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Life Cycle Assessment of a Plumpy'Nut sachet

Final report

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Summary

1. Scope & Objectives

Project objectives and system boundary setting

2. Impact of current practice

Avoided plastic leakage due to current collection

3. Opportunities for end-of-life

Comparison of impact of different scenarios

4. Bigger picture

Importance of Plumpy'Nut sachet in full life cycle of product

5. Conclusions

Main lessons and recommendations

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How to read the report

Refer yourselves to these icons to help you navigate the presentation

This icon signals a main take-away.

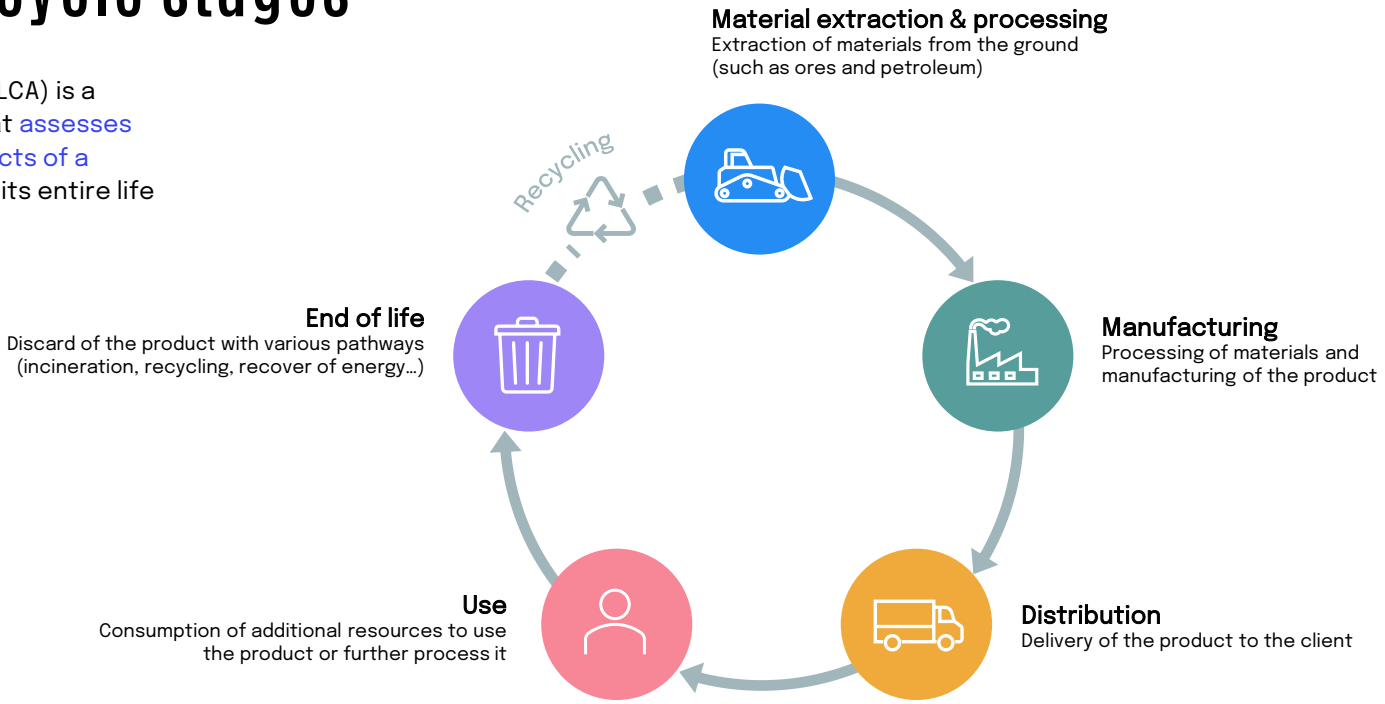
This icon signals a hypothesis, or a methodology note

This icon signals a main action for impact

This icon signals a limitation, a warning

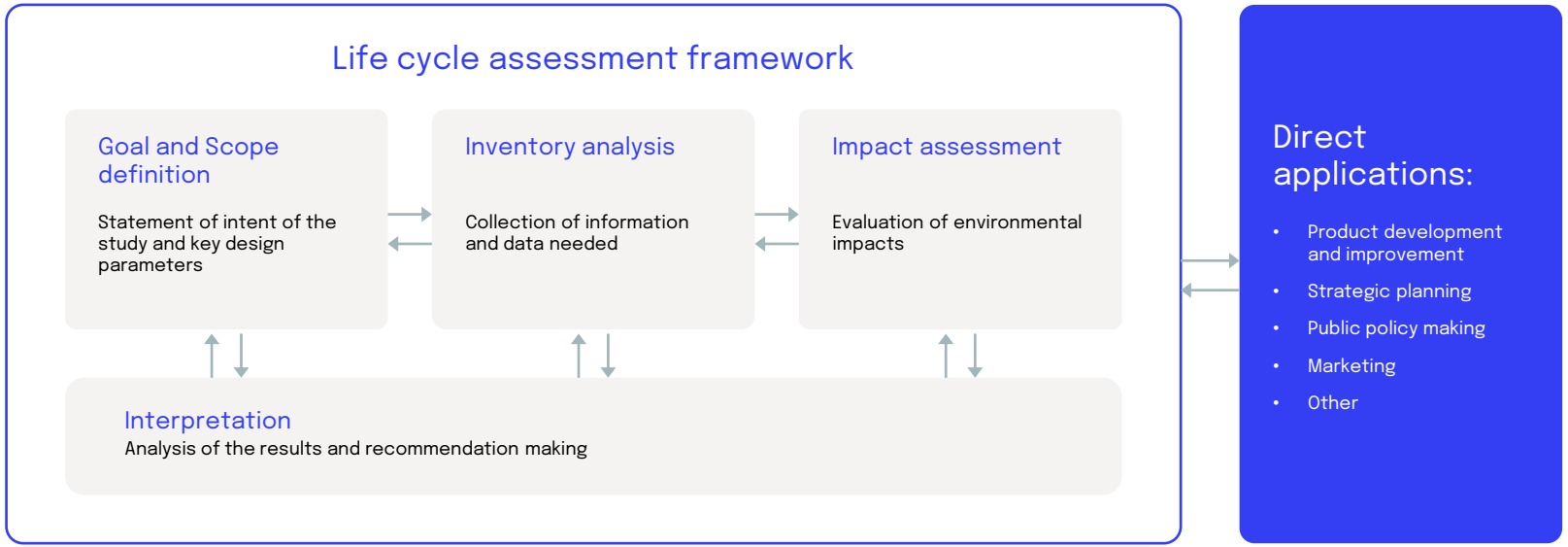
About: Life cycle stages

Life Cycle Assessment (LCA) is a systemic framework that assesses the environmental impacts of a product or service over its entire life cycle.



About: ISO framework

- The approach is defined by the ISO 14040/14044 standards and contains the steps shown in the graph below
- The process of conducting a LCA is iterative, each step feeding the others



About: Impact assessment - Environmental footprint (EF)

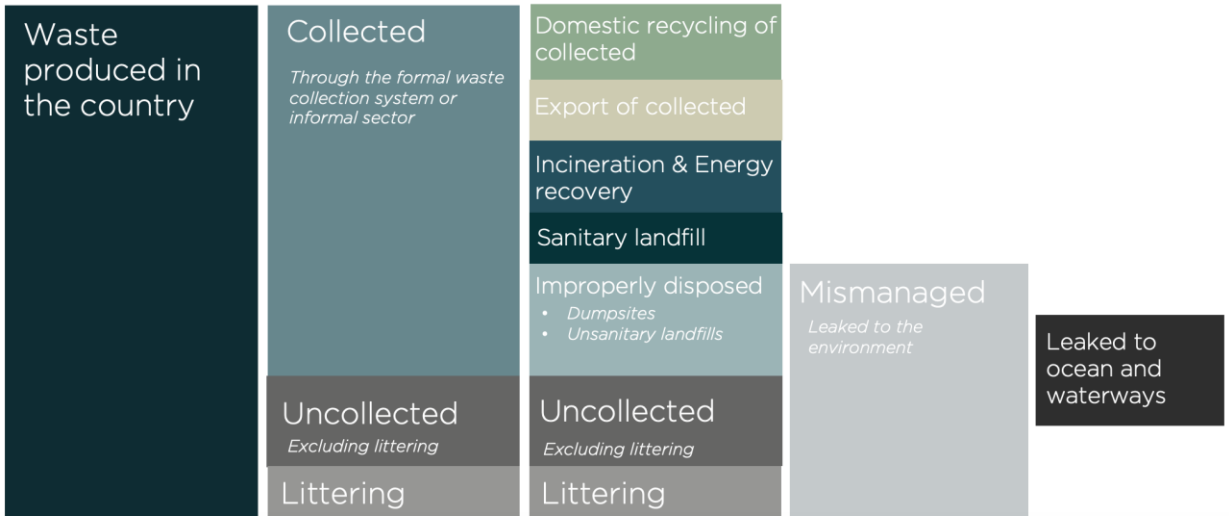
- Impact assessment method maintained by the European Commission
- Midpoint method allowing to express various impact categories
- A weighting is possible, allowing to derive an aggregated factor from the midpoint categories
- For this specific analysis only climate change impacts will be studied. Another assessment method will be used to address the environmental impact related to plastic leakage (see next slide).

Impact category	Indicator
Climate change	Radiative forcing as Global Warming Potential (GWP100)
Ozone depletion	Ozone Depletion Potential (ODP)
Human toxicity (cancer and non-cancer effects)	Comparative Toxic Unit for humans (CTU_h)
Particulate matter formation	Human health effects associated with exposure to $PM_{2.5}$
Ionising radiation	Human exposure efficiency relative to U^{235}
Photochemical ozone formation	Tropospheric ozone concentration increase
Acidification	Accumulated Exceedance (AE)
Eutrophication (terrestrial, freshwater, marine)	Accumulated Exceedance (AE); Fraction of nutrients reaching freshwater; marine end compartments
Ecotoxicity (freshwater)	Comparative Toxic Unit for ecosystems (CTU_e)
Land use	Soil quality index
Water use	User deprivation potential
Resource use (fossils)	Abiotic resource depletion
Resource use (minerals and metals)	Abiotic resource depletion

About: Plastic leakage

From the total waste produced in a country, a part of it will be mismanaged.

The mismanaged waste is the combination of improperly managed and uncollected plastic waste. Improperly managed waste is a fraction of waste that is disposed of in a waste management system where leakage is expected to occur, such as a dumpsite or an unsanitary landfill. A dumpsite is a particular area where large quantities of waste are deliberately disposed in an uncontrolled manner. A landfill is considered unsanitary when waste management quality standards are not met, thus entailing a potential for leakage.



1. Scope and objectives

Project objectives and system boundary setting

Objectives

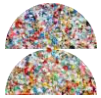
The main objective of this project is to better understand the environmental profile of the Plumpy'Nut sachet and to identify solutions to mitigate its impact. Four sub-objectives can de identified, as described below.

Assess the plastic leakage abatement from the new collection process in place in Africa

Quantify the advantage of the current collection process, in comparison to the former current practice

Assess the potential gains from various end-of-life options for the collected sachets

Compare the performance of the different end-of-life alternatives



Examine the strategic opportunities for the implementation of the end-of-life scenarios

Discuss on the feasibility of the actions that could be implemented

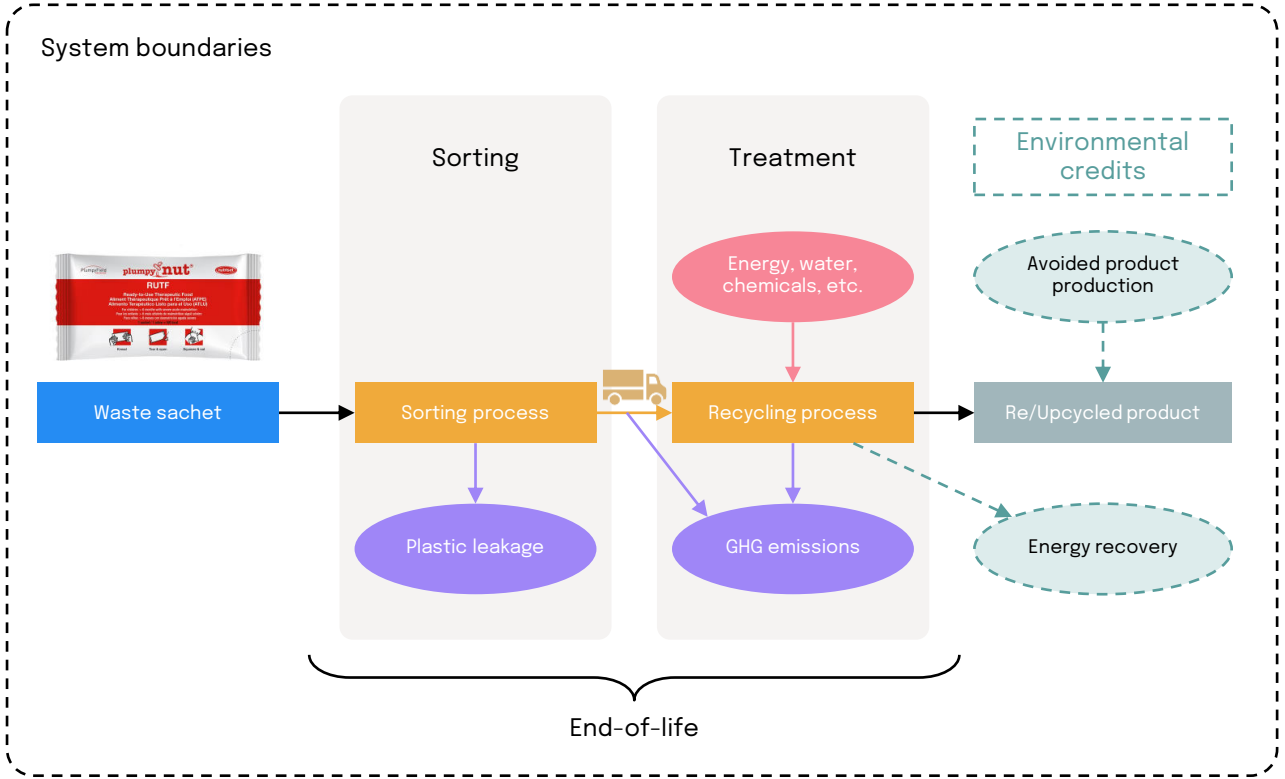
Understand the importance of the sachet in the Plumpy'Nut product

Quantify the part of the impact of Plumpy'Nut product that can be allocated to the sachet

System boundaries

This project focuses on the end-of-life of the Plumpy'Nut sachet.

The potential benefits of the reuse of the materials or of the recovery of energy during the treatment process will be considered in the quantification.



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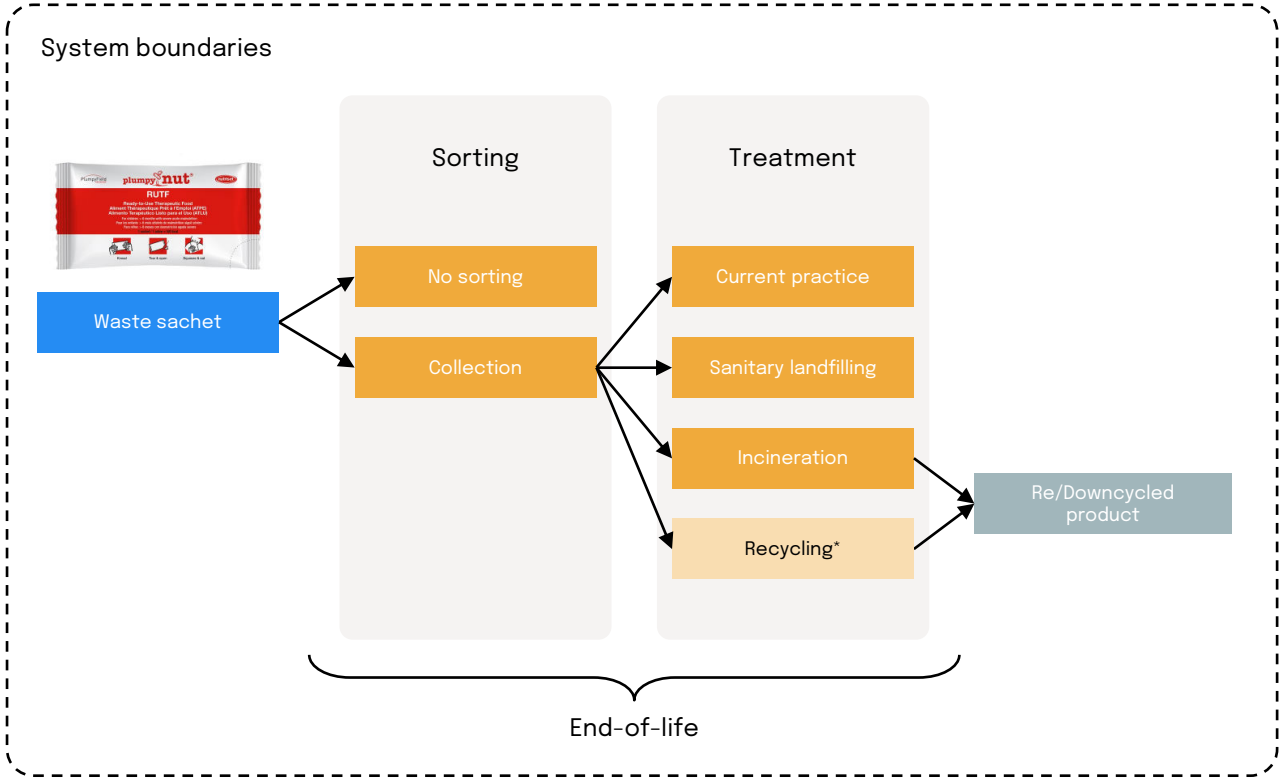
Scenarios

For the sorting phase, a calculation of the avoided leakage related to the collection of the sachets (current practice) in comparison to the absence of sorting (past practice) will be analysed.

For the treatment, the traditional end-of-life options are assessed with a high granularity, computing the related climate change impact, while the more uncertain recycling scenarios are assessed with a potential analysis.



* The impact related to the different recycling processes analysed will only be assessed in terms of the order of magnitude of the potential of the solution. This analysis is less granular due to the lack of data related to the processes that could be implemented.

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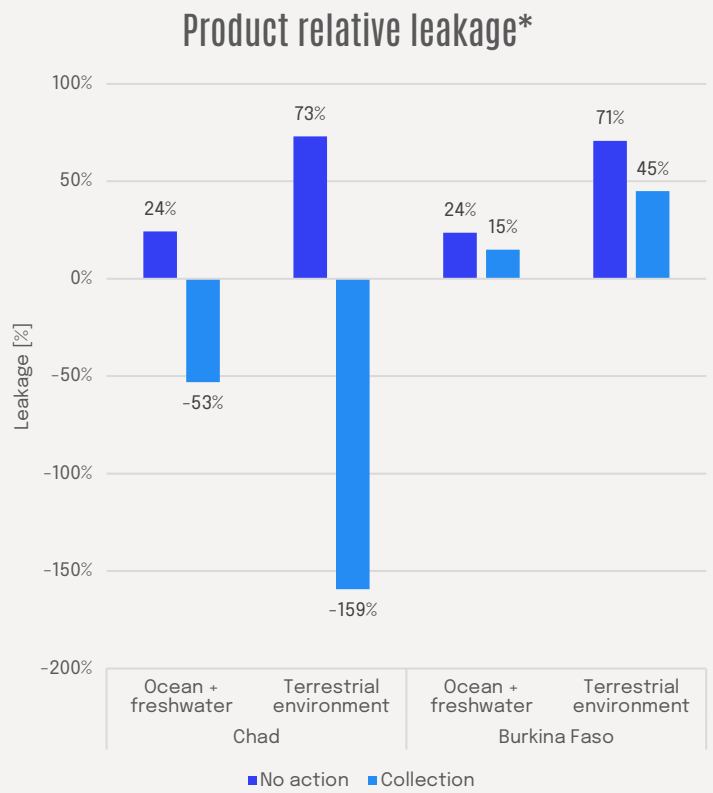
2. Impact of current practice

Avoided plastic leakage due to current collection

Relative avoided leakage

The reduction of plastic leakage related to the current collection process undergone in 2022 by Alima in Chad and Burkina Faso has been calculated.

- In Burkina Faso, the leakage to the environment of the Plumpy'Nut sachets decreased by 37% thanks to the collection system put in place.
- The negative numbers for Chad come from a collection rates higher than the amount of sachets distributed by Alima in 2022.
- The mismanagement waste indices and release rates where taken from EA internal database.



* Relative quantity of Plumpy'Nut sachets leaking into the environment

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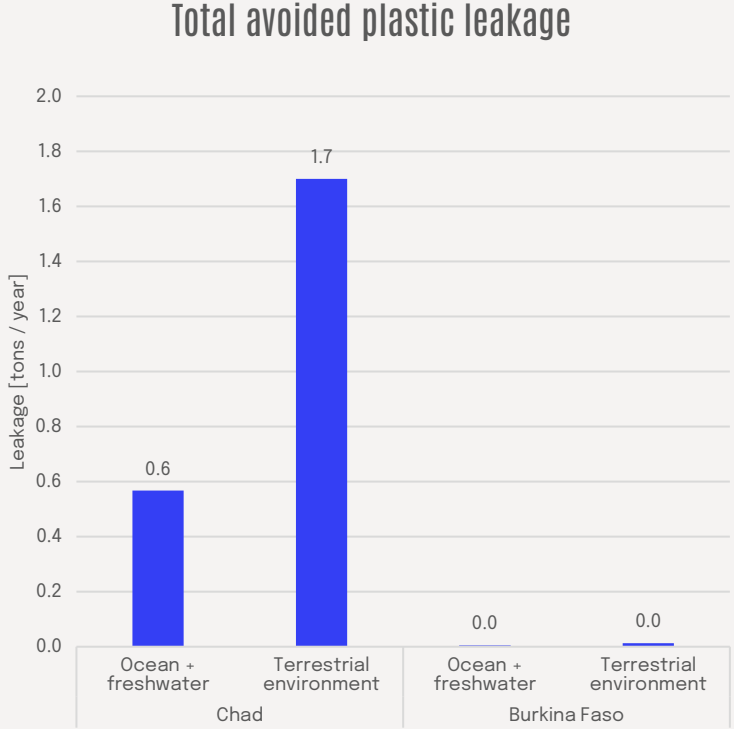
Absolute avoided leakage

2.3 tons of plastic

- 2022 collection rates allow to reduce leakage by 2.3 tons of plastic in Chad and Burkina Faso.
- Collecting Plumpy'Nut sachets allows to avoid a big amount of plastic from being leaked into the environment. The impact of the treatment of these sachets will be discussed in the remaining part of the report.



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3. Opportunities for end-of-life

Comparison of impact of different scenarios

Recycling potential

The potential environmental benefits of four recycling scenarios has been investigated.

Scenario name	Recycling process	Recoverable product	Estimated outcomes	
			Based on 2022 collected sachets	Based on 2022 distributed sachets
Concrete	Incineration + Recycling (treat ashes to allow for being incorporated in concrete)	Aluminium powder	Savings from concrete production: • <10 kg CO2 / year • <50 MJ / year • <10 L water / year	Savings from concrete production: • 30'000 kg CO2 / year • 200'000 MJ / year • 20'000 L water / year
Bricks	Cleaning + Recycling (remove aluminium; melt and mould plastic)	Plastic bricks	Brick production: • <10 m^3 / year	Brick production: • 1000 m^3 / year (equivalent to a 1'400 meters-long wall)
Plastic (chemical)	Cleaning + Recycling (chemically separate plastics and aluminium)	Plastic and aluminium scraps	Plastic scrap production: • <10 t / year Aluminium scrap production: • <10 kg / year	Plastic scrap production: • 600 t / year Aluminium scrap production: • 40'000 kg / year
Plastic (mechanical)	Cleaning + Recycling (mechanically separate plastics and aluminium)	Plastic and aluminium scraps		

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Recycling potential

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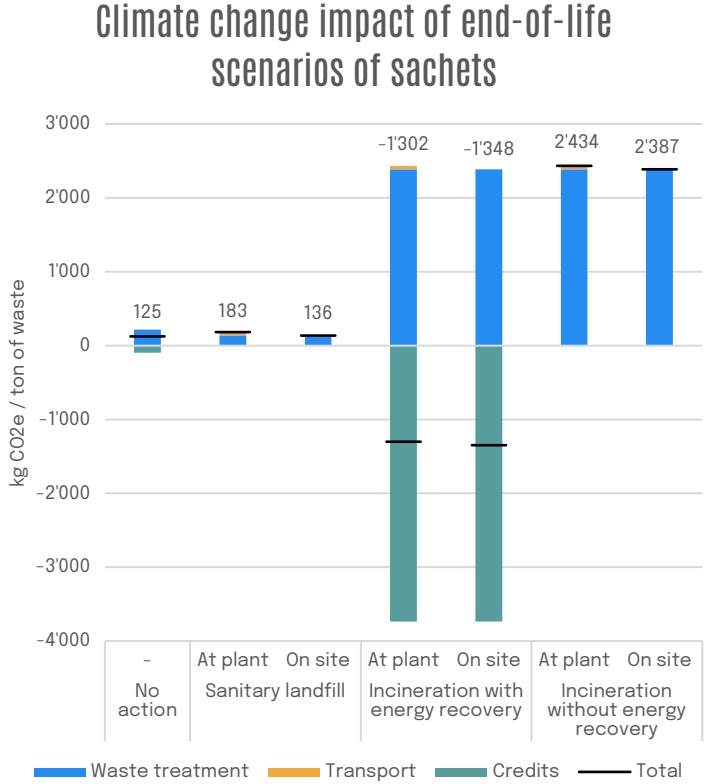
Plastic (mechanical)	Cleaning + Recycling (mechanically separate plastics and aluminium)	Plastic and aluminium scraps

- The current collection rates do not allow for the realistic implementation of a recycling process.
- The systemic collection of all the Plumpy'Nut sachets distributed in Chad and Burkina Faso, could represent a real potential for recycling.
- This analysis allows to understand the order of magnitude of the potential of each solution but does not represent a life cycle analysis of this solution. For that, more granularity on the recycling processes and the products that could be replaced would be needed.
- Methodology of calculations made can be found in appendices.

Other end-of-life options

As recycling might not be an opportunity with high potential for impact reduction in the mid-term, other classic end-of-life scenarios have been investigated and quantified with a life cycle analysis approach.

- In terms of climate change impact, having no action (4% recycled and 96% improperly managed*) or collecting 100% of the sachets to landfill them in sanitary sites have similar impacts.
- Incineration without energy recovery does not seem to be a beneficial option, in any scenario (at plant or on site).
- However, incineration with energy recovery reduces greatly the environmental impact of the end-of-life, even is undergone far from the collection site (at plant scenario).
- Scenarios consider that 100% of the waste generated is treated with the solution proposed. The realistic implementation of these scenarios is discussed later in the report.



* Data taken from What a Waste 2.0

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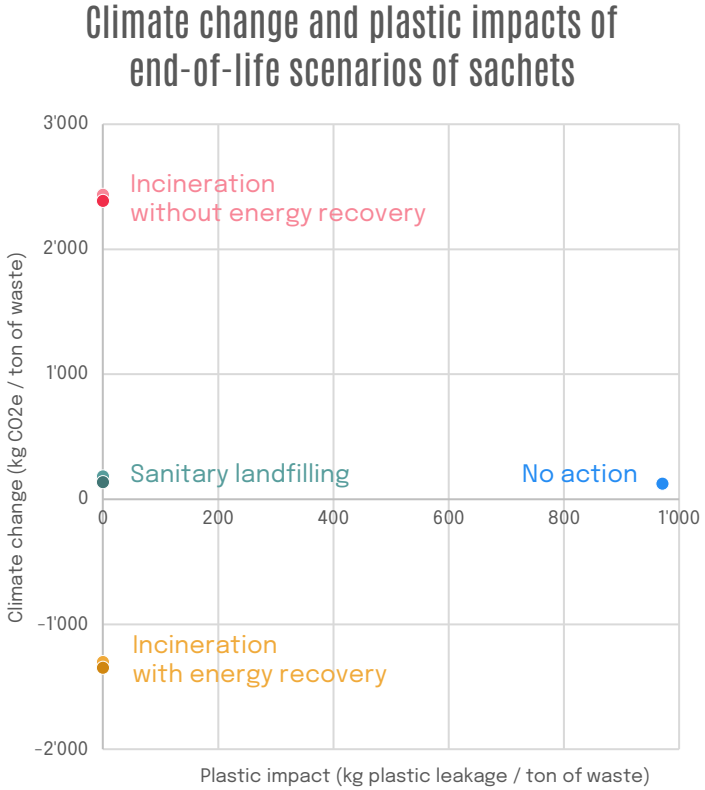
Other end-of-life options

The results regarding the impact on climate change are to be compared with the impact on plastic pollution.

- While the absence of action has a relatively low climate on change impact, its impact on plastic pollution is the highest.
- The option of incineration with energy recovery seems to be the most efficient option both in terms of plastic and climate impacts. This process could not realistically take place on site, but its implementation at plant seems to be worth it for its environmental benefits.
- The sanitary landfill scenario (both on site and at plant) is the most realistic impactful practice because it is more feasible and it could be undergone at low cost (in comparison to incineration with energy recovery).



Note: The darker dot represents the implementation of the solution on site while the lighter one its implementation at plant.

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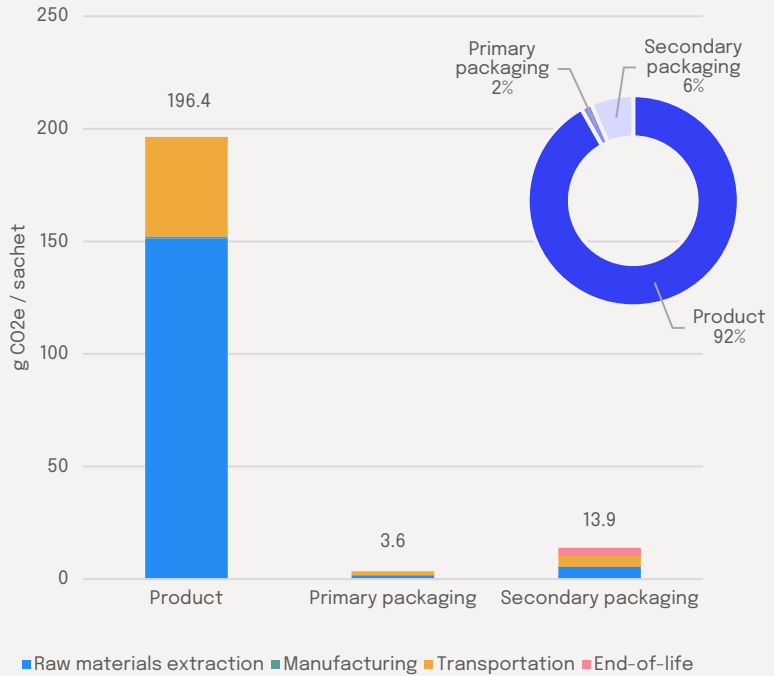
4. Bigger picture

Importance of Plumpy'Nut sachet in full life cycle of product

Full LCA of Plumpy'Nut

The full life cycle assessment (*i.e.* cradle-to-grave analysis of product) of Plumpy'nut is calculated to understand the contribution of the end-of-life of primary packaging (the sachet) in the total product impact.

- The major hotspot of the Plumpy'Nut product is the raw production of its ingredients (production of peanuts, oil, sugar,…), responsible for more than 70% of total impact.
- The impact of primary packaging represents only 2% of total product impact, with its end-of-life contributing to 0.1% of total impact.
- In regards to climate change impact, the reduction potentials in the product should be investigated.
- Only climate change impacts have been assessed for the total life cycle. Although end-of-life of primary packaging does not seem to be a hotspot for climate change, it surely is for plastic pollution, an action on the end-of-life thus remains relevant.



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5. Conclusions

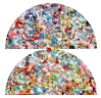
Main lessons and recommendations

Key takeaways

An assessment of the environmental impact of end-of-life options for the Plumpy'Nut sachet has been conducted as well as a full LCA of the Plumpy'Nut product, and the following conclusions can be made:

The current collection campaign conducted by Alima allowed to prevent more than 2 tons of plastic from leaking into the environment in 2022.

These collected sachets could be recycled, however the current amounts do not allow for a realistic process to be implemented. A systematic collection in Chad and Burkina Faso could however present a greater potential for recycling.



Although immediate recycling may not be feasible, other end-of-life options can help address both climate change and plastic pollution. The most promising solution is incineration with energy recovery, while the most feasible option is sanitary landfilling, either on-site or at the plant.

In a broader picture, the end-of-life of the sachet accounts for less than 1% of the climate change impact of the Plumpy'Nut product. While a good end-of-life the sachets greatly reduces plastic pollution, it is not a major hotspot for climate change action.

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APPENDICES

Recycling reduction potential

Concrete

- Potential benefits derived from: https://vedantaaluminium.com/blog/making-cement-green-fly-with-a-little-help-from-fly-ash/.

Bricks

- Plastic density considered to be the same as polyethylene: 0.9 g/cm^3
- Wall assumed to be 0.2 meters wide and 3 meters high.

Plastic

- A loss of 20% during the recycling process is considered (based on Ecoinvent modelling of recycling activities).

Sachets end-of-life

General comments

- Calculation uses the methodology of the circular footprint formula as defined by the European commission.
- Material specific treatments are considered for PET and PE while generic end-of-life factors are considered for the aluminium and ink content of the sachets.

Transport

- The No action scenario considers a transport from user to waste management facility of 20km by truck.
- The other scenarios consider no transport for *on site* alternatives and a transport of 200km by truck for *at plant* alternatives (simulating a plant in the capital).

No action

- The *No action* scenario considers the average practice in Burkina Faso, as in the What a Waste 2.0 database.
- Recycling assumed to be the production of plastic pellets.
- Landfilling assumed to be in open dumps with dry infiltration environments.

Energy recovery

- Efficiency of the energy recovery process is taken from European numbers as data is lacking on efficiency rates in Africa sites.

Plumpy'Nut LCA

General

- Final allocation between product and packaging is made for manufacturing process and transport based on mass of parts.

Transport

- Transport from raw materials extraction to manufacturing site is assumed to be 5000km by boat origin is mixed, 1000km by truck if origin is in Europe, and 400km by truck if origin is in France.
- Logistics for Chad and Burkina Faso are assumed to be similar.

Materials

- Adhesive tape is modelled as 50% plastic film and 50% methyl acrylate.
- Vitamins mix is modelled with 100% ascorbic acid.

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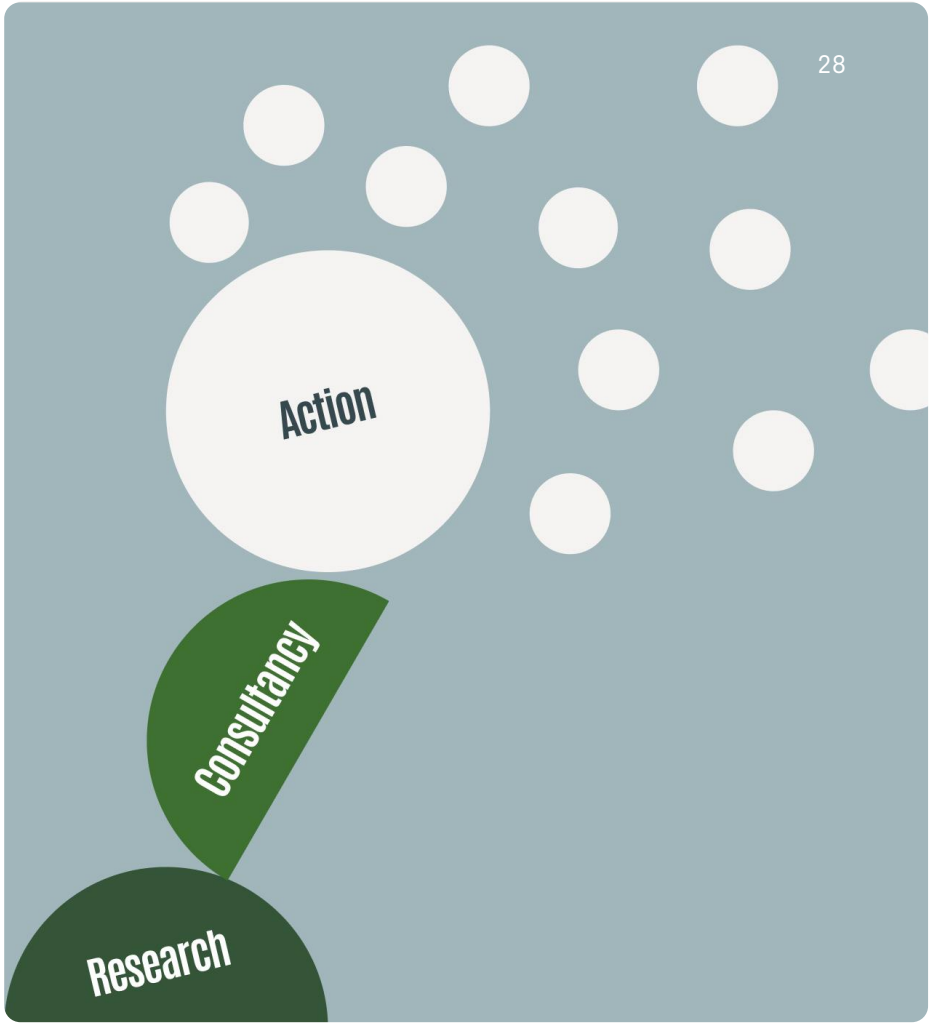
The first level, like the roots of a dandelion, is robust research, providing the foundation that supports all other efforts. EA services, solutions and expertise can be understood as the stem, with direct support being provided to foster the growth and success of clients and partner organizations. With these anchors in place, EA is positioned to directly and indirectly disseminate research-based and practical initiatives and action to create a ripple effect of positive impact and necessary change.

EA's commitment to broader change is also firmly established in the organization's design where all profits generated in the for-profit side, EA Sàrl, are reinvested in the non-profit arm, the EA Association, to support scientific advancements, global partnerships and the design of research-based solutions to expand environmental responsibility and reign in humanity's impact on the planet.

Learn more



The EA difference

A team of 15 passionate and dedicated sustainability consultants based in Switzerland, driven to make a positive impact. Our diverse team combines expertise in various sustainability domains to provide comprehensive solutions for your business.

Our co-founders possess an impressive collective experience of nearly 20 years in the LCA (Life Cycle Assessment) and footprinting space. Renowned as leading experts in their field, their extensive knowledge and entrepreneurial spirit set the foundation for our success.

With a specific focus on plastic and climate, we have successfully completed numerous projects for the industry and international NGOs in recent years. Our references go across multiple industries and sectors, including but not limited to the automotive, consumer goods, luxury, energy, agriculture, and construction industries.

Our approach extends beyond individual projects. We believe in promoting collaboration and fostering a federative, multisectoral mindset. By choosing our team, you gain access to a group of dedicated professionals who will work tirelessly to create impactful and sustainable change within your organization and beyond.

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