and costly materials to sort for existing single-stream collection MRFs.

Key factors making FPP challenging for MRFs

- **It overlaps with other materials** on conveyors and confounds recognition.
- **It tends to be contaminated by other materials of similar density (such as strings and twine, paper, etc.),** especially in presence of air classification and aeraulic transfer systems.
- **It accumulates on the rotating components of equipment** reducing their efficiency.
- **It can contain organic matter,** increasing the potential for contamination.
- **It is difficult to distribute evenly on a sorting belt,** due to turbulence and interference from other, heavier objects.
- **It involves a great deal of handling to produce a bale of FPP,** as a 750kg bale of FPP would contain between 75,000 and 225,000 single film units[8].

[8] Assuming a weight of between 5g and 15g per unit.

The sorting of FPP is more efficient in a dual stream collection model, as it bypasses the initial 2D/3D screening used to separate fiber products from containers in a single stream model.

(Figure 4 on the next page shows the differences in the FPP sorting proces in single and dual stream) models

Analysis of European models and site visits confirmed that, in a dual stream model, FPP is usually more prevalent in the container stream, which leads to a simplified separation from rigid plastics. FPP is removed in the process flow after the trommel screen by a ballistic separator, then routed to a control conveyor where the small proportion (<15%) of fibre present in the flow can be removed.

In the fibre stream, the low proportion of FPP requires only an optical sorter and two quality sorters in order to remove them from the flow. Based on a review of this process, the project team estimated the cost of sorting FPP to be under $300/tonne for both lines, which is significantly lower than in a single stream collection system.

FINDING #6

A dual stream collection model is better for sorting FPP, both technically and economically.

Despite the challenges, this research has demonstrated that there are solutions to process FPP more efficiently in a single-stream collection model. Through discussions with designers and equipment vendors, two main models are emerging:

01

The early-catch model,

where FPP is removed at the start of the line, preventing FPP from dispersing throughout the flows. This requires, among other things, the removal of traditional mechanical separation equipment after pre-sort, such as vision equipment in which the detection is based on the image and the signature rather than on the shape and the dimension. As this model requires additional equipment and significant changes in the flow of the MRF, it is likely only possible within the framework of the construction of a new facility.

The catch-all model,

where lower value materials (which includes FPP) are grouped in a series of flows towards the end of the process. In this model, sorting efforts are focused on value-added materials, ensuring that contaminants and low-value materials are removed from as many capture points as possible through optical, robotic and aeraulic sorting. The catch-all model appears to be a more reasonable solution for existing MRFs, as demonstrated within the framework of the Materials Recovery for the Future (MRFF) project[9], but only in the context where physical space is available and other equipment and processes are already highly efficient.

02

FINDING #7

Technologies and procedures exist to efficiently process FPP in a single-stream collection model but implementing them in existing MRFs is not always possible due to operational constraints.

[9] Materials Recovery for the Future Final Project Report (2023). Available at www.americanchemistry.com/content/download/14438/file/2023-MRFF-Final-Project-Report.pdf.

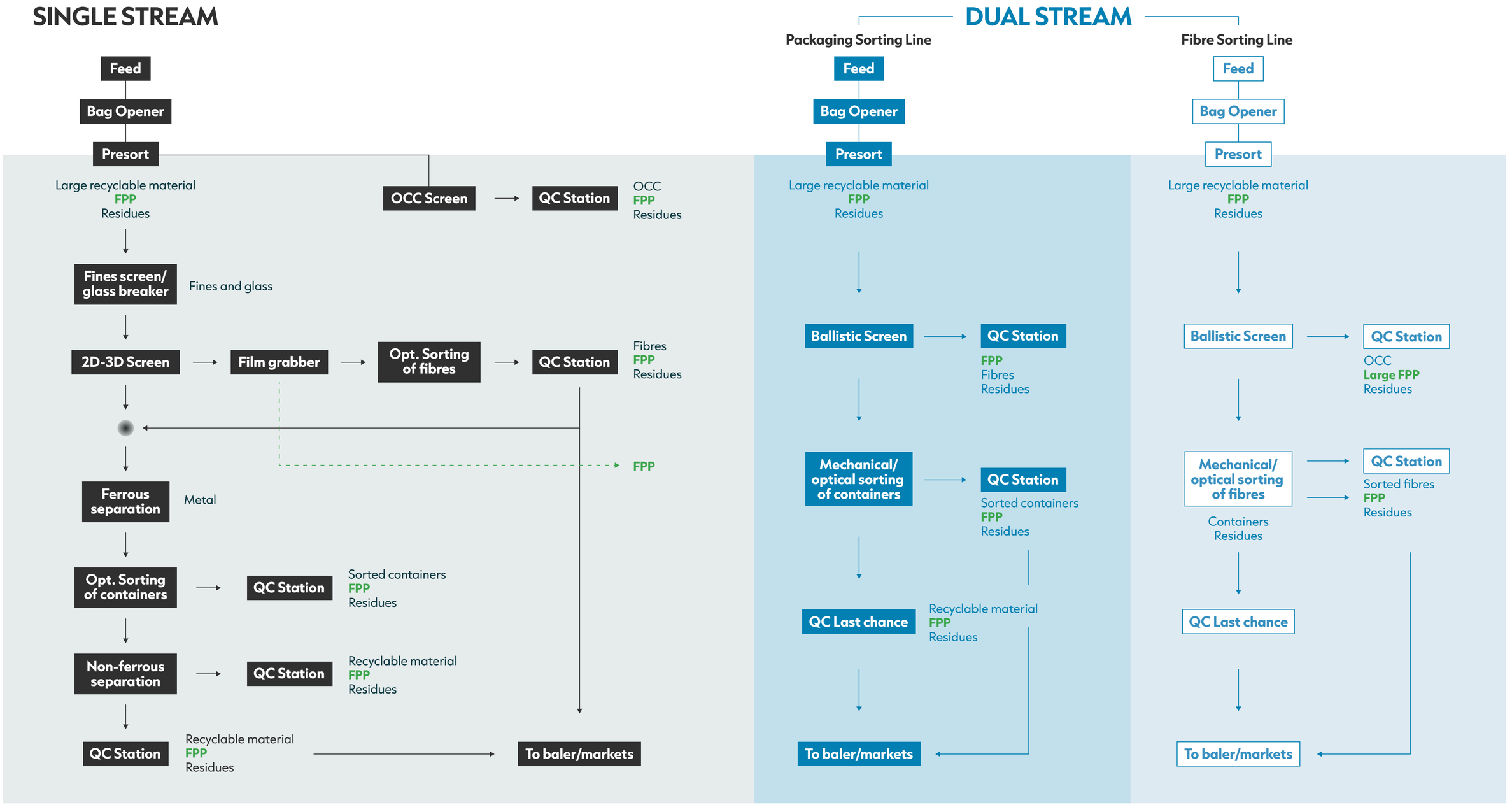


Figure 4: Generic representation of single and dual stream FPP sorting processes in MRFs

Reclaimers and End-markets for FPP

There are three major reclaimers that process residential post-consumer plastic film in Canada today, with others specializing solely in post-commercial sources.

LDPE LLDPE

In alignment with demand, they focus mainly on polyethylene (PE) materials, such as LDPE and LLDPE.

While some are equipped with optical sorters to treat incoming feedstock, others solely rely on separation undertaken by flotation tanks, which does not allow the adequate separation of PE film from PP or multi-materials packaging. Therefore, the demand for curbside collected FPP remains marginal compared to the ICI sector (e.g., pallet wrap, bags for deposit containers, etc.), which supplies a more homogeneous and higher-value feedstock. It is estimated that they can collectively process less than 30,000 TPY of FPP.

Chemical recycling can be complementary to mechanical recycling, and its ability to produce recycled resins that can be both transparent and suitable for food contact makes it well positioned to manage a multi-material FPP stream. However, chemical recyclers presently also mainly seek a supply of polyolefins (PE and PP), and as with mechanical recyclers, some technologies like pyrolysis have a limited tolerance to PVC/PVDC (1%) and other barriers such as PET, EVOH and nylon (5%). For these reasons, multi-material FPP is currently only recycled into low quality durable goods products, while a limited portion is sent to chemical recycling facilities to produce fuel, an activity that is generally not counted towards the recycling performance targets set by regulations.

To achieve both the stated regulatory and additional voluntary targets over the next 5+ years, it is expected that an additional capacity of 70,000 TPY would be needed. The reclaimers interviewed confirmed the potential to increase their processing capacity, but such investment would require long-term supply guarantees of high-quality material, as well as an increased demand for recycled resins.

FINDING #8

There are only a few FPP reclaimers in Canada and their capacity to process large volumes and non-PE FPP are limited.

According to the reclaimers interviewed, it is possible to achieve the quality specifications of several end-markets by separating the different resins used in FPP (PE, PP, and multi-materials) and using material from ICI collection.

Nevertheless, the resin produced will not be transparent or colourless. This explains why garbage bags, durable products, wood-plastic composites (WPC), and construction material are currently the primary products made from recycled FPP. To achieve the quality needed for transparent and food applications, chemical recycling facilities or advanced sorting and mechanical recycling technologies (such as deinking or attribute sortation) will be required.

FINDING #9

End markets for FPP collected through curbside collection systems remain limited, especially for hard-to-recycle materials.

9 Recommendations

The overall objective of the PRFLEX initiative was to identify concrete solutions to optimize the recycling system for FPP.

Based on the study carried out by the research team and its subsequent findings, nine recommendations were formulated to help meet the challenges currently faced by the entire FPP recycling value chain.

01

AIM for better harmonization of FPP through the implementation of design for recyclability measures.

Having FPP on the market that is not designed for recycling through Canada's existing recycling infrastructure makes it difficult for reclaimers to meet the quality specifications of the end-markets. For this reason, brand owners should be made responsible for the design choices they make, and measures should be implemented to support the transition to FPP that is designed to be recycled. Platforms for dialogue between brands, MRFs and recyclers need to be set up, where designers would be informed about specific technical constraints in sorting and recycling. For example, the Canada Plastics Pact has a microsite dedicated to the Golden Design Rules for Plastics Packaging[10], which showcases companies implementing innovative packaging solutions. Additionally, resources such as the Canadian Guidance for the Golden Design Rules[11] (specifically Rule #6 "Increase Recycling Value in Flexible Consumer Packaging"), the Pathways to Mono-Material FPP[12], and the APR Design Guide[13] could also serve as references to support design efforts towards recyclability. Finally, eco-modulation measures through EPR fees should look at setting much higher fees for multi-material structures compared to recyclable mono-material structures, where the technical or regulatory constraints allow for it. This would create a financial incentive for producers to evaluate alternatives, as well as reward brand owners integrating best practices in design for recyclability.

02

SET UP dedicated collection of FPP in ICI.

The study demonstrated that there is an untapped volume of FPP generated by the ICI sector. This feedstock is primarily made of polyethylene films and is more homogeneous. It can also be sorted at the source, meaning less contamination, and the materials are readily available in large quantities. It also doesn't contain certain specific impurities seen in curbside FPP, which increases the potential to produce higher quality recycled resins through mechanical recycling.

However, the research showed that managing FPP in a mixed waste collection or in MRFs dedicated to ICI materials does not guarantee that reclaimers can access this value-added supply due to potential cross contamination with other materials. Therefore, the main issue is around collection of this material, and setting up collection programs dedicated specifically to FPP from the ICI sector will be crucial. As the generators will greatly vary in size, volumes generated and operation types, the programs must be adapted to their context (frequency, storage method, etc.) and allow them to benefit from financial support to amortize the implementation costs when required. For example, some generators might benefit from purchasing compactors to reduce storage space and increase transport efficiency.

03

Through regulatory reporting and waste studies, IMPROVE the understanding of FPP composition and market.

The study highlights the lack of existing reliable and granular data on FPP composition and volume. It is thus difficult to precisely know the quantities and exact structures of mono-material and multi-material packaging, and to estimate which types of packaging contain problematic barriers. This lack of information is a major obstacle to investment in both MRFs and reclaimers. While some packaging may be compatible with existing channels, others are not, and their complex separation can compromise the overall recycling capacity. It would therefore be useful to develop better knowledge of the FPP put on the market, particularly through producer reporting to the PROs. To this end, PROs could classify FPP in several more precise categories and request additional design information that have an impact on the behaviour of FPP packaging in the value chain.

A harmonized way of measuring what is collected, sorted, and recycled should also be developed across Canada. Various stakeholders (governments, PROs, municipalities) could agree on a common characterization methodology, which should include a component enabling the identification of the different resins used.

[10] Canada Plastics Pact (2023). The Golden Design Rules for Plastics Packaging. Available at www.goldendesignrules.plasticspact.ca/.
[11] Canada Plastics Pact (2022). The Golden Design Rules for Plastics Packaging – Canadian Guidance Version 1. Available at www.goldendesignrules.plasticspact.ca/wp-content/uploads/2022/02/GDR-Canadian-Guidance-Version-1.pdf.
[12] Canada Plastics Pact (2022). Pathways to Mono-Material Flexible Plastic Packaging. Available at: www.plasticspact.ca/pathways-to-mono-material-flexible-plastic-packaging/.
[13] Association of Plastic Recyclers (2023). PE Film Design Guidance. Available at: www.plasticsrecycling.org/pe-film-design-guidance

04

ACCEPT all types of FPP in curbside collection and make MRFs responsible for capturing FPP, and not for separating FPP by resin or type.

Given the current state of sorting technologies utilized by MRF operators, alongside the level of plant automation and available space, it's clear that MRFs fall short in capturing the maximum amount of FPP, let alone be able to produce separate bales of FPP as per the specifications outlined by the reclaimers. This belief is validated by reclaimers and substantiated by instances where MRF operators attempted to generate bales of flexible PE, PP, or other materials. In these trials, the bales remained difficult to market because of the extra sorting needed before they could be washed and pelletized. The study also demonstrated the major efforts required to meet the various FPP recycling targets imposed by current and upcoming regulations. These objectives will only be attainable with a significant increase in the collection rate, which requires accepting all FPP types in curbside collection. It is estimated that doing so would significantly increase the quantity of FPP received at the MRFs, which would negatively impact their operations. In this context, it is therefore recommended that MRFs focus solely on maximizing the capture of FPP by producing bales of mixed FPP or combine them with rigid plastics (e.g., bales of plastics #3-7 including FPP). MRFs need to direct their efforts on removing the contaminants deemed problematic by the buyers (namely fibres, metal, and glass), leaving the responsibility for separating resins to the reclaimers.

05

Where not already implemented, EVALUATE the feasibility of dual stream collection.

The study demonstrated that FPP can be managed more efficiently in a dual-stream MRF, because its preliminary segregation from fibre during collection simplifies the sorting process. Once mixed with the containers and packaging, the task of withdrawing FPP can be done more easily with mechanical, optical or aeraulic equipment, as their mechanical properties differ. It is therefore recommended to explore setting up or converting to dual-stream collection, to both increase FPP collection rates and simplify its sorting at MRFs.

In 2021, it was estimated that about a third of the Canadian population was served through a dual stream system. While some provinces are already engaged in the process of transitioning to such a model, an economic assessment has to be performed to better understand the costs involved for a full transition across the country. This evaluation should gauge the extent of the transition in each province, with a detailed plan based on the current MRF capacity and future infrastructures that might be required.

06

When dual stream is not suitable, EVALUATE the feasibility of building new single-stream MRFs designed to sort FPP more efficiently.

If the conversion from single to dual stream collection is not possible, then building new single stream MRFs to effectively handle FPP is a preferred strategy. One viable approach to consider could be establishing long-term agreements with existing single stream MRFs to build new facilities, which could avoid pushback from the existing players who would have to retire existing facilities. In the context of the EPR transition, this decision will rest with the PROs. These new MRFs would be purposefully optimized to efficiently capture FPP, while ensuring alignment with reclaimer specifications. They would also be designed to handle the expected volume when FPP is solicited in the collection system, while mitigating the risk of contaminating the other commodities. This would also be an excellent opportunity to draw up specifications for the construction of new MRFs that would rely on best practices in performance and identify the most promising new technologies.

Ideally, a new network of such state-of-the-art single stream MRFs would be built across the country to ensure that the quantity and quality of FPP captured is maximized and the downstream recycling costs are reduced.

07

If building a new single-stream MRF is not feasible, IMPLEMENT solutions for reducing loose FPP, such as depots and bags-in-bag.

The current sorting infrastructure is not designed nor prepared to receive larger quantities of loose FPP, and a viable pathway must be identified to reduce the pressure on existing single-stream MRFs. This could be done by implementing alternative collection programs, such as:

- Depots and return-to-retail: Depots in commercial areas, ecocentres, and retailers can become FPP collection points on behalf of a stewardship agency, therefore reducing the amount of loose FPP going through curbside collection. Although this recommendation applies mostly to single stream, it can also prove beneficial in the context of a dual stream, as observed in Recycle BC's program.
- A bag-in-bag collection program: To alleviate pressure on single-stream MRFs, households could be encouraged to bundle FPP in one dedicated package, thus reducing the workload for sorters and maintenance teams. Experiences from pilot projects in certain regions of Canada reveal that sustaining such initiatives requires clear and continuous communication to citizens, but more research is needed to assess the rate of participation and its potential impact on the system.

08

DEVELOP new capacities for FPP separation at reclaimers and implement emerging sorting and recycling technologies.

The field assessment and interviews conducted with Canadian reclaimers demonstrated their technological expertise and their ability to prepare material in line with the evolving market demand. Regardless of the options selected to boost collection and capture, the responsibility for separating resins should therefore lie with the reclaimers. In this context, implementing a structured reclaimer front-end process (RFEP) network seems like the best option for FPP separation. To support FPP recycling from coast to coast, this network must rely on additional secondary sorting capacities in Western Canada and on the introduction of new RFEPs in Ontario and Quebec.

Sorting FPP in a dedicated RFEP also appears to be the most economical option and allows for more significant investment in advanced technologies. As an example, the investment required for the integration of artificial intelligence (AI), near-infrared (NIR) and digital watermarking material recognition might prove more judicious in a few dedicated installations, rather than if it were required to be installed in each MRF across the country. Based on a preliminary analysis, the cost of a new reclaiming facility is estimated at around $50 million, but retrofitting existing facilities with RFEP can be an interim step.

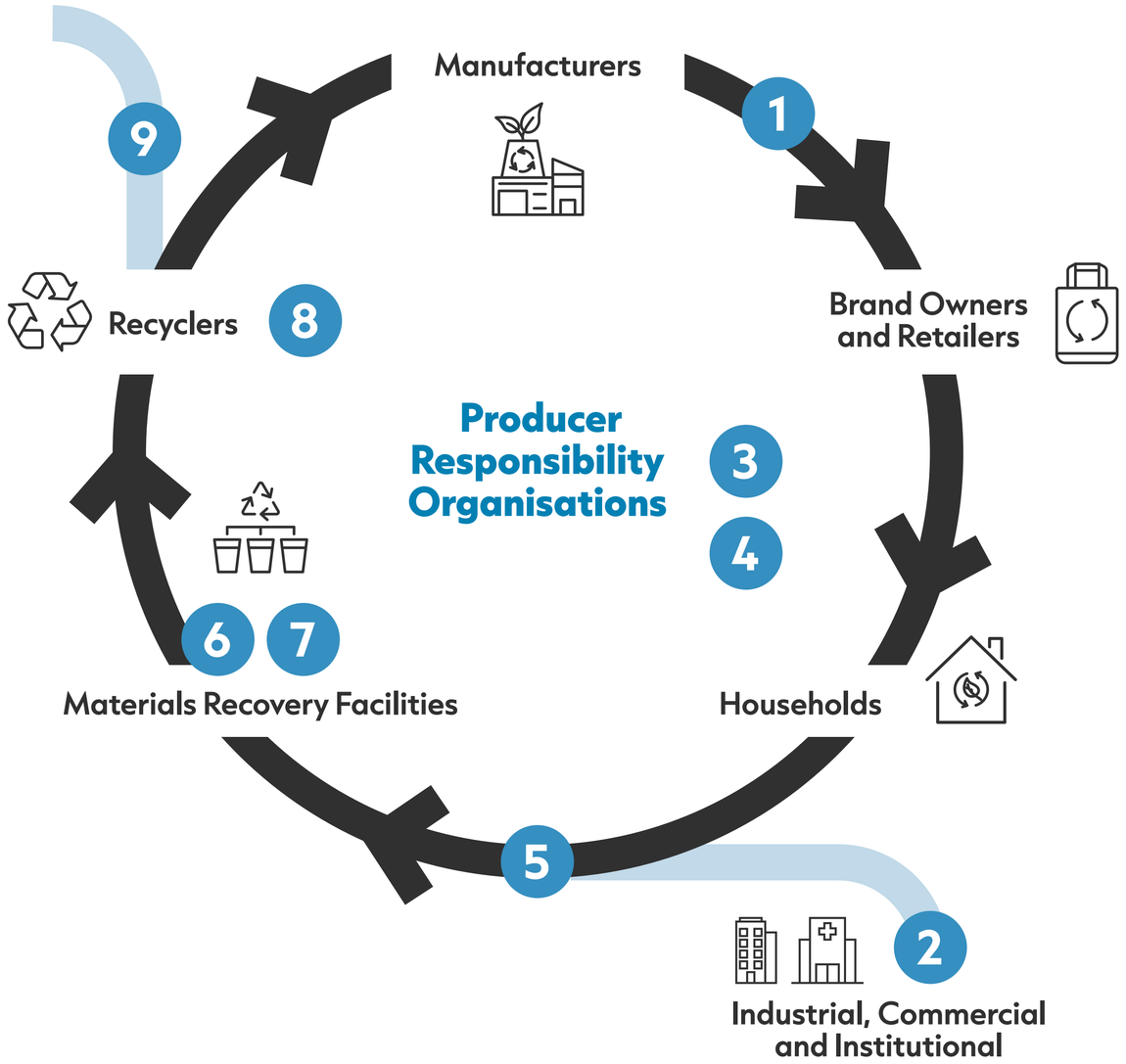
09

Through supply chain collaboration, SUPPORT the building of viable end-markets for all types of collected FPP, including hard-to-recycle materials.

As explained at the outset, the biggest obstacle to improving the value of FPP is the absence of a consistent market. Currently, there is demand for incorporating recycled PE resins into different kinds of high-quality products (such as shrink wrap and food packaging), but the limitations in sorting and mechanically recycling curbside FPP hinder meeting this demand. The reclaimers therefore tend to turn to post-commercial ICI sources, that are more often clear, colourless and less contaminated.

However, there are several markets that could be developed to help increase the demand for mechanically recycled resins made from residential polyethylene FPP. Such markets include agricultural and construction films, heavy duty bags and sacks, drainpipes and other durable goods like wood plastic composites and asphalt. In parallel, new outlets should be identified and developed for other specific FPP types, such as polypropylene or multi-materials. It is also critical to recognize the potential role that chemical recycling will play in the future of FPP recycling, particularly in the production of food-grade and transparent recycled resins.

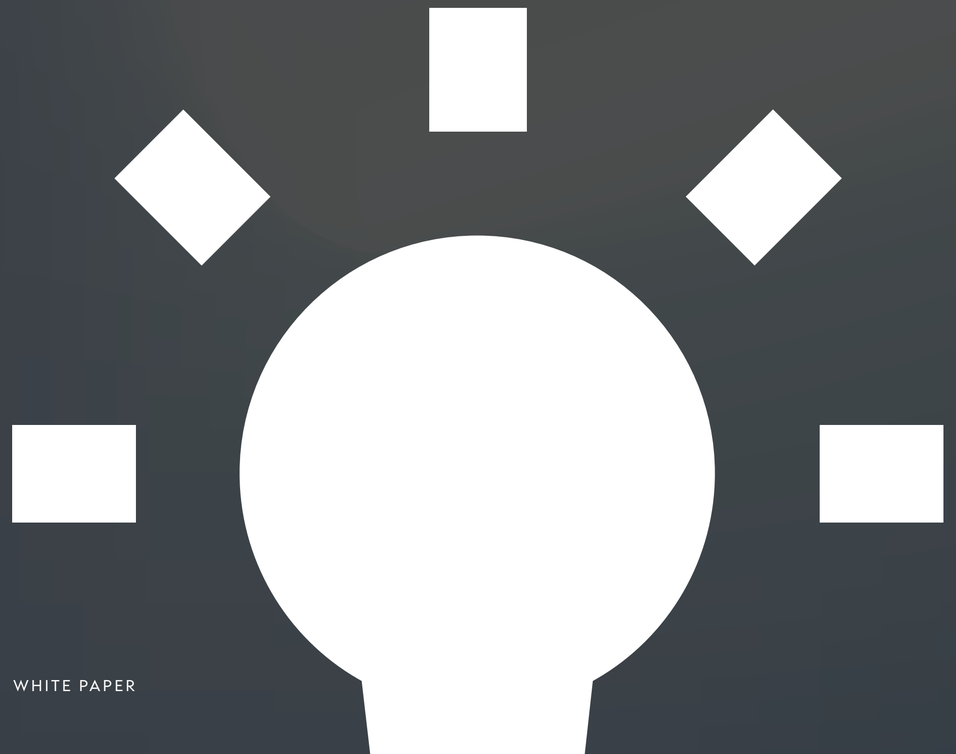
The Perfect Recycling System for FPP



1. **AIM** for better harmonization of FPP through the implementation of design for recyclability measures
2. **SET UP** dedicated collection of FPP in ICI
3. Through regulatory reporting and waste studies, **IMPROVE** the understanding of FPP composition and market
4. **ACCEPT** all FPP in curbside collection and make MRFs responsible for capturing FPP, and not for separating FPP by resin or type
5. Where not already implemented, **EVALUATE** the feasibility of dual stream collection
6. When dual stream is not suitable, **EVALUATE** the feasibility of building new single-stream MRFs designed to sort FPP more efficiently.
7. If building a new single-stream MRF is not feasible, **IMPLEMENT** solutions for reducing loose FPP, such as depots and bags-in-bag
8. **DEVELOP** new capacities for FPP separation at reclaimers and implement emerging sorting and recycling technologies.
9. Through supply chain collaboration, **SUPPORT** the building of viable end-markets for all types of collected FPP, including hard-to-recycle materials.

Conclusion

The main objective of the PRFLEX initiative is to identify favourable conditions for improving the capture and recycling of FPP in Canada.



The main objective of the PRFLEX initiative is to identify favourable conditions for improving the capture and recycling of FPP in Canada. This study painted a picture of the current generation and collection of FPP in the country, whether from the residential or ICI sector, and highlighted the shortcomings of the current collection system. The research also demonstrated that the current state of MRFs won't allow for high-capture rates of FPP, let alone meet the upcoming regulatory targets. The absence of markets and revenues for the sale of FPP inevitably forces them to concentrate their efforts on more lucrative materials, and to manage FPP as a contaminant.

Furthermore, the study demonstrated the need to structure and improve the current network of reclaimers across the country. Today, no Canadian reclaimer has the capacity to effectively separate FPP by type of resin at the scale that will be required in the near-term to meet existing targets, which underscores the need for building new infrastructure and establishing long-term contractual commitments. Finally, while current lower-quality outlets make it possible to integrate some mechanically recycled resins, the contribution of chemical recycling may become inevitable to meet the high demand for food-grade and transparent recycled resins.

In conclusion, managing FPP is complex. Reaching regulatory performance targets will take time and significant, coordinated investments, and a development and optimization plan should be envisioned over a ten-year horizon. In the context of EPR being expanded across Canada, it is up to each individual PRO to determine the set of solutions that best fits in the context of the provinces where they operate. It is also up to each reclaimer, existing or prospective, to determine their level of involvement in the development of new innovative processing capacities. Finally, it is also crucial for brand owners to immediately prioritize the transition to materials that are actually recyclable. To successfully solve the challenges posed by FPP, the involvement of all the supply chain actors and all levels of government will be essential.

Contact us here.