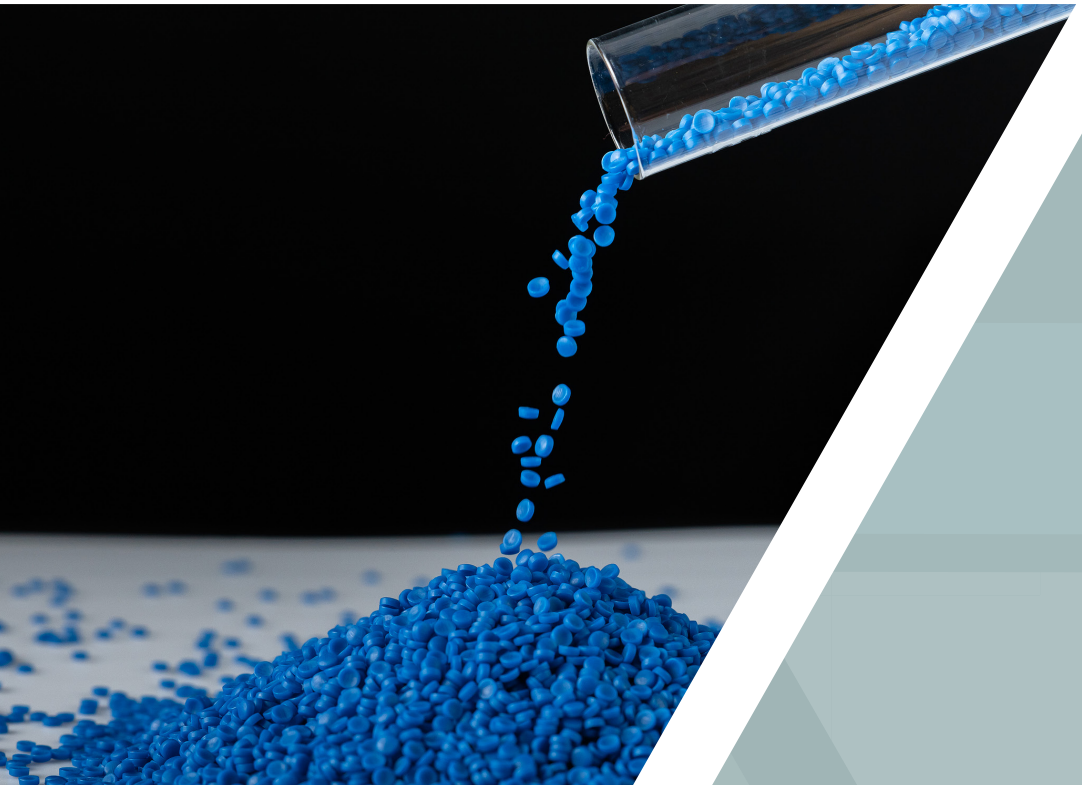
WHITE PAPER

Advanced Recycling: Seizing the Circular Plastics Opportunity



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CHEMISTRY INDUSTRY ASSOCIATION OF CANADA | PLASTICS DIVISION

Chemistry and plastics enable our modern and sustainable way of life and are key to developing a prosperous low-carbon economy for Canada.

Our modern way of life would not be possible without plastics. However, better post-use management of plastic products is required, and we need to move to a circular economy for plastics that recognizes plastics as a resource or feedstock, not a waste.

This will require simpler product design, improved sortation facilities and mechanical recycling technologies across the country, and harmonized recycling systems across provinces. This will allow plastics to be collected at a scale that makes it possible for industry to turn these items into new products.

In addition, many Canadian companies are leading the way on research into advanced recycling. These new technologies transform plastic products back into their basic molecules, allowing the production of new resins, pellets, and plastic products that will continuously recirculate in the economy.

Investing in plastics recycling infrastructure and technology will increase the availability and use of recycled plastics in products. Given recycled plastic resins have a lower environmental footprint than virgin resins, it will also increase the availability of made-in-Canada low-carbon products, providing an important trade advantage.

INDUSTRY ACTION

In June 2018, the Canadian plastics industry announced ambitious targets that underscore their commitment to a future without plastic waste:

By 2030
100% of plastic packaging will be **recyclable** or **recoverable**

By 2040
100% of plastic packaging will be **re-used**, **recycled**, or **recovered**

JUST LOOK AROUND YOU:

- lightweight food packaging that keeps food safe and fresh and reduces emissions from transporting them;
- the insulation that reduces wasted energy from heating and cooling our homes and buildings;
- the materials that make our vehicles lighter and improve fuel efficiency.
- the warm, waterproof or lightweight clothing we wear that includes polyester, nylon, acrylic.

All of these would be impossible without plastics.

Canada's zero plastic waste and circular economy goals

The global demand for plastics to reduce carbon emissions is growing at an incredibly rapid pace.

It is estimated that demand for plastics is expected to triple by 2050 to meet our climate change and emission goals because plastics is an energy efficient material with a lower environmental footprint than most alternatives.

It is also a major contributor to the Canadian economy, adding $35 billion annually and responsible for over 100,000 direct jobs in 2021. However, along with using more plastics in our everyday lives, how to effectively manage post-use plastics is a major global concern.

Today in Canada, because of inadequate sorting, contamination, limited end-markets, and insufficient investment in modern technologies, and more complex designs for some plastic products, 86 per cent of all postconsumer plastics end up in landfills.

In 2018, the Canadian Council of Ministers of the Environment (CCME) released its **Strategy on Zero Plastic Waste** which prioritizes the creation of incentives for a circular economy and innovation investments.

Compared to a traditional linear economy, where most of the products start as raw materials and are eventually thrown away in a landfill, a circular economy for plastics is a model where plastics never become waste. Rather, they are reused, recycled, and recovered after use so that they can re-circulate in the economy as new products and new plastics.

A circular economy for plastics in Canada could result in an annual GHG emissions savings of 1.8 MT of CO_2[1], as well as deliver on a variety of other federal and provincial policy objectives: recycling targets, zero plastic waste, clean technology, green economy, low-carbon economy, net-zero by 2050. To accomplish those outcomes, Canada needs transformational system change to address current recycling challenges and meet the demand for recycled plastics — to keep plastics in the economy and out of the environment.

As noted, global demand for plastics is set to triple by 2050 to meet our emissions goals. By implementing a circular economy for plastics, nearly 60 per cent of the 2050 demand could be covered by production based on previously used plastics.[2] In contrast, today's linear economy is only able to meet 6 per cent of real demand for recycled plastic.

According to a 2019 report by Closed Loop Partners, a N.Y.-based investment firm, between 2020 and 2025, the demand for recycled plastic content is expected to increase 55 per cent. Reaching a goal of a 30 per cent packaging recycling rate during this decade will require investment design innovation to align with downstream systems and increased investment into the collection and sortation system and downstream solutions[3].

Advanced recycling encompasses several transformational technologies that use solvents, heat, enzymes, and other means to purify or break down post-use plastics back into their molecular building blocks to create polymers, monomers, oligomers, or hydrocarbon products. These technologies are emerging as a critical means to implement the transition to a circular plastics economy and are an alternative to plastics incineration or landfilling.

[1] Deloitte. (2019). Economic study of the Canadian plastic industry, markets and waste. Government of Canada, Environment and Climate Change Canada.
[2] Hundertmark, T., Mayer, M., McNally, C., Simons, T. J., & Witte, C. (2019, October 28). How plastics waste recycling could transform the chemical industry. McKinsey & Company. https://www.mckinsey.com/industries/chemicals/our-insights/how-plastics-waste-recycling-could-transform-the-chemical-industry.
[3] Transitioning to a Circular System for Plastics: Assessing Molecular Recycling Technologies in the United States and Canada (Closed Loop Partners — November 2021, p. 46).

Role of Advanced Recycling

As much as 50 per cent of plastics can be recycled using traditional mechanical recycling methods; however, the remaining 50 per cent requires more innovative advanced technologies to harness the inherent value of post-use plastics.

While mechanical recycling works well for plastics such as beverage bottles, advanced recycling and recovery can utilise those plastics that are difficult to process mechanically, like flexible multilayer pouches, food and cosmetic-grade plastics, and monomers that can go into textile softeners,[5] thus lessening the need for materials to be landfilled.

These two systems can help decarbonize the production of plastic materials while meeting the rapidly growing unmet demand for various grades of recycled plastic resin.

What is advanced recycling and recovery

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The sector is made up of purification, depolymerization, and conversion technologies that can process a wide range of post-use plastics used across industries while also maintaining a high level of product integrity (e.g., like virgin quality resins). Advanced technologies can be used to recycle packaging, construction materials, textiles, durables (such as those used in electronics, home appliances, and automobiles), among other products.

While recycling back into plastic products remains the goal in the waste management hierarchy, one of the important immediate transitional markets for the output from these new plastics manufacturing technologies are fuel products. The materials that are transformed into liquid fuels,

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Enablers for Success

One of the main obstacles for advanced recycling right now is sourcing enough post-consumer plastic to be able to have a steady supply to meet potential demand. To reduce landfilling, there is a shift away from patchwork municipal programs in Canada to industry-led Extended Producer Responsibility (EPR) programs that lead to better access to feedstock and require that recycling targets be met. This also puts leading provinces in an attractive position for investments in advanced recycling.

Another key obstacle is dated technology in sortation facilities better quality sortation and baling is a benefit for mechanical and advanced recycling technologies.

[5] Transitioning to a Circular System for Plastics: Assessing Molecular Recycling Technologies in the United States and Canada (Closed Loop Partners — November 2021, p. 39).

Courtesy of GreenMantra Technologies Ltd.

for industrial or transportation use, replace fossil fuels and divert plastics from landfills. This step is described as advanced recovery, a higher step on the waste management hierarchy than disposal, and an important bridge to recycling processes. As these technologies expand and mature, it is expected that many may transition from creating a fuel such as ultra-low sulfur diesel to other materials in the circular economy.

Advanced recycling solutions are available now

Pyrowave, GreenMantra, Loop Industries, and Polystyvert are scaling advanced recycling technologies right here in Canada, making it possible to grow markets for recycled content while closing the loop on plastics and reducing the need for virgin plastic resin. Some of these companies have received government funding to further advance their technologies allowing them to make strides in growing recycled content markets.

In 2020 Pyrowave signed a joint development agreement with the Michelin Group to accelerate time-to-market for Pyrowave's innovative plastic waste recycling technology which will result in the implementation of new value chains in the circular plastics economy. This illustrates the opportunity advanced recycling technologies offer Canada to improve recycling rates and attract investment.

Economic and environmental value to Canada

In a report prepared by the Closed Loop Partners, it was estimated that there is a **$120 billion economic opportunity** in Canada and the US directly connected to the commercialization of advanced recycling technologies that could double the amount of plastic packaging recycled compared to 2019 recycling rates.[6]

The report also identified more than 40 providers either operating commercial scale plants in Canada and the U.S. or with plans to do so in the next two years. Another 60 were at the lab stage of maturity.

In its 2019 report, Deloitte noted that achieving a 90 per cent diversion or reuse of post-consumer plastic waste by 2030, would deliver significant benefits to Canada including $500 million of annual costs avoided and 42,000 direct and indirect jobs created.[7]

Advanced recycling can help mitigate climate change as the demand for virgin plastics will greatly decrease.[8] Since recycled plastics have a lower greenhouse gas footprint than virgin plastics, its increased use across Canada's manufacturing sector enables the realization of a lower carbon economy.

[6] https://www.closedlooppartners.com/research/advancing-circular-systems-for-plastics/Transitioning to a Circular System for Plastics: Assessing Molecular Recycling Technologies in the United States and Canada (Closed Loop Partners — November 2021, page 12).
[7] Deloitte. (2019). Economic study of the Canadian plastic industry, markets and waste. Government of Canada, Environment and Climate Change Canada.
[8] Canadian Energy Research Institute. Towards a Circular Economy of Plastic Products in Canada. April 2021.

Regulatory and policy conditions for success

Policy and regulatory changes in Canada can position advanced recycling to emerge as a major part of the solution in dealing with the post-use management of plastics and accelerating the transition to circularity.

Multiple new technologies are competing to meet the growing demand; building an attractive investment climate in Canada is critical to respond to this environmental imperative.

For advanced recycling to be successful, it will be necessary for policy makers to drive forward the following:

Recognize

- Recognize advanced recycling and recovery technologies as contributing to diversion from landfills and incorporate this recognition in Extended Producer Responsibility programs and targets.
- Recognize that value recovery rates will differ by technology and delineate environmental assessment paths accordingly. These can be adjusted over time to reflect technology advancements and should be set such that competition between mechanical and advanced recycling is avoided.
- Recognize advanced recycling and recovery technologies as clean, green, and sustainable technologies that contribute to a circular economy and qualify for government green financing supports including grants, loans, tax credits and other investment support measures.
- Recognize that meeting government mandates for recycled content minimums in plastic products requires access to sufficient supply. Only with adoption of advanced recycling technologies can we meet these requirements, otherwise about 50 per cent of plastics will continue to go to landfills.
- Recognize advanced recycling and recovery technologies as manufacturing facilities, not waste management, in the context of environmental assessments, regulations, and permitting.
- Recognize the variety of advanced recycling and recovery technologies and project configurations (stand-alone facilities or integrated with other facilities) for the purposes of environmental assessments, regulations and permitting.

Courtesy of GreenMantra Technologies Ltd.

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Incentivize

- Work collaboratively with industry to invest in, scale-up and commercialize advanced recycling technologies.
- Invest in modern collection and sortation processes and technologies.
- Implement financial incentives that encourage upstream collaboration, investment into feedstock preprocessing, and investments in best performing mechanical and advanced recycling operations

Harmonize

- Adopt a North American lens for policies and regulations associated with implementation of advanced recycling and recovery technologies, given the integrated Canada-US economy.
- Ensure that adequate high-quality feedstocks exist by establishing a scaled-up, harmonized recycling system across the country. Consistent Extended Producer Responsibility (EPR) programs across provinces are a key enabler to access the supply of post-use plastics.
- Adopt global mass balance attribution standards to measure and track recycled content with third party verification to ensure circularity claims are credible. This would be consistent with approaches adopted by other industries that have consumer trust and confidence.
- Ensure any recycled content targets are aligned with the rollout of provincial EPR programs and investments in recycling infrastructure and innovations.

Entrepreneurs are furthering innovation and policy makers can foster the conditions that will lead to further success and leadership in Canada. This will not only spur innovation but also foster an attractive investment climate which is tailored to our governments' sustainability goals.

Advanced recycling and recovery technologies can be a vital component of our efforts to reduce and ultimately eliminate plastic waste and it is time to seize the opportunity that lies before us.

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