



**CHEMISTRY INDUSTRY
ASSOCIATION OF CANADA**

THE ROLE OF CHEMISTRY

IN A CIRCULAR ECONOMY FOR PLASTICS

*While plastics enable our modern way of life,
they belong in the economy and not the environment*

ABOUT THIS PAPER

This paper identifies the value that plastics bring to our modern and sustainable lives, the urgent global issue of managing plastic waste in our oceans and environment and the chemistry industry's role in solving this issue. The federal government has committed to take action toward a resource-efficient lifecycle approach to plastics waste management. The chemistry sector, which includes plastic, has a long, well-established history of innovation to solve society's most pressing needs by developing new processes and solutions. Our industry supports the transition from a linear economy to a more sustainable approach that prioritizes the extension of product life cycles, extracting maximum value from resources in and after use. Canada's chemistry industry and its highly skilled workers are uniquely positioned to provide innovative solutions to avoid and extract value from plastic waste. But these ambitions will not be easy to achieve and will require significant investment and cultural shifts towards a more circular economy. Our industry is stepping up to provide workable solutions.

February 2019

INTRODUCTION

CHEMISTRY IS VITAL TO THE CANADIAN ECONOMY

Canada's \$52-billion chemistry industry transforms raw materials into the building blocks needed to manufacture the more than 70,000 products that ensure our quality of life. It converts and adds value to raw resources such as natural gas, crude oil, minerals, and biomass, creating intermediate products that are used as inputs in almost all other manufacturing sectors. With key clusters in Ontario, Alberta and Quebec, the Canadian chemistry industry produced \$35 billion worth of exports and was the second-largest exporter in 2017 (next to automotive).

Chemistry is directly responsible for 87,300 jobs in Canada. Industry employees are highly-skilled and well paid. Statistics Canada has estimated that for every job in the industry, another five indirect jobs are supported in complimentary sectors. In total, the industry supports almost 525,000 jobs in Canada. It is the fourth largest manufacturing sector in Canada. With the potential to attract up to \$25 billion in new investment over the next decade, Canada's chemistry industry is poised for growth. The growth is fueled by a strong demand for chemicals, which is expected to triple over the next 20 years.



MANAGING PLASTICS

More than 95 per cent of all manufactured products rely on chemistry and many of these include plastic resins. From wind turbines and solar panels, to vehicles and building materials, to the packaging that allows us to feed the world, plastics chemistry is vital to our economy.

These products that enable our modern way of life, however, do not belong in our waterways or in the environment. Today in Canada, as a result of inadequate sorting, contamination, limited end markets and not employing all the technologies available, nearly 80 per cent of all post-consumer plastics end up in landfills – three million tonnes annually. The current approach to producing, using and disposing of plastics poses a real threat to the environment and results in a significant loss of value, resources and energy.

In recent months, images of mismanaged plastic waste in our environment have left many Canadians frustrated and angry about the amount of plastic in their lives and the lack of visible and understandable solutions to address plastic waste. Our members are committed to working with all levels of government and other stakeholders to develop a more sustainable approach for waste management.



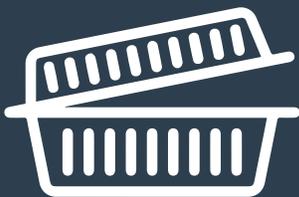
80% OF ALL POST-CONSUMER PLASTICS END UP IN LANDFILLS



PLASTICS ENABLE OUR MODERN AND SUSTAINABLE WAY OF LIFE



3.1 BILLION TONNES
OF FOOD WASTED PER YEAR



LIGHTER-WEIGHT **PLASTIC PACKAGING**
USES **2 TO 8 TIMES** LESS ENERGY THAN
ALTERNATIVE PACKING MATERIALS

FOOD PACKAGING

Roughly one-third of the edible food produced for human consumption is lost or wasted globally. This amounts to 1.3 billion tonnes per year, according to the UN Food and Agriculture Organization (FOA). Advanced packaging, namely plastics made possible by chemistry, can help reduce food waste and its related emissions by significantly extending product shelf-life and preventing damage during transportation.

For instance, plastic film helps increase shelf life of fresh meats to 21 days or more, and plastic vacuum packaging extends shelf life 10 times longer than store-wrapped meat, resulting in 75 per cent less food waste. In addition, using lighter-weight plastic packaging requires anywhere from two to eight times less energy than packaging materials such as glass, paper, steel and aluminum. Because of reduced weight and size, the capacity of every container is increased, resulting in fewer trucks on the road and reduced fuel emissions. (plastics.ca, novachem.com, dow.com)

MEDICAL EQUIPMENT

Plastics play a vital role in medicine in Canada. Without plastics, much of modern medical practice would not be possible, including materials used for vascular and heart surgery, joint replacement, prosthetics engineering, surgical reconstruction of new tissue, bone replacement, artificial muscle and organs.

Likewise, medical materials such as stethoscopes, IV bags and tubing, oxygen-supply tubing, oxygen tents, catheters, examination gloves, labware, plastic clips, splints, casts, body braces, sterile drug and equipment packaging, all rely on plastics. These materials can be transparent, easily sterilized and resistant to chemicals used in medicine, making them ideal for medical use. Plastics are even in the pills we swallow. Evonik produces a polymer coating for oral pharmaceuticals to ensure medicine is released at the optimal point of digestion. (evonik.com)



ENERGY CONSERVATION AND SUSTAINABILITY

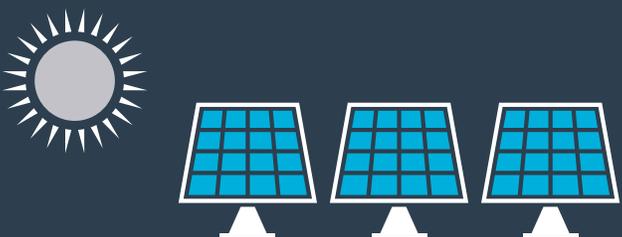
Chemistry is a critical part of nearly every renewable power generation source. From the composite materials in wind turbine blades, to solar panels, battery casings and components, insulating materials, and even nuclear and hydropower, plastics are essential.

SOLAR POWER

Solar system installations are expected to grow at an average rate of 15 per cent over the next five years. Recent advances in chemistry have transformed solar into a viable commercial energy source. UV-resistant, non-corrosive plastic resin makes durable, strong and cost-effective components for solar panels as well as polymer mounting systems. (dupont.ca)

WIND POWER

Chemistry allows energy producers to use windmill blade components that are lighter, stronger, longer and more cost-effective. In fact, more than seven tonnes of plastic resin can be found in a single 17-tonne wind turbine. Blades also require a chemical coating for durability because they are constantly exposed to the weather. (akzonobel.com)



HEATING AND COOLING OUR HOMES

Insulation, window coatings, reflective roofing and other innovative chemistry-based materials dramatically lower emissions from the building sector by reducing heat loss and the demand for cooling. With a combination of better energy efficiency standards and applied chemistry solutions, average energy savings of more than 25 per cent are achievable by using insulation, most commonly plastics. For example, three key plastic foam insulation materials — expanded polystyrene, extruded polystyrene and polyurethane — have been shown to reduce energy use and avoid 233 tonnes of CO₂ emissions for every tonne emitted in their manufacturing, installation and end-of-life management.

(dow.com, dupont.ca, basf.com)

LIGHTER VEHICLES

Reducing a vehicle's weight by 100 kg cuts its GHG emissions by 10 g/km through improved fuel efficiency. New polymers and high-tech plastics-based solutions, such as glass and carbon fibre, are designed to replace metal in cars and airplanes without compromising performance, comfort or safety. Many lightweight plastic automotive parts and components, including engine covers, front-end modules, lower bumper stiffeners, transmission cross-members, turbo charged engine pipelines, oil pans and body structural inserts, have already been commercialized. There are even prototypes of all-plastic wheels that reduce a car's weight by three kilos per wheel. (basf.com)

233
TONNES
OF CO₂



100 KG

RESPONSIBLE CARE®

CHEMICAL MANUFACTURING WITH SUSTAINABILITY AND INNOVATION

For more than 30 years, Canada's chemistry sector has been at the forefront of the journey toward responsible and sustainable chemical manufacturing. Founded in Canada in 1985, Responsible Care, the CIAC's UN-recognized sustainability initiative, is now practised in 67 countries and by 96 of the 100 largest global chemical producers. Through Responsible Care, CIAC member-companies have committed to continuous innovation to improve their products, processes and reliability. The ethic and principles for sustainability cover all aspects of a company's business, over the entire life cycle of its products.

Through the Responsible Care ethic, Canada's plastic resin producers are obligated to ensure sound stewardship of resin pellets during manufacture, transport and distribution. The industry is upgrading and implementing its Operation Clean Sweep® protocol to eliminate the escape of plastic pellets from industry operations, with a focus on preventing leakage into rivers and oceans. Efforts to increase recycling rates, implement eco-efficient waste management systems and reduce the amount of litter entering the world's waterways and landfills are important aspects of the Responsible Care ethic of continuous improvement and social responsibility.

Our members also work with their suppliers and customers to prevent product loss while also working to innovate for new products and processes that add value to society while reducing risks to human health and the environment.

For more information on Operation Clean Sweep, please visit opcleansweep.org. For more on Responsible Care, please visit canadianchemistry.ca/responsible-care/about-responsible-care.



Responsible Care®
Our commitment to sustainability.

THE CURRENT STATE

MARINE DEBRIS TOP OF MIND

On December 31, 2017, China stopped accepting nearly half of the world's shipments of recyclables, meaning much of this waste has since either been diverted to landfills or to other countries that lack the infrastructure to properly dispose of the materials. There has been intense attention placed on the mismanagement of plastic waste by the public, governments and civil society. Numerous municipalities, territories and nations around the world have grappled with how to tackle this issue.

Much of the recent attention has focused on marine litter with images of waterways clogged with plastic bottles and sea animals choked or injured by straws, fishing nets and other improperly disposed plastics, inducing public outcry in both Canada and abroad.

Plastics in the marine environment have also become top of mind for our federal government. In February 2018, in Davos, Switzerland Prime Minister Trudeau announced that Canada's Presidency of the G7 would see a focus on oceans and ocean health. Shortly after that, federal environment Minister Catherine McKenna announced she would be leading efforts to develop a G7 Plastics Charter. In June, five of the G7 countries signed on to the Charter at the summit in Charlevoix, Quebec.

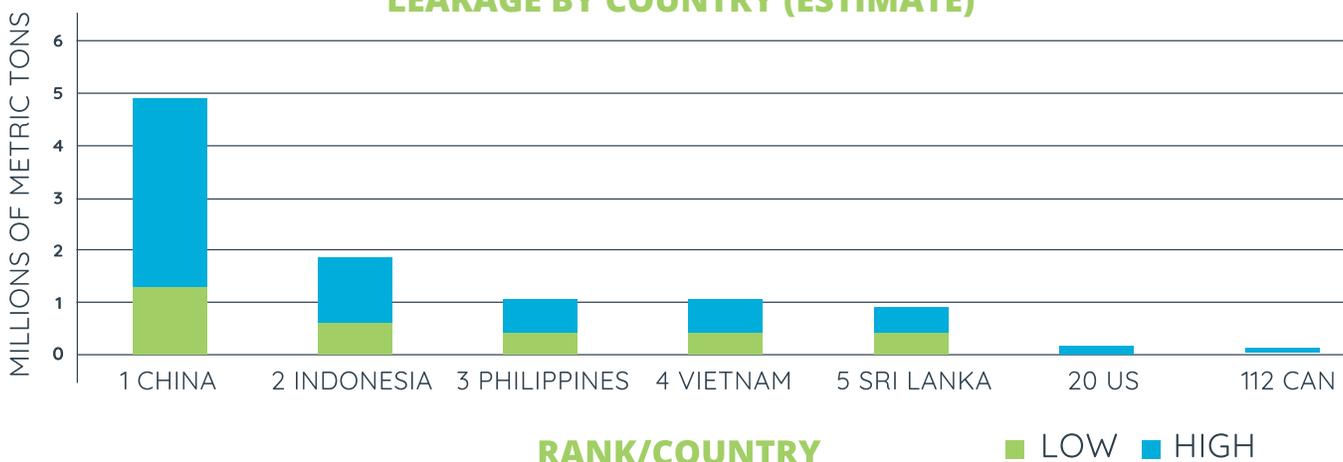
CANADA'S PLACE IN THE WORLD REGARDING MARINE LITTER

Research has found that 90 per cent of mismanaged plastic waste comes from 10 rivers in five Asian countries: China, Indonesia, the Philippines, Vietnam and Thailand – plus two African rivers. These five Southeast Asian countries have economies with growing middle-class populations but lack the waste management infrastructure to cope with the surge in plastic waste.

Canada, which has the world's longest coastline, on the other hand, ranked 187 out of 192 countries when looking at per capita leakage into the world's oceans (U.S. was #138). Canada was also far down the list in terms of raw numbers as the 112th-worst offender for contributing to marine litter. However, this does not diminish the need for Canada and other industrialized nations to play an important leading role in providing solutions for mismanaged plastic waste in our environment, both at home, and where the significant waste leakage is happening.

MOST PLASTIC ENTERS OCEANS FROM MISMANAGED WASTE

LEAKAGE BY COUNTRY (ESTIMATE)



PER CAPITA RANKING US#138 CAN#187

WHAT CANADIANS WANT

In June and July 2018, through Earncliffe Strategy Group, CIAC and its partners in the G7 Plastics Sustainability Coalition conducted a survey of 1,550 people across Canada to gauge their view on plastic waste and what they see as solutions to this issue.

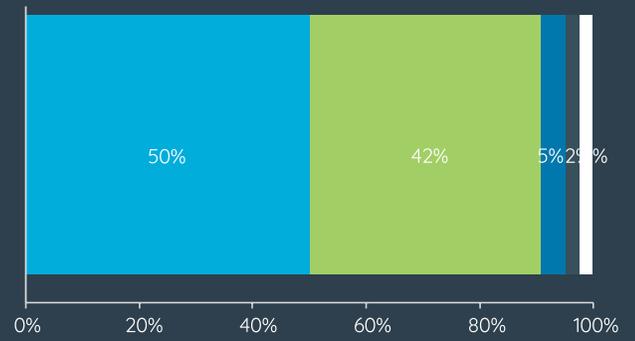
The polling found that virtually all respondents (92 per cent) were concerned about plastic waste. The greatest specific concerns about these plastics include that they are not biodegradable, they are not disposed of properly and that they could be replaced by an eco-friendly alternative. The majority (58 per cent) also felt consumers who fail to recycle properly are to blame for plastic waste in rivers, lakes and oceans. In short, Canadians are frustrated by the amount of plastic waste in their lives and by the lack of solutions being presented to them.

When asking about potential solutions, the vast majority of those surveyed said the best way to reduce plastic waste was to improve recyclability and recoverability of plastics. A full 78 per cent of Canadians favour actions to improve waste management and recyclability of plastics, including recovering and reusing plastic products by developing new technologies.

CONCERN ABOUT PLASTIC WASTE

Is plastic waste something that you are very concerned about, somewhat concerned, not very concerned or not concerned at all?

- Very concerned
- Somewhat concerned
- Not very concerned

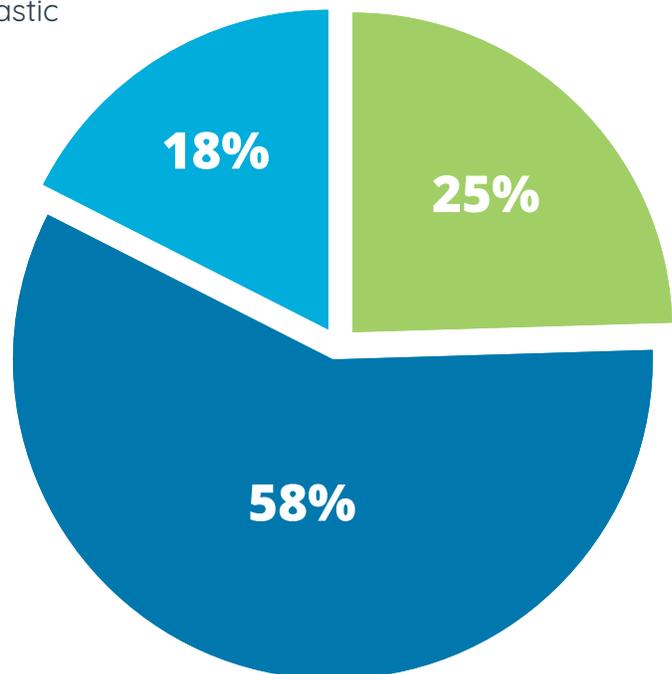


RESPONSIBILITY FOR PLASTIC WASTE

The majority feel consumers who fail to recycle properly are to blame for plastic waste in rivers, lakes and oceans

Who do you think is mainly responsible for the plastic waste that ends up in rivers, lakes and oceans?

- The companies that make and use plastics in products and packaging
- Consumers who do not recycle these products properly
- Government that have not provided the proper waste management systems



PROBLEMS WITH ALTERNATIVES

In the search to reduce the amount of plastic waste in our lives, some have turned to using alternative materials such as paper straws or cloth bags. There are some applications where alternatives could be used in place of single-use plastic. However, it is important to ensure the full life-cycle analysis of a product is considered, otherwise we could end up with an application made from a material that can be recycled but has a much larger overall environmental footprint. Some alternatives may not be a sustainable choice given their addition to greenhouse gas emissions, energy consumption and other environmental impacts during the production and transportation.

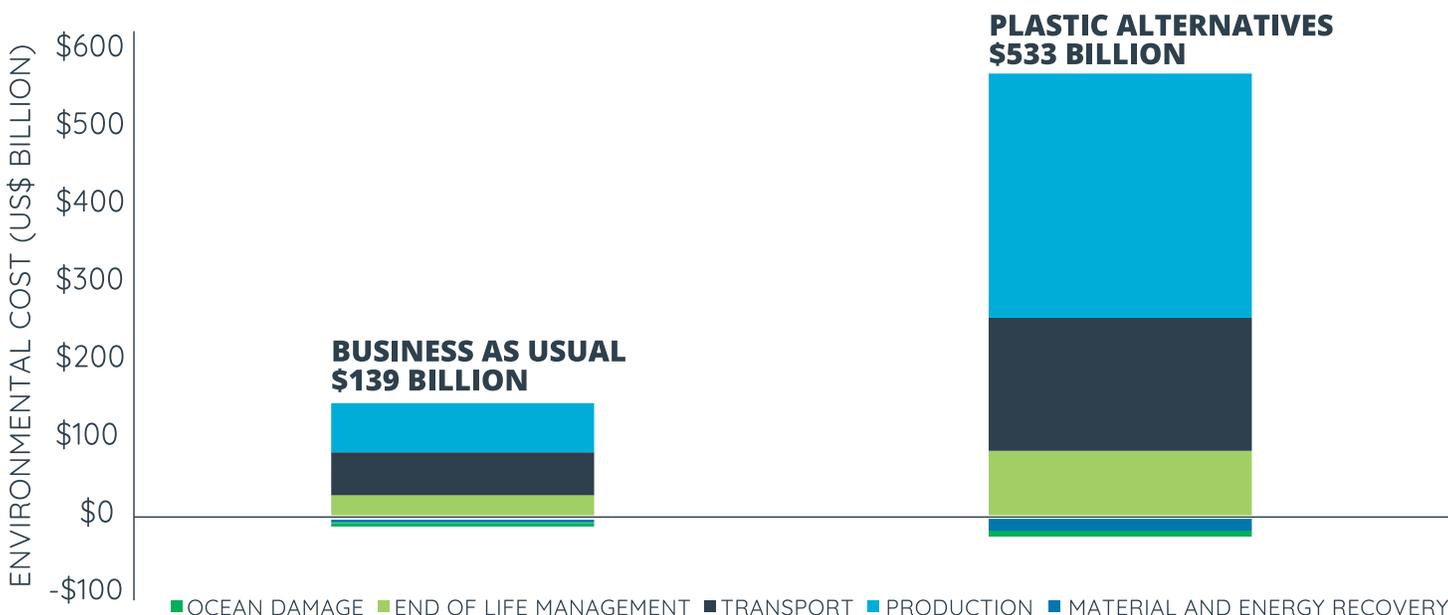
In 2016, the American Chemistry Council published a study called Valuing Plastics by Trucost which looked at how to reduce the natural capital costs of plastic including using alternatives. The study updated the research conducted by Trucost for the United Nations Environmental Programme in 2014.

Trucost found that replacing plastics in consumer products and packaging with a mix of alternative materials that provide the same function would actually increase environmental costs to society up to four times from \$139 billion to \$533 billion annually. The finding is not surprising, given the original drivers for using plastics: lightweight, energy efficient, mouldable, durable and cost effective. Trucost did identify ways to reduce the environmental costs of plastics, including:

- Improve transportation fuel efficiency — \$10.6B
- Increase use of lower carbon energy in plastics manufacturing — \$7.6B
- More efficient plastic packaging design for beverage and food sectors — \$7.3B
- Improve plastic waste collection and management in Asia — \$0.1B
- Increase packaging recycling and energy recovery — \$4.8-\$7.9B

PLASTICS AND SUSTAINABILITY

ENVIRONMENTAL COST OF PLASTIC USE IN CONSUMER GOODS IS 3.8 TIMES LESS THAN ALTERNATIVES



BIOBASED PLASTIC

Biodegradable bioplastics and compostable plastics have surged in popularity in recent years. These are typically used in short-life applications like single-use food packaging and utensils. Biodegradability and composting are opportunity areas, but pose their own unique challenges and alone will not solve the problem.

- **Biobased plastic:** These products are not necessarily biodegradable or compostable, but a percentage of the material is made from renewable sources (such as soy, corn, wheat, etc.). This can have environmental benefits in the production phase, but it does affect end-of-life management.
- **Biodegradable plastics:** These can degrade in natural environments. However, typically these degrade into methane, which is a potent greenhouse gas 25 times that of CO₂. Biodegradable does not mean compostable or recyclable.

SUPPORTING THE FEDERAL GOVERNMENT'S EFFORTS TO REDUCE MARINE LITTER AND PLASTIC WASTE

Canadians are looking to government and industry to provide real, workable solutions to this issue. Throughout 2018, there has been growing common ground and recognition of the need for cooperation between the plastics industry, governments, brand owners, businesses, NGOs, and concerned citizens to protect and restore the health of the world's oceans.

For instance, in June 2018, CIAC and the Canadian Plastics Industry Association (CPIA) offered support for the oceans and waterways focus of the Ocean Plastics Charter, which was endorsed by five countries at the G7 Summit. The Charter included commitments to:

- Ensure that plastics are designed for recovery, reuse, recycling and end-of-life management;
- Strengthen waste diversion systems and infrastructure;
- Stimulate innovation for sustainable solutions, technologies and alternatives across the life cycle; and other actions.

In September, along with the American Chemistry Council and CPIA, CIAC again provided support to the Canadian federal government in their announcement of the G7 Innovation Challenge to Address Marine Plastic Litter. CIAC stated that the Innovation Challenge will incentivize the development of new technology and processes, generate new ideas and build on the successes and innovations happening now in the plastics value chain. Challenges include finding solutions for construction waste, separation of mixed plastics, recycling of glass fibre-reinforced plastic, food packaging, sustainable fishing and aquatic gear, and others. Many of these solutions will involve chemistry.

SOLUTIONS

THE CHEMISTRY INDUSTRY'S AMBITIOUS TARGETS TO REDUCE PLASTIC WASTE

In June 2018, CIAC and CPIA announced ambitious targets that underscore their members' commitment to a future without plastic waste. Representing the broad plastics value chain in Canada, CPIA and CIAC and their members announced the following waste reduction targets:



A NEW ASPIRATIONAL GOAL OF
100% OF PLASTICS
PACKAGING BEING REUSED,
RECYCLED, OR RECOVERED BY

2040

AN AGGRESSIVE INTERIM GOAL OF
100%
OF PLASTICS PACKAGING
BEING RECYCLABLE OR RECOVERABLE BY

2030

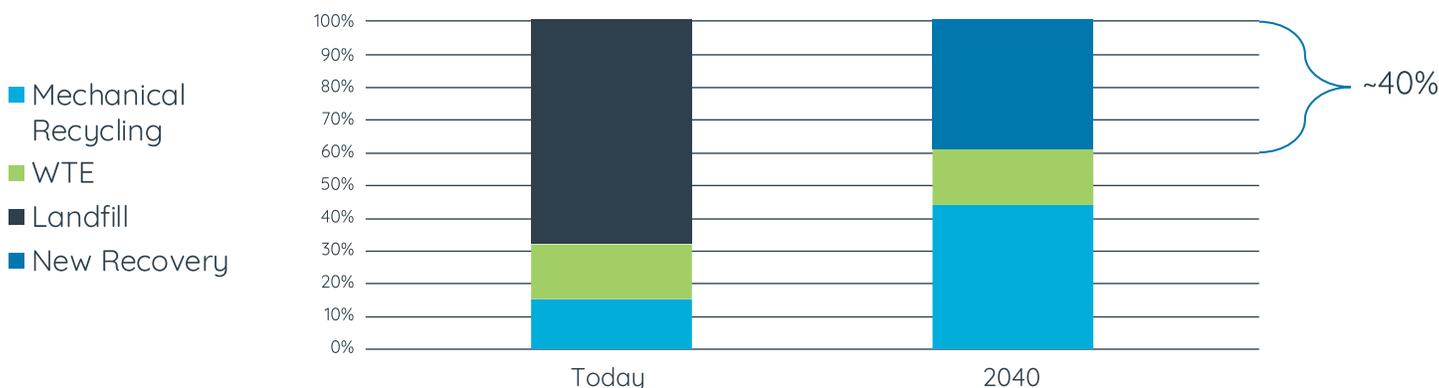


REACHING OUR GOALS

However, these goals will not be easy to achieve. Today in Canada, the cold reality is that nearly 80 per cent of post-consumer plastics packaging ends up in landfills. This is partially due to inadequate sorting and lack of viable end markets, but also due to lack of infrastructure to collect and process items in order to be recycled and recovered. It is important to note that Sweden diverts up to 90 per cent of its plastic waste today through a combination of recycling and recovery options.

New Recovery Solutions Are Essential

40% new recovery required, even with 3X existing plastics packaging recycling rate



In order to move to zero waste, the chemistry industry sees opportunities to triple mechanical recycling rates from 15 per cent to as much as 40 per cent, noting that this shift will take monumental changes to product design, consumer behaviour and waste management activities in Canada. The industry also foresees a limited increase for energy recovery by converting plastic waste into energy (currently at 15 per cent), due to a lack of public desire to increase this share. By 2040, that still leaves 40 per cent of post-use plastics to be diverted from landfill.

Innovations in plastics recycling to fuels (e.g. diesel) and chemicals, via advanced conversion technologies will be key to meet this gap. Where plastics can't be mechanically recycled, industry is exploring capabilities to process these materials back into chemicals used as feedstocks to manufacture new items. Where that isn't possible, plastics can be converted into fuels to replace coal and coke in the cement industry, used in industrial boilers and furnaces, or they can be converted into liquid fuels to lower the greenhouse gas footprint of diesel and heavy fuels.

These solutions are not in a distant future – many are already happening today. Our member-companies continue to lead the charge but require government acceptance and support to make commonplace, waste management offerings.

GLOBAL ALLIANCE TO END PLASTIC WASTE

In January 2019, an alliance of global companies from the plastics and consumer goods value chain launched a new organization to advance solutions to eliminate plastic waste in the environment, especially in the ocean, and to do this by transitioning to a circular economy for plastics.

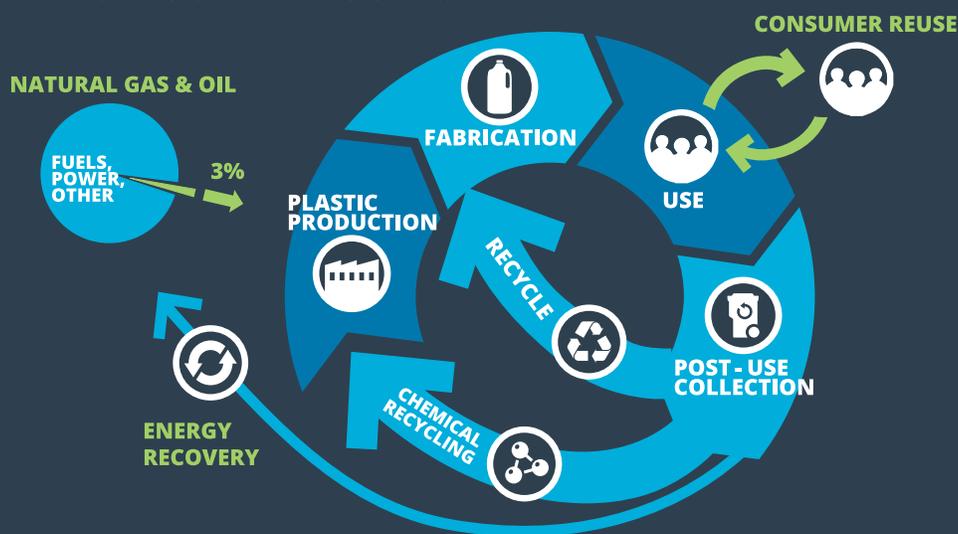
The Alliance to End Plastic Waste (AEPW) committed over US\$1 billion over the next five years to help end plastic waste in the environment. Made up of nearly 30 members from around the world, the Alliance is a not-for-profit organization that includes companies that make, use, sell, process, collect and recycle plastics, including chemical and plastic manufacturers, consumer goods companies, retailers, converters, and waste management companies. The Alliance will develop and bring to scale solutions that will minimize and manage plastic waste and promote solutions for used plastics by helping to enable a circular economy.

CIAC members NOVA Chemicals, BASF, Dow, Nouryon and Shell are founding members of the Alliance. For more information, please visit www.endplasticwaste.org

THE CIRCULAR ECONOMY

As the numbers show, we still live in a traditional linear economy, where most of the products start as raw materials and are eventually discarded. The chemistry sector is supporting the transition from a linear economy to a circular economy — one that prioritizes the extension of product life cycles, extracting maximum value from resources in use, and then recovering materials at the end of their service life.

PLASTICS IN A CIRCULAR ECONOMY



An important principle of the circular economy is increasing the capture of materials in waste streams so that they can be recycled, recovered and reused in new products. But a circular economy involves far more than just upgrading traditional mechanical recycling — it's a new economic model where, ultimately, the waste of one process becomes a feedstock for another process, and ultimately, waste is eliminated. The guiding principle is to use products and resources in the best way possible without any loss in performance and value or any increase in environmental life-cycle impact.

We will never be able to reach 100 per cent diversion / zero waste goals from mechanical recycling alone. Other waste management options of energy recovery and chemical recycling are needed to advance a circular economy.

INNOVATING TO ENABLE THE CIRCULAR ECONOMY

CIAC members are developing products and innovations that will help other sectors advance the circular economy to derive as much value as possible from their products.

CURBSIDE RECOVERY OF HARD-TO-RECYCLE PLASTICS

Dow Chemical has teamed with municipal and industry partners to implement an innovative program to collect hard-to-recycle plastic items — like juice pouches, straws, stir sticks, candy wrappers and plastic dinnerware — and convert them into valuable resources such as low-sulfur diesel and waxes and kept out of the landfill.

Through the Hefty® EnergyBag® program, residents in several North American municipalities are putting these plastics into special orange bags, where they are picked up and sent to local material recovery facility, sorted and sent to locally approved energy recovery facilities. By recovering the embedded energy in plastic to make new products, Dow and its partners are helping keep plastic waste out of our landfills, reduce greenhouse gas emissions and extract maximum value from our resources.

Supporting currently available energy recovery technologies such as pyrolysis, will lead to the development of chemical recycling, thereby making new plastics from old plastics and truly closing the loop on plastic waste. As of the end of November 2018 the program has collected over 376,000 energy bags and diverted approximately 252 tons of hard-to-recycle plastics from landfill. Dow plans to bring the EnergyBag® program to Canada in 2019. (dow.com)



FULLY RECYCLABLE STAND-UP FOOD POUCHES

As the leading suppliers of polyethylene in the Americas, **NOVA Chemicals and Dow** have developed a versatile, all-polyethylene (PE) version of the popular stand-up pouch package used for food products. The structures are compatible with #2 HDPE recycling streams — which are widely accepted at recycling centers — while retaining the performance, processability and cost-competitiveness of existing mixed-material structures. The stand-up pouches are used for a wide variety of applications including dry foods, frozen foods, liquids, confectionery, pet foods and non-food items. However, most existing stand-up pouch packaging is made from mixed materials and therefore cannot be easily recycled.

Using this same concept, NOVA and Dow have also developed an easily recyclable, oxygen-barrier film for food packaging. Meat, cheese, nuts, and other food have traditionally required rigid or non-recyclable mixed-material packaging but can now use recyclable flexible packaging technologies instead. (novachem.com, dow.com)

BIODEGRADABLE PLASTICS

In the 1990s, **BASF** was the first major plastics manufacturer to develop a biodegradable plastic, called Ecoflex. This certified compostable and biodegradable polymer is an important raw material for many compostable and biobased plastics. It is elastic, water and tear-resistant, processable with conventional film plants (for polyethylene), printable, weldable, and suitable for food contact. Ecoflex breaks down naturally with no accumulation of toxins to the environment.

A new BASF product, Ecovio, consists of Ecoflex and a high content of polylactic acid. Ecovio is used in organic waste bags, dual-use bags (shopping, then for organic waste) or agricultural films. Compostable packaging solutions such as paper-coating, shrink films, foam packaging and injection molding products can also be produced with Ecovio. (basf.com)

CONVERTING POLYSTYRENE

ReVital Polymers, Pyrowave and **INEOS Styrolution** announced a partnership in 2018 to recycle polystyrene packaging collected in consumer curbside and depot recycling systems as well as other sources such as restaurants, offices, schools and universities.

This made-in-Canada collaboration will use advanced recycling technology from Pyrowave that will recycle single-serve polystyrene packaging and use recycled polystyrene in the manufacturing of new products and packaging. This Canadian solution will help reduce the amount of polystyrene packaging going to landfill regardless of colour, food residue or odours. (ineos-styrolution.com, revivalpolymers.com, pyrowave.com)



PROJECT STOP

In 2018, **NOVA Chemicals** announced a three-year investment of nearly \$2 million to prevent plastic debris from reaching the ocean. The investment supports Project STOP, a new global initiative to reduce marine plastic pollution especially in countries with high leakage of plastics into oceans. Project STOP was co-created in 2017 by Borealis, a sister company of NOVA Chemicals, and SYSTEMIQ, a firm that invests in innovative solutions for sustainable land-use, material and energy systems.

NOVA Chemicals' investment will support the first city partnership in Muncar, a coastal fishing community located in Banyuwangi, Indonesia. With minimal waste services in place, many citizens are forced to dump their waste directly into the environment. Muncar was chosen as the first STOP location due to the seriousness of the challenge, coupled with strong leadership and environmental commitment at national, regency and local levels. (novachem.com)



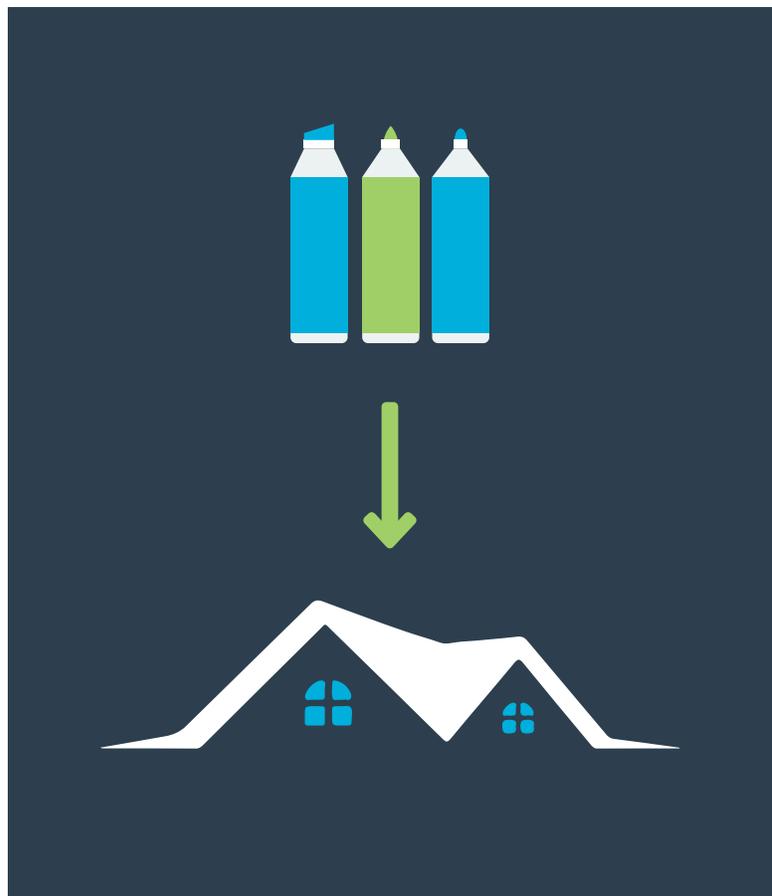
OCEAN CONSERVANCY AND CIRCULATE CAPITAL

Dow has been a long-time supporter of global initiatives to combat plastic wastes. Dow is a founding member and investor of \$100 million in Circulate Capital to keep plastics out of the natural environment while promoting prevention and remediation. Dow has also been a lead sponsor of Ocean Conservancy's International Coastal Cleanup program for over 20 years, and jointly formed the Trash Free Seas Alliance to analyse and address causes of ocean plastic pollutants. Dow also recently committed \$1 million to Ocean Conservancy to further support scalable waste collection and recycling solutions in Southeast Asia. (dow.com)

ADVANCED RECOVERY OF PLASTICS

Since 2010, **GreenMantra Technologies**, located in Brantford, Ontario, has been transforming hard-to-recycle materials such as grocery bags and film, and converts them into high-value waxes and other specialty chemicals. These materials have a broad range of applications in the coatings, plastics processing, adhesives, roofing and paving industries.

In one example, GreenMantra works with local schools to collect dried up writing markers and through a process of chemical recycling, converts them into valuable polymer additives used as an ingredient in high performance, polymer modified asphalt shingles made by Malarkey Roofing Products. The shingles have enhanced flexibility and performance in extreme weather conditions, and the polymers also provide the shingles with the highest levels of impact resistance and granule retention for exceptional durability. By creating value from plastic waste, innovators like GreenMantra are helping to drive a more circular economy where plastics are beneficially reused rather than landfilled. (greenmantra.com)



CHEMCYCLING BY BASF

BASF has taken up the challenge of chemically recycling plastic waste through their global ChemCycling project. Plastic waste which currently is landfilled or incinerated can and will be recycled. Mixed or impure plastic waste is transformed into syngas or an oil using thermochemical processes by partner companies. The oil can then be fed into BASF's production Verbund and partially replace naphtha as feedstock to produce all kinds of new chemical products. This can save fossil resources. The project is still in the pilot phase but holds huge potential for creating a circular value chain. (basf.com)

POLICY TO CREATE A CIRCULAR ECONOMY FOR PLASTICS IN CANADA

Implementing a circular economy for plastics will enable society to sustain economic growth while improving the environment for future generations, as we strive to use products and resources in the best way possible without loss in performance or increase in environmental life-cycle impact.

Achieving goals to eliminate plastic waste in Canada will require major shifts in resources and policy. Below are our recommendations to ensuring efforts to create a circular economy in Canada are successful.

IMPROVE AND STANDARDIZE WASTE COLLECTION AND DIVERSION

The mantra of “reduce, reuse, recycle” must also include “recover.” Getting to 100 per cent diversion of plastic packaging will require radical innovation, and the use of both recycling and recovery options. It will require a whole of society approach with significant support and investment from not just industry but governments and stakeholders as well. Specifically, industry needs investments in collection and mechanical recycling, chemical recycling using pyrolysis and gasification technologies, energy recovery and enabling regulations.

Consistency in waste collection across jurisdictions to facilitate recycling and recovery for residential, commercial and institutions is imperative to our goals. It is also important to standardize and harmonize definitions and policies across Canada to recognize plastic recovery and conversion to energy as diversion (e.g. Nova Scotia recognizes materials diverted from landfill to advanced facilities to make new plastic feedstocks, fuel replacement as diversion).



Recommendations:

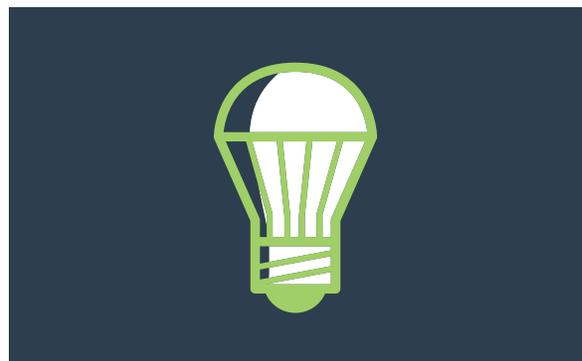
- Working with provinces and municipalities, the federal government invest in improvements to standardize waste collection and sorting in Canada.
- Federal and provincial governments should promote well-designed, industry-led extended producer responsibility systems to inform consumer behaviour and help establish markets.
- Federal and provincial governments should review, revise and standardize policies that currently provide disincentives to the processing and use of waste materials as feedstock, such as value-added recovery.
- Federal and provincial governments should develop standardized, supportive policies across jurisdictions that consider energy recovery (or resource recovery) where non-recyclable plastics today can displace coal/ pet coke (e.g. cement) or petroleum fuels (e.g. plastic to diesel fuel).
- Federal and provincial governments need to recognize that acceptance and use of non-combustion energy recovery technologies such as pyrolysis are needed for chemical recycling (i.e. making new plastics from old plastics).
- All levels of government should treat post-consumer plastics as a resource, not a waste.

PROMOTE INNOVATION

As we grow chemistry production in Canada, we must ensure that systems are in place to recover the value of waste plastics as potential feedstocks. As our case studies in the previous section show, innovative technologies currently exist in niche areas to facilitate the collection, recycling and recovery of plastics – all of which are needed to divert more valuable plastics from landfill and extend their life cycle. Canada can become a global leader in the recycling and recovery of plastics by investing in chemical recycling technologies and other innovative forms of deriving benefits from plastic waste. Our 2018 survey showed that Canadians believe developing new technology to allow us to recover and reuse more plastics is the most attractive alternative to restricting the use of plastics.

Recommendations:

- Federal government should invest in programs that will allow Canada to become a leader in the commercialization of technologies to recycle, recover or transform all plastics by 2040.
- Federal and provincial governments should ensure any definitions of recycling/diversion include chemical recycling (to fuels, to chemicals) in addition to mechanical recycling.



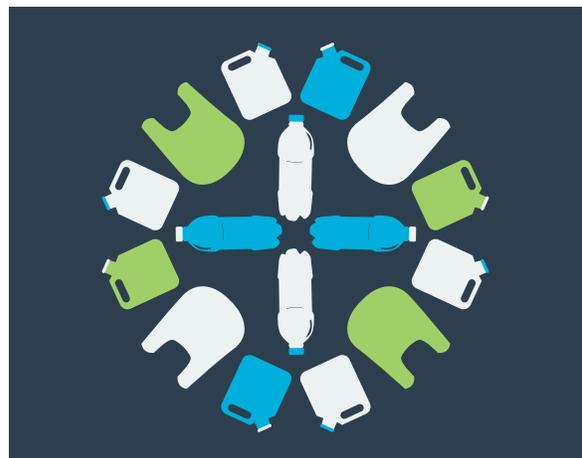
ENSURE SCIENCE AND LIFE-CYCLE DECISION MAKING

Foregoing simplistic virtue signalling and ensuring that policies for reducing plastic waste are evidence-based and best practice will be critical in making real progress to enable the circular economy. Materials should be judged on a life-cycle basis and with their societal value assessed. A material that can be recycled but has a much larger overall environmental footprint does not improve sustainability.

The previously mentioned study conducted by Trucost in 2016 shows that the environmental cost of alternatives to plastic packaging is 3.8 times higher when taking into account increased environmental impacts of manufacturing, transportation, end-of-life recovery, etc.

Biobased, biodegradable and compostable plastics can, in some instances, be damaging to the environment and may not offer the most viable solution for waste plastics in the environment. Many municipalities do not have the infrastructure to break these items down and consumers mistakenly believe these products decompose on their own, which leads to littering and contaminating recycling feedstock.

It is also important to remember that not all single-use plastics are the same. Plastics for medical uses are single-use and are considered by a majority of Canadians to be essential to ensure human health and safety.



Recommendations:

- All levels of government in Canada should ensure that policies for reducing plastic waste are evidence-based, based on the full life cycle of a product and best practice. Forego simplistic virtue signalling.
- Federal government must define “single-use” plastic.

PROMOTE RESPONSIBLE CARE®

There is tremendous alignment between the principles of Responsible Care and the federal government's broader societal agenda in regards to reducing waste. CIAC members are signatories to Responsible Care — the Association's UN-recognized sustainability initiative. Responsible Care inspires its members to take actions that improve the sustainability of their operations and reduces harm throughout the entire life cycle of their products.

Committing to the ethic and principles of Responsible Care is a condition of membership in CIAC. This commitment extends through to their transportation and service company partners. The initiative's codes influence the decisions CIAC member-companies make every day.

Recommendations:

- Investment and other supports by governments at all levels should be tied to companies committed to meeting Canadian's expectations and global standards for social responsibility through participation in initiatives such as Responsible Care.
- In line with the United Nations Environment Programme, all levels of government should recognize and promote Responsible Care so that the Canadian chemistry sector remains a world leader in responsible and sustainable manufacturing and in energy and resources efficiency.

ABOUT CIAC AND CANADA'S CHEMISTRY INDUSTRY



CHEMISTRY INDUSTRY ASSOCIATION OF CANADA

The Chemistry Industry Association of Canada is the association for Canada's chemistry sector leaders, innovators, solution providers, and world class stewardship pioneers. We share our members' stories with decision-makers at the federal and provincial level to shape public policy that supports innovation, investment, jobs and the environment. We're known for being a pragmatic, policy-based organization that represents members' interests based on solid analysis and scientific data.

As the founders of Responsible Care®, the industry's globally recognized sustainability initiative, our commitment to its ethics and principles means that we are focused on the betterment of society, the environment and the economy and that we do the right thing and are seen to be doing the right thing.

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