

ADDRESSING SINGLE-USE PLASTIC PRODUCTS POLLUTION USING A LIFE CYCLE APPROACH



ACKNOWLEDGEMENTS

Lead author: Alison Watson

Case study contributors: Sarah Da Silva, Ryan Parmenter (Environment and Climate Change, Canada); Alex Jose Saer Saker (Ministry for the Environment, Colombia), Christoffer Vestli (DG Environment, European Commission); Soodevi Soobron (Ministry of Environment, Solid Waste Management and Climate Change, Mauritius); Rachel Chiaroni-Clarke (Office of the Prime Minister's Chief Science Advisor Aotearoa-New Zealand); Cesar Hugo Davila Romero (Ministry for the Environment, Peru); Dismas Karuranga (Ministry for the Environment, Rwanda); Justin Sealy (Solid Waste Management Authority, Saint Lucia); Cheryl Leem (Ministry of Sustainability and the Environment, Singapore); Wassana Jangprajak (Ministry of Natural Resources and Environment, Thailand).

LCA meta-study authors: Gustav Sandin, Sofia Miliutenko, Christin Liptow (IVL Swedish Environmental Research Institute AB) Yvonne Lewis, Pippa Notten and Alexandra Gower (TGH Think Space).

Reviewers (in alphabetical order): Guy Castelan (PlasticsEurope); Rachel Chiaroni-Clarke (Office of the Prime Minister's Chief Science Advisor Aotearoa-New Zealand); Breanna DeFreitas (Environment and Climate Change, Canada); Zoie Diana (Nicholas School of the Environment, Duke University); Guillermo González Caballero (Ministry of Environment, Government of Chile); Wassana Jangprajak (Ministry of Natural Resources and Environment, Thailand); Rachel Karasik (Nicholas School of the Environment, Duke University); Janice Gan (National Environment Agency (NEA), Singapore); Justin Sealy (Solid Waste Management Authority, Saint Lucia); Robert Suchopa (Unipetrol Centre for Research and Education); Dina Abdelhakim; Pablo Montes Iannini; Susan Mutebi-Richards; Helena Rey De Assis; Steven Stone, Ran Xie (UNEP).

This publication is **commissioned and supervised** by the United Nations Environment Programme and the Life Cycle Initiative (Economy Division): Llorenç Milà i Canals, Claudia Giacobelli.

Recommended citation: United Nations Environment Programme (2021). Addressing Single-use Plastic Products Pollution Using a Life Cycle Approach. Nairobi.

Design and layout: UNESCO

ISBN: 978-92-807-3841-4

Job number: DTI/2339/PA

Copyright © United Nations Environment Programme, 2021

This publication may be reproduced in whole or in part and in any form for educational or non-profit services without special permission from the copyright holder, provided acknowledgement of the source is made. United Nations Environment Programme would appreciate receiving a copy of any publication that uses this publication as a source. No use of this publication may be made for resale or any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme. Applications for such permission, with a statement of the purpose and extent of the reproduction, should be addressed to the Director, Communication Division, United Nations Environment Programme, P. O. Box 30552, Nairobi 00100, Kenya.

Disclaimer

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory or city or its authorities, or concerning the delimitation of its frontiers or boundaries. Mention of a commercial company or product in this document does not imply endorsement by the United Nations Environment Programme or the authors. The use of information from this document for publicity or advertising is not permitted. Trademark names and symbols are used editorially with no intention of infringement of trademark or copyright laws. The views expressed in this publication are those of the authors and do not necessarily reflect the views of the United Nations Environment Programme. We regret any errors or omissions that may have been unwittingly made.

**ADDRESSING SINGLE-USE
PLASTIC PRODUCTS POLLUTION
USING A LIFE CYCLE APPROACH**

TABLE OF CONTENTS

Foreword	4
Executive Summary	5
Glossary	8
Acronyms	9
Introduction	10
PART 1	
LCA META-ANALYSES ON SINGLE-USE PLASTIC PRODUCTS AND THEIR ALTERNATIVES	11
Individual Reports	12
Shopping bags	12
Beverage bottles	13
Takeaway food packaging	13
Beverage cups	14
Tableware	14
Nappies	15
Menstrual products	16
Face masks	17
PART 2	
POLICY ACTIONS TO ADDRESS SINGLE-USE PLASTIC PRODUCTS POLLUTION USING A LIFE CYCLE APPROACH	19
Policy action	20
Policy instruments	20
The importance of using life-cycle thinking in policymaking	20
Importance of a gender lens in policymaking	20
Resources for developing policy	23
PART 3	
CASE-STUDIES OF NATIONAL-LEVEL ACTIONS TO ADDRESS POLLUTION FROM SINGLE-USE PLASTIC PRODUCTS USING A LIFE-CYCLE APPROACH	25
Case Study – Canada	27
Case Study – Colombia	29
Case Study – European Union (EU)	30
Case Study – Mauritius	31
Case Study – New Zealand	32
Case Study – Peru	33
Case Study – Rwanda	34
Case Study – Saint Lucia	35
Case Study – Singapore	36
Case Study – Thailand	38
Conclusions	39
Appendix	40
References	41
Endnotes	44

FOREWORD



Plastic pollution is a major environmental issue that we must urgently address given the scale of the problem and our increasing levels of consumption. We need bold action and commitment at all levels. And we need stakeholders to work together to develop lasting solutions across the life-cycle of plastic products.

Policymakers play a critical role in ensuring that the conditions and incentives for reducing single-use plastic products pollution are established and effectively support the technology and long-term behavioural change we need to eradicate plastic pollution.

This is why this Report, summarizing government actions to address single-use plastic products pollution and assessing the full life-cycle environmental impacts of single-use plastic products in comparison with their alternatives, is so important.

The findings emphasize critical points that policymakers should consider when developing policy on this topic. Importantly, it emphasizes that products intended for single use are the problem, regardless of their material. Policymakers should not only promote reusable products but promote multiple uses of those products. This will require policy interventions at different leverage points across the life-cycle of products. And these interventions will need to be tailored to local conditions where the policy will be implemented and enforced, addressing also the needs (e.g. re-training) of those sectors most affected (e.g. producers of single-use plastic products no longer produced). Overall, it needs to be recognized that a systemic transformation of the plastics economy is needed, and therefore a comprehensive policy response is needed, rather than isolated actions.

There will always be environmental impacts from products that we produce and use. Trade-offs will need to be made. But life-cycle thinking helps us identify those trade-offs and potential impact reductions in a transparent way while addressing burden-shifting.

Countries that have provided case studies in this Report are all demonstrating their commitment to action. They represent only a small number of the many countries determinedly working to address plastics pollution, with noticeably increasing attention on the issue over recent years. The sharing of experiences from different approaches to addressing plastic pollution can illuminate valuable lessons on developing policy, as well as on the complexity of the issue. Important knowledge gaps, for example, around information and consumer behaviour, as well as access to alternative materials and end-of-use waste management methods can be identified. They also demonstrate that much can be done already with the development of a clear timetable of action and supporting infrastructure.

Yet, we can and need to do more. This is even more critical at a time when our efforts to reduce our reliance on single-use plastic products are challenged by the global COVID-19 pandemic.

Two years ago, Member States called for the information contained in this Report under a specific Resolution initiated by India on Single-Use Plastic Products at the Fourth session of the UN Environment Assembly. Now, we must continue to build on this good work and encourage comprehensive national efforts through strong science and good governance.

Ligia Noronha
Director Economy Division
United Nations Environment Programme

EXECUTIVE SUMMARY

In response to the request by Member States at the Fourth session of the UN Environment Assembly in March 2019¹, this report describes: a) actions taken by Member States to address single-use plastic products (SUPP) pollution and b) the full life-cycle environmental impacts of single-use plastic products in comparison with their alternatives.

The Report includes results of LCA meta-analyses on SUPP and their alternatives, an elaboration on a variety of resources and mechanisms related to actions to address SUPP pollution, as well as country-level case studies on policy development presented by a selection of Member States. The development of this Report was supported through a four-part webinar series hosted by UNEP in October 2020.

A summary of recommendations from the LCA meta-studies, as well as key findings from the country-specific case studies on actions implemented by Member States is set out below. A critical finding, however, of this work is that “single-use” is more problematic than “plastic”. Therefore, Member States are encouraged to support, promote and incentivize actions that lead to keeping resources in the economy at their highest value for as long as possible, by replacing single-use plastic products with reusable products as part of a circular economy approach. This will require systems change.

Summary of recommendations from LCA meta-analyses on single-use plastic products and their alternatives

Key points that policymakers should consider when developing policy, based on the results of the LCA meta-analyses, include:

▶ Promote reusable products

Most often, reusable products have lower environmental impacts than single-use products. The meta-studies concluded that the more times a product can be used the lower the environmental impact of that product. Incentivize both reusable products and reuse rates in policy interventions.

▶ Use LCA and a range of robust information sources

LCA provides important insights for policymakers but these need to be supplemented with a range of additional studies and knowledge. Impact assessment of litter and health impacts are not yet well accounted for in LCA studies and should be carefully considered. There are also information gaps relating to long-term impacts on ecosystems and health e.g. microplastics. Social aspects as well as gender analysis also need careful consideration.

▶ Know your context

Be geographically and socially specific to the location to which the policy will apply. For example, understand the energy use at the source of production, the recycling capability within the community, and the mode of disposal at end-of-life. Factors, such as the weight of plastic products and recycling rates can differ between regions and countries. Littering may be a significant factor where waste-management systems and infrastructure for collection and recycling are weak.

▶ Production is a significant contributor to the environmental footprint of single-use plastic products and their alternatives

Consider opportunities to avoid or reduce negative environmental impacts within production and save impacts from production by reducing consumption of such products, or by keeping the products in the economy for longer through reuse.

▶ End-of-life scenarios have a substantial influence on environmental impact results

Each product material should be assessed considering the most feasible end-of-life option.

► **Promote product design for circularity, including reuse**

Lighter, smaller, and more durable products within the same material categories will reduce environmental impacts. Design innovation might also help reduce food waste or the environmental footprint of washing for reusable tableware. Design can also lead to different decisions at end-of-life that will impact on recyclability or disposal. A well-designed Extended Producer Responsibility scheme can also help positively influence design choices.

► **Recognize trade-offs**

There will always be trade-offs in policy decision-making. The important aspect is to transparently identify these where possible, minimize them, and reduce burden-shifting. LCA studies can help make trade-offs transparent. Policymakers will need to decide how to best prioritize impacts according to their context. Be aware that environmental footprints of SUPP alternatives will depend on a range of factors which need to be assessed on a case-by-case basis. There may also be important social considerations which LCA have not taken into account, including the need to consider a gender lens when comparing different products and their use.

► **Factor in future technology innovation and change, as well as scale-up potential**

Novel production technologies may need time to develop and scale up before they can perform at the same or better standard than established large-scale technologies. Recycling technologies for certain types of packaging, for instance, are developing rapidly. And power generation systems, transportation and recycling processes may change over time.

► **Reduce the use of single-use products whatever the material**

Replacing one disposable product (e.g. made of plastic) with another disposable product made of a different material (e.g. paper, biodegradable plastic) is only likely to transfer the burdens and create other problems. Further, to avoid burden shifting between the environmental and the social dimension, it is important to support current manufacturers of single-use products to shift their focus towards the production of more circular and sustainable commodities.



Summary of key findings from country-specific case studies

Key lessons shared in the country-specific case studies on actions to address SUPP pollution, include:

► **There are many actions and solutions already being implemented to address single-use plastic product pollution**

Understanding what stakeholders are doing at local, regional and international levels is important, as well as exploring opportunities for new business models and/or support to help scale-up activities.

▶ **Consideration of a range of policy interventions is vital, as well as understanding the underlying economic drivers for behaviour**

For example, it may appear to be cheaper to dump waste than to recycle it when some costs are externalized. A mix of policy interventions is often required.

▶ **All stakeholders need to be involved in developing and implementing policy across the life-cycle of SUPP**

Some governments have developed informal and/or formal agreements with the private sector to work on collaborative efforts to reduce plastics pollution. Civil society has also been actively involved in many policy developments. The informal waste sector is a significant stakeholder in many countries and decision-makers are encouraged to find a way to integrate this sector into policy. Across the various levels of engagement, gender equality must be taken into consideration as women are key stakeholders in purchasing and waste management practices at the household and community levels. Encouraging the participation of women groups is also essential.

▶ **The establishment of dedicated gender-balanced teams and resources tasked with developing and implementing SUPP policy is beneficial**

This team should draw on resources across departments in government and look for areas to embed SUPP policy across other policy initiatives, for example, in tourism policy activities or health-related actions. Addressing SUPP, e.g. promoting their replacement with reusable alternatives, is likely to affect genders differently and thus it is critical to ensure that the proposed policies are gender responsive.

▶ **All materials have an impact, “the issue isn’t just plastic, it’s how we use it” with, “the most sustainable product being the multi-use product”**

Analysis of SUPP alternatives is therefore important, as well as developing a good understanding of how to encourage reuse of products multiple times. Addressing single-use plastic products pollution requires systems change.

▶ **A life-cycle approach can help identify trade-offs and prevent burden-shifting**

LCA can highlight hotspots and when complemented by other evidence it can help inform policymaking. LCA should not, however, be used by itself for policy development. Aspects like litter or microplastics impacts are not yet adequately considered by LCAs. Other factors, for example, socio-economic conditions and culture are also important.

▶ **Access to quality, timely and location-specific data on the plastics sector is critical**

This informs policy development and is essential to the evaluation of policy but represents a significant issue for many policymakers.

▶ **Behavioural research provides insight on how different policies can help drive change related to people’s actions regarding the use of SUPP**

For instance, how different targeted communication and education strategies can enhance information, motivation and skills such that consumers can make better decisions around reuse, recycling and waste disposal. Utilizing a gender lens can also highlight the gendered roles and behavioural preferences of women and men which can help unlock long-term behavioural change.

▶ **The design of products and management of products pre-consumer use is an important area of action**

Design can significantly reduce the environmental impacts of plastic products and their alternatives. Other co-benefits should also be explored when contemplating design modifications. For example, new designs for tableware could also consider how to reduce food waste. Considering how stakeholders use products in different ways can also reveal opportunities for reducing impact.

▶ **Monitoring and enforcement are important in implementing SUPP policy, including the use of clear definitions**

Understanding the effectiveness of different policy approaches over time, including the enforcement of certain policy interventions is critical. A well-communicated timeline of policy and legislative action can send early signals to stakeholders of the need for future change to operations and/or behaviour. This can aid the transition towards new behaviour, activities, and innovation needed to support policy objectives. Clear definitions are essential to policy enforcement.

▶ **The global COVID-19 pandemic presents significant challenges**

Efforts of countries to reduce single-use plastic product pollution come under additional pressure in a pandemic. Safety and health requirements are essential along with a strong science-based approach to understanding the necessity for specific exemptions for the use of single-use plastic products. At the same time, it is important to note that it is usually the way we use products, rather than the products themselves, which guarantees safety (e.g. handwashing as opposed to wrapping items in plastic). There may also be opportunities for creative solutions and new business models that can address plastic pollution.

GLOSSARY

▶ **Bio-based /Bio-plastic**

A type of plastic derived from biomass such as organic waste material or crops grown specifically for the purpose, which may or may not be biodegradable (UNEP 2015).

▶ **Biodegradable**

Capable of biodegrading under biological process of organic matter, which is completely or partially converted to water, CO₂/methane, energy and new biomass by microorganisms (bacteria and fungi).

▶ **Compostable**

Capable of biodegrading under specified conditions and timescales, usually only encountered in an industrial composter (standards apply).

▶ **Deposit-Return-Scheme (DRS)**

DRS works by adding a surcharge (deposit) on a product (e.g. beverage bottles) when this is purchased, which is refunded when the empty container is brought to a collection point. DRSs effectively create an incentive to return empty containers, so they can be reused or recycled. Also known as deposit-refund system, deposit-return system, take-back-scheme/system or advance deposit fee.

▶ **Energy mix**

Share of different primary energy sources (e.g. wind, hydro, biomass, photovoltaics, oil, coal, nuclear...) from which secondary energy for direct use - such as electricity, or heat - is produced in a specified geographic area (e.g. country energy mix).

▶ **Extended Producer Responsibility (EPR)**

Policy approach under which the responsibility of producers – financial and/or physical – is extended beyond the use of their products, e.g. for the treatment or disposal of post-consumer products/waste. By varying the financial contributions of producers to the system according to the ease of recycling or recovery, EPR schemes may be effective ways of influencing product design towards enhanced circularity.

▶ **LCA (Life-Cycle Assessment)**

Compilation and evaluation of the inputs, outputs and potential environmental impacts of a product system throughout its life cycle (ISO 14040:2006 and 14044:2006). See Annex 1 for further detail.

▶ **Life-Cycle Thinking**

A mostly qualitative approach to understand how our choices influence what happens at each of the stages of the life cycle of an industrial activity: from raw material acquisition through manufacture, distribution, product use and disposal. This approach is needed in order to balance trade-offs and positively impact the economy, the environment, and society.

▶ **Lightweight plastic carrier bags**

Plastic carrier bags with a wall thickness below 50 microns.

▶ **Microplastics**

Generic term for small pieces of plastic under 5 mm.

▶ **Recycling (Material recycling)**

Reprocessing, by means of a manufacturing process, of a used (packaging) material into a product, a component incorporated into a product, or a secondary (recycled) raw material; excluding energy recovery and the use of the product as a fuel (ISO 18604:2013).

▶ **Reuse (of packaging)**

Operation by which packaging is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market, enabling the packaging to be refilled (ISO 18603:2013).

▶ **Single-use plastic products**

are products made wholly or partly from plastic and that are not conceived, designed or placed on the market to accomplish, within their lifespan, multiple trips or rotations by being returned to a producer for refill or reused for the same purpose for which they were conceived (EU 2019/904). Often also referred to as disposable plastic products.

ACRONYMS

DRS	Deposit-Return-Scheme
EU	European Union
EPR	Extended Producer Responsibility
HDPE	High-density polyethylene
HS Codes	Harmonized Commodity Description and Coding Systems
ISO	International Organization for Standardization
LCA	Life-cycle assessment
LDPE	Low-density polyethylene
PE	Polyethylene
PET	Polyethylene terephthalate
PLA	Polylactic acid
PP	Polypropylene
SUPP	Single-use plastic product/s
UNEP	United Nations Environment Programme

INTRODUCTION

Objective, Scope, and Organization of the report

The objective of this report is to support policymaking on single-use plastic products using LCA as a tool to complement evidence-based decision-making. It presents a range of actions already undertaken by Member States to address plastic pollution with a particular emphasis on actions that have been informed by life-cycle thinking, as well as the results of eight meta-studies on LCA of single-use plastic products and their alternatives. This report responds to operative paragraph 8c of Resolution 9 of UNEA 4 (Resolution 9 UNEP/EA.4/Res.9) and is organized as follows:

PART 1

Presents a summary of eight meta-analyses undertaken that examine LCA studies conducted on single-use plastics products and their alternatives.

PART 2

Provides a summary of actions already undertaken by Member States to address plastic pollution and notes a range of comprehensive resources for Member States to access further information and support on this aspect.

PART 3

Shares case studies that demonstrate efforts by various countries towards the development and implementation of policy on single-use plastic products.

Life-Cycle Assessment (LCA)

LCA is the calculation and evaluation of the environmentally relevant inputs and outputs and the potential environmental impacts of the life-cycle of a product, material, or service (ISO 2006a; ISO 2006b). Such analysis allows decision-makers to better understand the impacts of consumption and production of products and services and can therefore inform policy and actions aimed at reducing the environmental impact of single-use plastics products. Like any tool, however, LCA does not replace the need to draw upon a range of information sources when making decisions. Further information on LCA is provided in Annex 1.

PART 1

LCA META-ANALYSES ON SINGLE-USE PLASTIC PRODUCTS AND THEIR ALTERNATIVES



Part 1 summarizes the main findings and recommendations of eight meta-analyses of LCA studies on single-use plastic product categories and their alternatives, on the following product categories: shopping bags; beverage bottles; beverage cups; takeaway food packaging; tableware; nappies; menstrual products; and personal protective equipment (facemasks).

Over 50 LCA studies were considered across the final eight reports and these were selected based on specific criteria, including completeness, transparency, geographic coverage, publication date (post-2000), and language (English)². Preference was also given to peer-reviewed studies. Each report can be downloaded at <https://www.lifecycleinitiative.org/single-use-plastic-products-studies/>.

It is important to note that there is inherent bias in the selection criteria given only LCA studies in English were included and the LCA studies were also predominantly carried out in developed countries.

Together, the final reports identified the following ten key factors that should be considered by decision-makers when developing policy on single-use plastics and their alternatives (figure 1).

FIGURE 1

Ten factors for policymakers to consider when using LCA to inform policymaking on single-use plastic products and their alternatives



PROMOTION OF MULTIPLE-USE

Can you reduce the use of single-use products and incentivise reuse, whatever the material?

LCA studies show that the more times a product can be used the lower the negative environmental impact, whatever the material of the product.



SOURCES OF INFORMATION

Are a range of information sources being used?

A range of resources to best characterise environmental and social impacts, particularly those impact categories not covered by LCA is recommended, e.g. impacts from littering or microplastics, gender analysis.



CONTEXT-SPECIFIC DATA & INFORMATION

Do you have robust data & information?

Policies must be context-specific as product systems differ between locations e.g. feedstocks used for bio-based plastics, or to what extent landfilling, incineration or recycling can be expected to be employed at end-of-life.



FUNCTIONAL DIFFERENCES

Are there functional differences that need consideration?

There are often functional differences like size and delivery of container or the need to consider health and safety requirements that should be considered.



PRODUCTION

How can impacts be reduced at production stage?

Production is often a big contributor to environmental impact. Consider also differences within categories and between material categories e.g. the choice between using fossil-based, recycled or bio-based resources.



TECHNOLOGY MATURITY

What is the level of technological maturity of solutions?

The current performance of a novel/new solution may not be representative of future environmental performance. Consider how performance can change in the future



END OF LIFE PRACTICES

What are the end-of-life practices in your location?

There are large differences in the environmental impact of products depending on collection, recycling and reuse rates, and to what extent materials are eventually landfilled or incinerated with energy recovery.



FUTURE CHANGES

What is the potential for change?

Consider future changes in production technologies or end-of-life practices. Future scenario assessments as a complement to studies on current (and past) product systems can help inform policymaking.



TRADE-OFFS & BURDEN-SHIFTING

Are trade-offs and burden-shifting identified?

Recognise and manage trade-offs and risks of burden-shifting between environmental impacts. Evaluate all potentially relevant env. impact categories, and combinations of policies.



DESIGN

How can the design of products help reduce environmental impacts?

Lighter durable products can reduce environmental impacts. Consider co-benefits (e.g. reducing food waste). Design can also lead to different end-of-life decisions that will impact on recyclability or disposal.

Individual Reports

Shopping bags

The report “Single-use plastic bags and their alternatives: Recommendations from Life Cycle Assessments” provides a meta-analysis of seven LCAs published since 2010. The LCA studies considered single-use plastic bags (SUPB) with alternatives including conventional reusable and bio-based LDPE bags, paper bags, biodegradable bags, reusable polypropylene bags as well as reusable bags using various rates of recycled material. Considering the impacts of all life-cycle stages, the environmental ranking of bags varied across different environmental categories. For example, the SUPB was considered a poor option in terms of litter on land, marine litter and microplastics, but it scored well in other environmental impact categories, such as climate change, acidification, eutrophication, water use and land use. Overall environmental rankings, therefore, depend on what environmental aspects are relevant for a specific case or what aspect is given the highest priority. Guidance is provided on important characteristics of bags (design, use and disposal) that should be considered when comparing the environmental impacts of different plastic bag options and their alternatives. These are presented in **figure 2**.

The report also concluded, “that reducing environmental impacts of bags is not just about choosing, banning, recommending, or prescribing specific materials or bags, but also about changing consumer behaviour to increase the reuse rate and to avoid littering”.

The report points out that reusable bags need to be used multiple times for optimum reduction of environmental impacts. Policymakers should, therefore, also give adequate attention to the design of bags for durability, incentivizing the reuse of bags, the provision of adequate waste management and end-of-life solutions, and the accessibility and affordability of such alternatives across a range of stakeholders. Consumer and business education about the minimum number of times different bags should be reused by consumers to achieve better environmental performance might also be important. Additional factors that should be considered when developing policy on single-use plastic bags are presented in **figure 3**.

Beverage bottles

The report “Single-use plastic bottles and their alternatives: Recommendations from Life-Cycle Assessments” was based on a meta-analysis of seven life cycle assessment studies. These studies compared single-use plastics bottles with different types of single-use plastic bottles (e.g. using virgin, recycled, PLA and bio-based PET bottles); beverage containers made of other materials (e.g. aluminium cans, carton packaging systems, glass

FIGURE 2

Characteristic of **bags** that influence their environmental impacts
Source: UNEP 2020a.

<p>The material and weight of a shopping bag</p>	<p>A bag with the same material but double the weight has double the impact unless it is reused more times or used to carry more goods. The LCAs in the meta-analysis indicate that a SUPB weighs approximately 6 g in China, India, Singapore and the US, but 18-20 g in Finland, Spain and the UK.</p>
<p>The number of times a bag is used</p>	<p>If a bag is used for shopping twice instead of once, it has only half the environmental impact per shopping round. Again, using it for another use (e.g. bin liner) also helps reduce impact.</p>
<p>The technology and material/energy use of production processes</p>	<p>The climate impact of paper bags varies greatly, depending on what fuel is used in the pulp and paper production.</p>
<p>The waste-management process</p>	<p>Paper bags that end up in landfills cause emissions of methane with high climate change effect, while plastic bags are relatively inert. On the other hand, incineration of used plastic bags affects the climate through emissions of fossil carbon dioxide (CO₂). The environmental impacts of biodegradable bags are reduced if the bags are composted, while most other bags benefit from material recycling.</p>

bottles, reusable steel bottles); and non-container means for providing drinking water. **Figure 4** illustrates characteristics of beverage container materials that should be considered in policymaking.

Take-away food packaging

The report “Single-use plastic takeaway food packaging and its alternatives: Recommendations from Life-Cycle Assessments” summarized knowledge about the environmental impact of single-use plastic packaging and alternatives for take-away food, based on a meta-analysis of six LCA studies. Reflections on five additional studies were also included. In addition to plastic materials (made of fossil and bio-based resources, virgin or recycled content), other materials investigated included aluminium, paper/cardboard/wood and glass (the latter only for reusable containers). Factors that policymakers should consider when developing policy based on LCA information are summarized in **figure 5**.

FIGURE 3

A selection of factors that policymakers should consider when developing policy on **single-use plastic bags** and their alternatives
Source: UNEP 2020a.

Design	▶ The design of bags can improve environmental performance and/or incentivise behavioural change, e.g. design reusable bags durable enough to ensure they can be reused many times.
Incentivising reuse	▶ Bags that are designed for multiple uses (reuse) have lower impacts than SUPBs in most environmental impact categories if they are actually used a sufficient number of times (50-150 times for cotton bags, 4-8 times for paper bags, 5-10 times for reusable LDPE bags for, and 10-20 times for durable, non-woven PP bags). Policymakers should give careful attention to how to best incentivise high reuse rates and be aware of trade-offs between products.
Provision of education & accessibility to alternatives	▶ Clear consumer information, sensitization and communication need to be in place for consumers to reduce or avoid the use of single-use bags. Campaigns and educational programmes can also be directed to minimize the littering of bags (especially plastic bags), as well as other impactful behaviours such as dumping and open burning of plastic bags. Alternatives (such as reusable bags) need to be accessible and affordable to all consumers.
Balancing trade-offs and burden-shifting	▶ Banning single-use plastic bags while favouring other single-use alternatives can result in environmental trade-offs. For example, single-use paper bags have less impact of littering, compared to SUPBs, but may have higher impact on other environmental categories (Climate Change, Acidification, Eutrophication, Ozone Depletion, Land use change). When defining policies on bags, policymakers should consider these trade-offs within their specific geographical context.
Collection and recycling capability	▶ In countries with under-developed waste-management systems and poor infrastructure for collection and recycling, the arguments against SUPBs are stronger because littering and associated environmental impacts are greater. Reusable and degradable alternatives, such as cotton or paper bags, should be considered as options to reduce these impacts. Collection and sorting systems need to be able to effectively segregate degradable plastic bags from non-degradable bags, and use corresponding processing and recycling technologies for effective treatment.
Incineration capability	▶ Bio-based bags with no fossil co-polymers have the advantage of climate-neutral incineration. They might have a lower total impact on the climate compared to conventional SUPBs, particularly when the materials are produced with renewable process energy and the bags are sufficiently reused.
Information gaps	▶ Impact assessment of litter is not yet well accounted for in LCA studies and should be carefully considered.
Geographical context	▶ Evaluating different policies requires understanding country-specific information and data, particularly on the waste-management system, the weight of the bags and the number of times each bag is used, because these factors vary between countries and have an important impact on the environmental performance of different options

FIGURE 4

A selection of factors to consider in understanding the environmental impact of **plastic bottles** and their alternatives
Source: UNEP 2020b.

The material and weight of a beverage container	▶ The studies show great differences between container materials e.g. single-use glass bottles were found to have a worse environmental performance compared to alternatives for almost all impact categories. There are often trade-offs between impact categories e.g. one study shows 2 litre PET bottles to be environmentally preferable in many impact categories, except for eutrophication, ozone layer depletion and terrestrial ecotoxicity potential, where aluminium cans show better results.
Functional differences	▶ Different beverage systems might have different functional differences e.g. the container's capacity to deliver large volumes to households that lack access to clean water.
The volume of the beverage container	▶ The volume can influence performance e.g. cartons can be the best choice for juice packaging of small volumes, larger PET bottles are environmentally preferable to smaller ones, when delivering a set volume.
Maturity of the technologies and production routes	▶ Whether a solution for providing beverages is a novel/small-scale/established largescale solution may also considerably influence its environmental performance – but the environmental impact of the small-scale solution could decrease over time e.g. bio-based plastic bottle technology.
Reuse rate and End of life practices	▶ Collection, recycling and reuse rates, as well as to what extent materials are eventually landfilled or incinerated with energy recovery are important factors e.g. glass bottles might need to be reused at least three times to be environmentally comparable with aluminium cans and PET bottles. Increasing the recycling of PET bottles from 24% to 60% can reduce climate impact by 50%. Closed loop systems with high recycling rates of beverage bottles provide important contributions to the circular economy and efficient collection systems.
Geographical context	▶ The location where production, use and end-of-life takes place, user behaviour and other parameters, all influence the environmental impact of solutions. Recycling rate of containers, such as PET bottles or aluminium cans, are an example of an important geographically dependent parameter.

Beverage cups

The report “Single-use beverage cups and their alternatives: Recommendations from Life Cycle Assessments” summarized knowledge about the environmental impact of single-use plastic beverage cups and their alternatives, based on a meta-analysis of existing meta-studies of single-use beverage cups, LCA studies comparing single-use beverage cups, as well as LCA studies comparing single-use and reusable beverage cups for hot and for cold drinks. Key conclusions of the report are presented in **figure 6**. In addition, the setting of where the cup is used could be an important determinant of whether it actually gets reused and the associated impacts. Certain closed settings such as concerts, sports games, conferences that have traditionally relied on single-use cups may be well suited to reuse systems because it doesn’t rely on individuals remembering to bring a cup, and cups can be returned and used again more often as part of a pool of products rather than being individually owned. Such settings may provide a good opportunity for more targeted policies to reduce single-use cups.

Tableware

The report “**Single-use plastic tableware and their alternatives: Recommendations from Life Cycle Assessments**,” included disposable plates, bowls, trays and cutlery used by the foodservice industry in restaurants or canteens. Single-use options considered by the six LCA studies in this report included compostable single-use tableware (e.g. Mater-Bi, PLA, wood-fibre based (CTMP) and bagasse-fibre based); single-use plastic (e.g. polystyrene, polypropylene (PP)); and paper tableware (single-use): LDPE-lined paper and wax-lined paper. Reusable options investigated included plastic (e.g. PP) and other reusable materials (e.g. porcelain, melamine and stainless steel).

Again, the geographical, and end-of-life context is an important feature of understanding the environmental impact of any tableware product. Policymakers should first develop a robust understanding of how tableware are currently produced, used and disposed of, in the region that the policy is being developed for, including such factors as energy mix, recycling rates, and disposal methods. Social and economic considerations will also likely be relevant, for example how people eat predominantly (i.e., at home, restaurants, hawker centres, alone, in large groups, individually or via shared meals) are useful contextual factors that drive different behavioural outcomes and use of tableware. There is also an opportunity to highlight the potential for reducing single-use

plastic products that consumers may not even require, such as SUPP tableware that come by default as part of buying a product, e.g. single-use plastic cutlery with take-aways even if the consumer might have their own tableware at point of eating the food.

Additionally, key points to consider are outlined in **figure 7** and should be addressed when developing policy.

Nappies³

The forthcoming report “Single-use nappies and their alternatives: Recommendations from Life Cycle Assessments,” analyses eight LCA studies and considered both single-use and reusable options including conventional nappies, single-use glueless nappies, single-use bioplastic nappies, and reusable cloth nappies.

The Report concluded that cloth nappies had lower environmental impacts across almost all impact categories. It also noted that the consumers had significantly more control over the environmental impact of nappies when using home-washed nappies and can take steps to lower this impact, for example, by using cold water in a front-loading washing machine and by line-drying. However, the additional work burden for parents, often women, to wash and dry nappies, may be seen as a deterrent and this should be taken into consideration in the adoption of sustainable solutions.

The end-of-life treatment of single-use and reusable nappies was found to be a significant determinant of life-cycle environmental impacts with disposable nappies having the highest impact score for climate change and human toxicity, largely due to significant quantity of such nappies disposed of in landfills.

Environmental performance can, however, continue to be improved through technology and design developments. The weight of disposable nappies, for example, has been reduced by nearly 50% over the last three decades, and this has significantly decreased environmental impact. With regards to disposable nappies, glueless disposable nappies appear to offer several advantages over conventional disposable nappies and are potentially 32% more eco-efficient than conventional nappies. Further innovation across nappy systems should therefore be encouraged, including on waste management infrastructure, design, and on production and manufacturing processes. Novel recycling approaches also offer significant potential. A non-exhaustive list of factors that policymakers can consider in the development of policy are included in **figure 8**.

Menstrual products

The forthcoming report “**Single-use Menstrual Products and their Alternatives: Recommendations from Life-Cycle Assessments**” reviews three LCA studies on menstrual products, which covered both single-use and reusable options, including single-use tampon (with and without applicator), single-use sanitary napkin, reusable sanitary napkin, and the reusable menstrual cup (UNEP 2021d).

The small number of LCA studies in this analysis means that any conclusions should be treated with caution. The reusable menstrual cup was found to have lower impacts than the single-use sanitary pad and tampon across all impact categories, and less than 10% of the costs of the disposable products over one year. For the menstrual cup, the production of raw materials, as well as the use phase (washing), are the most significant contributors to the environmental impacts.

Removing the applicator from the tampons reduces several impacts and overall make the tampon a better choice than the sanitary pad. When comparing the two single-use products, the sanitary pad has the highest environmental impact score.

Policymakers should be aware of the need to consider cultural and social aspects related to the selection and use of different menstrual products. The choice of menstrual product often involves factors including social norms, product availability, access to clean water, and cost which can all have considerable influence on women’s choices. Further studies across countries and considering a range of location-specific differences would be useful for this product category.

FIGURE 5

A selection of factors that policymakers should consider when developing policy on **takeaway food packaging** and their alternatives. Source: UNEP 2020c.

Functional difference between take-away food packaging	▶ Policies should consider the environmental impact of the packaging itself (its production, end-of-life stage, etc.) but also, for example, how well the packaging prevents food waste e.g. due to its technical performance, influence on consumer behaviour. Different materials may be suitable for different types of packaging and for different types of food.
Environmental impact between & within material categories	▶ There are differences between single-use plastic packaging and single-use paper-based packaging, with the later often found to be preferable although lack of recycling or composting infrastructure can change the conclusion. Note that when producing single-use plastic packaging, there are different production routes and feedstocks – virgin or recycled, fossil- or bio-based, different types of bio-based – resulting in considerably different environmental impact.
Future packaging solutions and surrounding systems	▶ Consider the future potential of novel production technologies compared to established large-scale technologies. Recycling technologies for certain types of packaging (e.g. PLA) are developing rapidly. And power generation systems, transportation and recycling processes may change over time.
Reuse systems	▶ Reuse systems should be considered when adopting policies regarding reusable containers, including their transportation from the customer back to the retailer (modes and distances), washing technologies and practices, etc. Be aware of health and safety requirements related to reusable containers.
End of life practices	▶ Consider full cradle-to-grave assessments and ensure that each material is assessed considering the most feasible end-of-life option e.g. biodegradable packaging shows environmental benefits when industrial composting or anaerobic digestion is chosen as end-of-life option e.g. increasing the current EU aluminium recycling rate from 54% to 75%, as per the EU 2025 proposal, might reduce GWP from production of aluminium containers by 23% compared to the current situation.
Geographical context	▶ Many aspects are geographically dependent, such as available feedstocks for bio-based packaging, available power generation technology, consumer behaviour with regard to reuse and recycling, and available waste management systems and end-of-life practices.
Trade-offs and burden-shifting	▶ Trade-offs will exist e.g. a single-use aluminium container is the worst option in terms of depletion of elements, ozone layer depletion, human toxicity, marine and terrestrial ecotoxicity, whereas the single-use PP container is worst in terms of abiotic depletion of fossil resources, acidification, eutrophication, freshwater aquatic ecotoxicity, climate change, photochemical ozone creation and primary energy demand.
Policies must be based on several sources of information for environmental impact	▶ Consider LCA studies together with other sources of relevant information on environmental aspects. Aspects seldom covered by LCAs are food safety (chemical leaching to food), health impacts of packaging materials, and terrestrial and marine littering and the subsequence effects on ecosystems.

Face masks

The forthcoming report “Single-use facemasks and their alternatives: Recommendations from Life Cycle Assessments,” reviews two LCA studies on face masks, which covered both single-use and reusable options (UNEP 2021e). One UK and one German study were analysed. The small number of LCA studies in this analysis means that any conclusions should be treated with caution.

In general, reusable face masks were found to have the lowest environmental impact when compared to single-use face masks. For single-use masks, the manufacture of masks and transport are the most significant contributor to the impacts. Whereas for reusable masks, the largest contributor to environmental impacts was dependent on the use phase, for example, how the masks were washed (e.g. by hand or by machine) and whether single-use filters

were used, with the transport of these filters making a substantial contribution to impacts.

The increased use of facemasks in 2020 due to the COVID-19 pandemic makes this a high-profile SUPP with global sales of these products surging over the last year. Policymakers need to be aware of the significant waste and environmental issues associated with the use of these masks. At the same time health and safety aspects need to be appropriately considered. A comprehensive assessment needs to be undertaken as part of any policy development. UNEP has produced a series of factsheets on COVID-19 which provide helpful information for policymakers on management of facemasks and other single-use plastic products as part of emergency pandemic responses. See <https://www.unenvironment.org/resources/factsheet/covid-19-waste-management-factsheets>

FIGURE 6

A selection of factors that policymakers should consider when developing policy on single-use beverage cups and their alternatives. Source: UNEP 2021a.

Reusable beverage cups have a lower environmental impact than single-use cups	▶ Reusable cups are more environmentally sound than using any other single-use alternative to serve drinks, as long as washing of the reusable cups between uses is done efficiently (this means ideally using a dishwasher, or if handwashed using cold water).
Single-use cups	▶ Single-use cups have similar environmental impacts regardless of the material they are made of (whether it is bio-plastic, fossil-based or paper). If there is a need for single-use options only, the least environmentally problematic choice would be to use paper cups (PLA lining), which would be recycled, rather than landfilled.
Function and design	▶ The size and weight of the cup should be considered within the same material categories - the larger or heavier the cup, the higher the environmental impact. Also consider “add-ons” that sometimes partner with beverage cups, e.g. lids to prevent spilling of drinks or bands, sleeves, or carriers to make the cup more transportable. These will increase environmental impact and be relevant when considering transitioning from single-use to reusable alternatives. The acceptability of using reusable alternatives should also be considered and promoted.
Manufacturing stage	▶ A large contributor to the environmental impact of beverage cups is the manufacturing life-cycle phase. Consider factors such as the amount and type of energy used, whether it is fossil or renewable, as well as the availability of feedstocks.
Use phase of reusable beverage cups	▶ The use phase (mainly washing) is the most significant contributor to the impact of reusable cups, followed by manufacturing. When washing cups, both water temperature and electricity source to heat the water were more important than whether cups are hand-washed or dishwasher cleaned (for which the studies gave no clear preference).
Reuse	▶ Multiple reuses of cups are important. For example, reusable cups need to be reused between 20 and 70 times for the global warming potential to be lower, and between 20 and 40 times before fossil fuel resource depletion is lower than PET, PP and PLA cups respectively.
Recycling	▶ The higher the recycling rate the lower the impact. Consumers behavior during the use phase is very important, as well as the end-of-life technology used. Paper cups can become the better option in terms of climate impact than reusable cups if recycling of exceeds 80% or if washing of reusable cups between uses is inefficient. Recycling paper cups rather than sending them to landfill can reduce their climate impact significantly (by 36%).
End-of-life	▶ The end-of-life scenario also has a substantial influence on the impact category results for single-use beverage cups. For lined paper cups, incineration and recycling are favoured over landfilling. For petroleum-based cups, recycling is the best end-of-life option from a global warming perspective followed by landfill and lastly incineration.

FIGURE 7

A selection of factors that policymakers should consider when developing policy on **single-use tableware** and their alternatives.
Source: UNEP 2021b.

Reusability	Reusable tableware has lower impacts across all impact categories compared to disposable options.
Weight	Lightweight tableware, regardless of material, consistently has lower impacts than heavy-duty tableware across all impact categories. However, lightweighting single-use products may also lead to higher rates of litter.
Production	For all tableware products, production has the highest contribution to the environmental impacts. Innovation to reduce production-related impacts is therefore important.
Design	The design of lighter weight yet durable tableware is important. Other design aspects for reusable tableware might also be of interest, e.g. designs which help to cut down food waste, or reduce water use in washing.
End of life	End-of-life waste treatment is an important contributor to environmental impact, especially whether it is homogenous (e.g. compostable products with food waste) or heterogeneous (e.g. plastic products with food waste). Recycling/composting or a combination of recycling/composting with incineration and/or landfill is better than just landfill.

FIGURE 8

A selection of factors that policymakers should consider when developing policy on **single-use nappies** and their alternatives.
Source: UNEP 2021c.

Product innovation, material	The use of bio-based plastics and glueless nappies generally leads to lower environmental impacts than conventional disposable nappies.
Weight	Glueless nappies have a lower impact in comparison to conventional single-use nappies mainly due to material savings (glueless nappies weigh 23% less).
Design	Nappies that are designed to be lightweight, use less material and are more absorbent, resulting in less nappy changes for the baby will likely perform better across environmental impact categories.
Reuseability	For reusable nappies, the number of nappies purchased, and nappy washing, drying and ironing behaviour strongly affect the results. Overall environmental impact is normally lower than disposable nappies. Design of systems to support the use of disposable nappies are important e.g. outside drying capacity.
Consumer use	Consumers can be encouraged to make changes to help reduce environmental impact, for example by changing how they clean reusable nappies (e.g. cold wash/line dry), choosing lighter nappies (less material) with correct fit (avoiding leakage), disposing of nappies correctly (particularly for bio-based nappies). Consumer education is therefore a useful intervention.
End of life	Bio-based nappies should be composted at end-of-life, wherever possible. Recycling has lower impacts than incinerating or landfilling of disposable nappies. Social acceptability and infrastructure to enable the large-scale recycling of nappies still needs development, however. Incineration is shown to be the least preferred disposal option for disposable nappies, especially with respect to climate impacts.

PART 2

POLICY ACTIONS

TO ADDRESS SINGLE-USE PLASTIC PRODUCTS
POLLUTION USING A LIFE CYCLE APPROACH



Policy action

There is an increasing trend by governments, civil society organizations and the private sector towards the further development of policy and actions to address the environmental impact of single-use plastics products over the last decade. These actions have been noted at international, regional, national, and subnational levels (Table 1).

At the national level, there has been significant focus on actions concerning the use of single-use plastic bags, with some form of policy on the phasing out of these products and actions being undertaken at the national or sub-national level in over 150 countries.

An informative guide on plastics pollution policy development over the last two decades can be found in the comprehensive **20 Years of Government Responses to the Global Plastic Pollution Problem** (Karasik et al. 2020).

The Ad hoc open-ended expert group on marine litter and microplastics (AHEG) have recently collated Member State actions in the **Report on the stocktake of existing activities and action towards the long-term elimination of discharges into the oceans, to reduce marine plastic litter and microplastics** (UNEP 2020e).

The annual reports of the New Plastics Economy Global Commitment led by Ellen MacArthur Foundation in collaboration with UNEP also tracks the progress of its government signatories on addressing plastic pollution. Since the launch of the Global Commitment in 2018, two annual reports have been published in 2019 and 2020 and are available at <https://www.newplasticseconomy.org/projects/global-commitment>.

Policy instruments

A range of policy instruments are being used by governing authorities, at local, regional and national levels, to achieve a reduction in plastics pollution. These can be summarized into three categories: command and control (regulatory), market-based (economic), and information and voluntary (information, education and outreach) instruments. Examples of these are provided in Table 2. An analysis of regulatory and market-based policy interventions can be found in the UNEP (2018a) report on the legal limits of single-use plastics and microplastics.

Effective policies often require a mix of interventions to be used and should consider the broader context and needs of the society to which the policy will affect. Case studies and examples of measures introduced by governments are provided by UNEP (2018b) and sets out a ten-step roadmap for governments to consider when developing policy on SUPP.

Further support for those working to develop laws and regulations that limit or manage single-use plastic product can be found in the report on tackling plastic pollution (UNEP 2020d). This resource guides how to develop legislation on single-use plastic products, outlines the main regulatory alternatives, and suggests the core elements that each should include. The guide gives examples of existing provisions from laws regulating single-use plastic products, as well as more detailed information in the form of national case studies.

The importance of using life-cycle thinking in policymaking

Life cycle thinking assists policymakers to recognize opportunities for improving environmental performance through the identification of the full environmental impacts of single-use plastic products and their alternatives across the entire life cycle of a product. It also helps to identify potential trade-offs and burden-shifting that might arise in the selection of one policy intervention over another, which is a critical aspect of policymaking. Policy interventions can then be targeted appropriately (e.g. addressing low levels of recycling, supporting materials innovation, or by investing in different waste-management infrastructure).

Different tools can be used to facilitate life cycle thinking, including LCA. LCA, however, should only be viewed as one tool to help policymakers identify 'hotspots' or points of intervention to which policy could be usefully considered. A broad evidence base is needed to fully inform policymaking.

As the number of national policies has increased over the last twenty years and the problem definition has evolved, more comprehensive policies have emerged that aim to address multiple stages of plastic product lifecycles (Karasik et al. 2020).

Importance of a gender lens in policymaking

The report by OECD (2020) emphasizes that, "targeting gender roles and behavioural preferences in consumption as well as waste generation and prevention could be a key pillar in transition to circular economy not only by reducing waste but also by addressing some gender inequalities through recognizing the value of jobs supporting circular economies." This also recognizes that at the household level, women are often central in managing plastic in terms of domestic purchasing decisions, recycling and disposing.

TABLE 1

Summary of Actions on Single-Use Plastic Products.

Source: UNEP 2018a; UNEP 2018b; UNEP 2020d; UNEP 2020e; Karasik et al. 2020.

INTERNATIONAL	SUB-NATIONAL
<p>Approximately 33 international policies or agreements address plastics pollution in some manner. There are no globally binding agreements with specific and measurable targets to address plastic pollution. There is growing policy development at international level now bringing more focus to work on single-use plastic products pollution, notably in the United Nations Environment Assembly (UNEA) and its Ad Hoc Expert Group (AHEG) on marine litter and microplastics.</p> <p>→ e.g. MARPOL, Basel Convention, UNEA Resolution 4/6 "Marine Plastic Litter and Microplastics", 2019 UNEA Resolution 4/9 "Addressing Single-Use Plastic Products Pollution". Basel Convention 14/13 Further actions to address plastic waste under the Basel Convention, 2019. BC-14/12: Amendments to Annexes II, VIII, and IX to the Basel Convention, 2019.</p>	<p>Numerous sub-national policies</p> <p>→ e.g. City of Darebin, Victoria, Australia: 2018 Banned balloons, disposable food containers and cups at events on council property, 2017. Portland, Oregon: Chapter 17.103 Prohibition and Restrictions on Single-Use Plastic, 2016. Punjab, India: The Punjab Plastic Carry Bags (Manufacture, Usage and Disposal) Control (Amendment) Act, 2016. Victoria Environment Protection Amendment Bill 2019. City of Peabody Regulation Regarding the Use of Disposable Plastic Bags at Retail Establishments, 2019. Chapter 16 of the San Francisco Environment Code: Food Service and Package Reduction Ordinance, 2019. The Environmental Protection (Microbeads) (Scotland) Regulations 2018. Washington State, US: SB 5397: Concerning the responsible management of plastic packaging, 2019.</p>
REGIONAL	PRIVATE SECTOR
<p>Increasing number of regional approaches, with strong emergence of policies related to the Regional Seas Programmes and European Union efforts.</p> <p>→ e.g. Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment. East African Community Polythene Materials Control Bill, 2016. Pacific Regional Waste and Pollution Management Strategy 2016–2025. SPREP Pacific Regional Action Plan Marine Litter, 2018. Antarctic Treaty Resolution 5 (2019) - ATCM XLII - CEP XXII, Reducing Plastic Pollution in Antarctica and the Southern Ocean. ASEAN Framework of Action on Marine Debris 2019.</p>	<p>Growing number of individual company or collective approaches across companies to reducing SUPP and development of specific targets related to reducing single-use plastic product pollution.</p> <p>→ e.g. Operation Cleansweep</p>
NATIONAL	CIVIL SOCIETY/PUBLIC/PRIVATE PARTNERSHIPS
<p>At least 127 countries have adopted some legislation on single-use plastic bags. Increasing focus on other SUPP. Relatively few policy responses to microplastic pollution. National level policy responses to microplastic pollution primarily defined microplastics as microbeads in cosmetic products.</p> <p>→ e.g. National-level ban on single-use plastic bags (many). Seychelles: Environment Protection (Restriction on Importation, Distribution and Sale of Plastic Utensils and Polystyrene Boxes) Regulations 2017. United Kingdom: Producer Responsibility Obligations (Packaging Waste) Regulations 2017. Denmark: Statutory Order on Deposits on and the Collection, etc. of Packaging for Certain Beverages, 2016. Finland: Reduce and Refuse, Recycle and Replace: A Plastics Roadmap for Finland, 2019. Rwanda: Law on the Prohibition of Manufacturing, Importation, Use, and Sale of Polyethylene Bags and Single-use Plastic Items. 2019; Belize: Pollution from Plastics Regulations 2020. Panama: Regulating the Reduction and Progressive Replacement of Single-use Plastics in 2021, 2019. Samoa: Public Notice Plastic Prohibition (Ban) 2019. Chile: Law that bans the use of plastic bags (Law 21.100)</p>	<p>Increasing CSO activity to address SUPP pollution and advance circular economy approaches.</p> <p>→ e.g. The New Plastics Economy Global Commitment, led by the Ellen MacArthur Foundation with UNEP, and Plastics Pact (e.g. UK Plastics Pact, Circula El Plástico in Chile) supported by the Ellen MacArthur Foundation, Life Cycle Initiative, Surfrider Foundation, Alliance to End Plastic Waste. The Global Tourism Plastics Initiative. Chile ElijoReciclar (public private initiative)</p>

TABLE 2

Selection of policy instruments used by governing authorities, at local, regional and national levels, to achieve a reduction in plastics pollution.

Source: UNEP 2018a; UNEP 2018b; UNEP 2020d; Karasik et al. 2020.

REGULATORY

POLICY STATEMENTS

- e.g. National Plastics Waste Management Strategy, zero-waste policy

BANS

- e.g. ban on single-use plastic shopping bags, plastic waste landfill ban, ban on imported waste, ban on production and use of microbeads in products

TRADE POLICIES

- e.g. ban on imported waste, support for trade initiatives that boost alternatives to single use plastics products, targets on reducing trade in certain plastics

MANDATED LABELLING AND INFORMATION DISCLOSURE

- e.g. mandatory consumer information on recyclable material on plastic products

REPORTING

- e.g. reporting requirements on number of plastic bags distributed in supermarkets

EXTENDED PRODUCER RESPONSIBILITY SCHEMES

- e.g. introduction of a EPR across the life cycle of the product, eco-design and material content

LIMIT/RESTRICT USE

- e.g. restrict use of non-recyclable plastics,

RESPONSIBLE HANDLING

- e.g. recycling targets for plastic waste, introduction of separate collection streams for plastic products

ECO-DESIGN STANDARDS

- e.g. targets to reduce add-ons like single-use plastic carry bag/holders for beverage cups, mandated % of recyclable material in products

PROCUREMENT

- government procurement policy to avoid use of high impact single-use plastic products

MARKET-BASED

TAX

- e.g. plastics beverage packaging tax, landfill & incineration taxes, pollution tax

LEVY

- e.g. levy on single-use plastic product producers/sellers

SUBSIDY

- e.g. subsidies supporting innovation/ production/ research efforts on new materials

PAY AS YOU THROW SCHEME

- e.g. charge for plastic waste disposal

PAYMENTS

- e.g. deposit refund schemes

INFORMATION & VOLUNTARY

RESEARCH

- e.g. commission studies, reports, best practice development, undertake LCA

VOLUNTARY LABELLING AND INFORMATION DISCLOSURE

- e.g. encourage voluntary disclosure schemes, certification, labelling of recyclable content

DATA COLLECTION/REPORTING

- e.g. collect data, show trends to support new behaviour

VOLUNTARY BEST PRACTICE GUIDANCE

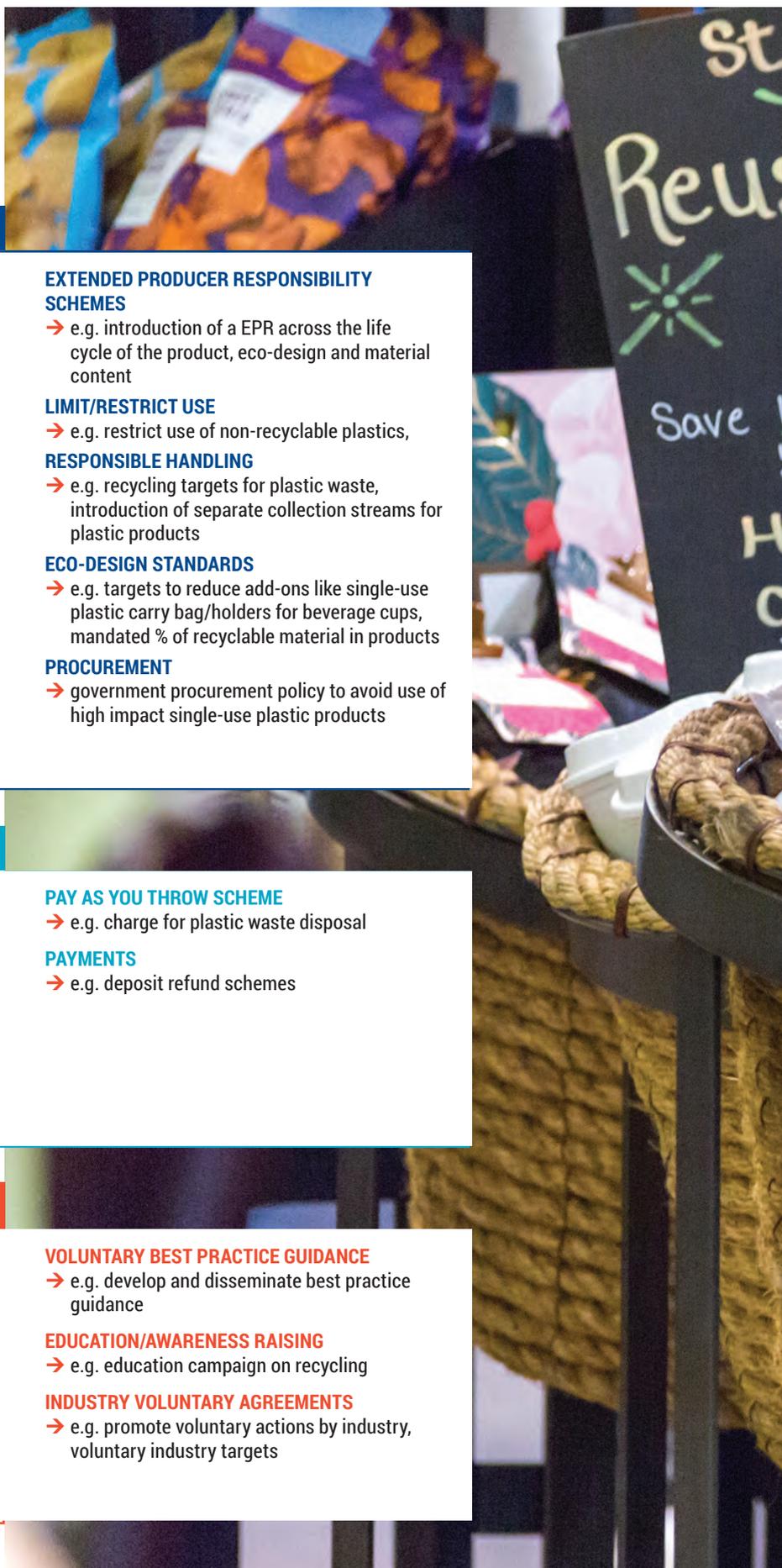
- e.g. develop and disseminate best practice guidance

EDUCATION/AWARENESS RAISING

- e.g. education campaign on recycling

INDUSTRY VOLUNTARY AGREEMENTS

- e.g. promote voluntary actions by industry, voluntary industry targets





A gender dimension is also critical when understanding the potential of, and impact from, various policy interventions. For example, it is important to understand specific consumer behaviours and what the current challenges they face are, as well as the different impacts policy interventions will have across stakeholder groups, as the use of products by various stakeholders can involve a range of different interactions. Gender analysis is an important tool that should be used in the development of policy.

Resources for developing policy

Developing policy on single-use plastic products is an important but complex activity for all governments. Governments and policymakers at all levels can learn much from each other by sharing their experiences in the development, implementation and ongoing monitoring and enforcement of policy related to single-use plastic product pollution. A selection of case studies is included in Part 3 of this report.

In addition, there is a growing number of recently published resources that can help guide policy development. For example, the National Guidance provides policymakers with advice and useful online resources on identifying plastic leakage 'hotspots', finding their impacts along the entire plastic value chain, and then prioritizing actions once these hotspots are identified (UNEP 2020f). See the project website here.

WECF (2017) draws attention to the links between gender and plastics consumption and production, with focus on the impacts of the chemicals used in plastic production on human health, as well as the roles of women and men as agents of change in reducing the impacts of plastics on the environment (especially marine environment) and human health.

The report on Addressing Marine Plastics (UNEP 2019a) helps to identify a core set of priority solutions to be implemented by targeted stakeholders from across the plastics value chain under different time horizons and at different geographical scales. This roadmap can be used as a reference by funding agencies, governments and civil society organizations to define the scope of their respective strategies and to facilitate and scale up the interventions on plastic pollution. Another report on Addressing Marine Plastics (UNEP 2019b) identifies gaps to address marine plastics at each value chain stage and recommends actions to be taken by different stakeholders to achieve a circular economy for plastics at the global level. **Identification of technical and financial resources and mechanisms for supporting countries in addressing marine plastic litter and microplastic** (UNEP 2020g) is another useful resource. Furthermore, a report

by UNEP (2020g) assists countries in identifying technical and financial resources for tackling plastic litter.

A report on single-use plastic products in tourism (UNEP 2021f) identifies key hotspots and gives recommendations for tourism businesses and policymakers to address single-use plastic products pollution in the tourism sector. Hotspots analysis have also been used to guide national action plans and roadmaps for low-carbon and resource-efficient tourism as part of a project targeting developing countries and small island developing States to accelerate more resilient, resource-efficient, low-carbon development. Under this initiative, Saint Lucia, Mauritius, and Dominican Republic have prepared policy recommendations and developed concrete action plans aimed at reducing the use of problematic SUPP with clear targets and intervention areas (One Planet Network, 2020).

The **Plastics Policy Inventory** is a free, searchable online database of policies adopted to reduce plastic pollution that governments may use as examples for crafting existing legislation. Policies in the inventory include those policies analysed in the “20 Years of Government Responses to the Global Plastic Pollution Problem” report (Karasik et al. 2020).

The recent stocktaking report by the Ad Hoc Expert Group on marine litter and microplastics, about existing activities and action by different stakeholders with the aim of the long-term elimination of discharge into the oceans, can be consulted through an online repository and dashboard (United Nations Environment Assembly, n.d.).

Additional resources can also be found on the **One Planet Network-Wide Plastics Initiative** web page.



PART 3

CASE STUDIES

OF NATIONAL-LEVEL ACTIONS TO ADDRESS POLLUTION FROM SINGLE-USE PLASTIC PRODUCTS USING A LIFE-CYCLE APPROACH



Several comprehensive assessments on national-level actions to address single-use plastic products pollution have been published in the last two years. This includes specific examples of interventions implemented within countries (UNEP, 2018a), and more recently, a full database of actions at international, regional, national, and sub-national levels (Karasik et al. 2020).

The ad hoc open-ended expert group on marine litter and microplastics (AHEG) has also recently collated Member States' actions to reduce marine plastic litter and microplastics (UNEP 2020e). These efforts combined demonstrate efforts to meet Resolution 4/6 of the United Nations Environment Assembly (UNEA), to develop a monitoring system for tracking the responses of various stakeholders to the global plastic pollution problem, including governments.

This section does not seek to duplicate the work in the aforementioned reports but provides further insight on Member States' actions as gathered through a reporting and webinar series held in October 2020. In this series, a selection of Member States presented in webinar sessions and/or provided written feedback on their experiences in developing policy on single-use plastic products using a life-cycle thinking approach. These included: Canada, Colombia, Mauritius, New Zealand, Rwanda, Peru, Singapore, South Africa, Saint Lucia, Thailand, United Kingdom, and the European Commission. The webinar recordings and copies of presentations can be viewed here.

Written feedback from Member States has been collated and presented in the following section.



Canada⁴

Case Study

Context

The Government of Canada has developed an integrated management approach to plastic products to reduce waste and pollution⁵. This includes a management framework that has been developed to categorize different single-use plastics, set management objectives for each, and choose the best instrument to achieve the chosen objective. For example, some products may be best managed by assigning end-of-life management to producers through EPR policies, while others would benefit most from material or product specifications such as recyclability standards. Using this framework, six single-use plastic products were identified as potential candidates for prohibitions or restrictions. These products met all the criteria for being both environmentally and value-recovery problematic, meaning the best way of preventing these items from entering the environment from litter is to eliminate them from the Canadian market or restrict their use.

It is also important to note that the environment is an area of shared jurisdiction between federal, provincial, territorial and Indigenous governments in Canada. Other levels of government are also taking action to reduce plastic waste and pollution, such as developing and implementing EPR producer responsibility policies that manage single-use plastics at end-of-life, as well as introducing local-level prohibitions or restrictions on some single-use items such as bags.

Life-cycle thinking

Challenges and barriers to reducing plastic waste and pollution exist at a range of different points in the life-cycle of plastic products and packaging. For example, some products are not designed with recyclability in mind, while for other products the principal challenge is low collection rates at end-of-life. To achieve zero plastic waste, governments, businesses and others in Canada are tailoring solutions to fit the different challenges and barriers posed at different life-cycle stages.

Three areas where federal measures can effect needed changes at different life-cycle stages have been identified. These include managing single-use plastics, establishing performance standards such as recycled content requirements, and ensuring end-of-life responsibility. Actions will seek to eliminate sources of plastic pollution, strengthen domestic end-markets for recycled plastics, improve the value recovery of plastic products and packaging, and support innovation and the scaling up of new technologies.

Consultation is currently being undertaken on the best instruments to achieve these objectives.

Life-cycle assessments are a valuable source of evidence, along with other sources of information such as scientific studies of environmental impacts and litter clean-up data, to help guide its actions. Among other things, LCAs are also useful to help avoid or mitigate unintended consequences from alternative products, materials, or systems.

Challenges to policy development

Single-use plastics play a wide range of roles in our daily lives. Some are necessary for protecting human health or preserving food, while others are considered convenience items. One challenge has been determining how single-use plastics should be managed, taking into consideration the role they play. The management framework for single-use plastics was used as a tool to:

- ▶ assess the environmental and value-recovery challenges associated with a single-use plastic item;
- ▶ consider whether they merit exemption or accommodations for reasons such as performing an essential function or lack of viable alternatives;
- ▶ assign management objectives and choose the best instrument to manage the challenges specific to each item.

These led to the identification of the six single-use plastics products for possible prohibitions or restrictions which are all largely convenience items given to individuals to transport purchased goods (e.g., checkout bags and six-pack rings) or to transport or consume food or drink (e.g., straws, cutlery and foodware). Even some of these items, however, can play useful or even vital roles – for example, straws are used to administer medication, and people with disabilities may rely on single-use plastic straws in restaurants and other public spaces. The Government is consulting Canadians on how to consider these uses in future policy.

Evaluating trade-offs

Areas where consideration may be required for exemptions or accommodations include:

- ▶ where a single-use plastic performs an essential function (for example, accessibility, health and safety, security); and

- ▶ where no viable alternative exists that can serve the same function.

In addition, regulatory measures developed by the Government of Canada must undergo a range of different assessments that are designed to provide policymakers with crucial perspectives on the distributional impacts of any proposed actions. These include:

- ▶ **a cost-benefit analysis**, which provides a structured approach to identify and consider the economic, environmental and social effects of a regulatory proposal;
- ▶ **the small business lens**, which requires federal regulators to identify and take into account the needs of small businesses when designing regulations;
- ▶ **a strategic environmental assessment**, which considers the scope and nature of the likely environmental effects of a proposal, the need for mitigation to reduce or eliminate adverse effects, and the likely importance of any adverse environmental effects, taking mitigation into account;
- ▶ **a gender-based analysis plus**, which is an analytical tool to assess how diverse groups of women, men and gender-diverse people may experience policies, programmes and initiatives; and
- ▶ **an assessment of modern treaty implications**, which helps determine whether there are implications for treaties or self-government agreements with indigenous peoples that requires regulators to consult with rights-holders.

For regulatory measures, these assessments are published in a Regulatory Impact Analysis Statement that accompany draft regulatory text.

Developing the evidence base for action

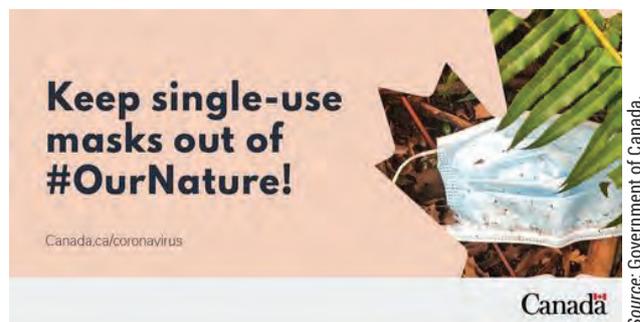
The development of a strong evidence base to inform actions to reduce plastic waste and pollution is important and this included:

- ▶ developing a Science Assessment of Plastic Pollution (Canada [Ministry of Environment and Climate Change 2020](#));
- ▶ commissioning an Economic Study of Canada's Plastics Industry, Markets and Waste ([Canada Ministry of Environment and Climate Change 2019](#)); and,
- ▶ gathering data from shoreline litter clean-ups and litter audits conducted across Canada.

These sources of evidence shed light on the scale of the challenge to be addressed in protecting the environment from plastic pollution and working towards zero plastic waste. For example, the Science Assessment of Plastic Pollution shows that plastic is everywhere in the environment, including water, air and soil. Building the evidence base for addressing single-use plastics (and plastic waste generally) has also highlighted the important benefits of a circular economy for plastics. For example, the Economic Study of Canada's Plastics Industry, Markets and Waste estimated that achieving zero plastic waste by 2030 would save CAD 500 million in avoided costs, create 42,000 direct and indirect jobs, reduce greenhouse gas emissions by 1.8 megatonnes of carbon dioxide equivalent, and substantially reduce the amount of plastic pollution generated in Canada.

Consumer communication

An important action has been to ensure that Canadians have the information they need to play their part in reducing the amount of plastic waste they create, correctly sorting and binning recyclable plastics, and avoiding littering, among other things. Education on the science and evidence that shows the nature and scale of plastic waste and pollution is also a key focus. For example, the Government has published its Science Assessment of Plastic Pollution and an Economic Study of Canada's Plastic Industry, Markets and Waste. These sources help Canadians understand that, for example, only 9% of plastic was recycled in Canada in 2016, while 29,000 tonnes entered the environment as pollution. Communications also help spread the word on how Canadians can reduce their plastic waste footprint, including through social media such as Environment and Climate Change Canada's Twitter account.



During the COVID-19 pandemic, the Government of Canada has also conducted outreach on the importance of properly disposing of personal protective equipment (PPE). Environment and Climate Change Canada and Health Canada have both launched English and French social media campaigns on PPE waste that have reached over 100,000 people.

Colombia⁶

Case Study

Context

Colombia launched its National Circular Economy Strategy in 2018. A key early action was establishing a multi-stakeholder committee to help implement the National Plan of Sustainable Management of Single-Use Plastics (“Plan”), consisting of twenty-two members from the public, private and academic sector. The Plan contains six strategic actions and ten transversal activities with Action One being the “Gradual replacement of single-use plastic products”. In 2019, single-use plastic products were prohibited and/or restricted in protected areas in Colombia covering some 17,466,974 hectares, which corresponds to 8.4% of the national territory. At the end of 2020, the Ministry of Environment and Sustainable Development presented the regulatory instrument for the sustainable management of plastics that included the prohibition of these products from January 2022.

Life-cycle thinking

Both plastic materials and possible substitute materials are evaluated and compared on criteria defined by the national government, and by using standardized LCA protocols based on the Colombian Technical Standard under ISO 14040. Policymakers also consider the potential for activities across the entire life-cycle of plastics products to help reduce pollution as part of the circular economy approach.

Challenges in policymaking

A lack of quality recycled plastic in the market and the variation in purchase and sale prices often pose considerable problems. Formalizing in some way the informal waste sector and increasing the recycling rate through the waste pickers is another important challenge. Waste pickers play an important role in Colombia concerning the collection and transport of plastic product waste. Therefore, these stakeholders had to be considered in the design of the policy. In Colombia, the waste pickers now receive a part of the waste tariff, based on the materials (by weight) that they collect and send to the recycling companies. This proved to be an effective way to help formalize the sector. Finally, Colombia has identified the need to improve access to context-specific and timely data on single-use plastic products and their alternatives.

Collaboration

Collaboration is an important aspect of policy development in Colombia with an emphasis on involving all stakeholders in the process. This includes both national

and local governments who need to work together on the design and implementation of policies on single-use plastics. Moreover, NGOs, waste pickers’ organizations, industry and EPR packaging waste organizations are also important contributors to the design and implementation of policies and the development of financial support mechanisms. Stakeholders may also need to be supported to transition into new ways of working, for example, through the development of new businesses models.

Consumer change

While key aspects to develop and inform citizens have not been unified yet, the Ministry of Environment has been working on a National Program of Communication, Culture, and Environmental Education over 2019-2020. The first step of this Program will be to sign an agreement between public and private entities interested in improving the current conditions of waste management, including on single-use plastic products. The construction of the Program and its implementation will draw on a range of stakeholders across government and the private sector and aim to formulate a unified discourse by national and territorial entities on waste management and circular economy so that the public is informed about different actions. A key action will be to ensure there is adequate infrastructure to support change. The Ministry of Environment is also designing eco-labelling strategies and policies, along with a national communication campaign.



Source: Ministerio de Ambiente y Desarrollo Sostenible.

European Union (EU)⁷

Case Study

Context

The EU has several legal instruments addressing single-use plastic products and marine litter. EU marine environment legislation requires that EU Member States monitor and assess marine litter quantities and impacts and take measures to reduce them.

The European Parliament and Council Directive (1994) lays down measures aimed, as a first priority, at preventing the production of packaging waste and, as additional fundamental principles, reusing packaging, recycling and other forms of recovering packaging waste. The Waste Framework Directive, as amended in 2018 by the European Parliament and Council Directive (2018), requires Member States to take measures aimed at halting the generation of marine litter and measures to prevent, reduce and clean-up litter, as well as to identify products that are the main sources of marine litter.

The European Parliament and Council Directive (2019) on single-use plastic products and fishing gear includes a hierarchy of measures that are tailored to reflect the availability of alternatives to plastic products in certain uses, and other measures deemed most adequate to reach the objective of curbing littering of single-use plastic products. These measures include: an ambitious and sustained reduction of the consumption target for single-use plastic versions of drink cups and food containers; a ban of some of the most common single-use plastic products including cutlery, plates, straws, stirrers, food and beverage containers, made of expanded polystyrene and products made of oxo-degradable plastics; product requirements for beverage containers, including on recycled content for plastic bottles, and marking requirements for cups for beverages; EPR schemes to contribute to the cost of prevention, waste management and cleaning-up of litter; and separate collection targets for single-use plastic bottles of 77% by 2025 and 90% by 2029.

Life-cycle thinking

Directive 2019/904 was preceded by a study from a consultant⁸, an LCA study⁹, and an impact assessment¹⁰. The studies identified the existing alternatives to SUPP and compared the LCA impacts of SUPP with reusable and single-use non-plastic alternatives. The life-cycle assessment was undertaken for certain single-use plastic products to feed into an impact assessment accompanying the proposal on “reducing marine litter: action on single-use plastics and fishing gear.” The impact assessment of the Directive calculated that it will

bring benefits in terms of reduction of marine litter (50% reduction of plastics littering from top 10 SUP items) CO2 reductions (equivalent to around 3.4 million tonnes) avoided environmental damages (23 billion Euros) cost saving for consumers (6.5 billion Euros) and job creation (30 000 new jobs).

Challenges in developing policy on single-use plastic products

The main challenge was the short timing for the negotiation and approval of the European Commission proposal due to the complex EU decision-making process. The implementation will also be challenging in areas such as the definition of plastics, single use, criteria on costs relating to the cleaning-up of litter for EPR systems and rules for calculating recycling content.

Consumer communication



When the proposal of the Directive was released, the European Commission launched an awareness campaign¹¹ focusing on the negative impacts of SUPP and how individual behaviour changes could make a difference. The development of a communication strategy was the first preparatory step. The conclusion of the desk research, based on analyses of available reports, data and existing campaigns, was that EU citizens, in particular younger generations, are already very well aware of the environmental impacts of single-use plastic products, but this knowledge does not translate into their daily choices. Therefore, another campaign covering this aspect was not thought to be appropriate and another angle and message was chosen: that ‘SUPP are part of our daily life but using existing available alternatives to plastic forks, plastic plates, plastic bottles, plastic straws can actually make your life easier and save oceans from plastic litter’. The objective was to challenge – through a series of humorous incidents – a common perception of SUPP as convenient items and to encourage people to reflect and change their “relationship

status” with these products. An external evaluation confirmed the campaign efficiency, effectiveness, relevance, coherence and added value. The campaign received the EU Ombudsman award and is considered one of the most successful communication campaigns implemented by the European Commission.

Article 10 of the SUPP and fishing gear Directive states that “Member States shall take measures to inform consumers and to incentivize responsible consumer behaviour, in order to reduce litter from products covered

by this Directive”. Article 8(2)(a) foresees that EPR systems will help to cover the costs of the awareness-raising measures referred to in Article 10.

Design as an element of policy interventions

Because caps and bottles are the most littered SUP items in the EU, Article 6 of the Directive foresees an eco-design obligation for caps and lids to remain attached to the bottles from July 2024. The standardization body of the EU (CEN/CENELEC) will prepare a harmonized standard.

Mauritius¹²

Case Study

Context

The Government of Mauritius announced the development of a ten-year Environmental Master Plan in June 2020 which will set the political and strategic orientations of the environment for 2020-2030, as well as an Action Plan for the next five years. Measures under this Master Plan involve action across eight pillars, including on the circular economy and solid waste management; protection of coastal areas and the marine environment; and control of plastic waste. Mauritius has been active in developing measures on single-use plastic products for many years, having introduced a ban on the use of plastic bags in August 2015. As part of policy under the Master Plan, a further ban on ten single-use plastic products will also be introduced under the “Environment Protection (Control of Single-Use Plastic Products) Regulations 2020”. This will ban from January 15, 2021, single-use plastic products as follows: plastic cutlery (forks, spoons, knives, chopsticks), disposable plates, straws, drink stirrers (stirrer), containers with hinged lids, lids of plastic containers and single-use plastic containers, and disposable (take-away) containers. From April 15, 2021, straws attached to the drink cartons, disposable trays and containers with hinged lids used only for drinking, packaging of raw (fresh) and refrigerated products such as fruit, meat, seafood and chicken will also be banned in Mauritius.

Use of life-cycle thinking

A comprehensive regulatory impact assessment (Economisti Associati, 2015) was undertaken before the introduction of the ban on plastic bags investigated options to reduce the impacts of plastic bags in Mauritius. This assessment looked at impacts across the life-cycle of plastic bags. The study also drew on LCA studies to help identify

possible impacts of different choices and trade-offs. The Government was also able to draw on an LCA study of PET bottles and assessment of disposal options in Mauritius.

Communication

Public sensitization, awareness-raising and clean-up activities are an important component of the policy on SUPP. Messages on SUPP and policy are communicated to different target groups accordingly, such as children, youth, women’s community groups, and senior citizens. Several radio talks and TV programmes have highlighted the impacts of plastic products and their alternatives. Advertisements highlighting key messages have also been developed. The Government also supported expo events where providers that offer alternatives to SUPPs are encouraged to promote their products.

Challenges encountered when developing policy

A variety of challenges have been encountered, including resistance from manufacturers to proposed changes, and the high cost of alternatives for some products. Enforcement is also an issue and implementation of policies, particularly bans require ongoing monitoring to ensure that certain SUPPs are not imported into the country and sold. Fines need to be imposed and at a level that effectively discourage lawbreakers.

New Zealand¹³

Case Study

Context

In 2019, the Chief Science Advisor to the Prime Minister of New Zealand convened an expert panel to provide evidence-based advice to the Government to reduce the impact of plastic on our environment (New Zealand, Office of the Prime Minister's Chief Science Advisor 2019). This culminated in the report 'Rethinking Plastics in Aotearoa New Zealand', which included a series of recommendations that are currently being implemented.

The importance of a life-cycle thinking approach

In *Rethinking Plastics*, life-cycle thinking was used to guide policy recommendations. For example, the report purposefully developed a series of case studies to highlight the types of questions related to single-use plastic products where the use of life-cycle thinking could help provide insight and uncover trade-offs, including:

- ▶ Are reusable products always better than single-use alternatives?
- ▶ Should we switch to bio-based plastics?
- ▶ Is recycled plastic better for the environment?
- ▶ Should we ban plastic packaging altogether?
- ▶ Should we use an alternative material to plastic?

The use of LCA

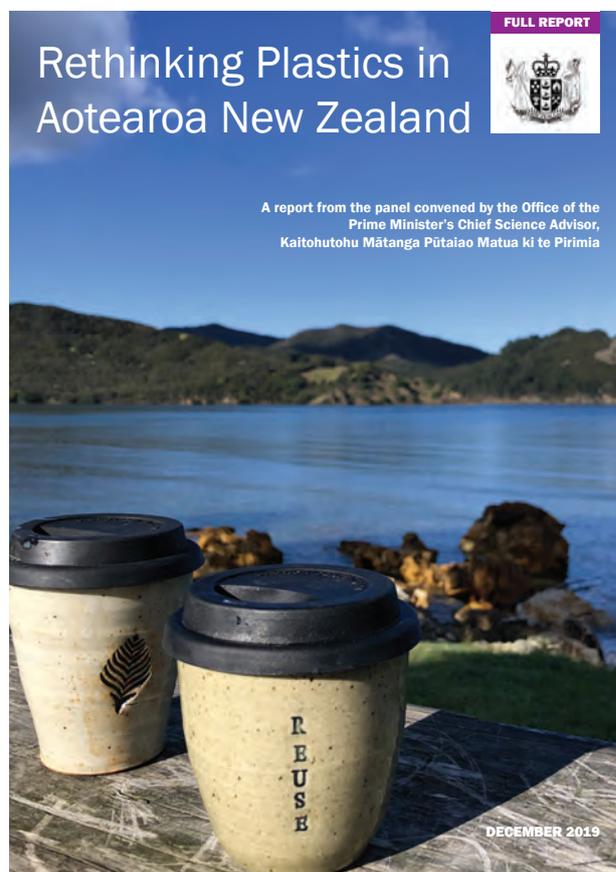
Life-cycle assessment (LCA) is recognized as an important tool that can be used to inform plastics policy in New Zealand, but only makes up part of the evidence base due to study limitations and other necessary considerations. For example, the Ministry for the Environment used LCA to inform New Zealand's single-use plastic bag ban policy, referencing several LCA studies (New Zealand, Ministry for the Environment 2018) which later came into effect on 1 July 2019. Other key considerations that fed into the policy decision included the impacts of littered plastic bags on the environment. The insights into trade-offs and unintended consequences provided by LCAs (e.g. unexpected surge in carbon emissions from the use of an alternative) are crucial pieces of evidence to inform plastics policy decisions. The report recommended that the government facilitate organizations' access to life-cycle assessment-based decision-support tools, supported by New Zealand-specific datasets, to help embed life-cycle thinking in broader plastics decisions beyond government.

Challenges encountered when developing policy on single-use plastic products

The biggest challenge was identifying policy priorities given the sheer size and scope of the plastic waste problem in New Zealand and the resulting large number of changes needed as part of a systems change. Charting a clear path forward for the many stakeholders involved in plastics was seen as essential and led to a recommendation for a National Plastics Action Plan, which is currently being developed. Another key challenge was the lack of publicly accessible data to quantify Aotearoa New Zealand's plastic and this led to a recommendation on the need to obtain better data to inform policy changes and use as a baseline to measure the impact of future policy changes.

Opportunities

The research found that while there was no silver bullet to fix the plastics problem there was a huge number of promising ideas and innovations that had already been developed and/or implemented in smaller communities across New Zealand, many of which could be scaled-up with further support and encouragement.



Peru¹⁴

Case Study

Context

The Plastics Law 2019 (Regulation 30884) regulates single-use plastic and disposable containers and is framed in the principles of minimization and recovery of waste, as well as promoting the transition towards a circular economy (Government of Peru 2019). It directs businesses to replace non-reusable plastic bags with reusable bags or others whose degradation does not generate contamination by microplastics or dangerous substances. The Plastics Law also establishes a tax on the use of single-use bags, as well as plastic bags. There are also prohibitions on the acquisition, use, entry or commercialization of plastic bags, plastic straws, containers or expanded polystyrene containers for beverages and food for human consumption in protected and cultural heritage areas, museums, and public institutions.

Manufacturers of PET bottles for beverages for human consumption, personal hygiene and other similar ones, must include post-consumer recycled PET material (PET-PCR) in the production chain in at least fifteen per cent (15%) of its composition. The incorporation of sustainability criteria such as reuse, returnability, recyclability, biodegradability, microplastics contamination in the design of products is also mandated under the Plastics Law.

The use of life-cycle thinking

Analysis of the life cycle of plastics was considered in the development of the regulations despite the difficulties of obtaining data and evidence of leaks in the model. The Plastics Law prioritizes minimization of plastic waste and promotes eco-design as well as the extension of the useful life of products. Life-cycle thinking is also a feature of the design phase of plastic products regulated by the Plastics Law because criteria of biodegradability, reuse, returnability and recyclability in the design phase need to be considered with a prevention approach in mind.

Challenges in developing policy

A significant challenge was the lack of detailed, reliable and context-specific information, to have a clear, concise baseline of the real magnitude of the plastics problem in the country. The creation of a registry of manufacturers, importers and distributors of polymeric-based bags was established to improve the information for making better decision-making. The informal waste sector also represented a great challenge for the generation of information and measurement of the impact of the approved regulations.

Trade-offs

Some exclusions were established for food safety reasons (e.g. to contain food or wet-processed inputs) and for reasons of hygiene or health. Technical regulations were developed to carefully guide these exclusions and to encourage ongoing improvements to design, where possible.

Consumer communication

Since 2018, the #MenosPlásticoMásVida initiative has promoted the responsible consumption of single-use plastic products such as plastic bags and straws among citizens. Effective environmental education and information actions consisted of a range of activities including educating citizens, food market traders and supermarket chains about the importance of reducing the use of single-use plastic products. Drawing on the support of environmental promoters, municipal promoters and environmental leaders was helpful. Connecting with the public on the impacts of single-use plastic products on the environment, especially on coastal marine ecosystems and their biodiversity, was a valuable communication method, especially combined with the provision of guidance on alternatives to single-use plastic products.



Rwanda¹⁵

Case Study

Context

Rwanda started developing policy on plastic shopping bags in 2004 after a government assessment showed significant human health, agriculture productivity, water drainage systems, air and water quality issues caused by plastic pollution. In 2008, regulations relating to the prohibition of manufacturing, importation, use and sale of polythene bags in Rwanda was introduced and extended to all packaging plastics. In 2019, a new law came into force to cover not only polythene bags but also other types of plastic material which are contributing to environmental pollution. Furthermore, the revised regulation now has a wider scope to include single-use plastic products.

Challenges encountered when developing policy

A key challenge was to find appropriate and sufficient alternative packaging material (new technologies) for some specific items such as food and beverage products. Changing the habits of stakeholders when it comes to the use of SUPPs and their alternatives is also a difficult task and requires changing public perceptions but also the consideration of cost issues. The regulation, therefore, targets single-use plastic items to which alternatives are more readily available on the market or which people can largely go without. Lastly, the emergence of a black market for plastic bags from neighbouring countries remains a complex and problematic issue.

Strategies that have worked well

Strong political will from the top management of the country to the grass-roots level is critical. This was consolidated through a wide-reaching and ongoing awareness-raising and sensitization programme reaching all levels of the

population and carried out through different media channels such as TV, radio, meetings, and conferences. Further, the monthly community works, Umuganda¹⁶, draws attention to the collection of plastic pollution through community clean-up initiatives and is a helpful education tool. Regular inspections to control compliance and control of the entrance of plastics at all country borders has also contributed to better success of the policy.



Source: Rwanda Environment Management Authority.

Saint Lucia¹⁷

Case Study

Context

The Government of Saint Lucia approved a ban on the importation and eventually the use, manufacturing, sale and distribution of Styrofoam and selected single-use plastic foodservice containers in June 2019, with its implementation taking effect in August 2019. This ban was in response to increasing concern about the impacts of plastic products pollution on the island including on tourism, by littering of public places e.g. streets, parks, beaches, etc., environmental blight, clogging of drains/waterways, and deposition in the marine environment. A commitment for Saint Lucia to be landfill-free by 2030 was also made, noting that reducing the quantity of plastics (which makes up over 20% of the waste stream) could help to extend the lifespan of the landfill.

Life-cycle thinking

In combination with stakeholder consultation, alternatives to SUPP were researched both in terms of the final cost to consumers, their environmental impact, and their suitability as an adequate replacement. Life-cycle thinking underpinned the development of regulations, with a strong waste hierarchy guiding all actions, with the focus being to first reduce waste to the largest extent possible.

Challenges in developing policy

Developing policy on SUPP is complex and requires clear ongoing communications with stakeholders. Uncertainty concerning stakeholders (importers, retailers, consumers) reaction to the policy is a challenge due to possible financial implications. On the other hand, some stakeholders benefit positively due to new opportunities for commercial activities arising. It is important to sensitively address issues, such as how to deal with existing stock and supplies that were already committed by suppliers but that had not arrived on the island, and then sensibly establish a cut-off point agreeable to all stakeholders.

It was also noticed that many alternatives to SUPP were generally more costly. Given the higher cost of environmentally-friendly products, the Government decided to forgo revenue, to reduce this burden on consumers. Obtaining suitable alternatives, however, to replace restricted items was also sometimes difficult.

Access to adequate data was also a challenge. For example, certain plastic products do not have disaggregated HS Codes in the customs and excise system and this made it difficult to segregate single-use plastic products and

Styrofoam to better understand the impact that these specific items would have on revenue. Lastly, adequate enforcement and monitoring systems to ensure the restricted items are not missed during inspections is an ongoing concern.

Trade-offs

SUPPs are apparently cheap, convenient and can offer sanitary advantages, therefore, cost and convenience, as well as health and safety need to be considered. Stakeholders, for example, were willing to forgo Styrofoam, but were more reluctant to stop using PET and HDPE plastics given that they represented convenient and often-used products that were also often cheaper than alternatives. Some of the least expensive alternatives also did not suit the needs of the market, for example, they led to increased food spillage. Factoring in a transition period to help stakeholders switch to suitable alternatives while maintaining progress on the policy objectives will involve making trade-offs. As a result of the high costs of alternative products, import duties were zero-rated thereby foregoing a 5%-20% revenue that may have been gained from import duties.

Consumer communication

Saint Lucia found that public education needed to be catered to different target audience needs, lifestyle and income. Visual forms of education were also regarded to be the best and most efficient way to reach persons rather than news reports. Lastly, a combination of strategies was employed with encouraging success. These included setting up drop-off depots for SUPP, the use of public service announcements (PSAs), both video and audio on the use, reuse and disposal of SUPPs, and action on the part of the private sector to partner with State agencies in supporting/financing PSAs.

STYROFOAM BAN - PHASE 1
BAN on importation - August 1st 2019

Target food service containers material:
Polystyrene and Expanded Polystyrene, also known as Styrofoam®,
Plastics -Polyethylene terephthalate (PET) and High-Density
Polyethylene (HDPE).

Final date for landed containers July 31st, 2019 (after this date,
containers will not be released by the Department of Customs)

Ban on the use and sale August 1st, 2020.

Ban Covers:

1. All Styrofoam® food service containers including cups, plates,
hinged take-away containers and trays
2. Other selected plastic cups, plates and containers.

Phase 2: Other single use plastics to be announced
12 month phase out: August 1st, 2019 - July 31st, 2020

Source: Government of Saint Lucia

Singapore¹⁸

Case Study

Context

In August 2019, Singapore announced its Zero-Waste Masterplan. The Masterplan sets out Singapore's strategy to move from a linear "take-make-dispose" model towards a circular one that reuses resources endlessly. To do this, Singapore has set ambitious targets – for example, to reduce the amount of waste (per capita) sent for disposal by 30% by 2030. This is on top of an existing target to achieve a 70% overall recycling rate by 2030 (Singapore, Ministry of the Environment and Water Resources 2019). To catalyse the transition to a circular economy, the Government has introduced the Resource Sustainability Act, which includes legislative frameworks to manage packaging waste including plastics, such as mandatory reporting for packaging, which will lay the groundwork for an EPR for packaging waste management no later than 2025.

Life-cycle thinking

The National Environment Agency (NEA) commissioned the National University of Singapore in 2016 to conduct a life-cycle assessment (LCA) of the environmental impact of carrier bags made of different materials for grocery shopping as well as food packaging made of different materials used for dine-in and take-away meals in Singapore. These packaging types were selected for the LCA study as they are widely used in Singapore. The study¹⁹ enabled a better understanding of the relative environmental impacts of using both disposables and reusables made of different materials in Singapore. The key takeaway was that all types of materials have an environmental impact (e.g. plastic, paper, or degradable plastics) with the overall environmental impact of reusables lower than that of disposables.

The approach toward disposables, including single-use plastic products

Singapore has a comprehensive waste collection system. Recyclables are collected for sorting and recycling, and all non-recyclable incinerable wastes are collected and disposed of at waste-to-energy (WTE) plants. These WTE plants are fitted with modern flue gas treatment systems to ensure that flue gases are treated to meet local air emission standards. The resulting incineration ash is disposed of at the offshore Semakau Landfill. The collection and incineration of all non-recyclable incinerable solid wastes, as well as stringent anti-littering and clean-up measures, prevents waste such as single-use plastic products from leaking into the environment. Given

this approach to waste management, Singapore's waste challenges and solutions may not be the same as those of other countries. For instance, a ban or charge on packaging made of a particular type of material (e.g. plastic) may result in these products being substituted with disposable products made of other materials such as paper or degradable plastics, which also incur environmental impacts and may not lead to an improvement in environmental outcomes. Therefore, the current policy focus is on reducing the excessive use of all types of disposables, including single-use plastic products.

Legislative frameworks to manage packaging waste, including plastics

The introduction of the mandatory packaging reporting (MPR) framework²⁰ from 2021 aims to bring greater awareness to companies on the potential for waste reduction within their business operations, and spur them to take action upstream to reduce the amount of packaging used and packaging waste disposed of. The MPR will lay the groundwork for an EPR framework for packaging waste management, which will require businesses to become financially and/or physically responsible for the collection and end-of-life management of their packaging. This will eventually also help to incentivize upstream reductions in packaging, which will result in fewer resources being used in production and reduce waste generation. The first phase of the EPR will be a Deposit Refund Scheme²¹ for beverage containers. Singapore is also phasing out the use of disposables for dining-in at hawker centres²², and is installing water dispensers in public places to reduce the consumption of bottled water. At the same time, Singapore is building up its local recycling capabilities to process plastic waste. There are already some plants in Singapore which carry out mechanical recycling for high-grade industrial plastics, and Singapore is looking into expanding mechanical recycling capability to process post-consumer plastic waste. Singapore is also studying the feasibility of chemical recycling, which complements mechanical recycling, as the former is able to process contaminated plastics that cannot be mechanically recycled such as contaminated single-use plastics, and convert these into higher-value products such as pyrolysis oil that can be used to manufacture new plastics.

Consumer communication

A nationwide "Say YES to Waste Less" awareness campaign aims to build public awareness on the excessive consumption of disposables, its impact on the

environment, and the need for reduction. The campaign was launched in 2019 in partnership with major food and beverage establishments, malls/retail chains, e-tailers, supermarkets, hotels, schools, and other organizations to reduce their use of disposables as well as encourage consumers to use reusable bags, bottles/tumblers, and containers whenever possible. The campaign focuses on providing visual cues at points of sales/consumption to nudge consumers to make the behavioural switch, as well as highlighting the impact of their actions and the need to address the use of disposables in Singapore. Some retailers have also provided incentives for consumers who bring their own reusable products.

A Citizens' Workgroup on Reducing the Excessive Consumption of Disposables was convened in 2020 to co-create practical and inclusive recommendations to

address the excessive use of disposables. The Workgroup will produce its recommendations, which could range from policy to ground-up initiatives, in early 2021.

Challenges in policy development

A challenge with using the LCA study for policy development was to summarize and communicate the findings to the public in an easy-to-understand manner. The other challenge was to disseminate this information widely to the public as well as companies and organizations, to help make more informed choices. LCA also has its limitations – for example, findings from the LCA are context-specific to the period in which the study was conducted, as the environmental impact of products is dependent on the sources that their raw materials come from and where the products are manufactured, which may differ over the years.



Source: National Environment Agency (NEA), Singapore.

Thailand²³

Case Study

Context

The Prime Minister initiated a policy dialogue in April 2018 directing the Ministry of Natural Resources and Environment, together with all sectors (government, private and public) to accelerate the implementation of integrated plastic waste management from the production process, distribution, consumption and disposal. Consequently, the Ministry of Natural Resources and Environment has established a plastic waste-management sub-committee under the National Environment Board. Through this, they appointed three working groups to support systematic plastic waste management and developed the Roadmap on Plastic Waste Management (2018-2030) and a (Draft) Plastic Waste Management Action Plan (2018-2022) to serve as a framework and direction for preventing and solving plastic waste countrywide. The Roadmap on Plastic Waste Management is now being implemented together with relevant agencies and stakeholders.

Life-cycle thinking

Life-cycle thinking concepts and principles were used for developing the Roadmap on Plastic Waste Management (2018-2030). They included considering different parts of the life cycle from production and design processes to consumption and post-consumer stages. The 3R principles (reduce, reuse and recycle) along with Public-Private Partnerships that emphasized collaboration with stakeholders (government, public, and private sector) across the plastic products system was also important, along with a circular economy approach and responsible consumption and production.

Challenges in developing policy

The challenge is to move beyond the use of single-use plastic products to the uptake of multiple-use products so

that the 3Rs – reduce, reuse, recycle – can be well implemented. Recycling rates are also very low in Thailand. A challenge to be addressed is therefore designing a system which bans single-use plastic products while at the same time providing alternative reusable products and improving waste collection coverage to send all collected waste to appropriate end-of-pipe treatment facilities, to ensure that plastic has little opportunity to “leak” into the environment. How to connect to consumers and encourage them to change behaviour is a major challenge in developing policy on single-use plastic products.

Trade-offs

In developing the policy on single-use plastic products, issues like environmental damage needed to be weighed against desirable factors like consumer convenience. This required thinking about what alternative products or substitute materials could be used instead of SUPP that offer similar convenience and cost. However, there is also widespread public support for action on SUPPs. Therefore, some of these trade-offs between the banning of selected single-use plastic items versus consumer convenience and cost are acceptable.

Collaboration

An important stakeholder group in Thailand is the informal waste sector, which plays a vital role in waste management and in promoting the 3Rs in communities. This informal sector, therefore, needs to be considered in any policy. Other private sector players such as the Plastic Industry Association and related businesses are also organizations that play an important role in designing policy processes. Several collaboration approaches, including a Memorandum of Understanding (MoU) with food delivery platforms, were undertaken to help make the shift towards less use of single-use plastic products. The MoU is a voluntary agreement between the Pollution Control Department and food delivery platforms and restaurants to collaborate on activities to reduce the problem of plastic waste by driving a reduction of single-use plastics products in food delivery operations.

Consumer communication

Many programmes have been introduced to promote public education and awareness. They include recycling programmes in communities (organic waste utilization, recyclable waste bank); awareness and education programmes promoting the use of less single-use plastic products; as well as campaigns related to the reduction of plastic bags in fresh markets and supermarkets.

Source: Pollution Control Department, Ministry of Natural Resources and Environment, Thailand.



CONCLUSIONS

The overarching message of the LCA meta-analyses, case studies and numerous resources is that addressing single-use plastic products pollution requires systems change.

Multiple actions across the life cycle of plastic products are needed and a range of policy interventions employed to reduce environmental impacts. In addition, gender analysis and an assessment of the social impacts from SUPP and their alternatives should also be incorporated in the policy development process. For instance, to address shifts in employment from single-use plastic products manufacturing to systems based on reuse models.

The single use of any product needs careful examination. Replacing one disposable product (e.g. made of plastic) with another disposable product made of a different material (like paper, or biodegradable plastic) is only likely to transfer the burdens and create other problems. Generally, the environmental impact of a product can be reduced the more it is used.

What is required, therefore, is a different way of using materials within the economy. Circular economy approaches are evoked by many of the Member States that are developing comprehensive responses. A circular economy approach is based on the principles of designing out waste and pollution and keeping products and materials in use at their highest possible value so their overall consumption is also reduced. This can be mainly achieved through reusing the products many times. A circular economy approach requires changes in the design of products and new business models and goes well beyond the “closing the cycle” activities at end-of-life.

It is also important to note that whereas single-use plastic products are often associated with lower prices, their actual costs are often much higher once the externalities they cause are taken into account, like the health impacts related to the emissions generated across the plastics life cycle, reduced revenue in tourism and fisheries, ecosystem impacts, or costs of clean-up. Thus, policymakers should thoroughly consider the full costs of consumption and production in any evaluation of impacts.

This year, the world has faced a global COVID-19 pandemic. This has created significantly more challenges to much-needed action on single-use plastic product pollution, particularly as consumption of single-use plastic products has increased in many areas. Despite this, efforts to address plastic pollution have continued, as highlighted by the country case studies in this report. The case studies also further highlight that public opinion in many countries is highly supportive of action on plastic pollution.

Our plastic pollution crisis highlights the need for an urgent systems transformation through a broad range of comprehensive policy measures at all levels. The process of defining necessary actions requires a new way of thinking and requires strong communication and buy-in from all stakeholders, with particular attention to those that most need to change their business operations, and to consumers that need to significantly shift their behaviours. In all these contexts, a gender lens should also be utilized.

Lastly, it will be important to monitor and assess the effectiveness of different policy approaches, including the enforcement of certain policy interventions, over the coming years. Policies will likely require modification over time to best meet the objective of reducing pollution. This will demand ongoing coordination and integration across the many local, national, regional, and international approaches to addressing single-use plastic products pollution.

Policies will likely require modification over time to best meet the objective of reducing pollution.

APPENDIX A

LIFE CYCLE ASSESSMENT

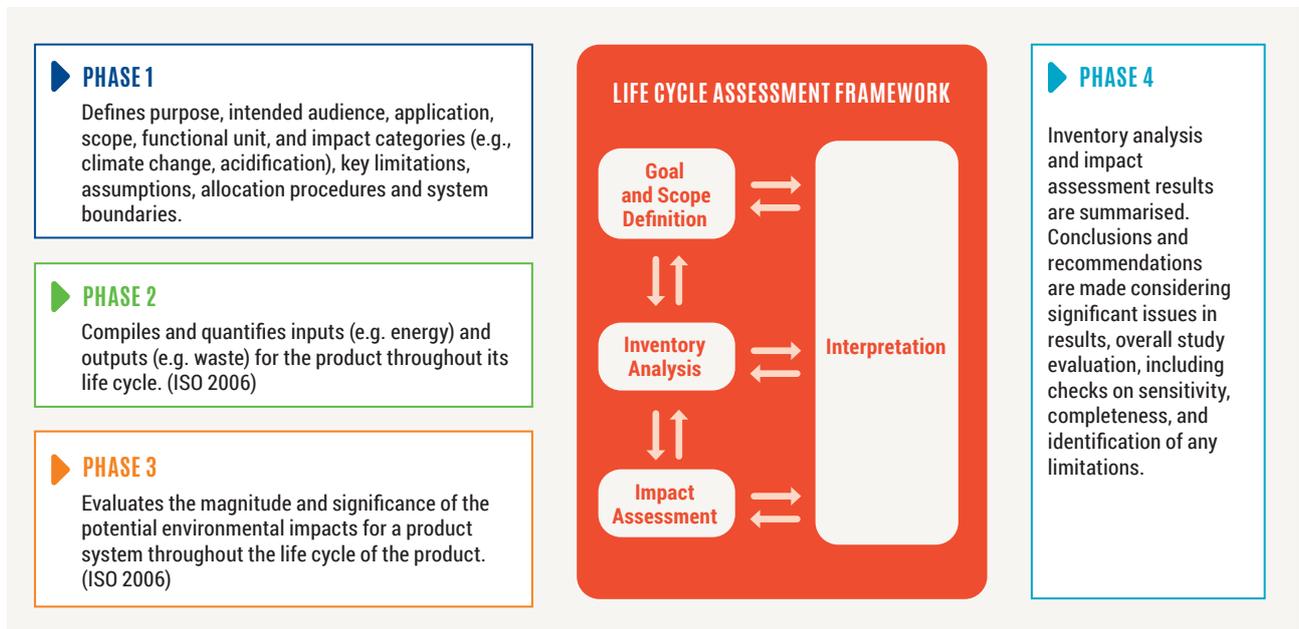
LCA is the calculation and evaluation of the environmentally relevant inputs and outputs and the potential environmental impacts of the life cycle of a product, material or service (ISO 2006a; ISO 2006b). It is a method of analysis that allows decision-makers to better understand the impacts of consumption and production of products and services and can therefore inform policy and actions aimed at reducing the environmental impact of single-use plastic products pollution. Like any tool, however, LCA does not replace the need to draw upon a range of information sources when making decisions.

It is important to note that LCAs of plastic products and their alternatives do not consider any ideology or value judgments that state that one material is inherently bad

or good. LCA aims to provide information through an objective science-based approach that assesses the environmental impact across the entire life cycle of the product or service, including extraction and processing, manufacture, transport and distribution, use, reuse and maintenance, recycling; and eventual disposal. LCA is also a useful tool to identify and help address the potential trade-offs and burden-shifting that can arise when developing and implementing policy on specific products.

According to the ISO 14040 series, LCA is structured in four phases: goal and scope definition, inventory analysis, impact assessment, and interpretation shown in the figure below (ISO 2006a).

THE FOUR PHASES OF LCA
 Source: UNEP 2003; ISO 2006a.



REFERENCES

- Canada, Ministry of Environment and Climate Change (2019). *Economic Study of the Canadian Plastic Industry, Markets and Waste*. Available at: http://publications.gc.ca/collections/collection_2019/eccc/En4-366-1-2019-eng.pdf. Accessed: 04 November 2020.
- Canada, Ministry of Environment and Climate Change (2020). *Science Assessment of Plastic Pollution*. Available at: <https://www.canada.ca/content/dam/eccc/documents/pdf/pded/plastic-pollution/Science-assessment-plastic-pollution.pdf>. Accessed: 07 November 2020.
- Economisti Associati, and BKP Development Research and Consulting (2015) Trade Regulatory Impact Assessment – Mauritius “ACP-EU TBT Programme Final Report (REG/FED/022-667)”. Available at: http://www.economistiassociati.com/files/151106%20TRIA%20Mauritius%20Final%20Report_0.pdf. Accessed: 20 October 2020.
- European Parliament and Council Directive (1994). 94/62/EC on packaging and packaging waste. Official Journal L365.
- European Parliament and Council Directive (2018). 2018/852 amending Directive 94/62/EC on packaging and packaging waste. Official Journal L150.
- European Parliament and Council Directive (2019). 2019/904/EC on the reduction of the impact of certain plastic products on the environment. Official Journal L155.
- Government of Peru (2019). *Regulation No. 30884 Regulating Single-Use Plastic and Disposable Containers*. Published August 22, 2019.
- International Organization for Standardization. (2006a). ISO 14040:2006 *Environmental management – Life cycle assessment – Principles and framework*. Available from: <https://www.iso.org/standard/37456.html>. Accessed: 29 October 2020.
- International Organization for Standardization. (2006b). ISO 14044:2006 *Environmental management – Life cycle assessment – Requirements and guidelines*. Available from: <https://www.iso.org/standard/37456.html>. Accessed: 29 October 2020.
- Karasik, R., Vegh, T., Diana, Z., Bering, J., Caldas, J., Pickle, A., et al (2020). *20 Years of Government Responses to the Global Plastic Pollution Problem: The Plastics Policy Inventory*. NI X 20-05. Durham, NC: Duke University. Available at: <https://nicholasinstitute.duke.edu/publications/20-years-government-responses-global-plastic-pollution-problem>. Accessed: 29 October 2020.
- New Zealand, Ministry for the Environment (2018). *Proposed mandatory phase out of single-use plastic shopping bags: Consultation document*. Wellington: Ministry for the Environment. Available at: <https://www.mfe.govt.nz/sites/default/files/media/Waste/plastic-bags-consultation-doc.pdf>. Accessed: 29 October 2020.
- New Zealand, Office of the Prime Minister’s Chief Science Advisor (2019). *Rethinking Plastics in Aotearoa New Zealand*. Auckland: Available at: https://cpb-ap-se2.wpmucdn.com/blogs.auckland.ac.nz/dist/f/688/files/2020/02/Rethinking-Plastics-in-Aotearoa-New-Zealand_Full-Report_8-Dec-2019-PDF-1.pdf. Accessed: 28 October 2020.
- OECD (2020). *Gender-specific consumption patterns, behavioural insights, and circular economy: 2020 Global Forum on Environment* (Paris 5-6 March 2020). Available at: <http://www.oecd.org/env/GFE-Gender-Issues-Note-Session-5.pdf>. Accessed: 29 November 2020.
- One Planet Network (2020). *Transforming Tourism Value Chains In Developing Countries And Small Island Developing States (SIDS) To Accelerate More Resource Efficient, Low Carbon Development*. [online]. Available at: <https://www.oneplanetnetwork.org/initiative/transforming-tourism-value-chains-developing-countries-and-small-island-developing-states>. Accessed 30 September 2020.
- Singapore Ministry of the Environment and Water Resources (2019). *Zero Waste Masterplan*. Singapore. [online]. Available at: https://www.towardszerowaste.gov.sg/images/zero_waste_masterplan.pdf. Accessed 30 November 2020.

- United Nations Environment Assembly (2019). *Resolution 9: Addressing single-use plastic products pollution* (15 March 2019). [Online]. U.N. Doc. UNEP/EA.4/Res.9. Available from <https://wedocs.unep.org/bitstream/handle/20.500.11822/28473/English.pdf?sequence=3&isAllowed=y>. Accessed 20 December 2020.
- United Nations Environment Assembly (2021) Stock-Taking Online Repository. [online]. Available at: <https://environmentassembly.unenvironment.org/stocktaking-online-repository>. Accessed 30 November 2020.
- United Nations Environment Programme (2015). *Biodegradable Plastics and Marine Litter. Misconceptions, concerns and impacts on marine environments*. United Nations Environment Programme (UNEP). Nairobi. Available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/7468/-Biodegradable_Plastics_and_Marine_Litter_Misconceptions,_concerns_and_impacts_on_marine_environments-2015BiodegradablePlasticsAndMarineLitter.pdf.pdf. Accessed 20 December 2020.
- United Nations Environment Programme (2018a). *A Summary of Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations*. Nairobi. Available at: <https://www.unenvironment.org/resources/report/legal-limits-single-use-plastics-and-microplastics>. Accessed: 29 October 2020.
- United Nations Environment Programme (2018b). *Single-Use Plastics: A Roadmap for Sustainability*. Available at: <https://www.unenvironment.org/resources/report/single-use-plastics-roadmap-sustainability>. Accessed: 29 October 2020.
- United Nations Environment Programme (2019a). *Addressing Marine Plastics: A Roadmap to a Circular Economy*. Wang, F., L. Talaue McManus, R. Xie (eds.). UN Environment Programme. Available at: <https://gefmarineplastics.org/publications/addressing-marine-plastics-a-roadmap-to-a-circular-economy>. Accessed: 29 October 2020.
- United Nations Environment Programme (2019b). *Addressing marine plastics: A systemic approach - Recommendations for action*. Notten, P. United Nations Environment Programme. Nairobi, Kenya. Available at: <https://gefmarineplastics.org/publications/addressing-marine-plastics-recommendations-for-action>. Accessed: 29 October 2020.
- United Nations Environment Programme (2020a). *Single-use plastic bags and their alternatives. Recommendations from Life Cycle Assessments*. Available at: <https://www.lifecycleinitiative.org/wp-content/uploads/2020/04/Single-use-plastic-bags-and-alternatives-Recommendations-from-LCA-final.pdf>
- United Nations Environment Programme (2020b). *Single-use plastic bottles and their alternatives. Recommendations from Life Cycle Assessments*. Available at: https://www.lifecycleinitiative.org/wp-content/uploads/2020/07/UNEP_PLASTIC-BOTTLES-REPORT_29-JUNE-2020_final-low-res.pdf
- United Nations Environment Programme (2020c). *Single-use plastic take-away food packaging and its alternatives. Recommendations from Life Cycle Assessments*. Available at: <https://www.lifecycleinitiative.org/wp-content/uploads/2020/12/SUPP-Take-Away-food-containers-15.12.20.pdf>
- United Nations Environment Programme (2020d). *Tackling Plastic Pollution: Legislative Guide on the Regulation of Single-Use Plastic Products*. United Nations Environment Programme. Nairobi, Kenya.
- United Nations Environment Programme (2020e). UNEP/AHEG/4/INF/6: *Report on the stocktake of existing activities and action towards the long-term elimination of discharges into the oceans to reduce marine plastic litter and microplastics*. Ad hoc open-ended expert group on marine litter and microplastics. Available at: https://papersmart.unon.org/resolution/uploads/k2002125_-_unep-aheg-4-2_-_advance.pdf. Accessed 2 December 2020.
- United Nations Environment Programme (2020f). *National guidance for plastic pollution hotspotting and shaping action - Introduction report*. Boucher J.; M. Zgola, et al. United Nations Environment Programme. Nairobi, Kenya. Available at: <https://www.unenvironment.org/resources/report/national-guidance-plastic-pollution-hotspotting-and-shaping-action>. Accessed 30 November 2020.
- United Nations Environment Programme (2020g). *UNEP/AHEG/2020/4/3: Identification of technical and financial resources or mechanisms for supporting countries in addressing marine plastic litter and microplastics*. Ad hoc open-ended expert group on marine litter and microplastics.

- United Nations Environment Programme (2021a). *Single-use beverage cups and their alternatives. Recommendations from Life Cycle Assessments*. Available at: <https://www.lifecycleinitiative.org/activities/key-programme-areas/technical-policy-advice/single-use-plastic-products-studies/>.
- United Nations Environment Programme (2021b). *Single-use tableware and their alternatives. Recommendations from Life Cycle Assessments*. Available at: <https://www.lifecycleinitiative.org/single-use-plastic-products-studies/>
- United Nations Environment Programme (2021c). *Single-use nappies and their alternatives. Recommendations from Life Cycle Assessments* (forthcoming). Available at: <https://www.lifecycleinitiative.org/single-use-plastic-products-studies/>
- United Nations Environment Programme (2021d). *Single-use menstrual products and their alternatives. Recommendations from Life Cycle Assessments* (forthcoming). Available at: <https://www.lifecycleinitiative.org/single-use-plastic-products-studies/>
- United Nations Environment Programme (2021e). *Single-use facemasks and their alternatives. Recommendations from Life Cycle Assessments* (forthcoming). Available at: <https://www.lifecycleinitiative.org/single-use-plastic-products-studies/>
- United Nations Environment Programme (2021f). *Rethinking Single Use Plastic Products in Tourism, Impacts, Management Practices and Recommendations* (forthcoming).
- Women Engage for a Common Future (2017). *Plastics, Gender and the Environment LCA Meta-Study Reports on Single-Use Plastic Products and their Alternatives*. Lynn, H., Rech, S., Samwel-Mantingh, M. WECF, Germany. Available at: <http://www.wecf.org/wp-content/uploads/2018/11/PlasticsgenderandtheenvironmentHighRes-min.pdf>. Accessed 2 December 2020.
- United Nations Environment Programme (2003). *Evaluations of Environmental Impacts in Life Cycle Assessment*. Meeting report Brussels, 29-30 November 1998, and Brighton, 25-26 May 2000. Available at: <https://wedocs.unep.org/handle/20.500.11822/7873>.



ENDNOTES

- 1 UNEA/EA.4/Res.9
- 2 Selection criteria are discussed in more detail in each specific report.
- 3 Nappies are also referred to as diapers in some countries.
- 4 Case study presented by the Department of Environment and Climate Change Canada/ Environnement et Changement climatique Canada.
- 5 More information can be found at <https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/plastics-proposed-integrated-management-approach.html>
- 6 Case study presented by the Ministry of Environment and Sustainable Development/Ministerio de Ambiente y Desarrollo Sostenible.
- 7 Case study presented by the European Commission.
- 8 https://ec.europa.eu/environment/waste/pdf/Study_sups.pdf.
- 9 “Life Cycle Inventories of Single Use Plastic Products and their Alternatives” Cambridge Econometrics, 2019.
- 10 https://ec.europa.eu/environment/circular-economy/pdf/single-use_plastics_impact_assessment.pdf.
- 11 https://ec.europa.eu/info/news/single-use-plastics-are-you-readytochange-2018-jun-05_en
- 12 Case study presented by the Ministry of Environment, Solid Waste Management and Climate Change.
- 13 Case study presented by the Office of the Prime Minister’s Chief Science Advisor, New Zealand
- 14 Case study presented by the Ministerio del Ambiente, Peru.
- 15 Case study presented by the Ministry of Environment, Rwanda.
- 16 Umuganda is a national holiday in Rwanda taking place on the last Saturday of every month for mandatory nationwide community work from 8 a.m. to 11 a.m.
- 17 Case study presented by the Saint Lucia Solid Waste Management Authority, Government of St Lucia.
- 18 Case study presented by the National Environmental Authority (NEA), Singapore.
- 19 The factsheet on the LCA study may be found here <https://www.nea.gov.sg/docs/default-source/mediafiles/news-releases-docs/cos-2018-media-factsheet-for-lca-study-findings-updated.pdf>.
- 20 Under the MPR framework, businesses with annual turnover exceeding \$10 million that place packaging on the market, including producers of packaged products and retailers such as supermarkets, will be required to report annually on the types and amounts of packaging materials (including plastic packaging) they are placing on the market and their plans to reduce, reuse or recycle packaging.
- 21 Under a Deposit Refund Scheme for beverage containers, producers such as soft drink companies will be required to finance the take-back of the used beverage containers with refunds offered to consumers when they return their empty beverage containers to designated return points.
- 22 Hawker centres are naturally ventilated premises, managed by the government, where there are many stalls selling a wide variety of local fare at affordable prices.
- 23 Case study presented by the Pollution Control Department, Ministry of Natural Resources and Environment, Thailand.



ADDRESSING SINGLE-USE PLASTIC PRODUCTS POLLUTION USING A LIFE CYCLE APPROACH



UN 
environment
programme

United Nations Avenue, Gigiri
P.O. Box 30552, 00100 Nairobi, Kenya
Tel. +254 20762 1234
unep-publications@un.org
www.unep.org