Guidelines for Corporate Plastic Stewardship

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Contents

Acronym List

ARC	Attributes of Recycled Content
CTI	Circular Transition Indicators
DALY	Disability-adjusted life year
EMF	Ellen MacArthur Foundation
EPR	Extended producer responsibility
GHG	Greenhouse gas
GRI	Global Reporting Initiative
HDPE	High-density polyethylene
IUCN	International Union for Conservation of Nature
JRC	Joint Research Centre
LCA	Life cycle assessment
LDPE	Low-density polyethylene
MCI	Material circularity indicator
OCS	Operation Clean Sweep
PET	Polyethylene terephthalate
PLP	Plastic Leak Project
PP	Polypropylene
RMS	Recycled Material Standard
UNEP	United Nations Environment Programme
WBCSD	World Business Council for Sustainable Development
WCC	Waste Collection Credit
WRC	Waste Reduction Credit
WWF	World Wide Fund for Nature

Introduction

Of the nearly 415 million tonnes of plastic produced per year, 12 million tonnes (three percent) end up in the ocean (Boucher et al. 2020a). To better manage natural resources and reduce plastic pollution, businesses are joining governments in making commitments to reduce plastic production and consumption by 19 million tonnes per year by 2040 and increase recycled content in products and packaging by 5.4 million tonnes per year by 2025 (Pew Trusts and SYSTEMIQ 2020).

These *Guidelines for Corporate Plastic Stewardship* advise companies looking to set and meet ambitious plastic waste reduction leadership commitments based on comprehensive and sustainable plastic stewardship strategies.

The *Guidelines* set out:

- High-level plastic footprint assessment metrics;
- A mitigation hierarchy illustrating the priority of different footprint and leakage mitigation strategies in a robust plastic stewardship programme;
- How to use plastic credits in the context of plastic stewardship; and,
- Three associated corporate leadership commitments and how they can be achieved.

A robust assessment of a company's total plastic footprint should be the starting point for any plastic waste reduction leadership commitment. Once a footprint is understood, companies can act to reduce their plastic impact and achieve associated commitments, as shown in Figure 1.

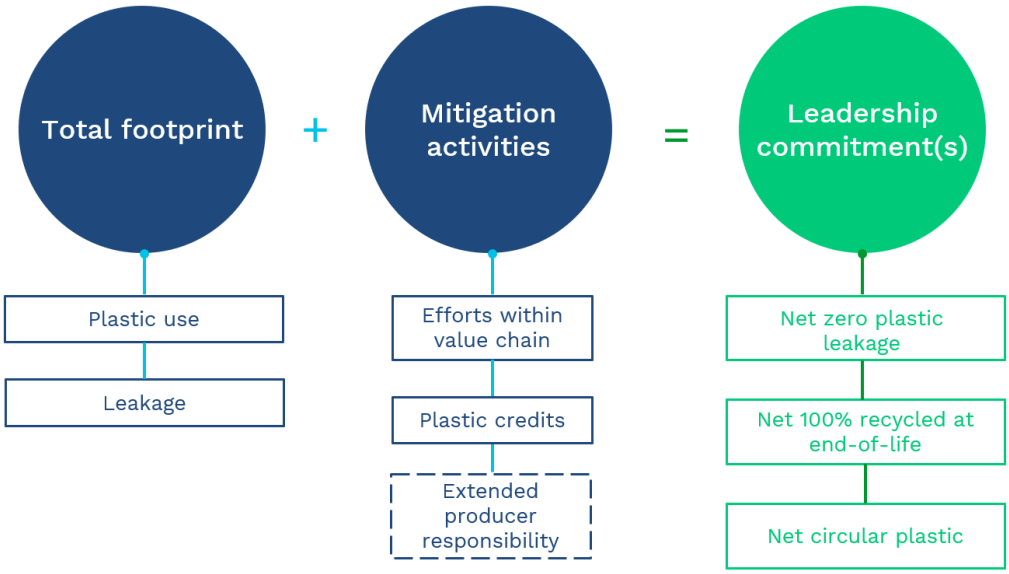

Figure 1. Activities undertaken to achieve leadership commitments[1]

[1] Note: Extended producer responsibility can only be counted as a mitigation activity if it can quantifiably be attributed to the company that uses it to compensate for plastic leakage. For more on this concept, see Section 3.3.2.

These *Guidelines* introduce three commitments that focus on dealing with plastic after it has been used at least once: Net Zero Plastic Leakage, 100% Recycled at End-of-Life and Net Circular Plastic. Achievement of these end-of-life and plastic feedstock sourcing-related commitments requires a reduction in plastic use, an increase in the use of recycled content, and implementation of collection and recycling activities. Such activities could occur both within and beyond a company's value chain (i.e. inside or outside its direct control or influence). As companies work to make their value chains more circular (Boucher et al. 2020a), they can use plastic credits to drive finance to new or scaled-up plastic waste collection and recycling projects to mitigate the impact of plastic waste that remains beyond their control.

1. Principles of a credible corporate plastic stewardship programme

The following principles should be applied at the highest possible level — ideally, company-wide. However, the same principles apply to more limited scopes (e.g. a product, market or brand). For ease of readability, this document refers only to the footprint and leakage of a 'company'. Readers are advised to substitute 'product' or 'brand' as appropriate.

1.1 Plastic stewardship requires regular and consistent accounting of plastic use and leakage, which relies on quality data sources

As a first step, companies should assess their annual plastic use, output and leakage in order to define a baseline year (see Figure 2). This assessment will allow them to map plastic use in terms of markets, products and material types and identify areas with high plastic leakage. All calculations (whether for plastic use, leakage, circularity or mitigation activities) should follow globally accepted accounting methods. Reporting should include, at minimum, the following:

- **Scope**: companies should clearly define the system boundaries and types of plastics considered (e.g. macroplastics, microplastics);
- **Data sources**: companies should cite references for all data and describe the extent to which the data are geographically and temporally correlated with the review period; and
- **Relevance**: the accounting of recycling or leakage as an end-of-life should be based on domestic recycling or leakage rates. Exports of post-consumer plastic should be accounted for using the average waste management rates in the destination country or a conservatively estimated average rate for all countries that import plastic waste. Items that are 'collected for recycling' should not be counted as 'recycled'.[2]

Companies should conduct regular (e.g. annual) evidence-based reviews of their accounting of current plastic use and leakage in order to report progress. These reports should include progress toward meeting waste reduction or circularity commitments. Internal assessment of such accounting

[2] Scoping, definitions, data collection instructions and modelling approaches are available in the National Guidance for Plastic Pollution Hotspotting and Shaping Action (Boucher et al. 2020b).

is an adequate starting point, but over time the form of review should transition to second or third-party audits.[3]

Regular and consistent accounting will equip companies with comprehensive information to identify potential opportunities for reducing plastic waste and leakage, and increasing plastic circularity.

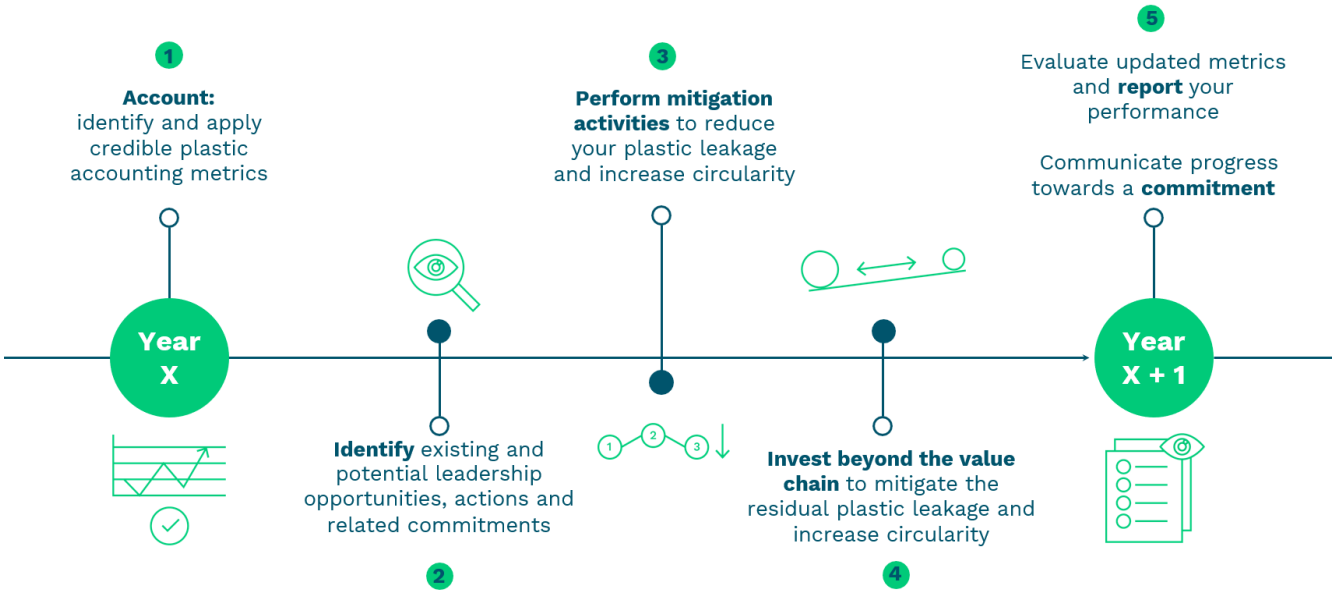

Figure 2. Elements of a plastic stewardship journey, from baseline year X to year X + 1

1.2 Plastic footprint and leakage mitigation activities should be prioritised using the hierarchy (see Section 3) and should aim to achieve transformative change

In considering different mitigation opportunities, companies should take into account various factors, including but not limited to the following:

- Prioritising mitigation opportunities higher in the value chain before those closer to use and waste management;
- Prioritising actions within a value chain before investing in outside mitigation actions;
- Considering potential negative impacts and tradeoffs, including but not limited to those described in Section 3.2; and,
- Reviewing the company's overall strategy and future needs.

Balancing these factors will lead to a plastic stewardship programme with mitigation activities that foster sustainability and help the company to achieve circularity at scale.

[3] Note: there is currently no specific reporting or assessment framework associated with these *Guidelines*.

1.3 Activities within and beyond the company's value chain should be accounted for separately and disclosed regularly

Two types of action can be considered within a company's value chain: interventions made directly by the company and those financed by the company from which it will directly benefit (e.g. investments in reducing suppliers' plastic use or new recycling infrastructure). These should be reported separately from the beyond value chain investments a company makes in activities to mitigate plastic pollution from which it will not directly benefit (e.g. support for waste-picker associations, plastic credit purchases or participation in extended producer responsibility schemes).

Companies should regularly update their plastic stewardship programmes and communicate progress and achievements as frequently as possible. Disclosure of within and beyond value chain actions should be as transparent and accessible as possible, for example, as part of the Ellen MacArthur Foundation's New Plastics Economy Global Commitment annual Progress Report[4] or in corporate reports on sustainability, packaging or other topics.

1.4 Plastic stewardship programmes should strive to achieve full circularity – keeping plastic in use for as long as possible

A company's plastic stewardship goals should promote continual improvement to ensure the highest level of impact in the most efficient manner. Crucially, companies should decrease their reliance on beyond value chain mitigation actions (i.e. plastic credits) over time, as they increasingly integrate activities to reduce their plastic footprint into the value chain.

2. Measuring plastic pollution: From assessment to accounting

2.1 The need for consistent plastic metrics

Existing plastic reporting schemes (e.g. the Ellen MacArthur Foundation's New Plastics Economy annual Progress Report and GRI: 301 (Global Reporting Initiative 2016)) rely solely on plastic inventories — quantities of plastic available on the market or quantities of plastic waste. However, plastic pollution is not a consequence of plastic *use* but of plastic *leakage* — when plastic exits a system of proper management. Plastic is not accounted for as a pollutant in the current life cycle assessment (LCA) framework. LCAs assume that 100 percent of collected waste goes to landfill, incineration or recycling.

To tackle these limitations, a set of metrics, reviewed by Boucher et al. (2019), have been developed in recent years. The Plastic Leak Project (Peano et al. 2020) is the most advanced plastic leakage assessment framework and can be implemented at both product and company levels. It provides a

[4] Available at https://www.newplasticseconomy.org/projects/global-commitment.

set of indicators to assess leakage from different sources throughout a product value chain or a company activity into different environmental compartments (e.g. air, water, soil).

These *Guidelines* are the first integrated framework to comprise combined best practices for standardised accounting and reporting of plastic footprints, footprint mitigation methods and commitments to reducing plastic waste and achieving circularity. Only when equipped with credible, comprehensive and legitimate data and analyses can company decision-makers understand the current status of the plastic problem, set targets, agree on and implement actions, and track progress towards targets over time. Section 2.2 aims to provide a framework for corporate plastic accounting metrics that companies can apply internally (evaluations of current status, comparison with a baseline year) or externally (reporting, credibly substantiating progress towards commitments).

2.2 Plastic accounting metrics

In these *Guidelines*, both quantitative and qualitative metrics are included. They cover plastic accounting from an LCA perspective and encompass plastic footprint and circularity.

The notion of a footprint may include three dimensions (Boucher et al. 2019) expressed by the following metrics:

1. The quantity of plastic used in a system;
2. The quantity of plastic emitted into the environment during production, transport, use or end-of-life of a plastic product (often referred to as plastic leakage); and,
3. The impact, direct or indirect, of pollutants emitted (or of leaked plastic) on human health and the environment.

Complementary circularity metrics reflect both input (recycled plastic as feedstock) and end-of-life (plastic collection and recycling rates). Circularity metrics allow companies to identify new values of their products and materials and mitigate risks from material price volatility and material supply (Ellen MacArthur Foundation 2019a).

Full company plastic accounting should reflect plastic accounting along the entire company value chain, from pellet production to plastic packaging and end-of-life (see Figure 3). Several categories of plastic use are defined, according to the stage in the company value chain at which plastics are used:

1. *Upstream plastic* never reaches a company's operations. This plastic is disposed of or leaks into the environment before it reaches a company's production site (e.g. plastic used in agriculture, such as mulching plastic and silage plastic, or at a supplier’s production site).
2. *Upstream-operational plastic* enters a company's operations attached to a product (e.g. tertiary packaging). This plastic leaves the company value chain as waste; it is not connected to the product when it leaves the company's operations.
3. *Upstream-downstream plastic* enters and leaves a company's operations together with the product (e.g. synthetic fibres used to produce a garment).
4. *Operational plastic* is used and disposed of during a company's operations (e.g. industrial plastics used at a production site). This plastic does not enter or leave operations with a product.

5. *Operational-downstream plastic* is attached to a product within a company's operational boundaries and leaves together with the product (e.g. primary, secondary and tertiary packaging).
6. *Downstream-only plastic* is never handled by the company. It is handled only by the retailer and the consumer (e.g. plastic grocery bags).

Post-consumer waste collected within a company's operational boundaries (which would typically occur in the hospitality or travel sectors) should be considered a flow reaching the downstream stage. For instance, a beverage bottle sold and collected after consumption in a hotel should be considered as an upstream-downstream flow.

Note that the need for different polymers in different applications (varying by sector) in each of the six categories of plastic use adds complexity to accounting.

Although full plastic accounting should reflect the entire value chain as well as macroplastics and microplastics, these *Guidelines* focus on a limited scope: macroplastics disposed of downstream of a company's operations. For mitigation purposes, it is recommended that a plastic footprint take into account at minimum the total operational and operational-downstream plastic use and, if reliable data are available, downstream plastic and that plastic's end-of-life. While this limited scope allows companies to undertake a first company footprint assessment with reduced complexity, companies should transparently report system boundaries to avoid interpretation as and comparison with full plastic accounting.

Figure 3 represents the use of plastic within the company value chain. Figure 4 illustrates details of one use of plastic (exemplified with upstream use) in a company value chain, which corresponds to a plastic life cycle. Figure 4 includes producing virgin or recycled plastic pellets, potential emissions of microplastics during the use stage and the ultimate fate of a product/packaging: recycling, incineration, landfill or leakage into the environment.

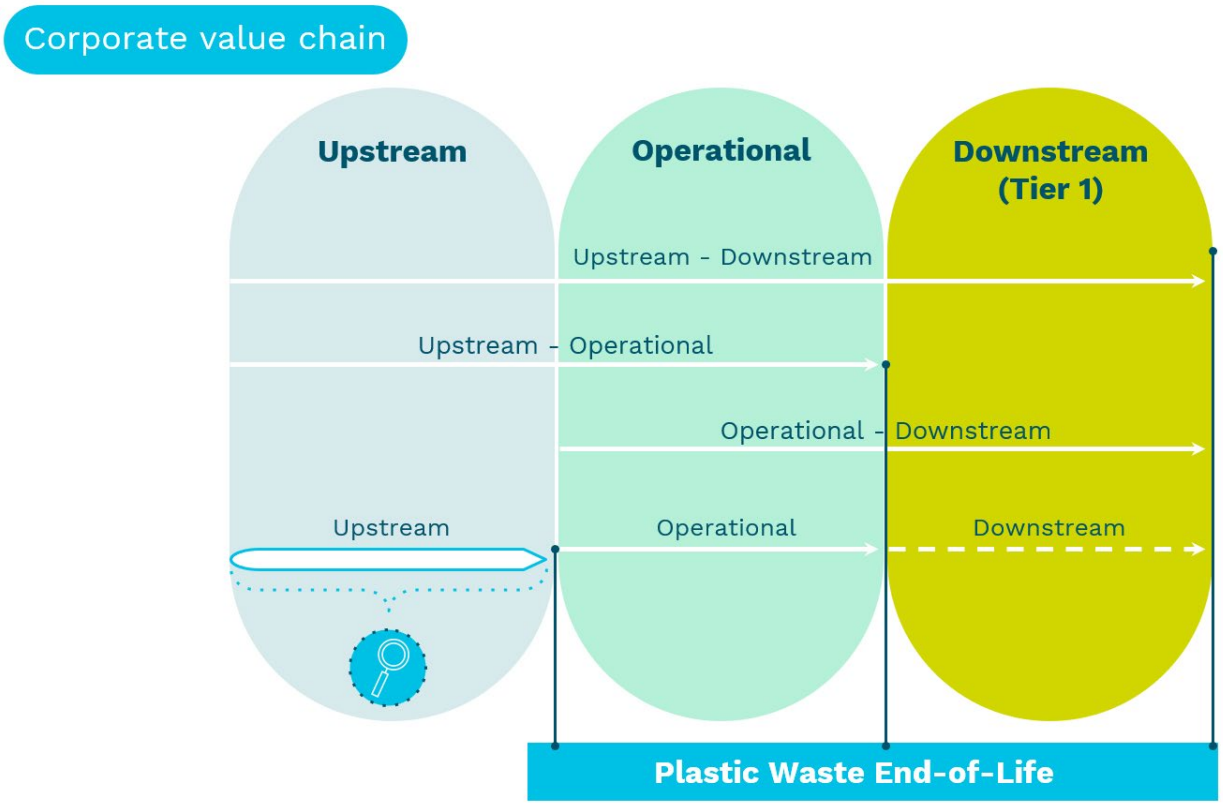

Figure 3. Plastic use across a value chain

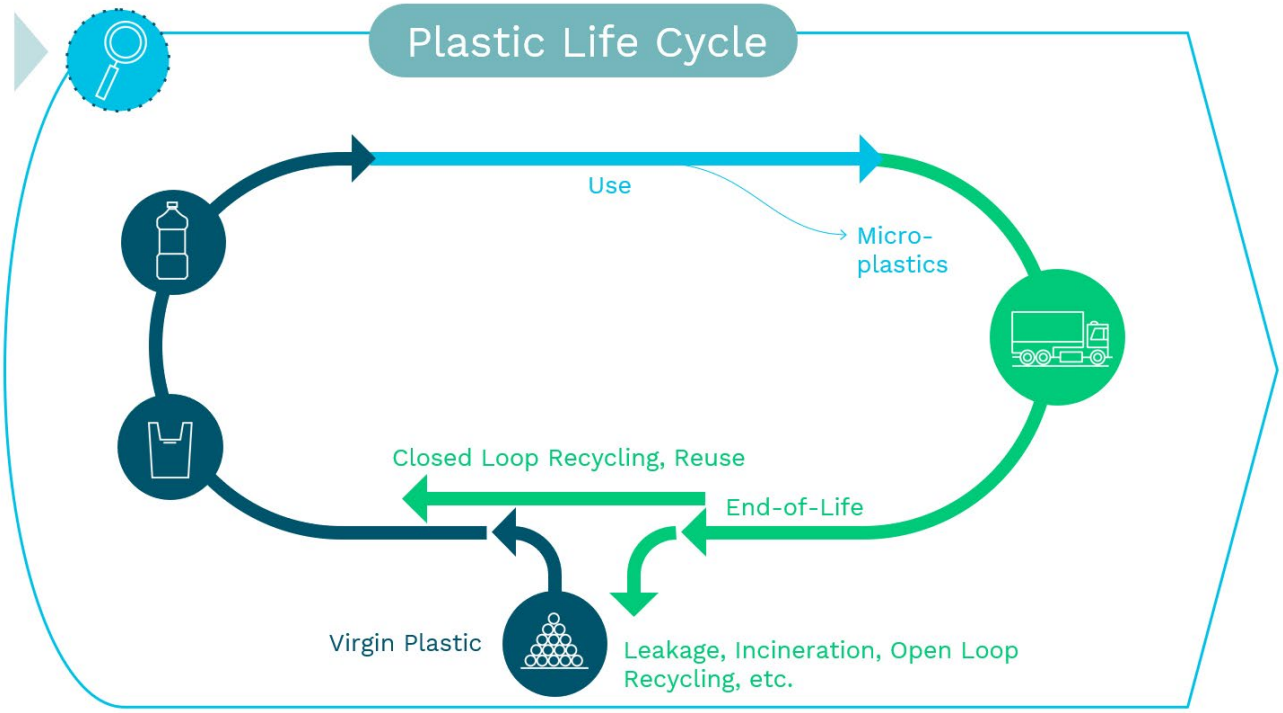

Figure 4. Life cycle of a single plastic product

Metrics for company plastic accounting are classified into the following categories:

- **Mandatory** metrics should be reported systematically to support the commitments set out in these *Guidelines*;
- **Optional** metrics should be used (in addition to mandatory metrics) if reporting against more than these commitments; and,
- **Future** metrics would ideally be reported but are not covered by the current state-of-the-art.

Table 1 classifies different metric types used to report on company plastic accounting, using this categorised approach. Table 2 and Table 3 describe these metrics in more detail. Optional and future metrics may become mandatory metrics in a future version of these *Guidelines*, depending on the evolution of company accounting practices and corresponding to state-of-the-art methodologies and data. Companies with specialised areas of high potential for plastic leakage should add to the list of mandatory metrics. For example, where accounting includes road markings or marine coatings, companies should report metrics related to microplastics released during surface maintenance.

Table 1. A categorised approach to metrics

Tier	Description	Metric
Mandatory	Shall be used for reporting related to the plastic waste reduction leadership commitments defined in Section 4. These metrics focus on plastic waste generated **downstream** of a company's own operations (**upstream-downstream** & **operational-downstream** uses). Downstream plastics that are never handled by the company, such as plastics handled by the retailer and the consumer (**downstream-downstream** use), are considered optional.	Plastic waste generated (packaging or product sales volumes)
		Recycled & non-recycled content of plastic waste
		Collected waste & waste treatment
		Mismanaged waste
		Downstream macroplastic leakage
Optional	Should be optionally reported for plastic accounting	Total plastic use including upstream, operational & downstream activities (plastics used at a farm, industrial textiles used at a production site)
		Other associated impacts (carbon footprint)
		Material circularity index
		Plastic use intensity
		Qualitative claims (plastic pledges, reduction actions, management systems)
		Microplastic leakage
		Macro- & microplastic leakage in oceans
		Macro- & microplastic leakage in other environmental compartments
Future	Should be optionally reported but are not covered by the current state-of-the-art at the time of publication of the *Guidelines*	Residual leakage after one year (fate)
		Impact of plastic leakage

Table 2. Metrics used in company plastic accounting – life cycle impact assessment and life cycle assessment inventory

LCA inventory / *Can be referred to as a footprint* / *Life Cycle Impact Assessment (LCIA)*

Metric type	Metric name	Unit	Possible source	Mandatory	Optional	Future	Comment
Macroplastic **use**	Total **plastic use** including upstream, operational and downstream activities	kg/y	Company data		✓		
Downstream macroplastic **waste**	**Total plastic waste** (packaging or product sales volumes) generated downstream of a company's own operations (**upstream-downstream** and **operational-downstream**)	kg/y	Company data	✓			
	Recycled and non-recycled content of plastic waste generated by downstream activities	%	Company data, estimation according to ISO 14021	✓			
Downstream macroplastic **end-of-life**	Waste management: share of incineration, landfill, recycling	kg/y , %	National statistics, World Bank (2018), National Guidance for Plastic Pollution Hotspotting and Shaping Action (2020)	✓			
	Mismanaged waste	kg/y	Recalculated based on waste management data, Plastic Leak Project (PLP), ReSource Footprint Tracker	✓			
Downstream macroplastic **leakage**	**Macroplastic leakage** (based on mismanaged waste and plastic residual value)	kg/y	PLP or other methodology	✓			
Macro- and microplastic **leakage** including **upstream, operational and downstream activities**	**Microplastic leakage**	kg/y	PLP or other methodology		✓		
	Macro- and microplastic leakage **in oceans**	kg/y	PLP or Joint Research Center (JRC)		✓		
	Macro and microplastic leakage **in other compartments**	kg/y	PLP		✓		
	Plastic leakage **after one year (fate)**	kg eq/y	PLP			✓	Not mature enough, prone to change in coming years
Macro- and microplastic **leakage impact**	Plastic leakage impact on human health and ecosystem quality	Disability-Adjusted Life Years (DALYs), Potentially Affected Fraction (PAF), etc.				✓	No quantitative method available
Other environmental impacts associated with plastic use	LCA metrics such as CO_2e	kg CO_2e, etc.	Carbon footprint based on IPCC (2013) Global Warming Potential (GWP)		✓		LCA methods

Table 3. Metrics used in company plastic accounting – circularity, qualitative, credits and commitments

	Metric type	Metric name	Unit	Possible source	Mandatory	Optional	Future	Comment
Circularity metrics	Plastic circularity	Material Circularity Index		Ellen MacArthur Foundation (EMF)		✓		
		Circular Transition Indicator		World Business Council for Sustainable Development (WBCSD)		✓		
		Plastic use intensity	%	Product and sector specific		✓		
Qualitative metrics	Plastic pledges / reduction actions	EMF Global Commitment, Global Reporting Initiative (GRI) waste	tonne plastic reduction	EMF	✓	✓		
	Management system	Certifications: Operation Clean Sweep® (OCS) certification, EMF Global Commitment		Various certifications		✓		
	Credits	Waste Collection Credit (WCC)	kg/y	*Guidelines for Leadership in Corporate Plastic Accounting*	✓			Defined in Section 2 of these *Guidelines*
		Waste Recycling Credit (WRC)	kg/y		✓			
	Commitments	Net Zero Plastic Leakage	kg/y		✓			Defined in Section 3 of these *Guidelines*
		Net Circular Plastic	kg/y		✓			

2.3 Reliable data sources

Companies can use both primary and secondary data to estimate plastic footprint and circularity metrics, as illustrated in Figure 5.

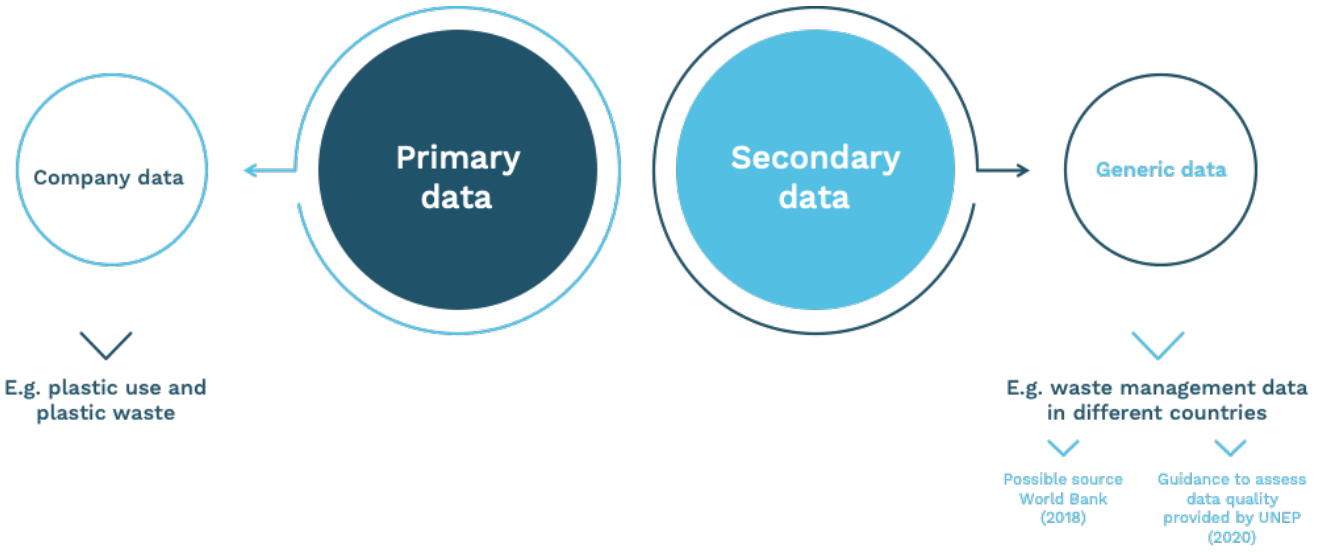

Figure 5. Primary and secondary data sources to estimate metrics (Kaza et al. 2018, Boucher et al. 2020b)

Robust plastic leakage accounting requires reliable data, especially for waste management (collection rates, recycling rates) of different polymers in various countries. Table 4 provides examples of publicly available waste management data that can be used to support plastic footprint accounting.

Table 4. Examples of data sources on waste management

Data source	Description	Limitations
International Union for Conservation of Nature (IUCN)-EA-QUANTIS National Guidance for Plastic Pollution Hotspotting and Shaping Action[5]	Detailed waste management data for plastics	Covers only Vietnam, Thailand, South Africa, Kenya, Mozambique, Tanzania, Cyprus, Mauritius
What a Waste 2.0 (Kaza et al. 2018); implementation of Plastic Leak Project guidance (Peano et al. 2020)	Global household waste data	Household waste data is extrapolated to plastics Import and export of waste between countries is not considered: default data considers that all waste is managed in the country of use and end-of-life, when in reality there is substantial international trade in waste.

The United Nations Environment Programme (UNEP) guidance (Boucher et al. 2020b) can be used to generate new country data if needed.

3. Plastic footprint and leakage mitigation activities

After calculating a plastic footprint, the next step on the plastic stewardship journey is the identification and implementation of mitigation activities. Only when realising meaningful activities to reduce their plastic footprint and leakage can companies justify progress towards the leadership commitments described in Section 4.2. Section 3 introduces the mitigation hierarchy and sets out ways that companies can avoid leakage and increase circularity.

3.1 The mitigation hierarchy

The most effective way to reduce a plastic footprint and leakage is to start with mitigation activities that are targeted as high up in the value chain as possible. The inverted triangle in Figure 6 illustrates actions for companies to consider at each stage of the value chain. The biggest opportunity for companies to prevent total plastic use and contribute to more circular value chains is through product redesign for reduction, reuse and recycling. These efforts should be complemented by increasing use of recycled material to replace virgin input, and ensuring that plastic waste that cannot be eliminated is appropriately managed.

Companies should prioritise increasing circularity in their supply chain before relying on external mitigation activities. However, quantifiable and additional beyond value chain measures (shown on

[5] Reports from pilot countries (Viet Nam, Thailand, Kenya, South Africa and Mozambique) available at https://plastichotspotting.lifecycleinitiative.org/pilots/.

the right in Figure 6) can be used to mitigate plastic waste. Investments in beyond value chain measures should complement, rather than replace, a company's current own best effort.

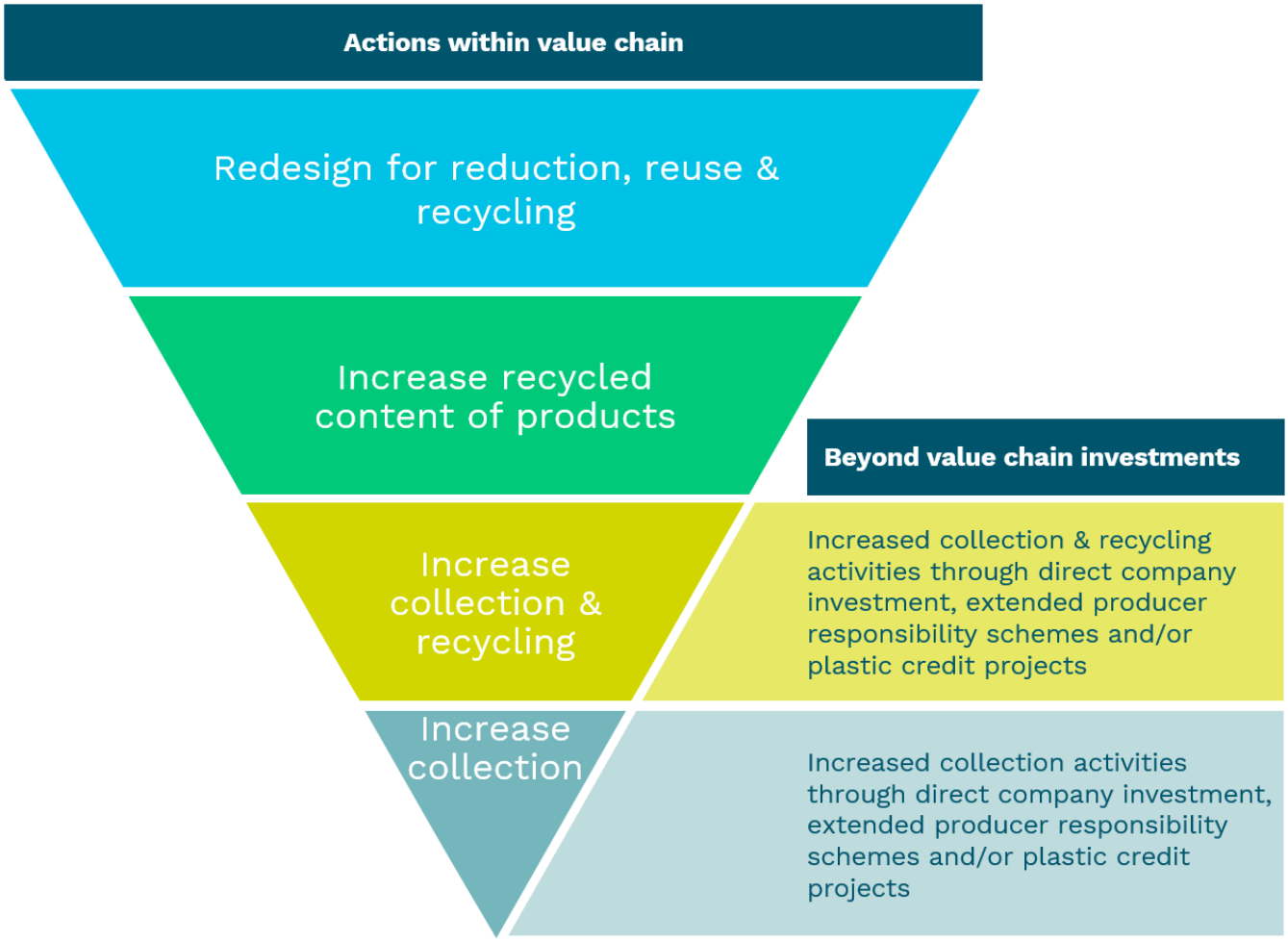

Figure 6. Hierarchy of plastic footprint and leakage mitigation activities

Differences in infrastructure and regulatory context may influence optimal design responses at each level of the hierarchy. There are almost always social, environmental and/or economic tradeoffs between the activities described in the plastic footprint and leakage mitigation hierarchy. These tradeoffs can be assessed by applying science-based methodologies to assess the entire life cycle of a product or piece of packaging and its environmental and social impacts. Companies should identify and prioritise the most beneficial actions, wherever they may sit in the hierarchy. Furthermore, implementation strategies should incorporate appropriate safeguards and mitigate any potential adverse impacts.[6]

[6] Further guidance on undertaking an LCA that considers social and sociological aspects (S-LCA) is included in UNEP's *Guidelines for Social Life Cycle Assessment of Products and Organisations* (UNEP 2020).

3.2 Potential plastic footprint and leakage mitigation activities: Within the value chain

This section presents a variety of opportunities to reduce plastic consumption and waste that fall under a company's direct control or over which it has influence.

3.2.1 Redesign for reduction, reuse and recycling

Companies should always consider redesigning their products for reduction, reuse and recycling as a first priority. Redesign processes should prioritise reducing the number of different materials and clearly conveying which plastic types are in a product or piece of packaging.

The following activities are ways of **reducing** plastic:

- Changing product design to eliminate plastic in the product itself or its packaging (e.g. switching from liquid to solid soap or avoiding microplastic ingredients in cosmetic products). Eliminating plastic may require redesign or reformulation of the product itself, but can enable drastic reductions in plastic use. Business model innovations — for example, reducing the time between production and sale — may be needed to eliminate plastic successfully.
- Lightweighting of a product/packaging to decrease plastic use. Lightweighting is typically an incremental process, allowing for continuous improvement rather than a drastic reduction in plastic use.
- Where environmentally sensible, replacing plastic with non-plastic materials designed for recycling (e.g. switching from plastic to responsibly produced paper). Replacement of plastics that are not considered recyclable in practice or at scale is particularly desirable. Substitution must be technically viable, must not generate unintended consequences and must facilitate recycling in practice and at scale (Ellen MacArthur Foundation 2020a). Refer to the World Wide Fund for Nature (WWF) Alternative Materials Tool (2020) for further guidance.

Switching to a **reuse** system (e.g. using a third-party or vending machine system to enable refills) can enable a drastic reduction in volume of material used. Reuse may include a change of materials (of plastic type or from plastic to non-plastic) or a change in product or packaging design. To leverage the full potential of reusable packaging, companies must adopt one of the following four models: refill at home, refill on the go, return from home, or return on the go (Ellen MacArthur Foundation 2019b). According to the World Economic Forum and Ellen MacArthur Foundation (2017), reuse is economically attractive for at least 20 percent of plastic packaging (by mass).

Companies can increase **recyclability** by considering the impact of design features on the feedstock value of a package, the productivity of the reclaimers, and the quality of the final post-consumer resin or finished product application (Association of Plastic Recyclers 2020). According to the Ellen MacArthur Foundation (2020b, p. 12), packaging is considered recyclable if "its successful post-consumer collection, sorting and recycling is proven to work in practice and at scale".

Examples of design strategies to enhance recyclability include, but are not limited to:

- Avoidance of multi-material composites that are difficult to recycle;
- Avoidance of uncommon materials — focus on polymers that are easy to recycle at scale;
- Avoidance of features that may make an item unrecyclable (such as tear-offs and labels), or making such features compatible with the target recycling stream;
- Design for disassembly, enabling plastics to be separated from other materials (e.g. in electronics);
- Limiting the use of dyes, pigments and inks; and,
- Avoidance of toxic additives that are not compatible with the recycling system.

Product and packaging developers contend with the requirements of their products *and* those of retailers and recycling associations. Companies should not think about the design of their product and packaging in isolation — it should be integrated with system redesign explorations (Ellen MacArthur Foundation 2020a).

When comparing tradeoffs between the above activities (some of which are described in Table 5), it is essential to appropriately define boundaries and focus on how a consumer uses a product. For example, in identifying the optimal packaging for hand soap, the functional unit should be defined as "cleaning hands X number of times" and not "packaging for Y kg or ml of soap". Beyond rethinking the exact function of the existing plastic packaging or product, this approach may reveal opportunities to fundamentally redesign the product and/or its delivery system. Guidance on how redesign can contribute to reducing total plastic use and when and how to use LCA is provided by the Ellen MacArthur Foundation (2020a).

Table 5. Examples of potential tradeoffs related to redesign for reduction, reuse and recycling

Environmental impacts	• Increased greenhouse gas (GHG) emissions due to the increased energy used in production or increased transport emissions of replacing plastic with other materials or more robust reusable or recyclable plastic packaging • Increased GHG emissions or water usage due to sanitisation requirements of reusable packaging • Increased GHG emissions due to lower product performance, e.g. increased food waste due to lower packaging performance • Increased GHG emissions and accumulation in the environment of a material substituted for plastic (if the new material is not functionally recyclable) • Increased toxicity to the environment from production or disposal of alternative packaging material
Social, health and safety issues	• Increased toxicity to consumer health of alternative packaging material • Decreased product safety due to use of alternative material • Competition with food production when using crops for bio-based packaging to replace plastic • Hygiene issues caused by improperly cleaned reusable products or packaging

3.2.2 Increase recycled content of products

Replacement of virgin with recycled plastic reduces the depletion of non-renewable resources used to create virgin plastic and drives the market for recycled materials, providing an incentive to remove plastic waste from the environment. Table 6 lists potential tradeoffs to consider when increasing the recycled content of a product, some of which may be mitigated by chemical recycling when it achieves scale.

Table 6. Examples of potential tradeoffs related to increasing recycled content of products

Environmental impacts	• Increased GHG emissions from transport due to higher weight of packaging with recycled content • GHG emissions associated with recycling processes may be greater than those of producing virgin plastic.
Social, health and safety issues	• Increased toxicity of recycled plastics for consumers. This could be managed by quality regulations (e.g. for food- or medical-grade plastic) that may limit the amount of recycled plastic content that a product is allowed to contain. • Decreased product safety when using recycled plastics

Note that use of post-consumer material is encouraged over that of pre-consumer material. Efficient, circular production processes should avoid using recycled pre-consumer waste; the Ellen MacArthur Foundation (2020b) excludes pre-consumer waste from its definition of recycled content.

3.2.3 Increase collection and recycling

There are two pillars to ensuring collection and recycling of plastic waste: *design for recyclability* and *post-use collection and recycling infrastructure*. Design for recyclability is discussed in Section 3.2.1.

Post-use collection and recycling initiatives, such as take-back systems, other collection initiatives and investments in recycling infrastructure, can complement product design. For example, a product needs to be heavy enough to avoid being blown away or littered. Once the product has been collected, its weight needs to be taken into account again as part of the sorting process.

One focus of collection and recycling systems should be maintaining the integrity and qualities of the original plastic. Closed-loop recycling, where waste is recycled into a very similar product, is preferred over open-loop recycling, where waste is used in a lower quality application.

3.2.4 Increase collection (where recycling is not possible)

Where recycling is not possible, companies should ensure, to the best of their ability, an end-of-life where plastic is permanently removed from nature. Appropriate end-of-life options for permanent removal from nature include:

- Reprocessing;[7]
- Incineration with energy recovery;[8] and
- Landfill.[9]

When there is a choice among these options, it is important to be aware of related safeguards and to follow relevant local or national regulations.

In jurisdictions where collection rates of compostable items are higher than those of plastics, one strategy to reduce plastic pollution is to increase compostable plastic use. However, the efficacy of using compostable plastics to improve a product's end-of-life depends on many factors — including consumer awareness and composting techniques — so it should not be seen as a universal solution.[10] The use of compostable plastic should not be confused with replacing plastics with non-plastic compostable materials.

3.3 Potential plastic leakage mitigation activities: Beyond value chain investments

After implementing activities to reduce the footprint within the value chain, a company will still have unavoidable plastic waste leakage. Companies can invest beyond their value chains – in efforts from which they will receive no direct benefit, in plastic credit projects or in extended producer responsibility schemes – to compensate for the plastic pollution that they cannot yet prevent.

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[7] Reprocessing may include using the collected plastic waste in, among others, construction materials (e.g. pavement tiles, plastic bricks), road construction, or other commodities (e.g. decorative craftwork, toys, household items) with commercial value.

[8] Use of plastic waste, including as refuse-derived fuel, as a raw material and/or source of energy to replace natural mineral resources (material recycling) and fossil fuels (energy recovery) in industrial processes (primarily energy intensive industries such as cement production and power generation). The energy recovery facility shall demonstrate successful end use of the recovered energy (i.e. for domestic and/or commercial use by the facility or other parties).

[9] In order for a landfill to qualify as an appropriate end destination, it should meet the following criteria: be government recognised or affiliated; have restrictions on access to avoid unauthorised waste scavenging; have a well-defined boundary; include mechanical compacting or levelling of waste; have periodic cover application (with soil or other material) to remove plastic waste from the influence of the outside environment; have a leachate drainage system or other reasonable measures to minimise, or preferably avoid, soil and water contamination; include sanitary lining or other reasonable measures to avoid waste being placed directly on the ground; have post-closure care requirements such as being capped when closed; control placement of waste (i.e. to specific areas in the landfill); and have measures to avoid fires (i.e. to avoid open burning).

[10] Refer to the following reports for guidance on use of compostable plastics: The New Plastics Economy (World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company 2016, chapter 6), Upstream Innovation (Ellen MacArthur Foundation 2020a, Plastics Composting section), and Breaking the Plastic Wave (Pew Trusts and SYSTEMIQ 2020, System Intervention 2 - Substitute plastic with paper and compostable materials).

3.3.1 Plastic credits

A plastic credit is a transferable unit representing a specific quantity of plastic pollution removed from the environment and/or put into the circular economy (i.e. collected and/or recycled) in excess of what would have happened in the absence of the credit-generating activity (i.e. business as usual). Plastic credits reduce the amount of plastic in the environment (or that which would have ended up in the environment) and increase the circularity of plastics through funding waste collection and/or recycling activities.

To be credibly used to compensate for a company's unavoidable plastic waste, plastic credits be associated with environmental benefits that are:

Real
All collected and/or recycled plastic waste and the projects that collect and/or recycle the plastic waste must be proven to have genuinely existed.

Measurable
All collected and/or recycled plastic waste must be quantifiable using recognised measurement tools (including adjustments for uncertainty) against a credible plastic waste collection and/or recycling baseline.

Independently audited
All collected and/or recycled plastic waste must be verified to the required level of assurance by an accredited validation/verification body with the expertise necessary in the country in which the project is taking place.

Unique

Each plastic credit must be unique and must only be associated with a single collection or recycling activity. Where a unit of collected plastic waste is also recycled, two credits can be issued for the same unit of plastic waste as long as it is clear what each credit represents. There must be no double counting or double claiming of the environmental benefit with respect to the collected and/or recycled plastic waste.

Transparent

There must be sufficient and appropriate public disclosure of information related to plastic waste collection and/or recycling to allow intended users to make decisions with reasonable confidence.

Conservative
Conservative assumptions, values and procedures must be used to ensure that the collected and/or recycled plastic waste is not overestimated.

Projects that generate plastic credits must adhere to social and environmental safeguards.

The Plastic Waste Reduction Standard, developed by Verra[1] in collaboration with the 3R Initiative and a multi-stakeholder committee of leading experts and practitioners, is a global standard for third-party certification of plastic waste collection and recycling projects that aim to generate plastic credits. Two types of plastic credits can be verified under the Plastic Standard: a Waste Collection Credit (WCC) represents one tonne of additional plastic collected from the environment and a Waste Recycling Credit (WRC) represents one tonne of additional plastic recycled. Each plastic credit issued under the Plastic Waste Reduction Program has a unique serial number in the Verra Registry, identifying key attributes such as the material type and location where the project activities that generated the credit took place.

Key plastic credit information

To best enable companies to meet their plastic stewardship goals, plastic credits should transparently convey certain attributes. To facilitate material, geographic, end destination and temporal matching (see Section 4.3), information about each credit's material type (resin, composite and/or form), the region where the plastic was collected or recycled, the collection and recycling processes (the activity and end destination of the material), and date of credit issuance should be listed in the publicly available project documentation. To enable the highest traceability level, this key information should also be included in the serial number of individual credits.

Potential strategies for plastic credit investment

- Transformational change: purchase credits that come from as high upstream as possible — preferably credits collected directly from the consumer rather than those that have been mined from landfills or at another stage of collection not directly following use.
- Deep impact: select one or more projects with which to establish long-term off-take agreements. This creates income stability for the project proponent and (depending on the arrangement) enables the credit buyer to lock in a fixed price per unit.

3.3.2 Extended producer responsibility schemes

EPR schemes enable companies to contribute to developing and enhancing waste collection and management infrastructure for the products they place on the market.[11] Such systems are implemented through legislation and/or producer responsibility organisations.

EPR contributions should only be used to mitigate a company's leakage if the impact of that company's contribution is: (1) quantified in terms of tonnes of waste collected and/or recycled beyond what would have happened without EPR and (2) directly attributable to an individual company (with no possibility of double counting).

[11] Adapted from Pew Trusts and SYSTEMIQ (2020).

3.3.3 Other beyond value chain investments

Many companies support plastic collection efforts as part of employee or local community engagement activities. To be included as viable mitigation of a company's leakage, these efforts should meet the following criteria:

- Be quantifiable;
- Demonstrably result in permanent removal and/or recycling of plastic waste that would not have happened in the absence of such activity; and,
- Present no risk of double counting (i.e. not claimed by any other organisation against its own leakage).

In general, companies are not recommended to use employee or local community engagement activities for mitigation due to the difficulty of meeting these criteria.

4. Plastic waste reduction leadership commitments and claims

Companies can demonstrate circular economy leadership through setting, achieving and communicating robust commitments around plastic use and management, while at the same time addressing plastic pollution. The following are three core plastic stewardship commitments covering different levels of ambition. Achievement of any of these commitments may involve product or packaging redesign, increases in use of recycled content, and implementation of collection and recycling activities.

4.1 Use of beyond value chain investments to achieve commitments

Despite a company's best efforts, there will be instances of plastic leakage that it cannot address within its value chain. Plastic credits provide a way for companies to take responsibility for the impact of plastic in the environment for which they are held accountable. The commitments introduced in these *Guidelines* use the word 'net' to indicate that not all activities used to mitigate plastic footprint and leakage are under the company's direct control or influence.

In the same way that use of the term 'zero net deforestation' acknowledges that some forest loss could be offset by forest restoration (WWF 2009), use of Net Zero Plastic Leakage, Net 100% Recycled at End-of-Life and Net Circular Plastic recognises that investment in plastic waste collection and recycling investments stimulated by plastic credits is currently necessary to achieve plastic waste leadership commitments. Some amount of plastic leakage is unavoidable due to current disparities in waste management systems worldwide, and the persistence of litter.[12]

In making the commitments presented in Section 4.2 (and any 'net' claims), a company should demonstrate that it is currently implementing mitigation activities within its value chain and has a

[12] Littering, i.e. the improper disposal of small, one-off items, occurs as a result of routine or recreational (e.g. tourism or major public events) activities and is common in all parts of the world, irrespective of income level (Velis et al. 2017).

plan to increase these over time. To ensure full transparency and promote the pursuit of direct actions where possible, companies should report separately what they have accomplished within their value chain and what they have taken responsibility for by investing beyond their value chain (WWF 2021).

Fulfilment of the commitments set out in this document is depicted by referring specifically to WCCs and WRCs generated under the Plastic Waste Reduction Standard (see Section 3.3.1 inset). However, any credible and robustly developed credit that represents the environmental benefits set out in Section 3.3.1 and additional waste properly removed from the environment or recycled could be used in place of WCCs or WRCs, respectively.

4.2 Credible commitments

4.2.1 Net Zero Plastic Leakage

Net Zero Plastic Leakage means that an equivalent to the total weight of plastic put into a market is permanently removed from the environment. As illustrated in Figure 7, a company can achieve Net Zero Plastic Leakage through a combination of collection activities both within and beyond the company's value chain, with any residual plastic leaked should be compensated for by retiring an equivalent amount of WCCs.

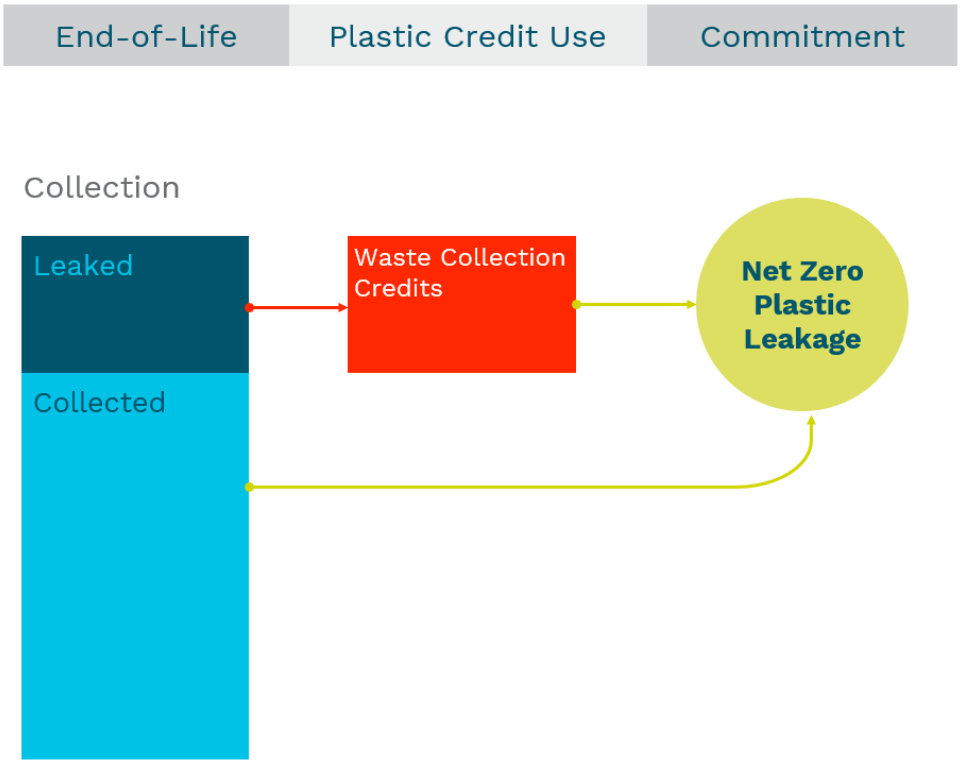

Figure 7. Compensating for plastic leakage to achieve a Net Zero Plastic Leakage commitment

4.2.2 Net 100% Recycled at End-of-Life

Net 100% Recycled at End-of-Life means that an equivalent to the total weight of plastic put into a market is recycled. A company can achieve Net 100% Recycled at End-of-Life through a combination of collection and recycling activities both within and beyond its value chain.

As illustrated in Figure 8, to achieve this claim a company should first attain Net Zero Plastic Leakage. Next, it should retire WRCs equivalent to the number of WCCs used to achieve Net Zero Plastic Leakage to ensure that amount of plastic is recycled. Finally, it should compensate for any plastic collected but not recycled (i.e. that which is converted to energy or ends up in a landfill) by retiring an equivalent amount of WRCs.

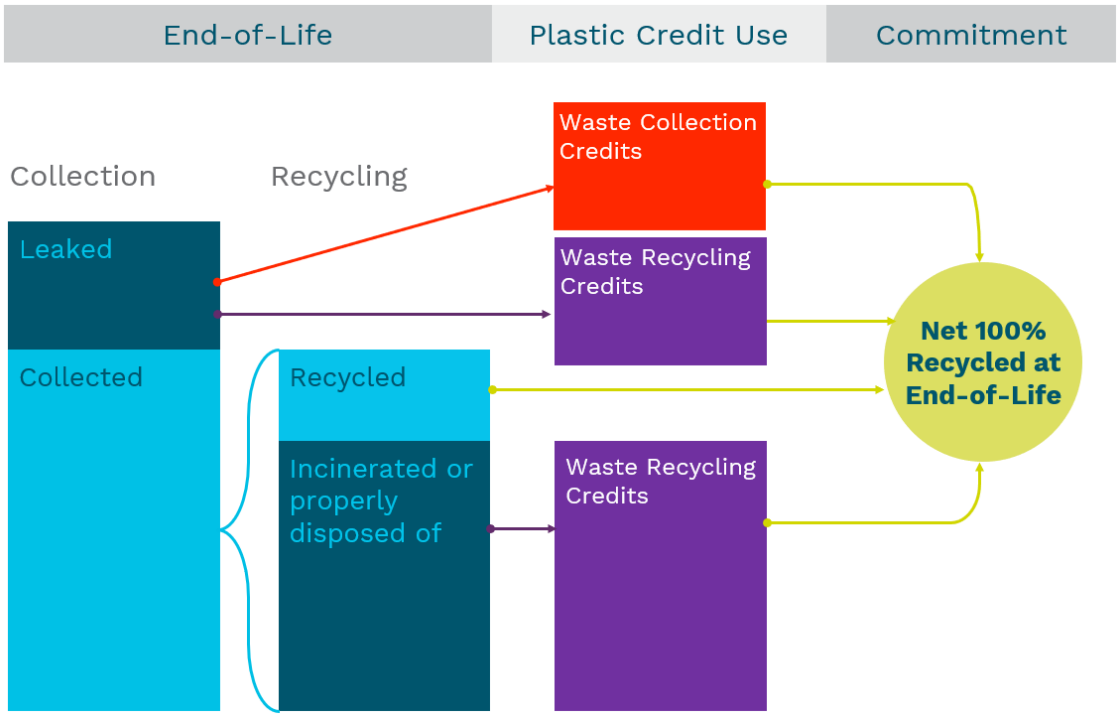

Figure 8. Compensating for plastic leakage and end-of-life other than recycling to achieve a Net 100% Recycled at End-of-Life commitment

4.2.3 Net Circular Plastic

The commitment to achieve net plastic circularity means that a company intends to use 100 percent recycled content and ensure that the content — or an equivalent amount of the same material type, compensated through the retirement of plastic credits — is recycled (see Figure 9). In the language of the World Business Council for Sustainable Development (2020) Circular Transition Indicators (CTI)

methodology, this means that the product has circular inflow and circular outflow;[13] Net 100% Recycled at End-of-Life represents the outflow side of Net Circular Plastic.

Due to the lack of recycled content of many plastic types, most companies will need recycled material credits such as those currently under development by the Recycled Material Standard[14] in order to achieve commitments of 100 percent recycled content.

Figure 9. Net Circular Plastic

4.3 Matching plastic credits with plastic leakage

Companies should take care to match the type of plastic that needs mitigation with the credits used.

4.3.1 Material type match

The material type (the plastic or plastic composite classification) should match between plastic leaked and the plastic credits used to mitigate that leakage and, for Net 100% Recycled at End-of-Life, between non-recycled end-of-life and plastic credits used to mitigate the lack of recycling. By ensuring this match, a company creates incentives for the material of its product/packaging to be collected and/or recycled. If the material it uses is collected and/or recycled in only a limited way, the company may be encouraged to switch to materials more suited to a circular economy.

4.3.2 Regional match

Appropriate regional correspondence of leaked plastic to credits depends on waste management capacity in the region where the leakage occurs.

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[13] Note that the CTI methodology suggests that sustainably grown renewable materials can be included in a circular system as renewable inflows and biodegradable outflows. Inclusion of bio-based materials will be considered in a future version of these Guidelines.

[14] The Recycled Material Standard (RMS) establishes the Attributes of Recycled Content (ARC) trading system. ARCs provide a means for brands to invest directly in expanding recycling capacity in exchange for a claim of one tonne of output produced from recycled input materials. More information about the RMS is available at https://www.rmscertified.com/.

When plastic leaks in markets with high waste management capacity (i.e. comprehensive collection or recycling infrastructure is established and functional), then the leaked material should be matched with credits from that region, if available. If credits of the same material type as the plastic leaked are not available in the same region, credits of the same material type should be sourced from regions with low waste management capacity.

When plastic leaks in markets where waste management capacity is low, credits that match the material type leaked should be obtained from the same region.

In these *Guidelines*, 'region' should be taken to mean 'country'. Where a country-level region is not appropriate, the credit buyer should justify a definition of region based on a special economic zone that is no larger than a United Nations designated region.[15]

4.3.3 Optional criteria to consider when selecting plastic credits

The greatest benefit can be earned from post-use plastic that is fully circular — utilised again for the same product/packaging. Therefore, it is best practice to purchase credits for which the material collected and/or recycled will be used for the same purpose as the original product (e.g. soft drink bottle to soft drink bottle). The ability to achieve circularity depends on many factors, primary among which is the plastic type and its initial use. Full circularity is currently most feasible for polyethylene terephthalate (PET) and high-density polyethylene (HDPE) resins.

Companies may wish to match the impact period during which a product is sold or distributed with the timeframe of credit generation.

4.4 How to make claims about these (and related) commitments

If a company's commitments and claims about plastic stewardship are not explicit, clear and independently verifiable, they represent a reputational risk. Examples of communications that could be used about the commitments in this document include the following:

- "We, Shampoo Brand W, aim to achieve Net Zero Plastic Leakage by 2025 by investing in reuse programme X in country Y, increasing the recycled content in our packaging, participating in producer responsibility organisation Z, and, in the markets where we are still working to implement collection systems for our products, investing in Waste Collection Credits (WCCs) generated by collection of HDPE bottles that would not have happened without our investment. The WCCs have been verified by a third party to the Plastic Waste Reduction Standard, ensuring that they represent real, additional, verified reductions."
- "At Company A, we have redesigned our carpets to use 100 percent PET to facilitate their recyclability, and have increased the proportion of recycled PET that we use by implementing a take-back programme and building a new, dedicated carpet recycling facility that employs

[15] See the United Nations Department of Economic and Social Affairs Statistics Division's list of geographic regions, available at https://unstats.un.org/unsd/methodology/m49/.

communities in region B. We purchased plastic credits, verified to the Plastic Waste Reduction Standard, generated in markets where our take-back programme is not yet active in order to support the collection and recycling of PET (further information about these plastic credits is available upon request). Through these two strategies, we have achieved Net 100% Recycled at End-of-Life."

- "Our Brand XX aims to achieve Net Plastic Circularity by 2030. We will do this through the following three-pronged strategy:
    - Use 100 percent recycled input by 2024.
    - Increase our take-back programmes, develop our collection activities and recycling facilities, and work with governments to build collection and recycling infrastructure to eliminate all waste into the environment besides litter by 2030.
    - Purchase Waste Collection Credits for the plastic that we can't avoid entering the environment, and Waste Recycling Credits for plastic that is not recycled. By 2030, we will only use plastic credits for litter remediation."

A wide variety of terms related to company plastic stewardship, such as 'Plastic Neutral' and 'One In, One Out', are already in use, and many more will evolve over time. Transparency about claims that address plastic footprint and leakage mitigation is crucial to credibly communicating leadership. Table 7 provides a list of elements for which information should be available and accessible.

Table 7. Elements to consider regarding claims related to plastic footprint and leakage mitigation

Element	Information required for full understanding
Accounting methods	Approaches used to calculate the amount of plastic in a footprint or that is leaked Approaches used in quantification of plastic credits used for compensating leakage or lack of recycling
Scope of compensation	Whether the claim includes the full environmental impact of the plastic, including all negative externalities of plastic in nature, or is limited to the mass of that plastic removed from the environment or fully recycled Whether compensation includes plastic inputs of a product, waste generated, assumed leakage or a combination of these
Double counting	Clear attribution of plastic credits , EPR impacts, or other beyond value chain investments used, should be clearly (and solely) attributable to the company
Plastic credits	How plastic credit purchases fit into the company's longer-term vision and strategy for reducing plastic pollution generated by their direct operations Whether these claims refer to plastic that would have been removed from the environment in a business-as-usual scenario or with governmental support

	Plastic credit serial numbers and registry references (to ensure that the credit has only been attributed to one buyer) Information on the specific material type and geography of the plastic pollution for which the credits are intended to compensate
Level of circularity of the claim	How close the commitment takes a company toward closing the plastic loop. For example, it is important to understand how the terms 'out of' or 'recover', if used in a claim, are defined: whether they mean 'out of/recovered from the environment' (and if so, what acceptable end-of-life scenarios are) or 'out of/recovered from the waste stream and recycled', or something else

5. Case study

5.1 Context

A fictional company, Ice Tea Co., sells 1 billion litres of bottled iced tea per year, typically in six-packs of one-litre PET bottles. Seventy percent of Ice Tea Co.'s sales are in the United States, and thirty percent are in China. The company has already performed as much lightweighting as possible. Currently, a litre of Ice Tea Co. iced tea has the following packaging:

- Primary packaging: one PET bottle weighs 20 grams (g); each bottle has a polypropylene (PP) lid that weighs 3 g;
- Secondary packaging: 20 g low-density polyethylene (LDPE) per six-pack; and,
- Tertiary packaging: 100 g LDPE per 1,000 litres (L).

As shown in Figure 10, plastics are used at different stages of the Ice Tea Co. value chain. Plastic pellets produced from virgin or recycled plastic are transported to various packaging production sites where they are used to manufacture primary, secondary and tertiary packaging and mulching plastic, and fertiliser and pesticide packaging. Agricultural plastics (e.g. fertiliser and pesticide packaging and weed prevention layers) are used and disposed of on the farms where sugar and tea are produced. The plastic packaging in which ingredients arrive at the iced tea production facility is disposed of on site. The plastic packaging in which the iced tea is delivered to the retailer is disposed of at the retail location. The primary and secondary iced tea packaging is disposed of by the consumer.

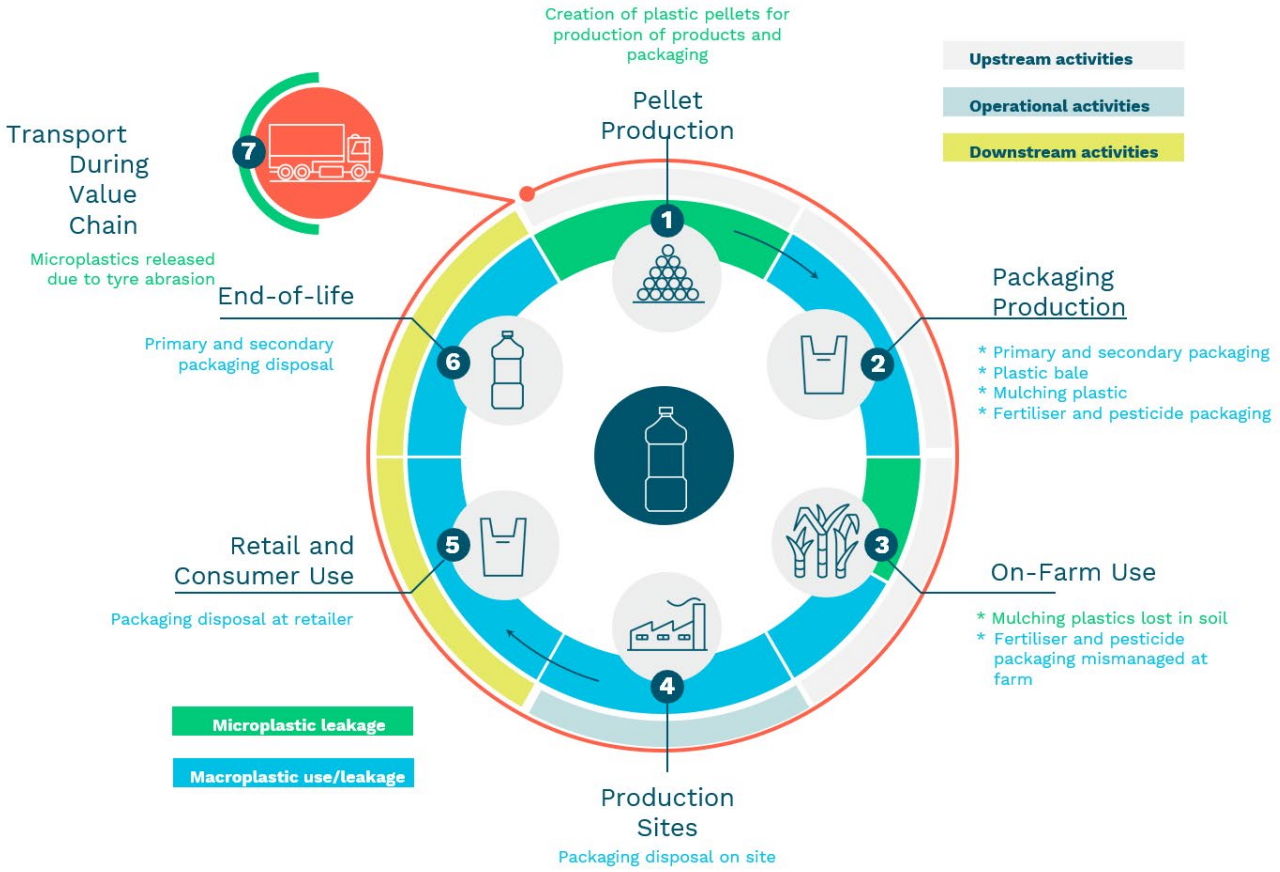

Figure 10. Plastic use and leakage in the Ice Tea Co. value chain

Macroplastic leakage may be caused by a farm's mismanagement of fertiliser and pesticide packaging, mismanagement of ingredient packaging at the iced tea production site, and lack of proper collection of packaging by a retailer or by a consumer after consumption.

Microplastics can leak into the environment during pellet production (e.g. accidental spill during transport), at the farm (e.g. from mulching plastics lost in soils) and from tyre abrasion during transport.

5.2 Plastic accounting metrics in baseline year X

In baseline year X, Ice Tea Co. assesses its company plastic accounting and communicates on the mandatory metrics set out in Table 8 and Figure 11, focusing solely on downstream packaging use and leakage. Therefore, neither plastics used and leaked during the upstream and operational stages nor microplastics are accounted for in this case study. Ice Tea Co. excludes littering from its footprint assessment based on the assumption that the tea will be consumed at home.

Table 8. Ice Tea Co. mandatory accounting metrics for year X (number rounding might lead the sum of waste treatment to slightly exceed 100%)

Metric type	Metric name	Type of packaging	Value	Unit
Downstream macroplastic waste	Total plastic waste generated by downstream activities	**Primary packaging**		
		PET bottle	20,000	t/y
		PP lid	3,000	t/y
		Secondary packaging		
		LDPE film	3,333	t/y
		Tertiary packaging		
		LDPE film	100	t/y
		Total	**26,433**	**t/y**
Downstream macroplastic end-of-life	Recycled and non-recycled content of plastic waste generated by downstream activities	**Primary packaging**		
		PET bottle	50%	
		PP lid	0%	
		Secondary packaging		
		LDPE film	0%	
		Tertiary packaging		
		LDPE film	0%	
	Collected waste: share of landfill, incineration, recycling	**US***		
		Incineration	13%	Reference: World Bank (2018)
		Landfill	53%	
		Recycling	35%	
		China*		
		Incineration	28%	Reference: World Bank (2018)
		Other	3%	
		Mismanaged	70%	
		Recycling	0%	
	Mismanaged waste	US	-	t/y
		China	**5,572**	**t/y**
Downstream macroplastic end-of-life leakage	Macroplastic leakage	PET bottle	15% release rate due to PET high residual value (PET is likely to be	
		Other plastics	100% release rate	
		Leakage	**1,989**	**t/y**
Credits	Waste Collection Credit	No use of credits		
	Waste Recycling Credit			
Commitments	Net Zero Plastic Leakage	No commitments		
	Net 100% Recycled at End-of-life			
	Net Circular Plastic			

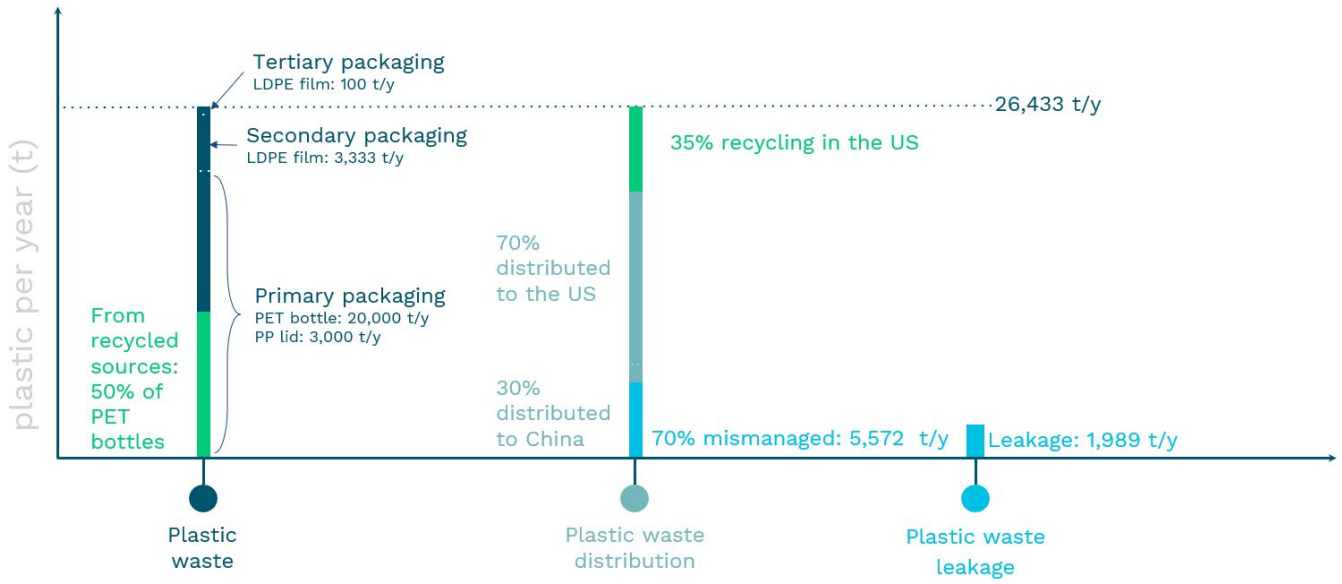

Figure 11. Ice Tea Co. mandatory accounting metrics for year X

Ice Tea Co. wants to achieve a commitment to Net Zero Plastic Leakage. It will reduce the plastic leaked from its value chain as much as possible, then compensate for the remaining leakage with WCCs. Leakage occurs in China for each packaging component (PET bottle, PP lid, LDPE film). Ice Tea Co. will use WCCs representing PET, PP and LDPE proportional to the ratio of each plastic type in the leaked waste.

Ice Tea Co. also commits to achieving Net 100% Recycled at End-of-Life. It must ensure that all downstream packaging is recycled at end-of-life. Ice Tea Co. will introduce measures to increase recycling of its products. It will compensate for waste leaked to the environment and waste collected and incinerated or landfilled using WRCs. Since some post-use packaging is not recycled in either China or the United States, Ice Tea Co. should use WRCs that match the material type generated in those countries.

5.3 Mitigation

After having measured its plastic footprint in the first year, the company starts to implement the activities below. The footprint is calculated for the fifth year following the first annual measurement.

5.3.1 Redesign for reduction and reuse

Eliminate

Ice Tea Co. prioritises innovations in their business model that enable drastic reductions in plastic waste and have co-benefits such as reducing GHG emissions. They start offering an iced tea concentrate which consumers can mix on their own with tap water. Within five years, 25 percent of the original turnover is sold as a concentrate. The new liquid has a concentration factor of ten, hence primary and tertiary packaging can be reduced by 90 percent, and secondary packaging is completely

eliminated — one bottle of concentrate will produce 10 litres of iced tea, which is more than the original content of the six-pack.

Elimination: 25% of the original turnover is sold as a concentrate		
Packaging type	**Change induced by mitigation**	**Final metric**
Primary packaging	PET bottle: 20 g PET per 10 L iced tea from concentrate (2 kg/t iced tea) 0.25 million t requires 500 t PET/y	Total PET weight decreases from 20,000 t/y to **15,500 t PET/y**
	PP lid: 3 g PP per 10 L iced tea from concentrate (0.3 kg/t iced tea) 0.25 million t requires 75 t PP/y	Total PP weight decreases from 3,000 t/y to **2,325 t PP/y**
Secondary packaging	LDPE film: for the concentrate, no secondary packaging is required 0.25 million t requires 0 t LDPE/y	Total LDPE weight decreases from 3,333 t/y to **2,500 t LDPE/y**
Tertiary packaging	Tertiary packaging is reduced by a factor of 10 LDPE film: 10 g per 1,000 L iced tea from concentrate (0.01 kg/t iced tea) 0.25 million t requires 2.5 t LDPE/y	Total LDPE weight decreases from 100 t/y to **78 t LDPE/y**

Reuse

In regions with poor quality tap water, customers would need to use bottled water to reconstitute the tea, which would not reduce plastic waste. In regions where this is the case and where LCA demonstrates a net GHG emission reduction when switching to reusable packaging, Ice Tea Co. introduces a reusable plastic bottle. The LCA considers the avoided emissions from packaging production and end-of-life and emissions from transport to and from the retailer. Glass is considered as a potential alternative to plastic for this reusable bottle, but performs much worse from a GHG perspective in the analysis. Within five years, 50 percent of the original volume of iced tea is sold in reusable plastic packaging.

Reuse: 50% of non-concentrate iced tea bottles are sold in reusable packaging. The reusable PET packaging weighs 40 g bottle/L and is reused on average ten times.		
Packaging type	**Change induced by mitigation**	**Final metric**
Primary packaging	PET bottle: 40 g PET per 10 L iced tea (10 usage cycles) for a reusable bottle (4 kg/t iced tea) 0.375 million t iced tea in reusable bottles requires 1,500 t PET/y	Total PET weight decreases from 15,500 t/y to **9,500 t PET/y**
	PP lid: 6 g PP per 10 L iced tea for a reusable bottle (0.6 kg/t iced tea) 0.375 million t requires 225 t PP/y	Total PP weight decreases from 2,325 t/y to **1,425 t PP/y**
Secondary packaging	LDPE film: 20 g per 6 L iced tea for a reusable bottle	No change: 2,500 t LDPE/y
Tertiary packaging	LDPE film: 10 g per 1,000 L iced tea for a reusable bottle	No change: **78 t LDPE/y**

Replace

The company considered forgoing plastic altogether when introducing its reusable bottle but decided not to do so because the LCA showed greater GHG emissions associated with glass than with the reusable plastic bottle. It also considered replacing the secondary packaging with cartons, but the LCA showed that carton production and use generated far greater GHG emissions. In addition, tests showed that the material's mechanical strength was inconsistent, causing some of the packaging to fall apart at the retailer level. Loose bottles separated from their packaging were difficult to sell, leading to food waste.

5.3.2 Increase recycled content

Ice Tea Co. increases the recycled content of all PET packaging, including the concentrate bottles and the reusable bottles, from 50 to 80 percent.

Increase recycled content: Recycled content of PET bottles increases from 50% to 80%.		
Packaging type	**Change induced by mitigation**	**Final metric**
Primary packaging	Recycled content of PET bottles is increased from 50% to **80%**	Recycled content of PET bottles: 80%

5.3.3 Increase collection and recycling

As a first step, the company increases the recyclability of its remaining single-use plastic bottles. It designs a bottle with a non-detachable lid that decreases leakage of lids and increases their probability of being recycled.

Second, the company implements a take-back system for its reusable bottles, both intact and damaged. In the next step, this take-back system is extended to single-use plastic bottles in the Chinese market, which reduces the rate of waste mismanagement to 10 percent and increases the recycling rate to 50 percent.

Collect and recycle: non-removable lid and take-back system in the Chinese market		
Packaging type	**Change induced by mitigation**	**Final metric**
Primary packaging	Take-back system in Ice Tea Co.'s Chinese markets reduces rate of waste mismanagement from 50% to 10%	Rate of waste mismanagement in China: 10% With a non-detachable lid and a lower rate of waste mismanagement of PET bottles, leakage is reduced to **126 t/y** and recycling in China is increased to 50%

5.3.4 Investment beyond the value chain

As Ice Tea Co. cannot motivate 100 percent of consumers to bring back empty bottles, it decides to invest in plastic credits certified to the Plastic Waste Reduction Standard to compensate for the remaining plastic waste that is still leaking and is not yet able to be recycled. To align with its messaging around iced tea being a great beverage to enjoy on the beach, it selects credits from projects that collect and recycle ocean-bound plastic in China. To support Ice Tea Co.'s promotion of recycling in the United States, it also purchases credits from projects that catalyse municipal plastic waste collection and recycling in the United States.

Investment beyond value chain to achieve Net 100% Recycled at End-of-Life		
Packaging type	**Change induced by mitigation**	**Final metric**
All packaging	Achievement of Net 100% Recycled at End-of-Life commitment	**WCC**: leakage in China of **126 t/y** needs to be compensated by WCCs **WRC**: **8,207 t/y** needs to be compensated by WRCs (see Figure 13).

5.4 Plastic accounting metrics and claims in year Y

After numerous mitigation activities, Ice Tea Co. can update its mandatory metrics (Figure 12 and Table 9).

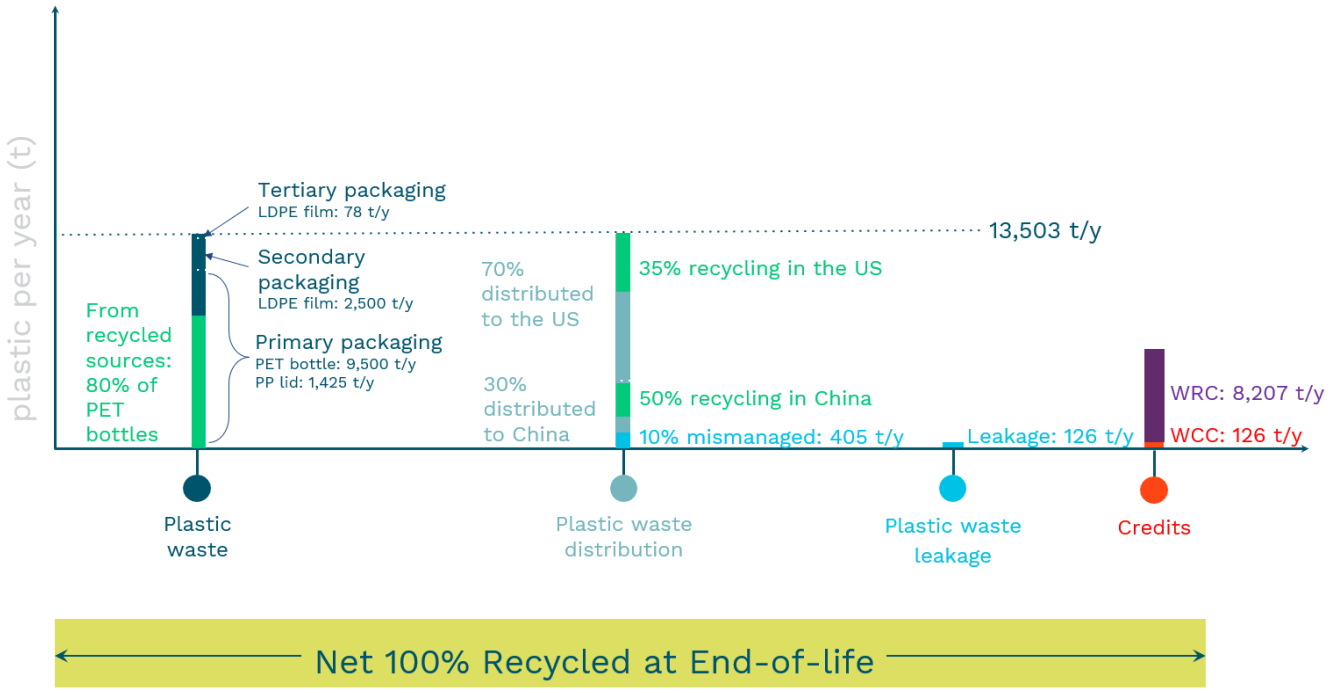

Figure 12. Ice Tea Co. mandatory accounting metrics for year Y

Table 9. Ice Tea Co. mandatory accounting metrics for year Y (number rounding might lead the sum of waste treatment to slightly exceed 100%)

Metric type	Metric name	Type of packaging	Value	Unit
Downstream macroplastic waste	Total plastic waste generated by downstream activities	**Primary packaging**		
		PET bottle	9,500	t/y
		PP lid	1,425	t/y
		Secondary packaging		
		LDPE film	2,500	t/y
		Tertiary packaging		
		LDPE film	78	t/y
		Total	**13,503**	**t/y**
Downstream macroplastic end-of-life	Recycled and non-recycled content of plastic waste generated by downstream activities	**Primary packaging**		
		PET bottle	80%	
		PP lid	0%	
		Secondary packaging		
		LDPE film	0%	
		Tertiary packaging		
		LDPE film	0%	
	Collected waste: share of landfill, incineration, recycling	**US***		
		Incineration	13%	Reference: World Bank (2018)
		Landfill	53%	
		Recycling	35%	
		China		
		Incineration	28%	Updated with mitigation activities
		Other	12%	
		Mismanaged	10%	
		Recycling	50%	
	Mismanaged waste	US	0%	t/y
		China	**405**	**t/y**
Downstream macroplastic end-of-life leakage	Macroplastic leakage	PET bottle and PP lid	15% release rate due to PET high residual value (PET is likely to be	
		Other plastics	100% release	
		Leakage	**126**	**t/y**
Credits	Waste Collection Credit	To Achieve Net Zero Plastic Leakage	**126**	**t/y**
	Waste Recycling Credit	To Achieve Net 100% Recycled at End-of-Life	**8,207**	**t/y**
Commitments	Net Zero Plastic Leakage		Achieved	
	Net 100% Recycled at End-of-life		Achieved	
	Net Circular Plastic	Not achieved: progress with 80% recycled content in PET bottles. Could be achieved by using credits such as those being developed by the Recycled Material Plastics with non-recycled content	**5,903**	**t/y**

5.5 Commitments: Net Zero Plastic Leakage and Net 100% Recycled at End-of-Life

As illustrated in Figure 13 and Figure 14, Ice Tea Co. achieves Net 100% Recycled at End-of-Life through mitigation activities within its value chain and use of WCCs and WRCs (without using WRCs, it would have achieved Net Zero Plastic Leakage).

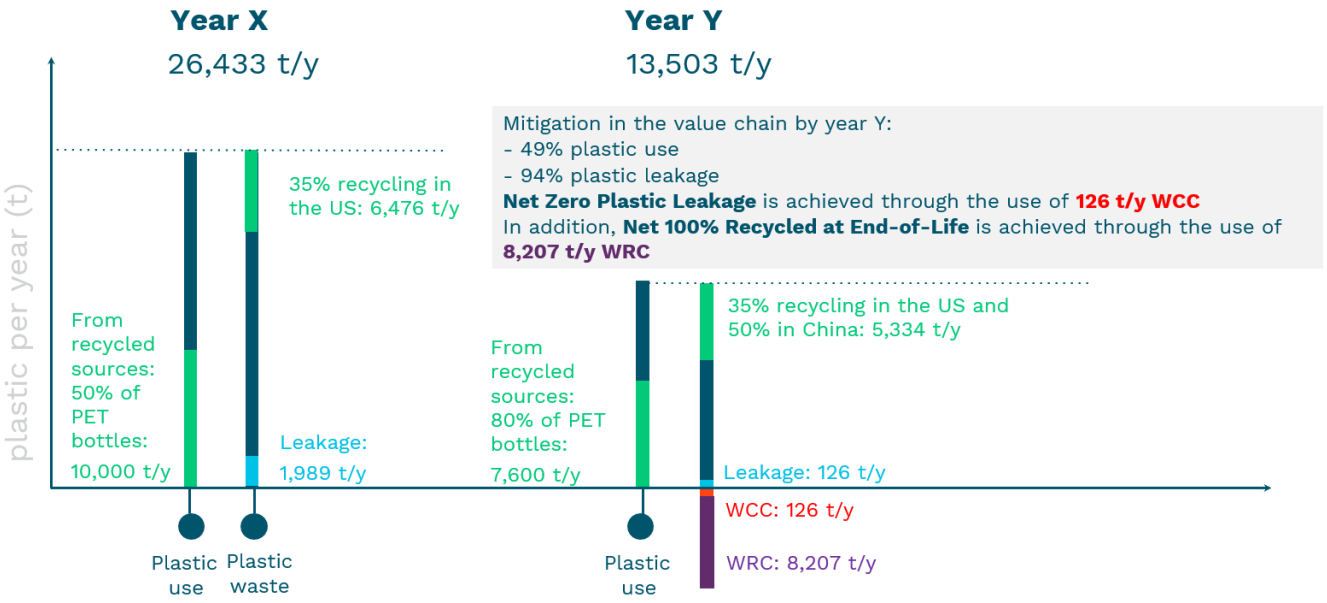

Figure 13. How Ice Tea Co. achieves Net 100% Recycled at End-of-Life commitment in year Y

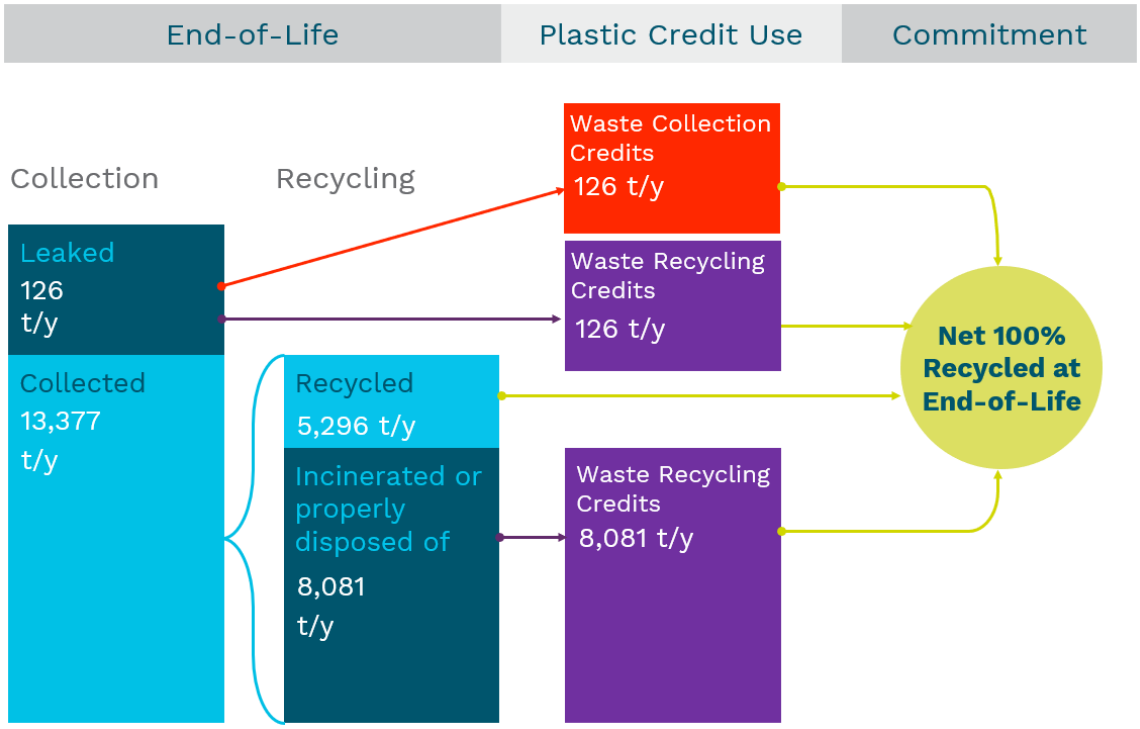

Figure 14. WCC and WRC requirements for Ice Tea Co. to become Net 100% Recycled at End-of-Life in year Y

Glossary

Additive

Additives are chemical compounds added (e.g. during shaping of the polymer, through injection moulding, extrusion, blow moulding, vacuum moulding) to improve the performance, functionality and ageing of the polymer. The most commonly used additives in polymeric packaging materials are plasticisers, flame retardants, antioxidants, acid scavengers, light and heat stabilisers, lubricants, pigments, antistatic agents, slip compounds and thermal stabilisers. Each additive plays a distinct role in delivering/enhancing the functional properties of a plastic product.

Release of additives to the surrounding environment is an undesirable side effect for both the manufacturer and the environment, since additive loss diminishes polymer attributes, and the presence of additives in the environment harms living organisms (Hahladakis et al. 2018).

Beyond value chain

Sources or processes outside of an entity's direct control or influence

Bio-based plastics

Plastics that contain materials wholly or partly of biogenic origin (ISO 16620-1:2015)

Circular economy

An economic model that is regenerative by design (WBCSD 2020). It is proposed as an alternative to the traditional linear economy in which products are made, used and disposed of. The circular economy model aims to keep resources in use for as long as possible to extract their maximum value.

End-of-life

Life cycle stage of a product (including packaging) that follows the use phase (adapted from Pew Trusts and SYSTEMIQ 2020)

Environmental impact

Changes in environmental conditions leading to impacts on the social and economic functions of the environment, such as the provision of adequate conditions for health, resource availability, and biodiversity. Impacts often occur in a sequence: for example, GHG emissions cause global warming (primary effect), which causes an increase in temperature (secondary effect), leading to a rise in sea level (tertiary effect), finally leading to loss of biodiversity (Miedzinski et al. 2013).

Extended producer responsibility (EPR)

Schemes that enable producers to contribute to the end-of-life costs of products that they place on the market (adapted from Pew Trusts and SYSTEMIQ 2020)

Leakage

A quantity (in grams) of plastic leaving the technosphere and ending up in the natural environment (Peano et al. 2020)

Life cycle

Consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal (ISO 14040:2006)

Life cycle assessment (LCA)

An environmental assessment method based on an inventory of potential flow of pollutants entering different compartments of the environment (e.g. air, water, soil) and the assessment of associated impacts of a product system throughout its life cycle (ISO 14040:2006)

Littering

The improper disposal of small, one-off items, such as throwing a cigarette butt, dropping a snack packet or tossing a plastic drink cup. Most of the time, these items end up on the road or pavement. They may or may not be removed by municipal street cleaning.

Macroplastics

Large plastic waste that is readily visible, with dimensions greater than 5 millimetres; typically, plastic packaging, plastic infrastructure or fishing nets (Boucher and Friot 2017)

Material type

A plastic or plastic composite classification; can be sub-categorised by packaging or product classification

Microplastics

Small plastic particulates between 1 and 5 millimetres in size (GESAMP 2019)

Mismanaged waste

Collected waste that has been released or deposited in a place from where it can move into the natural environment (intentionally or otherwise). Uncollected waste is categorised as unmanaged (Pew Trusts and SYSTEMIQ 2020).

Plastic

A material which contains as an essential ingredient a high polymer and which, at some stage in its processing into finished products, can be shaped by flow (ISO 472:2013). Plastics are commercially used materials made from monomers and other raw materials chemically reacted to form a macromolecular structure, a polymer, which forms the main structural component of the plastic. Plastics contain additives to achieve defined properties (Elias 2003).

Plastic credit

A transferable unit representing a specific quantity of plastic that has been collected or recycled from the environment, which would not have occurred under a business-as-usual scenario

Plastic footprint

The total amount and types of plastic used by a company/product/organisation/event and its impacts. Plastic footprints are calculated using all of the following metrics:

1. The quantity of plastic used in a system;
2. The quantity of plastic emitted into the environment during production, transport, use or end-of-life of a plastic product (often referred to as plastic leakage); and,
3. The impact, direct or indirect, of pollutants emitted (or of leaked plastic) on human health and the environment (Boucher et al. 2019).

These *Guidelines* use the term 'plastic footprint and leakage' to refer only to production, use and end-of-life contexts. In the future, upstream elements of the footprint may be added.

Polymer

Polymers are a group of organic, semi-organic or inorganic chemical substances containing large polymer molecules (Elias 2003).

Post-consumer material

Material generated by households or by commercial, industrial or institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose. This includes returns of material from the distribution chain (ISO 14021:2016).

Pre-consumer material

Material diverted from the waste stream during the manufacturing process (ISO 14021:2016)

Recycled plastic

A plastic made from recovered and recycled material. The term ‘secondary’ is often used interchangeably with ‘recycled’.

Region

For the purposes of these *Guidelines*, ‘region’ should be taken to mean ‘country’. Where a country-level region is not appropriate, the credit buyer should justify a definition of a region based on a special economic zone that is no larger than a United Nations designated region.[16]

Value chain

The full range of activities needed to create a product or service, comprising the steps that involve bringing a product from conception to distribution

Virgin plastic

A plastic made from virgin raw material, i.e. extracted crude oil. The term ‘primary’ is often used interchangeably with ‘virgin’.

[16] See the United Nations Department of Economic and Social Affairs Statistics Division’s list of geographic regions, available at https://unstats.un.org/unsd/methodology/m49/.

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Annexe 1

This annexe presents different sources for estimating the accounting metrics presented in Section 2. This list is not exhaustive and aims to provide initial ideas about methodology, data sources and frameworks to use to develop reliable metrics. Boucher et al. (2019) review a set of metrics developed in recent years that can be applied to complement those presented in this annexe.

Table 10. Possible sources for estimating accounting metrics

Source	Full reference	Description
Waste management data on a national or grid-cell scale		
World Bank	Kaza, S. et al. (2018). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. International Bank for Reconstruction and Development, The World Bank, https://openknowledge.worldbank.org/handle/10986/30317.	Solid waste data at national and urban levels, not specific to plastic
UNEP, IUCN and Life Cycle Initiative	Life Cycle Initiative (2021). National Guidance for Plastic Pollution Hotspotting and Shaping Action Pilots, https://plastichotspotting.lifecycleinitiative.org/pilots/.	Detailed plastic waste data collected in Kenya, Mozambique, South Africa, Thailand, Viet Nam, Cyprus, Menorca (Spain), and Tanzania
Methodologies to assess a plastic footprint		
Plastic Leak Project	Peano, L. et al. (2020). Plastic Leak Project Methodological Guidelines. Quantis & EA, https://quantis-intl.com/report/the-plastic-leak-project-guidelines/.	Methodology and supporting data to enable companies to calculate a company or product plastic footprint including macro- and microplastics
WWF ReSource Footprint Tracker	WWF (2020). ReSource Footprint Tracker Methodology Overview, https://resource-plastic.com/pdf/ReSource_Footprint_Tracker_Methodology_Overview_2020.pdf.	Tool to assess the plastic footprint of a company, focused on macroplastics (tracker available to ReSource member companies only)

Joint Research Centre (JRC)	Nessi S. et al. (2018). Environmental Sustainability Assessment Comparing Through the Means of Lifecycle Assessment the Potential Environmental Impacts of the Use of Alternative Feedstock (Biomass, Recycled Plastics, CO_2) for Plastic Articles in Comparison to Using Current Feedstock (Oil and Gas), Draft Report for Stakeholder Consultation. European Commission, https://eplca.jrc.ec.europa.eu/permalink/PLASTIC_LCI/Plastic_LCA_Report%20II_2018.11.20.pdf.	Methodology to integrate plastic footprint in LCA studies including macro- and microplastics.
Other indicators and frameworks		
Material circularity indicators (MCI) by the Ellen MacArthur Foundation (EMF)	EMF (2020). Material circularity indicator (MCI), https://www.ellenmacarthurfoundation.org/resources/apply/material-circularity-indicator.	The MCI tool allows companies to identify circular value from their products and materials.
Circular transition indicators (CTI) by World Business Council for Sustainable Development (WBCSD)	WBCSD (2020). Circular Transition Indicators (CTI), https://www.wbcsd.org/Programs/Circular-Economy/Factor-10/Metrics-Measurement/Circular-transition-indicators.	The Circular Transition Indicators (CTI) metric and tool allows companies to identify circularity performance of their products and materials.
New Plastics Economy Global Commitment by EMF	EMF (2020). The Global Commitment 2020 Progress Report, https://www.ellenmacarthurfoundation.org/resources/apply/global-commitment-progress-report.	This initiative builds a common vision and sets targets for 2025 to address plastic waste and pollution, starting with packaging.
Global Reporting Initiative (GRI) 306: Waste 2020	GRI (2021). Topic Standard for Waste, https://www.globalreporting.org/standards/standards-development/topic-standard-project-for-waste/.	Waste reporting framework for all types of waste

Operation Clean Sweep (OCS)	OCS (2020). Value of Operation Clean Sweep, https://www.opcleansweep.org/about/value-of-ocs/.	Operation Clean Sweep (OCS) is a product stewardship program of the American Chemistry Council's Plastics Division and Plastics Industry Association (PLASTICS) to help plastic resin handling operations implement good housekeeping and pellet, flake, and powder containment practices to work towards achieving zero pellet, flake and powder loss through the OCS pledge.

About these *Guidelines*

This document was developed by the following organisations:

3R Initiative

The 3R Initiative, named for its objectives of reducing plastic waste, recovering plastic from the environment and increasing recycling rates, aims to: (1) catalyse responsible design, use and recovery of packaging materials; (2) support companies in reducing their plastic waste footprints and mitigating potential leakage into the environment; and, (3) stimulate the development of new plastic recovery and recycling projects around the world.

EA

EA - Environmental Action is a mission driven research consultancy based in Switzerland and a member of the European Network of Ecodesign Centres (ENEC). EA is leading the development of plastic footprint methodologies and plastic waste management databases. More information can be found at www.e-a.earth.

South Pole

South Pole is a leading advisor and provider of global climate services, with over 400 experts in 18 offices globally. South Pole helps private and public organisations and companies reduce their impact on the climate while mitigating risk and creating value.

South Pole is a science-based company and its expertise covers project finance, data collection, and climate risk analysis, as well as the development of environmental commodities, such as measures for better plastic management, carbon neutral products and renewable energy credits.

South Pole has mobilised climate financing to over 700 projects that reduce greenhouse gas emissions in areas such as renewable energy, energy efficiency and sustainable land use.

Quantis

Quantis guides top organisations to define, shape and implement intelligent environmental sustainability solutions. In a nutshell, our creative geeks take the latest science and make it actionable. We deliver resilient strategies, robust metrics, useful tools, and credible communications. With offices in the US, France, Switzerland, Germany, and Italy, and clients around the world, Quantis is a key partner in inspiring sustainable change on a global scale. (Re)discover Quantis at www.quantis-intl.com.

The 3R Initiative, EA, South Pole and Quantis consulted with a broad range of organisations in the plastic waste and circularity space, including the Ellen MacArthur Foundation, International Union for Conservation of Nature, SEA Circular and Life Cycle Thinking and Sustainable Consumption and Production divisions of the United Nations Environment Programme, World Business Council for Sustainable Development, World Wide Fund for Nature and multiple corporates in the development of these *Guidelines*. We are grateful for their contributions. A draft version underwent public consultation in October 2020. The consultation draft and responses to the 158 comments received during the consultation are available at the 3R Initiative website (www.3RInitiative.org).

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