

Transforming Recycling and Solid Waste Management in North America

1. **Project duration:** from November 2021 to October 2025 (48 months)

2. **Budget (C\$):** 1,530,000

Phase I (Years 1 and 2 – Objective 1): C\$745,000

Phase II (Years 3 and 4 – Objective 2): C\$785,000

3. **Short statement of the issue(s) under this topic, need/gap identified; the project objective(s) and activities to address the issue; and expected outcomes and benefits/beneficiaries:**

The World Bank estimates that around 2 billion tonnes of municipal solid waste were generated in 2016, with Canada, Mexico and the United States generating 0.4-1.5 kg more waste per capita per day than the global average.¹ North America has the highest per capita plastic and paper consumption in the world. The region represents 21% of total plastics consumption² and four times the global average in per capita paper consumption.³

According to the World Bank, while waste is generally managed in an environmentally sound manner in North America, globally the mismanagement of waste is polluting the oceans, clogging sewers, and causing flooding, transmitting diseases, and increasing respiratory problems, and, according to 2016 data, generating 1.6 billion tonnes of carbon dioxide.

Reducing waste and closing material loops will help minimize the environmental impacts along the value chain of resources and products, as well as presenting considerable economic opportunities. Circular economy strategies, including various recovery options, are estimated to unlock \$4.5 trillion of economic growth around the globe.⁴ The World Business Council for Sustainable Development

¹ Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. [What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050](#). Urban Development. Washington, DC: World Bank. © World Bank. License: CC BY 3.0 IGO.

² Heller, M., Mazor, M., & Keoleian, G. (2020). [Plastics in the US: toward a material flow characterization of production, markets and end of life](#). Environmental Research Letters, 15(9), 94034–.

³ Mandy Haggith, Susan Kinsella, Sergio Baffoni, Patrick Anderson, Jim Ford, Rune Leithe, Emmanuelle Neyroumande, Neva Murtha and Bas Tinhout. 2018. [The State of the Global Paper Industry. Shifting Seas: New Challenges and Opportunities for Forests, People and the Climate](#). Environmental Paper Network

⁴ Accenture (2018), retrieved from <https://newsroom.accenture.com/news/the-circular-economy-could-unlock-4-5-trillion-of-economic-growth-finds-new-book-by-accenture.htm>

estimates that the global bioeconomy market could be worth up to US\$7.7 trillion by 2030, with significant opportunities for circular solutions.

The transition to a circular economy and increased material recovery also offers solutions to mitigate climate change. The magnitude of avoided GHG-emissions benefits from material circularity is highly dependent on the type of material and the local circumstances for energy offsets. For example, the US EPA estimates that recycling of various paper products could result in 2.64-3.59 Mt CO₂e reduction per short ton of paper,¹ and a study of the Canadian plastic sector estimates that diverting 90% of the plastic waste now going to landfills could result in 1.8Mt of CO₂e reduction by 2030.²

The objective of this proposal is to accelerate the uptake of circular economy and sustainable materials management practices that are needed to transform North American recycling and solid waste management and to realize the economic and environmental benefits for the region. This will be accomplished by developing milestone studies to better understand the opportunities for the recycling sector and secondary material markets in North America, an overview/description of the legal and policy relevant frameworks, identify emerging materials and technologies, and support stakeholder collaboration and knowledge sharing via networking activities. Building on the results of milestone studies and stakeholder input, the project will include pilot projects to assess the feasibility of innovative technologies or practices for adoption at scale across North America.

The project is expected to address information gaps, inform policy-making across Canada, Mexico and the United States, identify potential areas for policy coherence, and advance circularity and sustainable material management practices. The project will support CEC member states in their efforts to promote circular economy and sustainable materials management approaches to encourage eco-design and thus increase product and material reuse, recovery and recycling rates in North America. The transition to circular economy approaches that are restorative or regenerative by design is intended to prevent and eliminate waste through improved design of materials, products, and systems (including business models), allowing resources used in such processes and activities to maintain their highest values for as long as possible.

¹ US-EPA (2016), Waste Reduction Model, Documentation for Greenhouse Gas Emission and Energy Factors Used (2016), retrieved from: [Waste Reduction Model \(WARM\), Documentation for Greenhouse Gas Emission and Energy Factors Used](#)

² Government of Canada (2019), [Economic Study of the Canadian Plastic Industry, Markets and Waste](#)

4. Select the strategic pillar(s) from the 2021-2025 Strategic Plan that the project addresses:

- Clean Air, Land and Water
- Preventing and Reducing Pollution in the Marine Environment
- Circular Economy and Sustainable Materials Management
- Shared Ecosystems and Species
- Resilient Economies and Communities
- Effective Enforcement of Environmental Laws

5. Describe how the project uses strategic cross-cutting approaches in its implementation: Innovative and Effective Solutions and/or Diverse and Inclusive Stakeholder Engagement and Public Participation (including gender and diversity effects and opportunities, and youth):

The proposed activities will add value and accelerate sustainable materials management and inform the development of a circular economy in North America by supporting foundational knowledge creation; fostering collaboration between industry, academia, governments, and other relevant stakeholders; and strengthening public information sharing. The project will be an opportunity for entrepreneurs, including youth, in the recycling and recovery sector to develop sustainable materials practices and scale other emerging technologies for waste management and material recovery. The project will consider circular economy and sustainable material management opportunities for Indigenous communities, as appropriate.

6. Explain how the project can achieve more impact through trilateral cooperation:

The acceleration of the uptake of circular economy and sustainable materials management practices that are needed to transform North American recycling and solid waste management can be done through a process of exchange and discussion among the three countries. The milestone studies of the state of opportunities for the recycling sector in the region will offer wider perspectives on the supply and demand for secondary material and opportunities for innovation, given the integrated nature of key value chains across North America. By working together to collect information about recycling and waste management and facilitate a forum for open exchange with stakeholders, the three countries can create a shared understanding of potential barriers as well as opportunities for supporting the sector and making progress. The outcomes of the pilot testing phase will highlight different approaches and

technologies that could be expanded beyond national boundaries. As part of this project, the three countries will also strengthen their waste management networks, disseminate relevant information in the three CEC official languages and promote other initiatives focused on the circular economy.

7. Describe how the project complements, or avoids duplication with, other national or international work:

The project will expand on existing material recovery studies from the United States and Canada and cover a targeted scoping study of recycling infrastructure in Mexico. The milestone studies will open potential ways to scale-up opportunities around this industry, while broad stakeholder engagement in the process, and specifically in the pilot testing, is key to potential implementation of improvements in materials management in North America.

8. Describe how the project engages traditional ecological knowledge (TEK) experts or Tribal/First Nations/Indigenous communities, if applicable:

Where possible, the project will take into account traditional ecological knowledge of tribal and Indigenous communities that has the potential to be applied in the circular economy and opportunities for sustainable material management. In addition, Indigenous and tribal communities or organisations could participate in the project's discussion forums and final dissemination stage of the project outcomes.

9. Describe how the project engages new audiences or partners, if applicable:

The project has the potential to bring together stakeholders along North American value chains, from brand-owners and producers to recyclers and municipalities to exchange information, identify barriers to material recovery, and explore opportunities to expand the secondary material markets in North America. In this context, the project will create opportunities for discussions and exchange, the development of pilot projects as well as potential partnerships, amongst industry, academia, government organizations, and NGOs.

10. Identify the designated partner agencies or organizations committed to implementing this project, as well as other organizations that could be involved, or benefit from it, including through outreach efforts, collaborations or partnerships (e.g., federal agencies, other levels of government, academia, NGOs, the private sector, civil society, and youth):

Lead agencies or organizations	Country
Natural Resources Canada (NRCan)	Canada
Environment and Climate Change Canada (ECCC)	Canada
Agriculture and Agri-food Canada	Canada

Innovation, Science and Economic Development Canada	Canada
US Environmental Protection Agency (USEPA)	United States
US Department of State	United States
US Department of Energy ReMade Institute	United States
<i>Secretaría de Medio Ambiente y Recursos Naturales (Semarnat)</i>	Mexico
<i>Instituto Nacional de Ecología y Cambio Climático (INECC)</i>	Mexico
<i>Procuraduría Federal de Protección al Ambiente (Profepa)</i>	Mexico

Potential Expert Organizations and Networking Partners	Country
FPInnovations, researchers within government and universities (e.g., UBC Bioproducts Institute, Smart Prosperity Institute)	Canada
Regional recycling agencies	Canada
Canada Plastics Pact, BioDesign	Canada
PIP360, Canadian Product Stewardship Council	Canada
National Zero Waste Council	Canada
Circular Economy Leadership Coalition	Canada
Pembina Institute	Canada
World Wildlife Fund	Canada
Other actors implementing practices such as cities with plastic bags and fees, bottle bills	Canada
Researchers within government and universities (e.g., Center for Bioplastics and Biocomposites, Golisano Institute for Sustainability), Ellen MacArthur Foundation, University of Florida SMM research lab, University of Georgia	United States
US Plastics Pact, Association of Plastic Recyclers	United States

Sustainable Packaging Coalition	United States
The Recycling Partnership	United States
Closed Loop	United States
Institute of Scrap Recycling Industries (ISRI)	United States
Keep America Beautiful	United States
Plastics Industry Association	United States
Alliance to End Plastic Waste	United States
Circulate Capital	United States
Center for Biological Diversity	United States
Greenpeace	United States
Surfrider	United States
Beyond Plastics	United States
Natural Resources Defense Council	United States
Other actors implementing practices such as cities with plastic bags and fees, bottle bills	United States
Researchers within government and universities (e.g., University of Valle de Atemajac and University of Guadalajara research in bioplastics), National Autonomous University of Mexico, National Polytechnic Institute, Monterrey Institute of Technology and Higher Studies)	Mexico
Asociación Mexicana de Envase y Embalaje	Mexico
Asociación Nacional de Industrias del Plástico A.C.	Mexico

<i>ECOCE A.C.</i>	Mexico
PetStar	Mexico
Proyecto Fronterizo de Educación Ambiental	Mexico
Federación Nacional de Municipios de México	Mexico
Red Queretana de Manejo de Residuos A.C.	Mexico
Instituto Nacional de Recicladores A.C.	Mexico
Other actors implementing practices such as cities with plastic bags and fees, bottle bills	Mexico

11. In the following table, describe: the project objective(s) and the activities and subtasks planned to achieve the objective(s); the corresponding outputs, expected results and how they will be measured (performance measures); baselines (if known), and targets by end of the project; and the timeline and budget:

PHASE I: YEAR 1 AND 2 (OBJECTIVE 1)

OBJECTIVE 1	Accelerate the uptake of circular economy and sustainable materials management practices that are needed to transform North American recycling and solid waste management.
Activity 1 Budget C\$580.000	Milestone studies
Output(s)	<p>Three key studies, based on robust definitions of key terms that will allow sound compilation of specific data and figures, will be implemented with a focus on various waste streams, for example, plastics, bioplastics, and paper:</p> <ul style="list-style-type: none"> • Evaluating the current state of recycling infrastructure across North America. This would include expanding on existing studies in the United States and Canada, as well as evaluating the current state of recycling infrastructure across Mexico and could include regulatory frameworks in the region. • Evaluating opportunities and barriers in enhancing/improving secondary material markets and trade. • Evaluating emerging technologies and sustainable materials design pathways and best practices and examples implementing circular economy principles, taking into account traditional ecological knowledge of Indigenous communities. <p>The milestone studies will be key input for defining and developing appropriate pilot projects in phase two of this initiative, which may result in tools and resources to support stakeholder action. Examples of these could be catalogues of innovative packaging designs or other technologies, reports of best practices and case studies, traditional knowledge, practical guides for industry, etc.</p>
Expected results, performance measures	These studies will collate foundational knowledge to inform policy options that drive the transformation of materials management in North America, including potential ways to scale-up opportunities around this industry.

	<p>These studies will go beyond the existing studies of US and Canadian recycling and recovery infrastructure, including a targeted scoping study of recycling infrastructure in Mexico that focuses on sustainable materials; the studies will also evaluate opportunities and barriers in secondary markets throughout North America and consider emerging technology for materials recovery and recycling infrastructure and product design (e.g., sorting-related, material selection).</p> <p>Each study will include recommendations and possibly tools and resources for key actions by stakeholders that could further the development of the circular economy in North America. Recommendations could cover areas such as potential recycling metrics, harmonized regulatory framework for sustainable materials management, improvements in labeling clarity for recyclability/compostability, improvements in secondary markets, targeted investment in post-consumer solid waste management infrastructure, recycling standardization, consumer education, and increases in packaging biodegradability and compostability.</p>	
Baseline (current status), if known	Existing US/Canada recycling infrastructure studies and basic studies of waste management in Mexico	
Target (by project end)	Milestone studies completed and stakeholders successfully engaged	
Subtask 1.1	Conduct studies on recycling and recovery markets, innovative product design, sustainable packaging designs currently on the market and emerging materials recovery and recycling technologies.	Years 1 and 2
Subtask 1.2	Finalize report documenting outcomes of studies and outlining next steps.	Years 1 and 2
Activity 2 Budget C\$165,000	Stakeholder engagement: Develop a work program to identify relevant stakeholders and interested partners and promote their engagement into collaborative work on the topics related to the studies.	

Output(s)	<p>Consolidated group of engaged and relevant stakeholders (e.g., manufacturers that recycle post-consumer and residential materials, all levels of governments, the economic ministries of the three countries, business chambers, academia, NGOs, independent workers). The nature of this group will be two-fold:</p> <ul style="list-style-type: none"> - A consolidated group of engaged stakeholders acting as an “expert group” contributor to the preparation of the milestone studies, with the main goal of informing priority areas and scope as well as the general development of the studies. - A consolidated group of engaged stakeholders and a series of networking events. These networking events will provide opportunities to share and seek feedback on the result of the milestone studies as well as feedback and recommendations to be carried out in scoping pilot projects, and tools and resources to support stakeholders’ future endeavors. 	
Expected results, performance measures	Through the networking series, the CEC will analyze milestone studies, formulate working groups to determine next steps and receive feedback.	
Baseline (current status), if known	N/A	
Target (by project end)	Support knowledge dissemination, greater collaboration, and funding aligned for transformation with the appropriate North American stakeholders (e.g., industry, investors, academia, governments and NGOs) and facilitate networking activities/events.	
Subtask 2.1	Schedule and implement work program for the stakeholder expert group.	Years 1 and 2
Subtask 2.2	Schedule and implement work program on stakeholder engagement, including the organization and hosting of networking events for stakeholders to share and seek feedback on the result of the milestone studies, as well as feedback and recommendations to be carried out in the scoping pilot projects, and support decisions for next steps, including voluntary involvement in the pilots.	Years 1 and 2

PHASE II: YEAR 3 AND 4 (OBJECTIVE 2)

<p>OBJECTIVE 2</p>	<p>Pilot test the identified opportunities and technologies in the milestone studies to better understand the state of and opportunities for the recycling sector in North America, supporting the collaboration of stakeholders via networking activities/events.</p>
<p>Activity 3 Budget C\$460,000</p>	<p>Implement pilot testing</p>
<p>Output(s)</p>	<p>Building on the findings of the milestone studies, design and implement pilot projects through collaboration between industry, academia, governments and civil society on issues of circular economy and sustainable materials management strategies, with findings supported and adopted by various stakeholders.</p> <p>A report compiling the results of pilot projects that illustrate recommendations will be assessed at the project’s final conference.</p>
<p>Expected results, performance measures</p>	<p>Outcomes may include improvements in materials management in North America related to such topics as finance, product design, and cross-border trade enablers for recovered materials.</p> <p>Pilot projects demonstrating feasibility and providing evidence for level of impact, if technologies or practices are adopted at scale across North America.</p> <p>Other expected results are recommendations that can direct future innovation, research, and development.</p>

Baseline (current status), if known	N/A	
Target (by project end)	<p><u>Possible areas of focus for pilot projects may include:</u></p> <ul style="list-style-type: none"> • Analysis of circular materials design pathways to address waste reduction and maximize recovery of materials and improve circular economy practices • Analysis of improvements in sustainable, currently marketed packaging designs, incorporating biodegradability and compostability features into emerging and new product designs, while taking into consideration potential trade-offs • Analysis of improvements in sorting infrastructure to improve recycling and reduce contamination of recycling streams • Evaluation of recycling feedstock accessibility through better integration with existing supply chains, including secondary materials markets, recycling and composting facilities 	
Subtask 3.1	Analyze findings of the milestone studies and integrate stakeholder input in select pilot projects.	Years 3 and 4
Subtask 3.2	Conduct the pilot projects.	Years 3 and 4
Subtask 3.3	Finalize report documenting results/outcomes of pilot projects.	Years 3 and 4
Activity 4 Budget C\$325,000	Organize and host networking series and a project final conference	
Output(s)	A networking series of events and a project final conference are held.	

Expected results, performance measures	The networking series offers a forum for discussion and progress as well as increasing awareness of CEC reports and pilot projects. The series contributes to enhanced stakeholder engagement in disseminating pilot project findings and follow-up actions. Offering specific training may be considered. The final event is expected to assess progress and provide recommendations for next steps on adding value and accelerating the transition to circular economy in North America.	
Baseline (current status), if known	N/A	
Target (by project end)	The networking series promoted knowledge transfer, exchange, and cooperation amongst the project partners and the stakeholders.	
Subtask 4.1	Organization and coordination of the networking series	Years 3 and 4
Subtask 2.1	Organization and coordination of the project final conference	Year 4

12. Describe post-project expected impacts:

Expected impact (by when: month, year)	SMART performance measure(s)
By September 2023, an evaluation of emerging technology and sustainable materials design pathways and existing experiences implementing circular economy principles will be developed.	The Parties and the stakeholders will have a better understanding of emerging technology and previous experiences in the region.
By September 2023, a network for the recycling, reuse, material design and economics sector will be consolidated.	The network with all sectors (governments, academia, NGO and industry) will have identified potential activities.

By September 2025, project pilots will have been implemented.	The pilot project in each country will serve as a model for the implementation of new initiatives.
By September 2025, results dissemination to stakeholders and the general public will be completed.	The dissemination of results will further the exchange of knowledge.