WFP
World Food Programme

JOINT INITIATIVE
FOR SUSTAINABLE HUMANITARIAN ASSISTANCE PACKAGING WASTE MANAGEMENT

STREAMLINED LIFE CYCLE **ASSESSMENT** OF THE WORLD FOOD PROGRAMME **FOOD PACKAGING**

- Carole Manceau - carole.manceau@wfp.org
- Amro El-Zoubi - amro.elzoubi@tetratech.com

2024

Credit: © WFP/Abubaker Garelnabei

TABLE OF CONTENTS

1. INTRODUCTION

This report, developed by the Joint Initiative for Sustainable Humanitarian Assistance Packaging Waste Management and the World Food Programme, aims to foster collaborative learning by providing humanitarian organizations with an example of an efficient methodology for conducting a streamlined Life Cycle Assessment (LCA) of packaging tailored to humanitarian assistance settings. This report seeks to improve the understanding of the requirements, benefits, and limitations of the streamlined LCA. It estimates the environmental impact of **corrugated cardboard; three types of metallized laminated sachets** used for delivering ready-to-use supplementary food (RUSF): fortified biscuits, and Super Cereal Plus (SC+); and **three types of packaging for delivering vegetable oil: HDPE jerry cans, PET bottles, and tinned steel cans.**

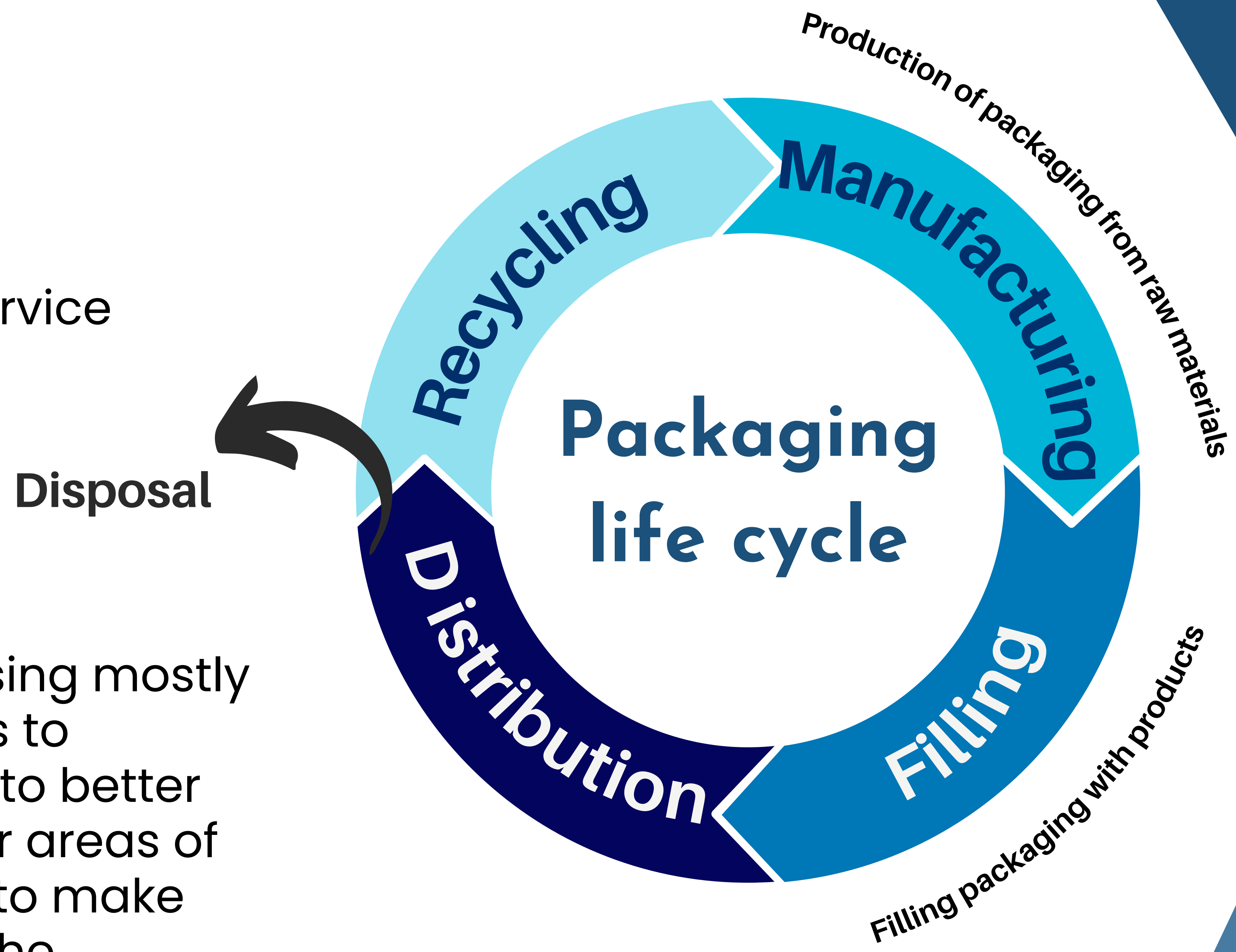
2. LCA DEFINITION

LIFE CYCLE ASSESSMENT (LCA)

A systemic framework that assesses the environmental impacts of a product or service over its entire life cycle.

STREAMLINED LCA

Focuses on key environmental impacts using mostly secondary data and making assumptions to produce results quickly. It is ideally suited to better understand the blind spots and any major areas of focus within the life cycle of a product, or to make internal decisions about how to improve the sustainability of a product.



3. METHODOLOGY

1 GOAL AND SCOPE DEFINITIONS

Defining the objective of the study, the type of packaging to be assessed, system boundaries, and environmental impact categories.

2 INVENTORY ANALYSIS

Collecting the required data from WFP suppliers (packaging material, weight, conversion process, transport).

3 IMPACT ASSESSMENT

Utilizing the LCA software (PIQET)* that uses the global Ecoinvent 3.9.1.** database and the Developer Environmental Footprint (EF 3.1)*** to analyze the collected data and assess the environmental impact of packaging.

4 DATA ANALYSIS

Drawing conclusions and providing recommendations based on the impact assessment results to better understand the environmental impact of packaging and choosing more sustainable options.

*PIQET is a streamlined LCA software tool designed to quickly calculate the environmental impacts and resource consumption profiles of different packaging options. https://piqet.com

** Ecoinvent is a global database offering life cycle inventory (LCI) data for conducting LCA studies, detailing inputs, outputs, and environmental impacts of processes across industries.

*** https://eplca.jrc.ec.europa.eu/LCDN/developerEF.html

4. OBJECTIVE OF THE ASSESSMENT

1. PACKAGING MATERIALS

Assess and compare the environmental impacts of different packaging materials, taking into account the inclusion of recycled content, to support informed decision making on packaging material choices.

2. PACKAGING DESIGN

Assess and compare the environmental impacts associated with changing the design (size) of packaging.

3. PACKAGING WASTE MANAGEMENT

Assess and compare the environmental impacts of different waste management methods.

5. PACKAGING SYSTEMS

The following packaging systems are assessed in this study:

Type of product	Primary packaging*	Product quantity per primary packaging	No. of primary packaging units per secondary packaging	Secondary packaging**	No. of secondary packaging units per pallet
Ready to Use Supplementary food (RUSF)	Metallized laminated sachets (HDPE/metallized plastic/PET)	100 g	150	Corrugated cardboard	48
Fortified biscuits	Metallized laminated sachets (metallized plastic/PP)	100 g	150	Corrugated cardboard	48
Super Cereal Plus (SC+)	Metallized laminated sachets (LDPE/metallized plastic/PP)	1500 g	12	Corrugated cardboard	64

*Primary packaging is the packaging in direct contact with the product itself
**Secondary packaging is the outer packaging that holds together the individual units of primary packaging

5. PACKAGING SYSTEMS

The following packaging systems are assessed in this study:

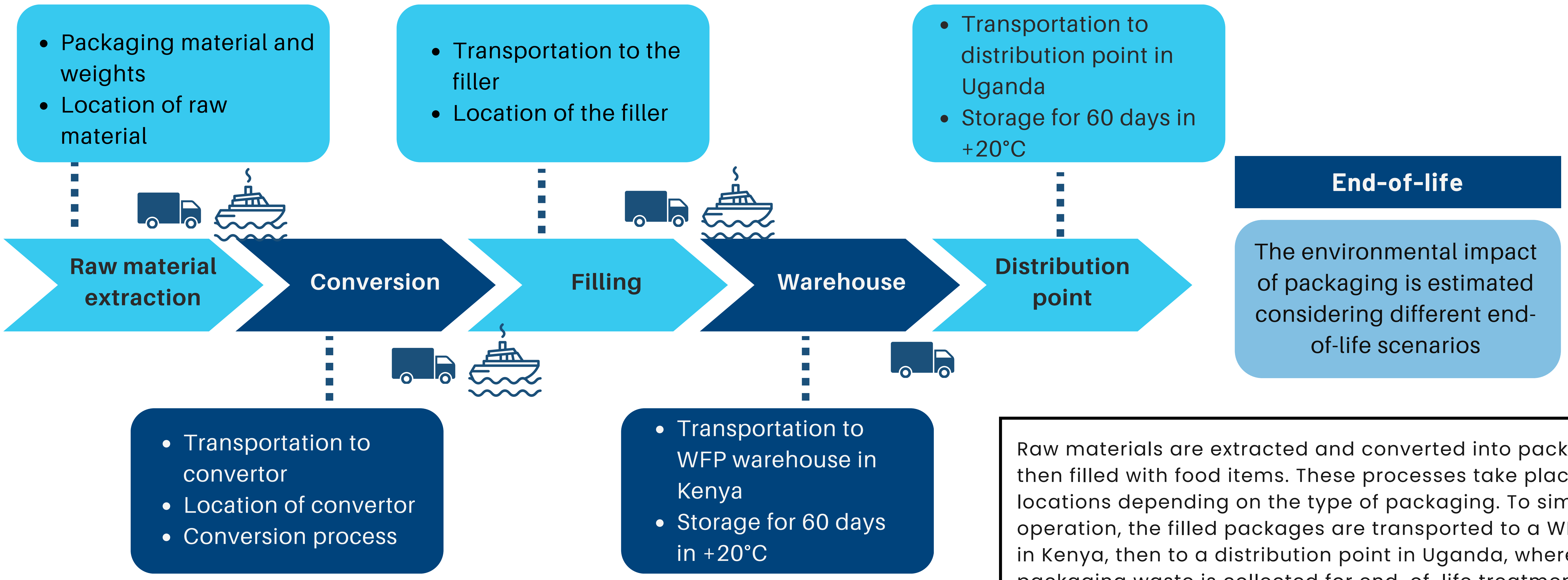
Type of product	Primary packaging⁎	Product quantity per primary packaging	No. of primary packaging units per secondary packaging	Secondary packaging⁎⁎	No. of secondary packaging units per pallet
Vegetable oil	HDPE jerry cans	4500 g (5L)	4	Corrugated cardboard	30
Vegetable oil	PET bottle	900 g (1L)	20	Corrugated cardboard	30
Vegetable oil	PET bottle	3600 g (4L)	5	Corrugated cardboard	30
Vegetable iol	Tinned steel can	3600 g (4L)	5	Corrugated cardboard	30

⁎Primary packaging is the packaging in direct contact with the product itself

⁎⁎Secondary packaging is the outer packaging that holds together the individual units of primary packaging

6. SYSTEM BOUNDARIES & END-OF-LIFE

This study examines the entire lifespan of packaging materials, from the extraction of raw materials, to manufacturing and disposal. The diagram provided below, which applies to all packaging materials analyzed in this study, outlines the various stages of the packaging lifecycle, along with the data collected at each phase. (Refer to Annex 12.2 for details on transport distances.)



Raw materials are extracted and converted into packaging, which is then filled with food items. These processes take place at different locations depending on the type of packaging. To simulate a WFP operation, the filled packages are transported to a WFP warehouse in Kenya, then to a distribution point in Uganda, where the packaging waste is collected for end-of-life treatment.

7. ASSUMPTIONS

LOSSES

Food and packaging losses are considered to be consistent in all types of packaging. Therefore, the impact of these losses is excluded from the assessment.

PALLETS

The impact of pallets is generally quite small and can be considered negligible given the high number and weight of packages that fit on a pallet.

TINNED STEEL CANS

Due to lack of data, the details of tinned steel cans (e.g., composition and weight) are not obtained by packaging suppliers but projected by the project team, based on their knowledge and experience, including an assumption that they are made of 60% recycled material.

CORRUGATED CARDBOARD

To differentiate between the impact of primary and secondary packaging, corrugated cardboard is assessed separately from primary packaging, with an assumption that they contain 35% recycled material.

7. ASSUMPTIONS

RECYCLING

This study assumes that end-of-life management is well-organized in humanitarian assistance. Therefore, it is anticipated that 70% of packaging waste (of all materials) could be collected and mechanically recycled where the waste is produced as defined in the system boundary.

LANDFILLS

This study considers only sanitary landfills, where waste is spread in thin layers, compressed to minimize volume, and then covered with compacted soil. While sanitary landfills are not usually available in countries where humanitarian assistance takes place, they are considered in this study to estimate their environmental impact in comparison to other end-of-life scenarios.

INCINERATORS

This study considers incinerators without energy recovery technology. The results are expected to differ for incinerators equipped with an energy recovery technology.

7. ASSUMPTIONS

RECYCLED CONTENT

Refers to mechanically recycled content in packaging materials. Recycled content is assumed to be safe for food packaging, and its environmental impact is estimated using emission factors from the Ecoinvent database. Packaging made of recycled content is assumed to provide the same level of protection as packaging made from new, virgin materials.

ELECTRICITY CONSUMPTION

Due to lack of data, electricity consumption is assumed to be similar in all types of packaging. Therefore, the environmental impact of electricity used to fill packaging with food products is excluded from this assessment.

8. ENVIRONMENTAL IMPACT CATEGORIES

This assessment compares the impact of packaging against the following environmental categories:

Indicator	Description
Climate change - (kg CO2 eq)	Indicator of potential global warming due to emissions of greenhouse gases (carbon dioxide, methane, etc.).
Ozone depletion - (kg CFC-11 eq)	Indicator of emissions to air that causes the destruction of the stratospheric ozone layer. Expressed by Chloroflurocarbons equivalent (CFCs) such as carbon, chlorine, and fluorine.
Particulate matter - (kg PM2.5 eq)	Indicator of the potential incidence of disease due to inhaling fine particles with diameters of 2.5 micrometers or smaller.
Soil carbon deficit from land use - (kg carbon deficit)	Indicator of the change in soil quality from land use and transformation, and its effects on soil fertility, biodiversity regulation, water retention, nutrient cycling, and soil structure maintenance.
Water use volume - (m3 water eq)	Indicator of the relative amount of water used, based on regionalized water scarcity factors.
Product Environmental Footprint (PEF) Weighted score (including toxics) - (Point)	A method of aggregating impact categories that have been normalised and weighted according to perceived relevance by the European Commission. (Refer to Annex 12.1 for details on PEF weighted score.)

9. DISCLAIMER

- Variations up to 15% are often within the uncertainty ranges of impact, particularly for non-climate change impact categories. **Therefore, differences in impact of less than 15% can be disregarded.**

- Packaging impact on soil carbon deficit and water use varies based on the location and technology used in production or recycling of packaging. **Therefore a case-by-case assessment is needed using primary suppliers' data.**

- The impact on ozone depletion is influenced by various factors, many of which are not entirely understood. As a result, the **findings of this study regarding ozone depletion should not be generalized, and a thorough assessment is necessary to understand this impact.**

- Database values often reflect European standards and requirements of recycling and landfilling, which **might not be appropriate in different locations, particularly as climatic conditions can vary significantly.**

OBJECTIVE 1. PACKAGING MATERIALS

10. IMPACT ASSESSMENT

10.1. COMPARING THE CLIMATE CHANGE IMPACT OF DIFFERENT PACKAGING (PRIMARY AND SECONDARY) THROUGHOUT THEIR LIFE CYCLE STAGES

What do these results show?

- Figures 1 and 2 show impacts of different packaging to climate change, considering landfilling as the end-of-life scenario. The figures are in a bar chart format to allow comparison of different packaging against one environmental indicator.
- **Scale**: Expressed as absolute impact on climate change (Kg Co2 eq).
- **Functional Unit**: Packaging used to deliver 1 kg of food product.

What's the value of showing data in this format?

- Allows us to compare the impact of different packaging systems on climate change, and identify which life cycle stage contributes most to climate change (i.e. hotspot analysis) so that more focused efforts can be made to address the stage with the greatest impact.

RUSF, SC+, AND FORTIFIED BISCUITS - COMPARISON OF PACKAGING CONTRIBUTION BY LIFE CYCLE STAGES TO CLIMATE CHANGE IMPACT, PER KG OF FOOD PRODUCT

Main takeaways:

- Although the environmental impact of sachets end-of-life is low compared to its production and transport, sachets should be collected and managed appropriately after use to decrease plastic pollution, which has serious impact on the environment, marine life, and human health.

- Consider cardboard reuse, repurposing, and recycling to avoid sending it to the landfill which leads to methane emissions, a potent greenhouse gas, increasing climate change impacts.

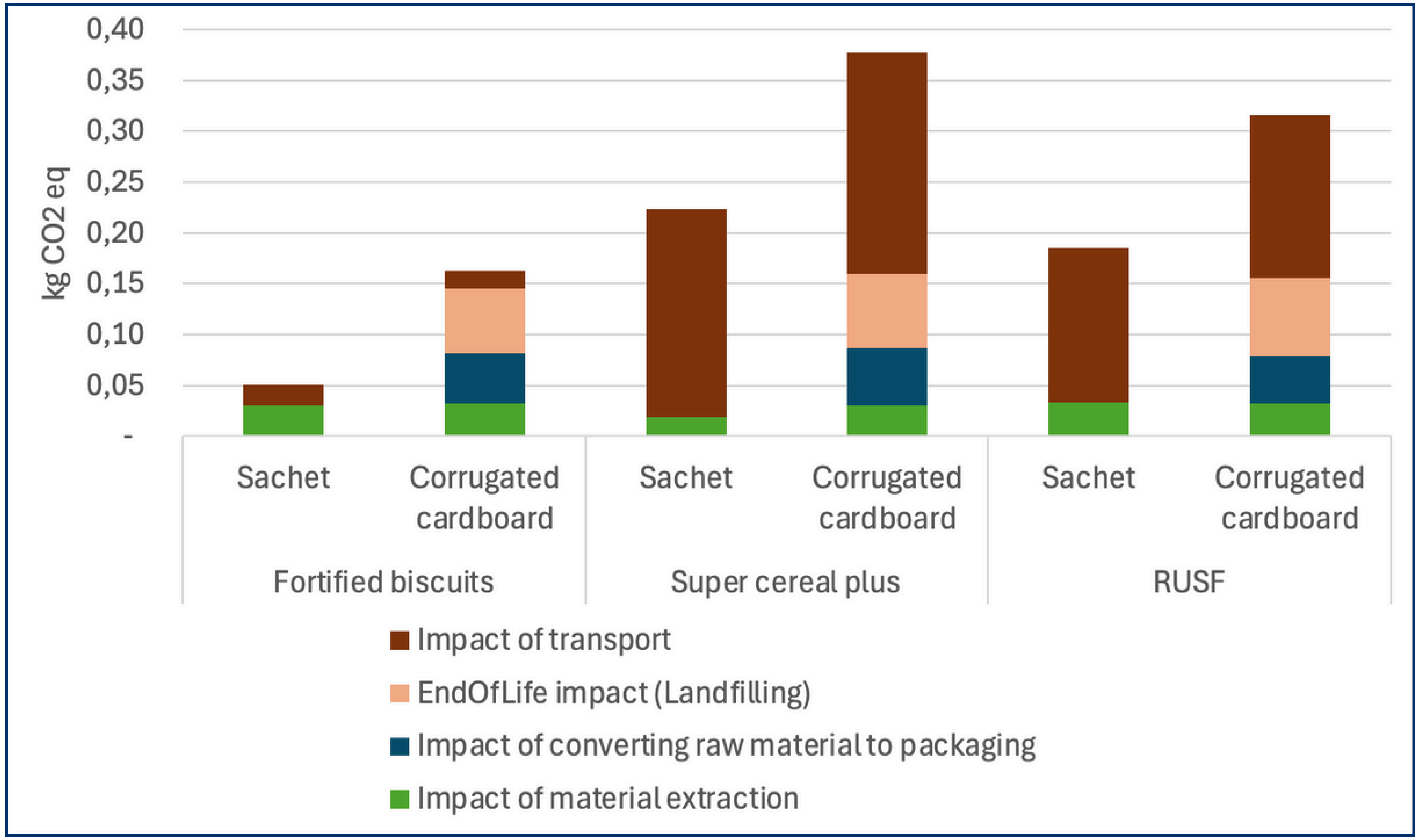


Figure 1: Climate change impact of food packaging per kg of food

HDPE JERRY CAN, PET 4L&1L BOTTLES AND TINNED STEEL CAN - COMPARISON OF PACKAGING CONTRIBUTION BY LIFE CYCLE STAGES TO CLIMATE CHANGE IMPACT, PER KG OF VEGETABLE OIL

- The climate change impact of producing and converting raw materials into tinned steel cans is roughly three times greater than that of plastic packaging (HDPE jerrycan and PET bottles).
- Extraction of fossil fuels to produce plastic and tinned steel can contributes to 50-70% of its overall impact on climate change.

Main takeaway: Production of tinned steel cans generates more greenhouse gas emissions than plastic packaging. However, tinned steel cans could be recycled multiple times without losing quality, unlike plastics. Despite this benefit, recycling tinned steel cans is challenging in countries where humanitarian assistance is provided. Therefore, further evaluation is needed to understand the pros and cons of using tinned steel cans versus plastic packaging.

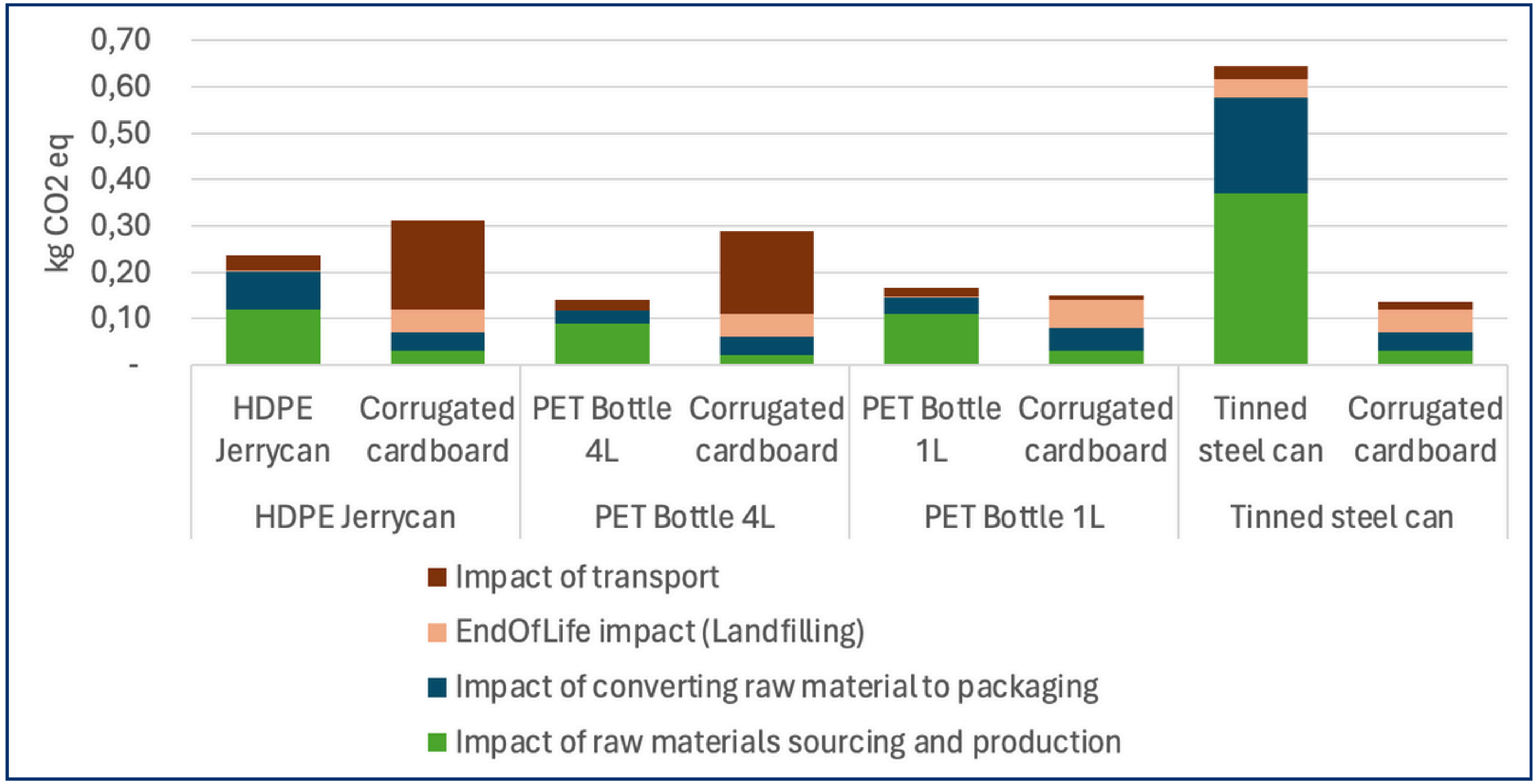


Figure 2: Climate change impact of vegetable oil packaging per kg of vegetable oil

10. IMPACT ASSESSMENT

10.2. ASSESSING THE ENVIRONMENTAL IMPACT OF USING RECYCLED MATERIALS IN PACKAGING

What do these results show?

- The following diagrams illustrate the impacts of using recycled content in HDPE jerry can (primary packaging) and cardboard (secondary packaging) compared to the use of virgin materials across six environmental categories; the closer to the center, the lesser the environmental impact.
- **Scale**: Expressed as the percentage decrease or increase in impact when replacing virgin with recycled content.
- **Functional Unit**: One unit of packaging.

What's the value of showing data in this format?

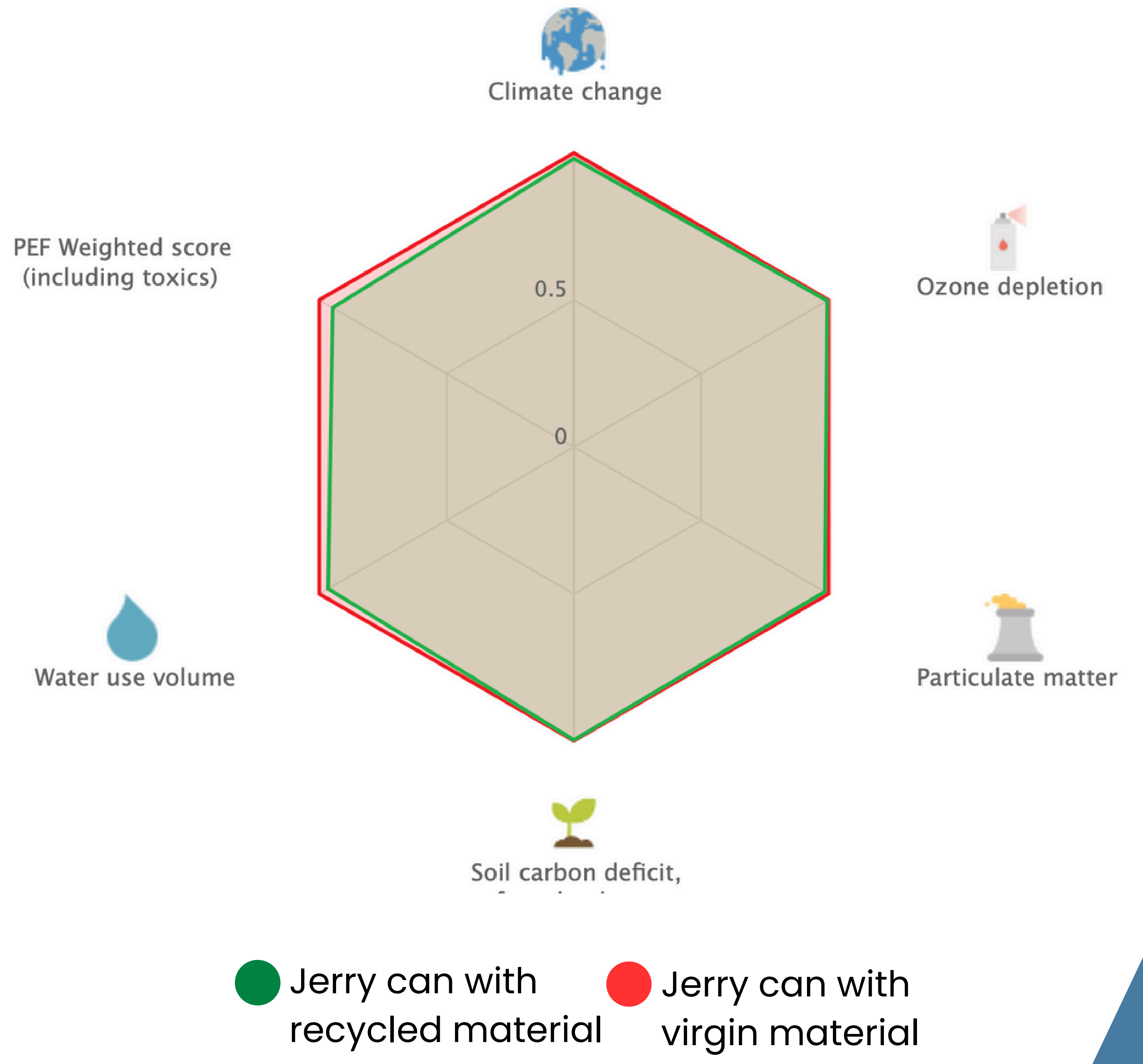
- Allows us to identify the advantages and disadvantages of using packaging made of recycled content compared to virgin materials.

COMPARING A VIRGIN HDPE JERRY CAN WITH ONE MADE FROM RECYCLED CONTENT

The environmental impacts of virgin material HDPE jerry can is compared with HDPE jerry can made of 20% recycled material.

Switching from a 100% virgin jerry can to a jerry can that uses 20% of recycled content, leads to a 5% decrease in the PEF weighted score. This decrease is mainly due to the decrease in water use and fossil resources use, which is included in the PEF score.

Main takeaway: Incorporating 20% recycled material into HDPE jerry cans results in a minimal decrease in environmental impact, which can be disregarded. However, it is important to note that plastic recycling reduces plastic pollution, keeps the material in use for longer time, and improves livelihoods of communities by creating new jobs in plastic waste collection and recycling.



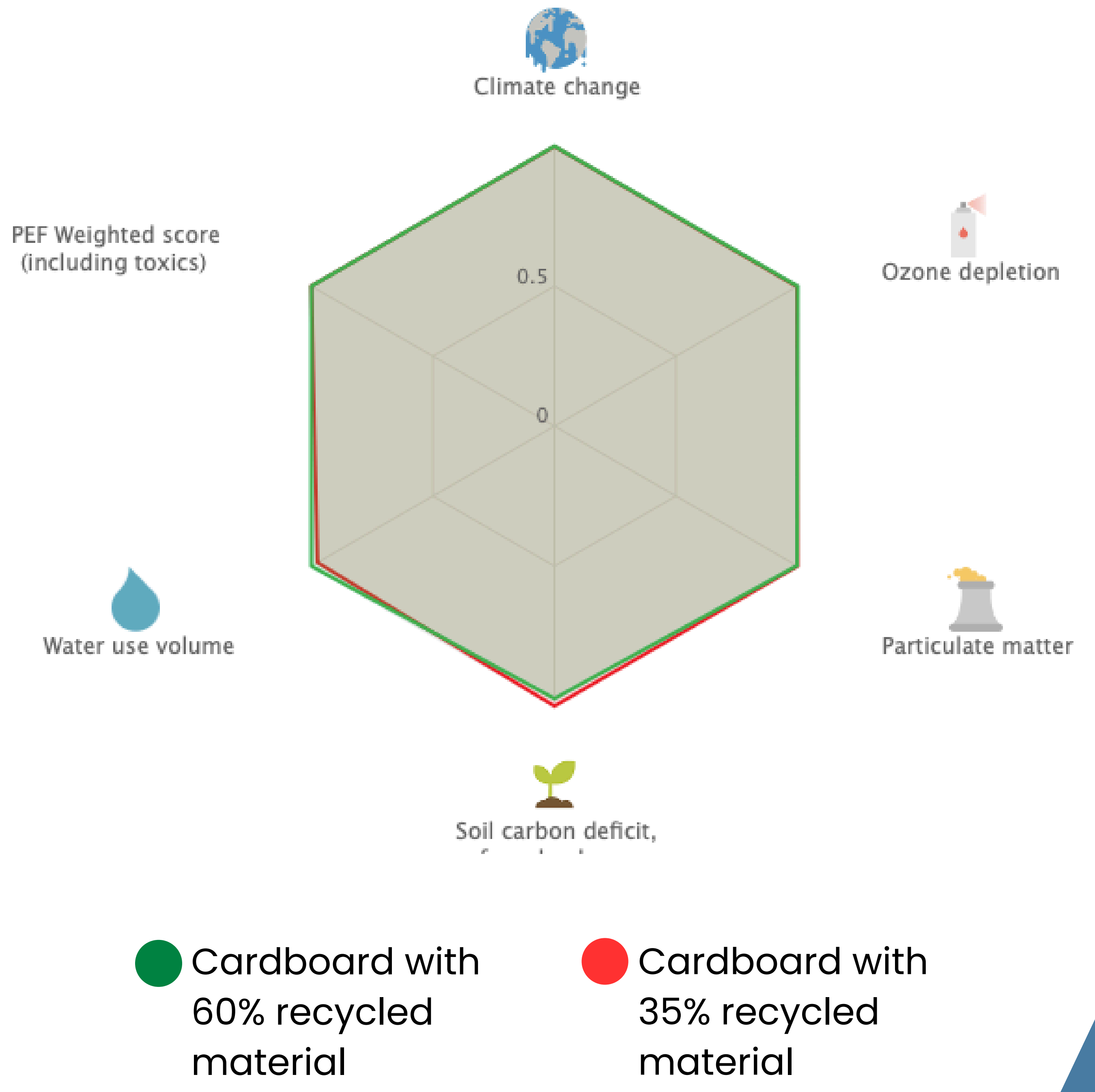
COMPARING CARDBOARDS OF DIFFERENT RECYCLED CONTENT

The environmental impacts of the standard cardboard made of 35% recycled material is compared with cardboard made of 60% recycled material.

Switching from 35% to 60% recycled content in cardboard slightly **reduces the impact on soil carbon deficit by 3%** due to the decreased need for producing new cardboard and the associated deforestation impact. However, this change **increases water use volume by 3%** as recycling cardboard requires more water than producing new cardboard.

These differences in impact are minimal and can be disregarded. Additionally, recycling cardboard generates greenhouse gas emissions. Therefore, increasing the percentage of recycled content only slightly reduces the impact on climate change.

Main takeaway: There are tradeoffs of using recycled cardboard when compared to fresh fiber cardboard. Further assessment is needed to estimate the environmental benefits of using recycled cardboard.



10. IMPACT ASSESSMENT

10.3. COMPARING THE IMPACT OF DIFFERENT PACKAGING MATERIALS AND DESIGNS ACROSS MULTIPLE ENVIRONMENTAL IMPACT CATEGORIES

What do these results show?

- The following spider diagrams illustrate the impact of several packaging systems across all six environmental categories; the closer to the center, the lesser the environmental impact.
- For the comparison of different metallized laminated sachets, and the comparison of different vegetable oil packaging, the functional unit is chosen to be packaging used to deliver 1 kg of food/vegetable oil.
- For the comparison of metallized laminated sachets and an alternative mono-material sachet, the functional unit is one unit of packaging.

What's the value of showing data in this format?

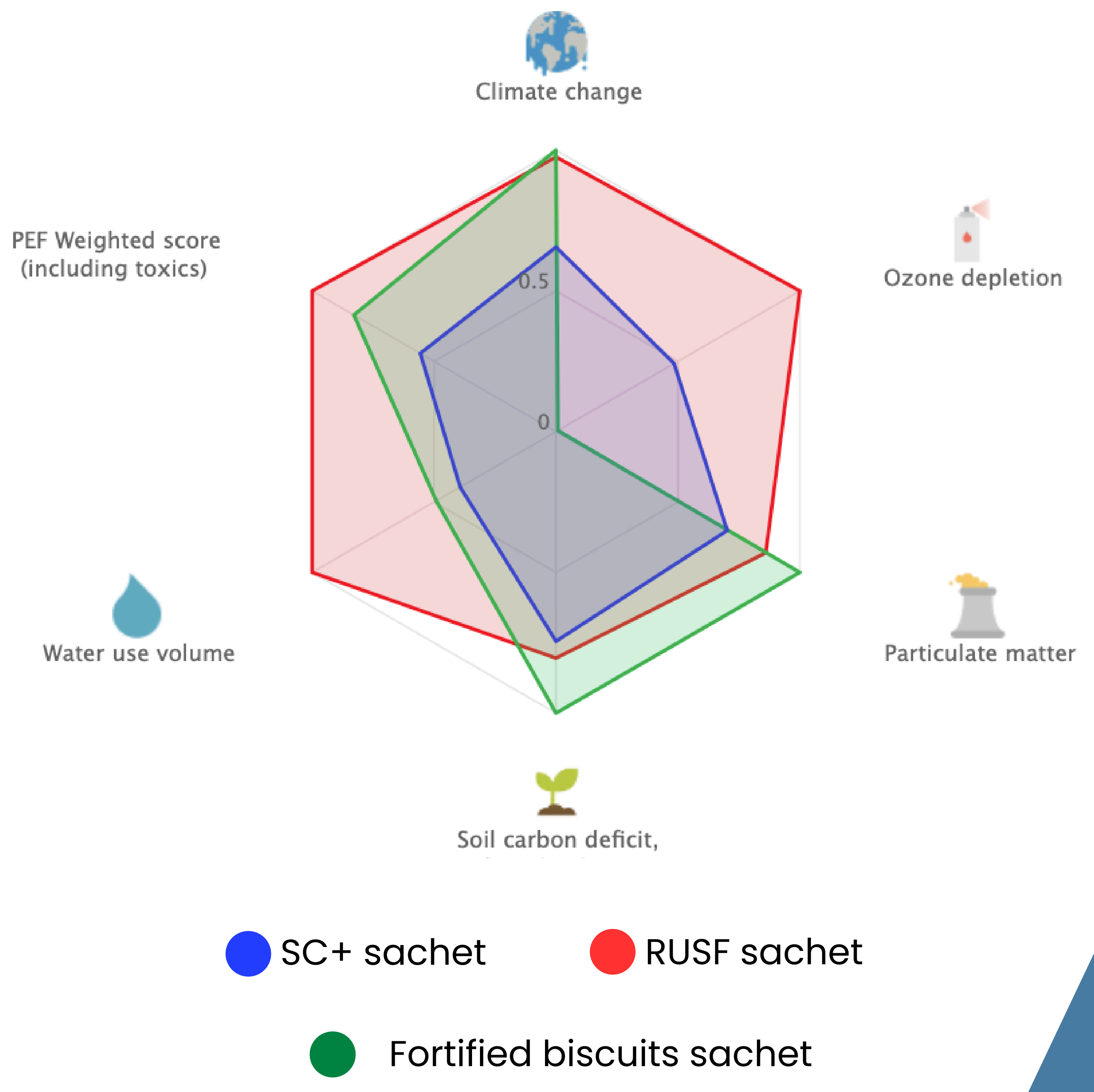
- Allows us to identify which packaging (material/size) may have highest or lowest environmental impacts according to a variety of environmental impact categories.

COMPARISON OF DIFFERENT METALLIZED LAMINATED SACHETS

SC+, RUSF AND FORTIFIED BISCUITS SACHETS, PER KG OF FOOD

- The SC+ sachet contains 1500g of product per package, while the RUSF and fortified biscuits sachets contain 100g. Due to this larger product quantity, the SC sachets have a higher volume, leading to improved packaging efficiency and lower PEF weighted score per kg of product.
- Although having similar packaging size, the impact on particulate matter and soil carbon deficit is higher in fortified biscuits sachets than in RUSF sachets due to longer distances travelled by truck.
- RUSF metallized laminated sachets have higher impact on ozone depletion, due to the PET layer in its composition.

Main takeaway: Generally, larger packaging volumes result in lower environmental impacts per kilogram of product. However, further evaluation is necessary to ensure the safe delivery of the product and the convenience for beneficiaries when increasing the packaging size, such as ease of carrying and use.

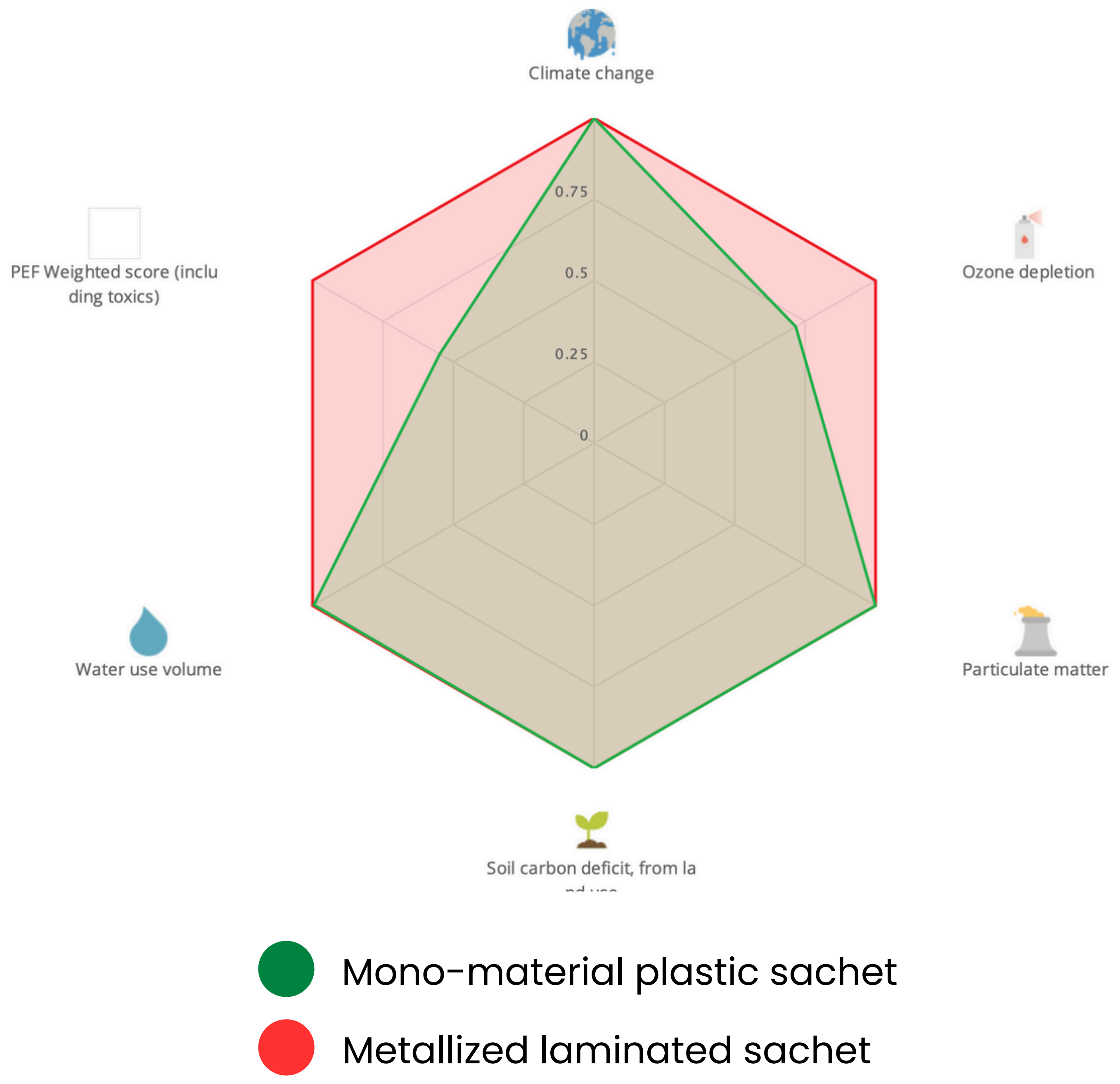


COMPARISON OF METALLIZED LAMINATED SACHETS AND AN ALTERNATIVE MONO-PLASTIC SACHET

The non-recyclable metallized laminated sachet is compared to an alternative sachet made of one type of plastic that could be 70% recycled and 30% landfilled at end-of-life.

Switching to an alternative mono-plastic material sachet and recycling 70% of it and landfilling the remaining 30% at the end of life, results in a 45% reduction in the PEF weighted score and a 30% reduction in ozone depletion impact when compared to metallized laminated sachet that is disposed in the landfill.

Main takeaway: Evaluate the feasibility of recycling in countries where humanitarian assistance is provided and collaborate with suppliers to transition from metallized laminated sachets to mono-plastic sachets, ensuring the safe delivery of food is not compromised.



COMPARISON OF DIFFERENT VEGETABLE OIL PACKAGING

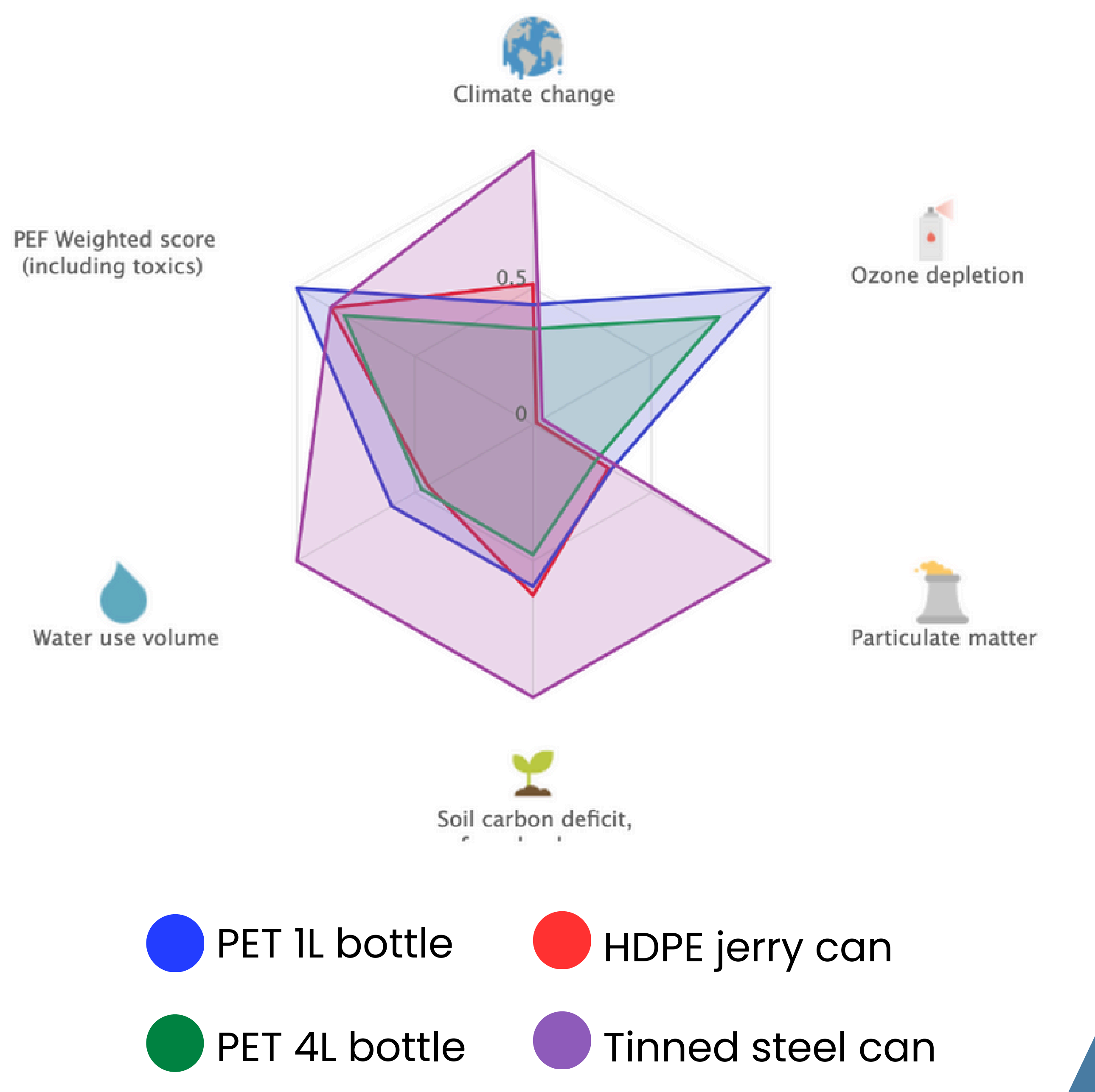
PET 1L BOTTLE, PET 4L BOTTLE, JERRY CAN AND TINNED STEEL CANS PER KG OF VEGETABLE OIL

- Replacing the PET 1L bottle with a PET 4L bottle reduces the impact on all environmental categories by approximately 20%.

- Due to the impact of material extraction and conversion to packaging, tinned steel cans have a greater impact on climate change, particulate matter, soil carbon deficit, and water use volume, than plastic (PET & HDPE) packaging.

- PET has a higher impact material to ozone depletion than HDPE and tinned steel, due to the purified terephthalic acid input driving CFC emissions.

Main takeaway: Switching from PET 1L bottle, tinned steel cans, and HDPE jerry cans to PET 4L bottle reduces the PEF weighted score. However, further evaluation is necessary to ensure the safe delivery of the product and the convenience for beneficiaries when increasing the packaging size, such as ease of carrying and use.



10. IMPACT ASSESSMENT

10.4. COMPARING THE IMPACT OF PACKAGING END-OF-LIFE SCENARIOS ACROSS MULTIPLE ENVIRONMENTAL IMPACT CATEGORIES

What do these results show?

- The following diagrams illustrate the impacts of different end-of-life scenarios against six environmental categories; the closer to the center (zero value), the lesser the environmental impact.
- **Functional Unit**: One unit of packaging.
- **Note**: In the case of HDPE jerry cans, PET bottles, and steel tinned cans, incineration always leads to higher impact than recycling and landfilling. Therefore, only recycling and landfilling are considered in the diagrams.

What's the value of showing data in this format?

- Allows us to identify which waste management method in comparison to others may have the highest or lowest environmental impacts according to a variety of environmental impact categories.

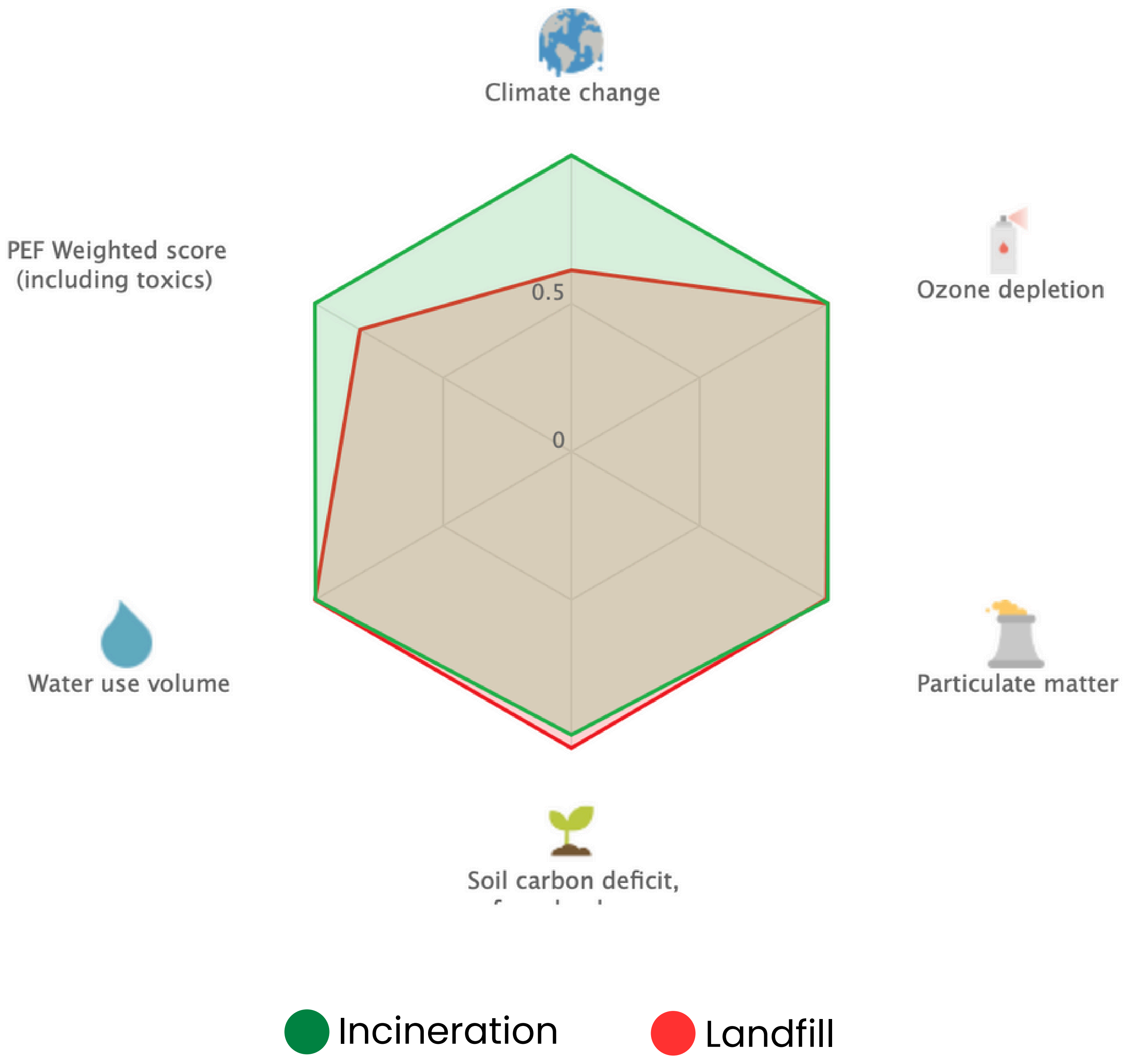
METALLIZED LAMINATED SACHET: COMPARISON OF END-OF-LIFE SCENARIOS

Since metallized laminated sachets are not recyclable, their environmental impacts are assessed when they are landfilled or incinerated at end-of-life.

Compared to incineration, landfilling metallized laminated sachets reduces the following environmental impact categories:

- 40% decrease to climate change
- 18% decrease in PEF weighted score

Main takeaway: Assess the possibility of sending metallized sachets waste to sanitary landfills (based on availability, capacity, community approval) for its lower environmental impact when compared to incineration. In addition, work with manufacturers to explore alternative recyclable sachets.



Note: The impact of incineration and landfilling is similar across the various types of metallized laminated sachets examined in this study (RUSF, fortified biscuits, and SC+ sachets).

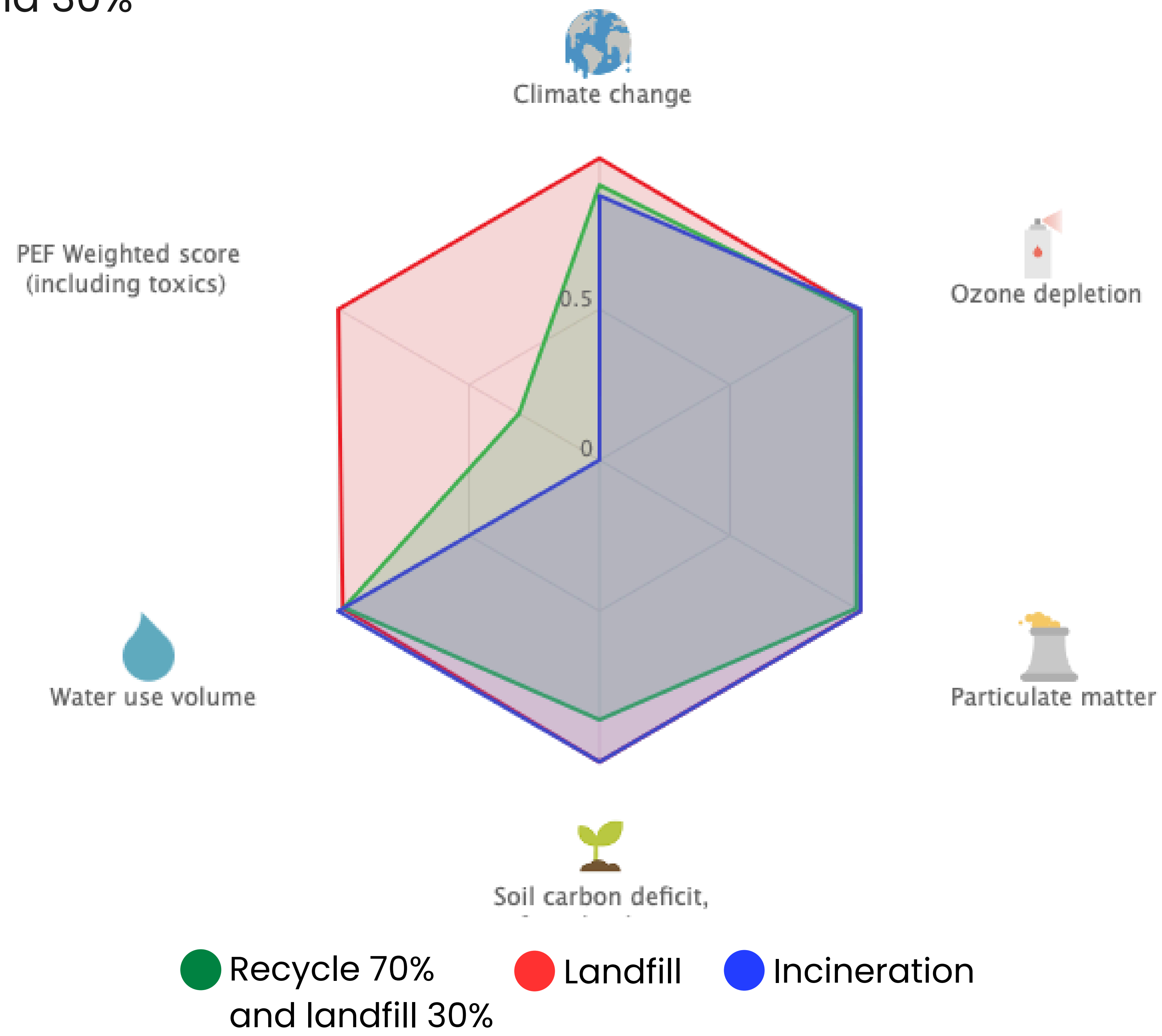
CARDBOARD: COMPARISON OF END-OF-LIFE SCENARIOS

The environmental impacts of cardboard are assessed when they are incinerated, landfilled, and the combination of 70% recycled and 30% landfilled at end-of-life.

Landfilling has the highest impact on all environmental categories due to leachate and methane emissions in the landfill. In contrast, incinerating cardboard results in the lowest PEF weighted score, due to the assumption of biogenic carbon neutrality.*

Recycling 70% of cardboards reduces the environmental impact on soil carbon deficit by approximately 15% compared to incinerating or landfilling. This is due to a reduced need for new production and the associated impact on deforestation.

Main takeaway: Prioritize cardboard reuse and assess the bigger picture of recycling, landfilling, and incineration. Although cardboard incineration shows a lower PEF weighted score than recycling, recycling keeps the material in use longer and improves livelihoods by creating jobs.



*Biogenic CO2 emitted during cardboard incineration is eventually sequestered during plant growth, resulting in zero net emissions.

HDPE JERRY CAN: COMPARISON OF END-OF-LIFE SCENARIOS

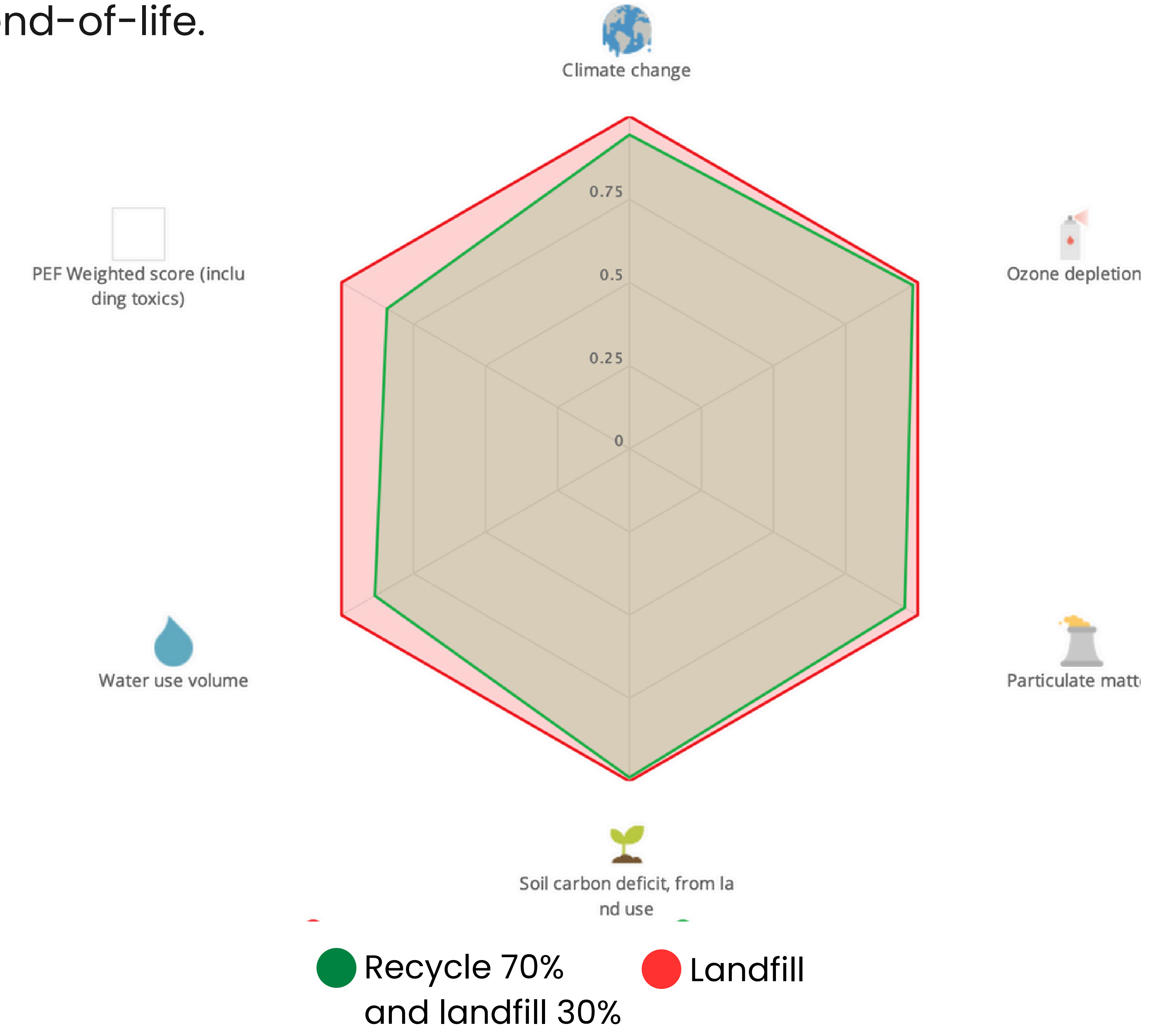
The environmental impacts of HDPE jerry cans are assessed when they are landfilled, and when 70% is recycled and 30% is landfilled at end-of-life.

Compared to landfilling, recycling 70% of HDPE jerry cans reduces the environmental impact due to reducing the need for new material production.

The main reductions are as follows:

- 6% decrease in climate change impact
- 12% decrease in water use volume impact
- 15% decrease in PEF weighted score impact

Main takeaway: Although the percentage reductions in environmental impact may not be substantial, exploring recycling options is important for decreasing plastic pollution, improving community livelihoods by creating jobs, and enhancing the dignity of waste pickers by recognizing them as green agents.



PET BOTTLES: COMPARISON OF END-OF-LIFE SCENARIOS

The environmental impacts of PET bottles are assessed when they are landfilled, and when 70% is recycled and 30% is landfilled at end-of-life.

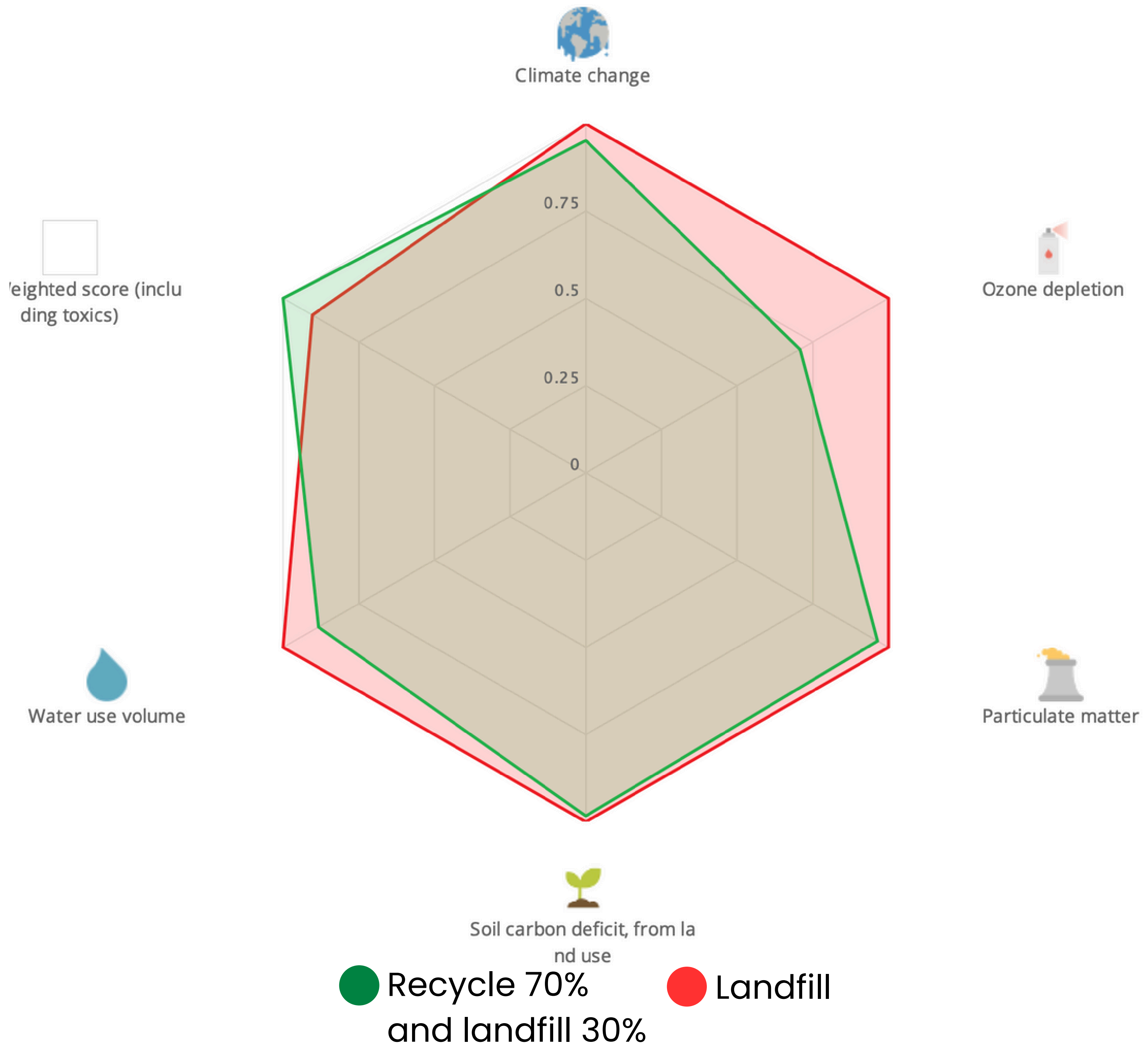
Compared to landfilling, recycling 70% of PET bottles reduces the environmental impact due to reducing the need for new material production.

The main reductions are as follows:

- 30% decrease in ozone depletion impact
- 12% decrease in water use volume impact

Landfilling PET bottle leads to a 10% decrease of the weighted score when compared to recycling. This is due to a higher impact on human toxicity when recycling the label of the bottle (made of coated paper) than landfilling. This difference in impact falls into the uncertainty range and can be neglected.

Main takeaway: Explore PET bottle recycling options to decrease the impact on ozone depletion and water use in addition to the social benefits of recycling (creating jobs).

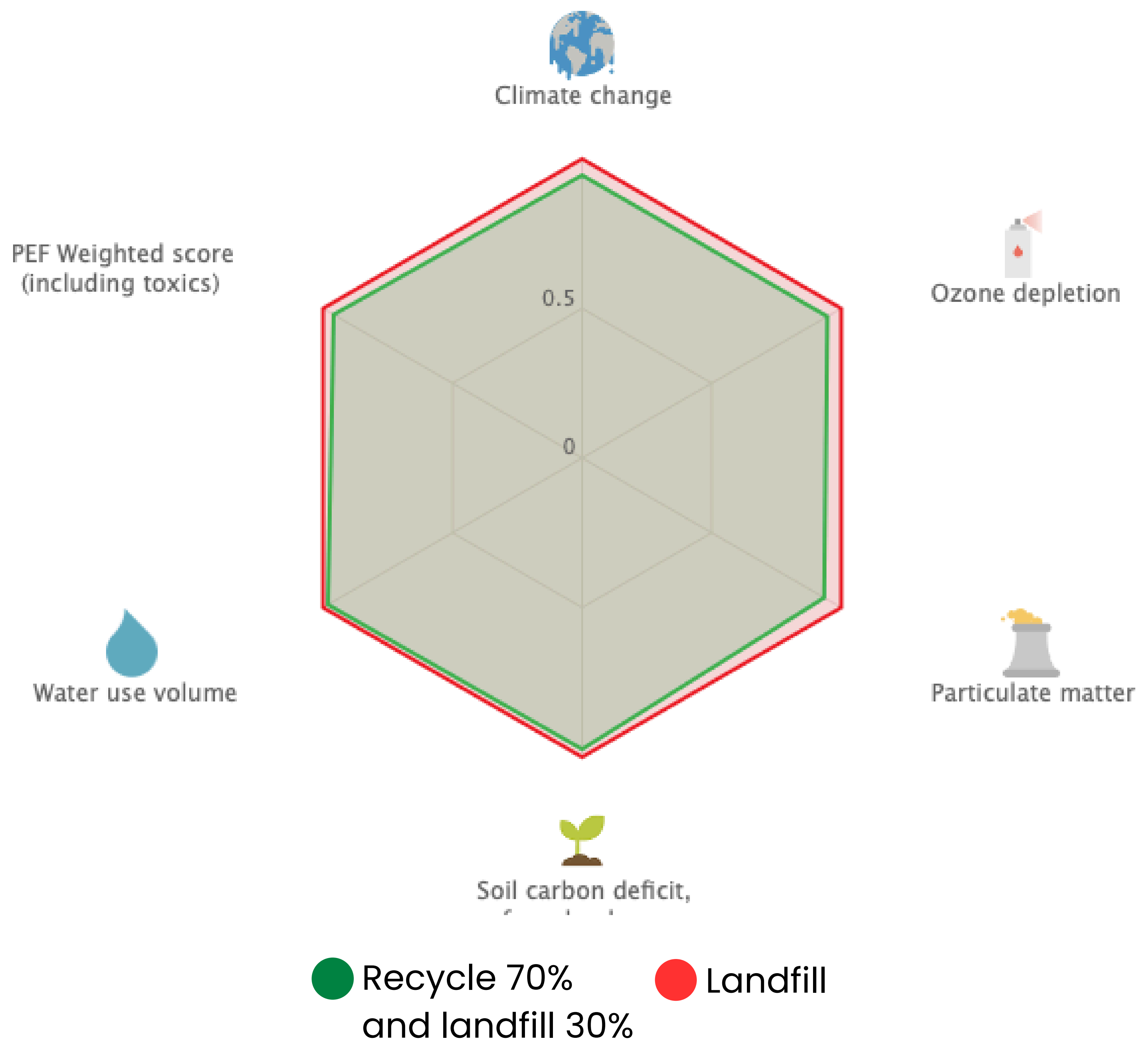


TINNED STEEL CAN: COMPARISON OF END-OF-LIFE SCENARIOS

The environmental impacts of tinned steel cans are assessed when they are landfilled, and when 70% is recycled and 30% is landfilled at end-of-life.

Compared to landfilling, recycling 70% of tinned steel cans reduces the environmental impact in all categories by an average of 4% by reducing the need for new material production.

Main takeaway: Although recycling steel tinned cans offers only a slight reduction in impact compared to landfilling, they can be recycled multiple times without quality degradation, unlike plastics. However, further evaluation is necessary to explore the recycling potential in a humanitarian context.



11. CONCLUSIONS & RECOMMENDATIONS

When choosing packaging materials and designs, as well as determining waste management methods, it is important to consider both the specific contexts and the broader aspects of food delivery. This includes factors such as the type of food being packaged, the quality and availability of packaging materials, the capacity and accessibility of waste management infrastructure in recipient countries, and social considerations like community preferences for certain packaging types. Additionally, it is important that streamlined LCA findings are interpreted by experts in LCA, packaging, and humanitarian operations to ensure accurate and relevant decision-making. The following conclusions and recommendations, based on the findings of this assessment, should be taken into account.

Weighing different environmental impacts is necessary.

- Tinned steel cans produce roughly three times more CO2 emissions during production compared to HDPE jerry cans and PET bottles. However, unlike plastics, tinned steel cans can be recycled multiple times without a loss in quality, even though recycling in the humanitarian context is challenging. **Further evaluation is needed to determine the proper choice of packaging material for delivering vegetable oil, considering likelihood of recycling and the convenience for beneficiaries of using one material over the other.**

Optimizing packaging size can reduce environmental impacts but must meet beneficiaries' needs.

- In general, increasing the volume of packaging reduces environmental impacts when measured per kilogram of product. To minimize environmental impact, **consider using larger packaging sizes (with more food per packaging unit) after confirming that food can be safely delivered in the appropriate dose (especially for specific nutritional products), and that the convenience of the beneficiaries is maintained.**

11. CONCLUSIONS & RECOMMENDATIONS

Changing packaging material, design and waste management method, can reduce the packaging environmental footprint.

- The most significant reduction in climate change impact is achieved by **switching from a tinned steel can destined for landfill to a jerrycan that could be recycled, resulting in a 60% decrease in the PEF score**. Additionally, **switching from a 1L PET bottle headed for landfill to a 4L PET bottle that could be recycled leads to a 30% decrease in the PEF score.**

Incorporating recycled plastic into packaging slightly reduces plastic pollution and generates opportunities for local communities.

- Recycling or using recycled content in plastic packaging (provided it is safe for food use) only slightly reduces the overall environmental impact, but it significantly helps in reducing plastic pollution. In the context of humanitarian assistance, it is important to consider economic and social sustainability, as **plastic collection and recycling initiatives can improve community livelihoods and elevate the dignity of waste pickers by recognizing them as green agents.**

Exploring environmentally friendly alternatives to metallized laminated sachets is needed.

- Since laminated metallized sachets are non-recyclable, **prioritize landfilling them over incineration due to the lower environmental impact associated with landfilling. Simultaneously, collaborate with manufacturers to investigate alternative packaging materials that are recyclable.**

12. ANNEXES

12.1 PRODUCT ENVIRONMENTAL FOOTPRINT (PEF) WEIGHTED SCORE

The PEF weighted score is calculated using a harmonized methodology developed by the European Commission, according the following simplified steps:

- **Normalization:** Each environmental impact category is divided by a normalization factor derived from societal and environmental benchmarks.
- **Weighting Factors:** Impact categories are assigned weighting factors based on current context, reflecting societal values and environmental priorities.
- **Weighted Scores Calculation:** Normalized impact scores are multiplied by their corresponding weighting factors.
- **Aggregation:** The weighted scores are scaled to 100 and combined to generate a single score, indicating the packaging's overall environmental performance. A lower score signifies better environmental performance, while a higher score suggests a greater impact.

The PEF weighted score includes the following environmental impact categories: Climate change-kg CO2 eq; Ozone depletion-kg CFC-11 eq; Human toxicity, cancer-CTUh; Human toxicity, non-cancer-CTUh; Particulate matter kg-PM2.5 eq; Ionising radiation-kBq U-235 eq; Photochemical ozone formation-kg NMVOC eq; Acidification-mol H+ eq; Eutrophication, terrestrial-mol N eq; Eutrophication, fresh water-kg P eq; Eutrophication, marine-kg N eq; Ecotoxicity, fresh water-CTUe; Resource use, minerals and metals-kg Sb eq; Resource use, fossils-MJ; Land use (soil quality index)-Pt; and Water use-m3 water.

12. ANNEXES

12.2 TRANSPORT DETAILS

These distances represent the total distance traveled by each packaging type from raw material extraction to end-of-life, as outlined in the system boundaries.

RUSF - Sachet	3,000 Km	10,000 Km
Fortified biscuits - Sachet	3,400 Km	6,000 Km
SC+ - Sachet	3,800 Km	6,200 Km
Vegetable oil - HDPE jerry can	7,000 Km	12,200 Km
Vegetable oil - PET bottles	7,000 Km	7,500 Km
Vegetable oil - tinned steel can	7,000 Km	11,400 Km

13. GLOSSARY

- **Objective:** Aim of the comparison, which identifies why is the assessment done and what should be achieved
- **Scope:** Includes details on geographical scope, system boundaries, and other system describing elements
- **Functional unit:** Function of packaging in quantitative terms to serve as a basis to measure the environmental footprint (for example: packaging needed to deliver one kg of food product)
- **Primary data:** Data collected directly by the manufacturer of packaging
- **Secondary data:** Data interpreted from the primary data
- **PE:** Polyethylene
- **PP:** Polypropylene
- **HDPE:** High-density polyethylene
- **LDPE:** Low-density polyethylene
- **PET:** Polyethylene terephthalate
- **RUSF**: Ready-to-use Supplementary Food
- **SC+:** Super cereal plus