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Webinar 2

Environmental impacts of humanitarian organizations: how to reduce them with bio-based materials?

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Technical: Questions, slides, etc.

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During event

Video, microphone, recording

- Video and mics are open for participants
- Please unmute yourself and turn on video when speaking
- This meeting is recorded and livestreamed
- Presentation and recording will be made public

Questions

- Ask anytime in chat
- Q&A will be live following questions in chat and asked live

After event

Presentation

- Recording will be shared on website https://bio4human.eu/
  - All registered will be notified via e-mail

Staying informed

- Visit Bio4HUMAN social media channels
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Webinaire Sommaire

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1. Introduction to the European Bio4HUMAN project
2. The challenge and possible solutions
3. End-of-life treatment solutions
4. Comparative analysis
5. Conclusions and Q&A

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Some questions...

- What is a bio-based material?

Biobased materials

Fossil materials

- Who has ever used a bio-based product?
  - Why did you choose this solution?
  - What were the challenges?
- What would be for you the advantages/disadvantages of a bio-based product (compared to a petroleum-based product)?

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- Project Name: Identifying bio-based solutions for waste management applicable to the humanitarian sector
- Horizon Europe, Cluster 6, CSA
- Duration: 30M (Start: 1 Jan 2024; End: 30 June 2026)
- 10 partners: multi-stakeholder approach
- 9 Work packages

GOAL = Reduce waste in humanitarian aid sector, using bio-based solutions

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People in Need

AIMPLAS PLASTICS TECHNOLOGY CENTRE

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IRISH BIOECONOMY FOUNDATION Growing Ireland's Bioeconomy Together

BIO EAST HUB EN

pah Polska Akcja Humanitarna

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Objectives

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Assess the scope to which bio-based innovative technological solutions and bio-based systems have the potential to be applied under the humanitarian context

Define and catalogue needs of the humanitarian sector in SWM

Assess the scope of available different bio-based innovative technological solutions and systems

Life Cycle Assessments of identified solutions

Conduct environmental LCAs of different bio-based innovative technological solutions

Map the process of LCA methodologies identification in the context of waste management solutions for humanitarian aid

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Objectives

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Socio-economic and governance aspects & Replication potential of identified solutions

Evaluate socio-economic and governance aspects of bio-based solutions identified

Conduct feasibility study for theoretically proposed solutions in 2 African countries

Development of guidelines and recommendations

Develop a set of guidelines and recommendations for policymakers, bio-based sector actors, humanitarian aid practitioners, and the scientific community

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Challenges and possible solutions

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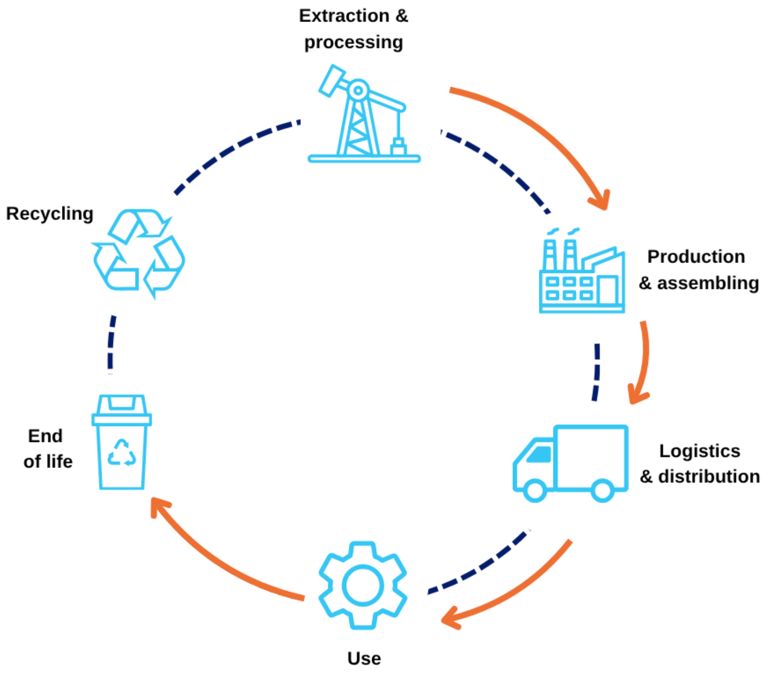
Definition of **Life Cycle Assessment**:

- Standardized assessment method (ISO 14040 et 14044) of environmental impacts, based on multi-criteria and a multi-stage analysis over the entire life cycle.

GOAL: to know and be able to compare the environmental impacts of a system throughout its life cycle



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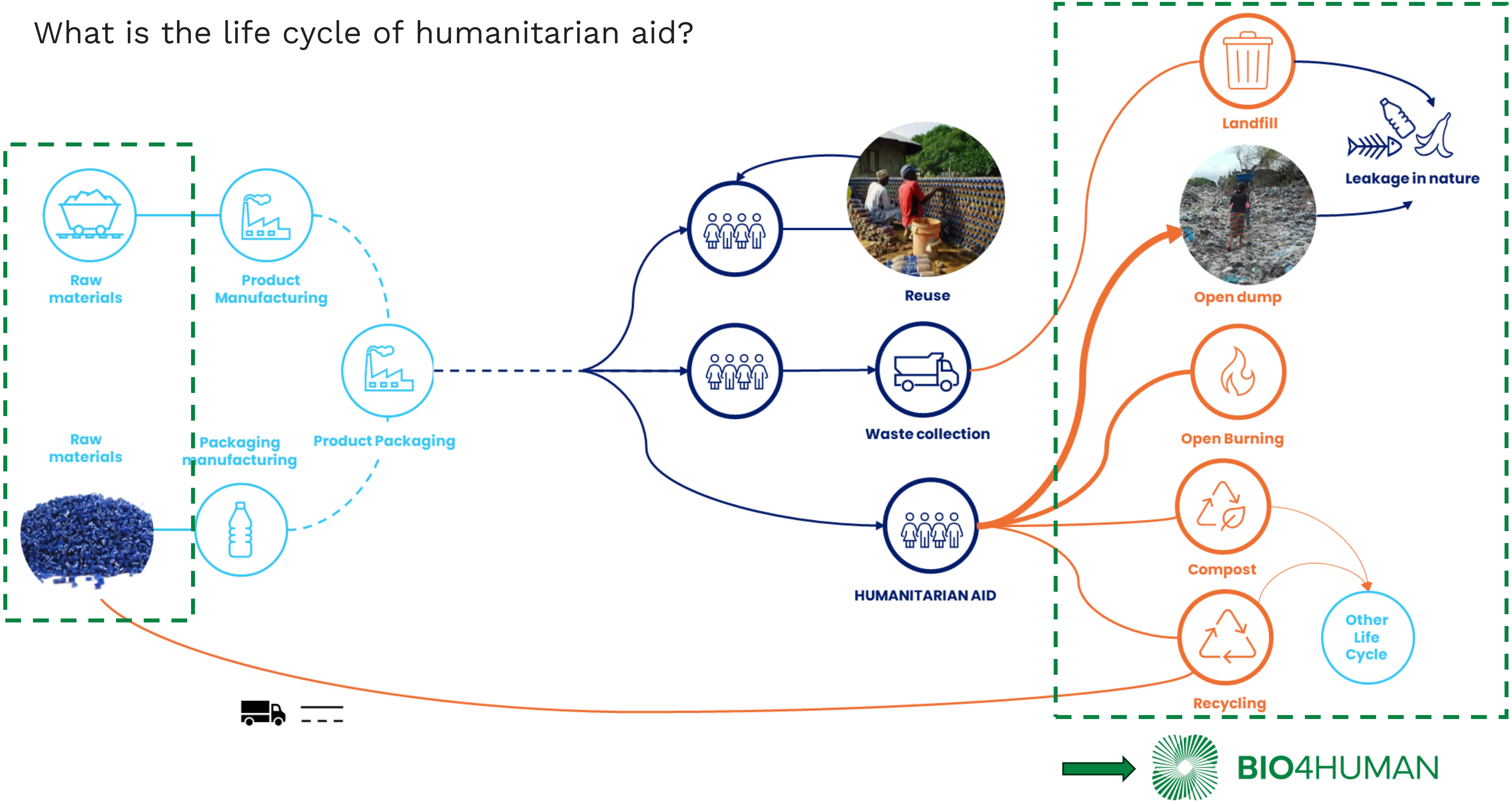
Challenges and possible solutions

What is the life cycle of humanitarian aid?



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The challenge – open dump

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Poor management:

Endangerment of people and the ecosystem

Waste dispersal in nature - > disease dispersal and environmental Destruction

BIO4HUMAN has identified solutions for improved management of organic and biodegradable waste

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Possible avenues – organic waste treatment solutions

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- 2 solutions to optimise the management of biodegradable organic waste:

  - **Bioconversion by black soldier fly (BSF) larvae**
    - ➢ Animal feed production (rich in protein and fat)
    - ➢ Fertilizer production

  - **Anaerobic digestion**
    - ➢ Biogas production
    - ➢ Fertilizer production

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what is BSF ?

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- >14 days of digestion of organic waste (food)
- Reduction of waste volume by 50-80%
- Requires a warm environment(24-30°C, with a stable climate and constant humidity 60%RH)
- Facilities on the African continent are already in operation

→ Production of **animal feed (dried larvae)** and digestate, which can be used as **fertilisers** (if rural areas and waste is hygienic)

More information on
https://prevent-waste.net/wpcontent/uploads/2025/06/FactSheet_BSF_2025-06.pdf

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BSF – its impact on the environment

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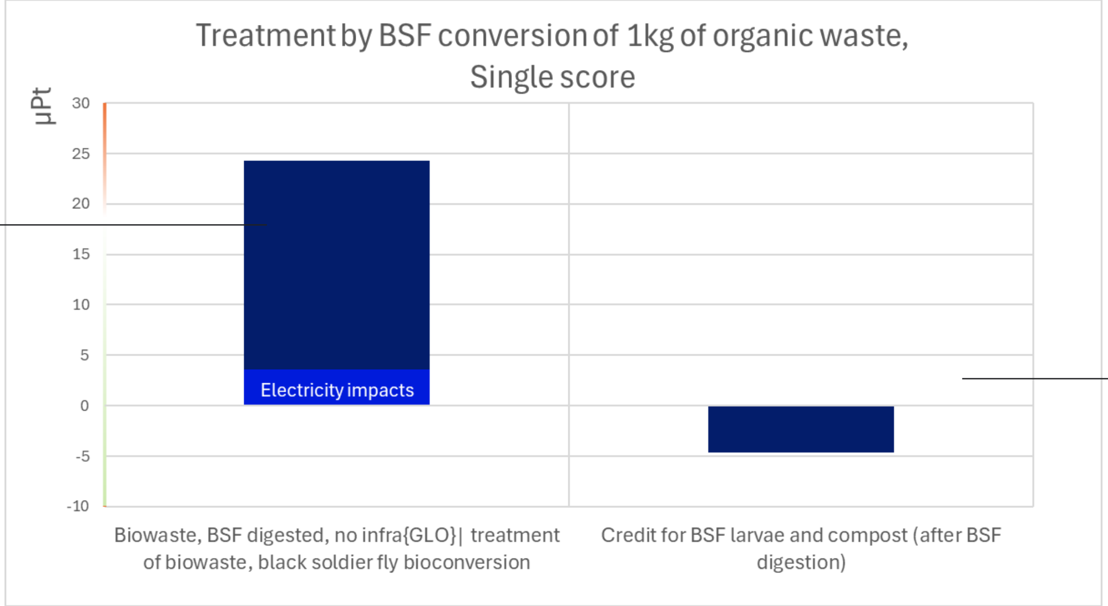
- Direct emissions (NH_3)
- Electricity consumption (avoidable if manual crushing and natural drying of the larvae)



- Fertilizing properties
- Avoided animal feed production (soybean)

[Multi criteria sustainability assessment of biogas production in Kenya - ScienceDirect]

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What is Anaerobic Digestion?

How does it work?

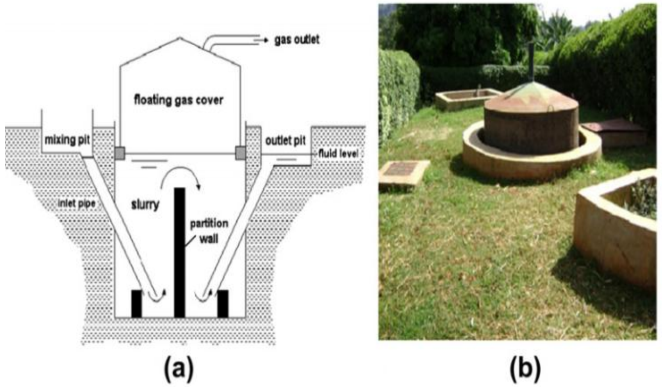

Fig. 1. Floating drum biogas digester: (a) general scheme and (b) typical plant in Kenya [30].

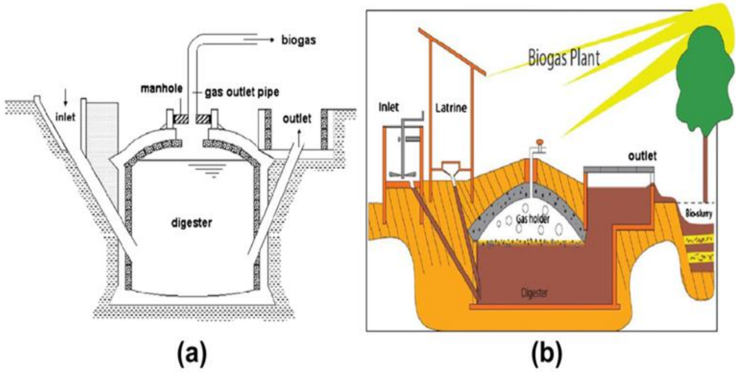

Fig. 2. Fixed dome biogas digester: (a) general scheme of a fixed dome biogas digester and (b) fixed dome digester with a coupled latrine [31].

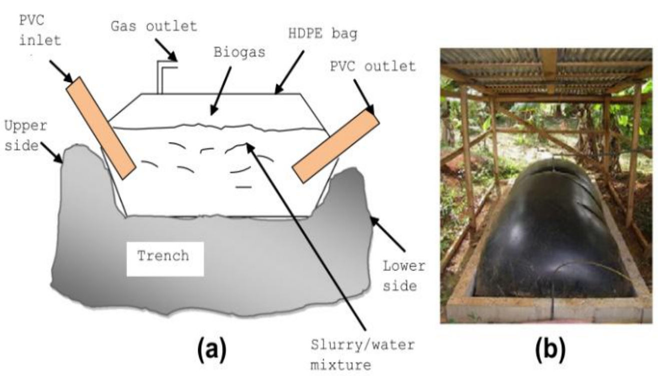

Fig. 3. Inflatable tubular digester (a) general scheme and (b) typical plant in Kenya.

Multi criteria sustainability assessment of biogas production in Kenya_ Nzila, 2012

Production of **biogas** and digestate, which can be used as **fertilisers** (if rural area and hygienic waste)

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What is Anaerobic Digestion?

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What technologies have been identified and studied?

Aspect	Modular micro-AD system	Single Stage Biogas Digester	Micro-biogas Digester	Domestic biogas technology
Type of digester	**Fixed, on the ground**	**Fixed dome**	**Fixed dome or portable**	**Floating drum**
Type of feedstock	**High lignocellulose agricultural crops (straw bagasse, wheat&rape)**	**All kinds of organic waste**	**All kinds of organic waste**	**Fibrous and non-fibrous organic (e.g., animal manure, food waste)**
Cost	**Medium to high**	**Low**	**Very low**	**Low to medium**
Operating conditions	**No additional heating**; 60-90 days	**45-55ºC**; 15-25 days	**20-40ºC**; 20-25 days	**35-55ºC**; 20-30 days
Construction materials/spare parts	Modular **bought**, 2 weeks installation	**Locally sourced** (stones, cement, wood, iron rods, PVC, copper pipes)	**DIY concrete** (2 mixers), 3 days; Portable: plastic	**Brick, concrete, with 2.5mm steel sheets** on the sides and the top
Labour construction	About 11 people	1 supervisor, 2 workers (18-62 days construction)	10-15 volunteers (construction); Portable: 1 person, 2 days	1 supervisor, 2 workers (18-62 days)
Biogas upgrading	**Optional add-ons**: -Biogas treatment pods to clean and dry raw biogas. - Biogas storage - Biomethane upgrade for bioCNG. - Combined heat and power biogas generator (CHP). - Biogas boilers - Control system with remote access - The Qube app	**combined heat and power (CHP) generator**	**Cooking and heating**	**Combined heat and power (CHP)** generator if biogas upgrading unit attached
Context	Tested in Delhi (India); Qube Renewables website	Divagri.org; the information is based on case studies from Uganda, Egypt, Kenya	Tested in Sweden and Egypt	The information is based on case studies from Kenya, Egypt, Italy

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Anaerobic digestion – its impact on the environment

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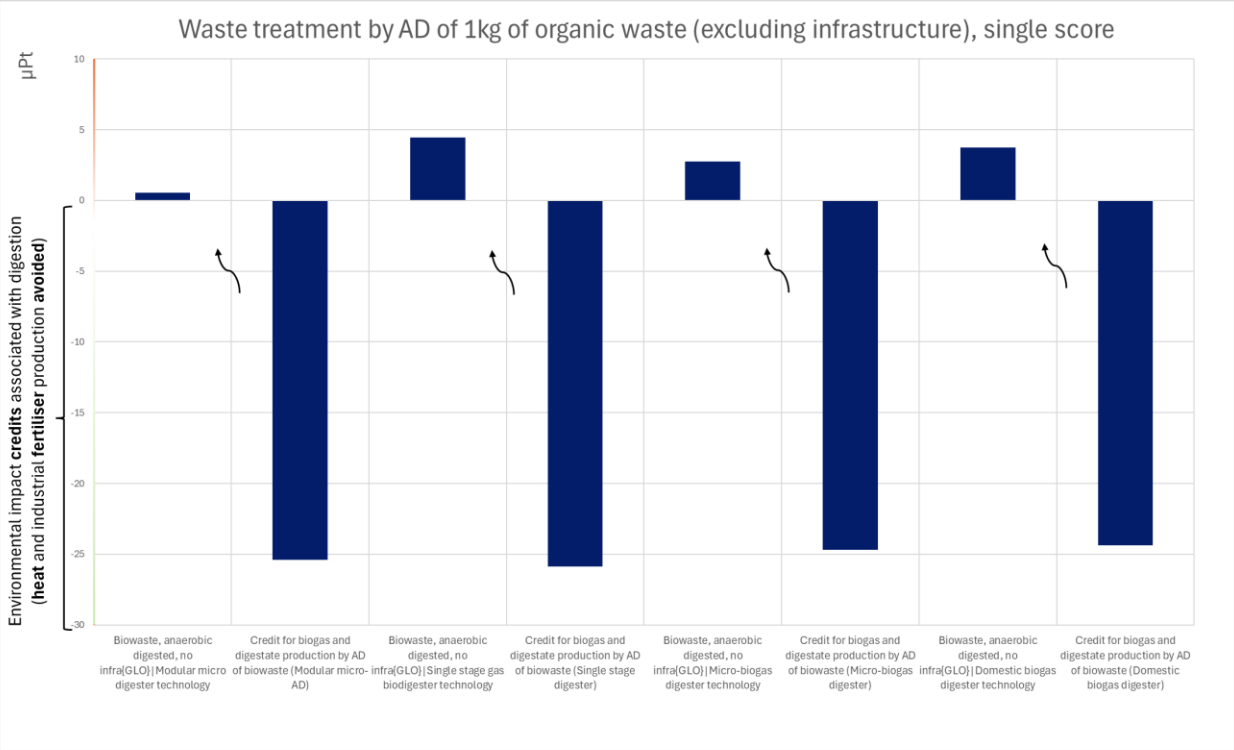
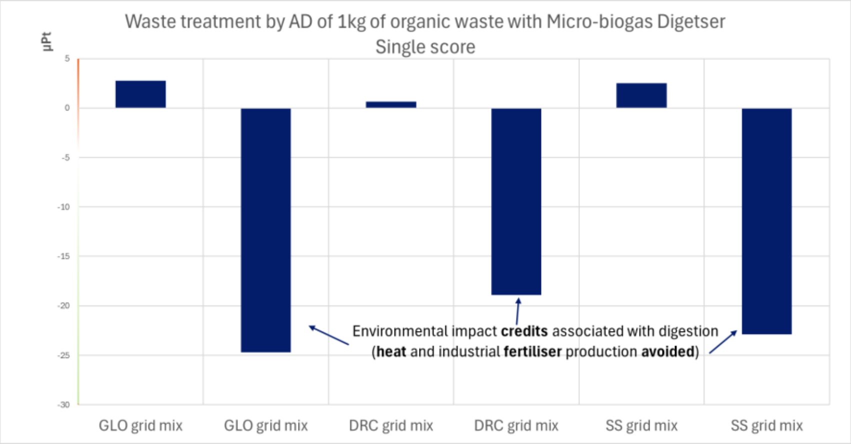


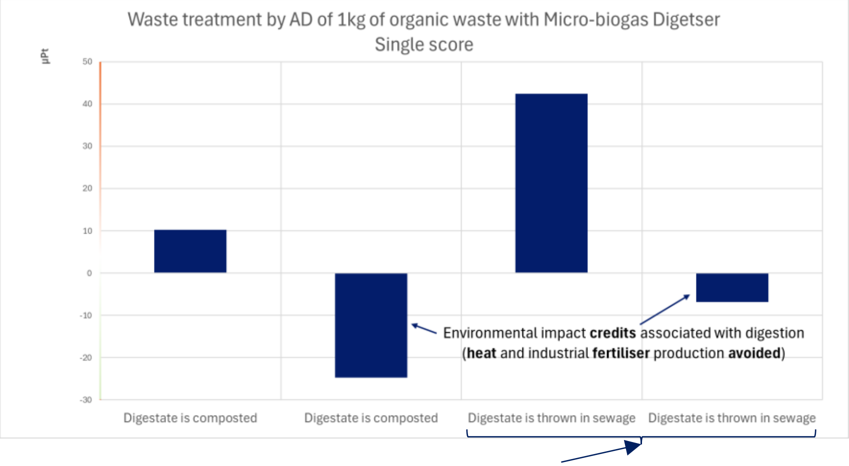
- ➢ Environmental impacts from **energy consumption** and **compost** (methane emissions)
- ➢ Impact credits (avoided heat production and industrial fertilisers)

Sensitivity analyses

- Processing location



- Rural or urban areas, hygienic or unhygienic waste



In urban areas or when waste is unhygienic, it is thrown down the drain

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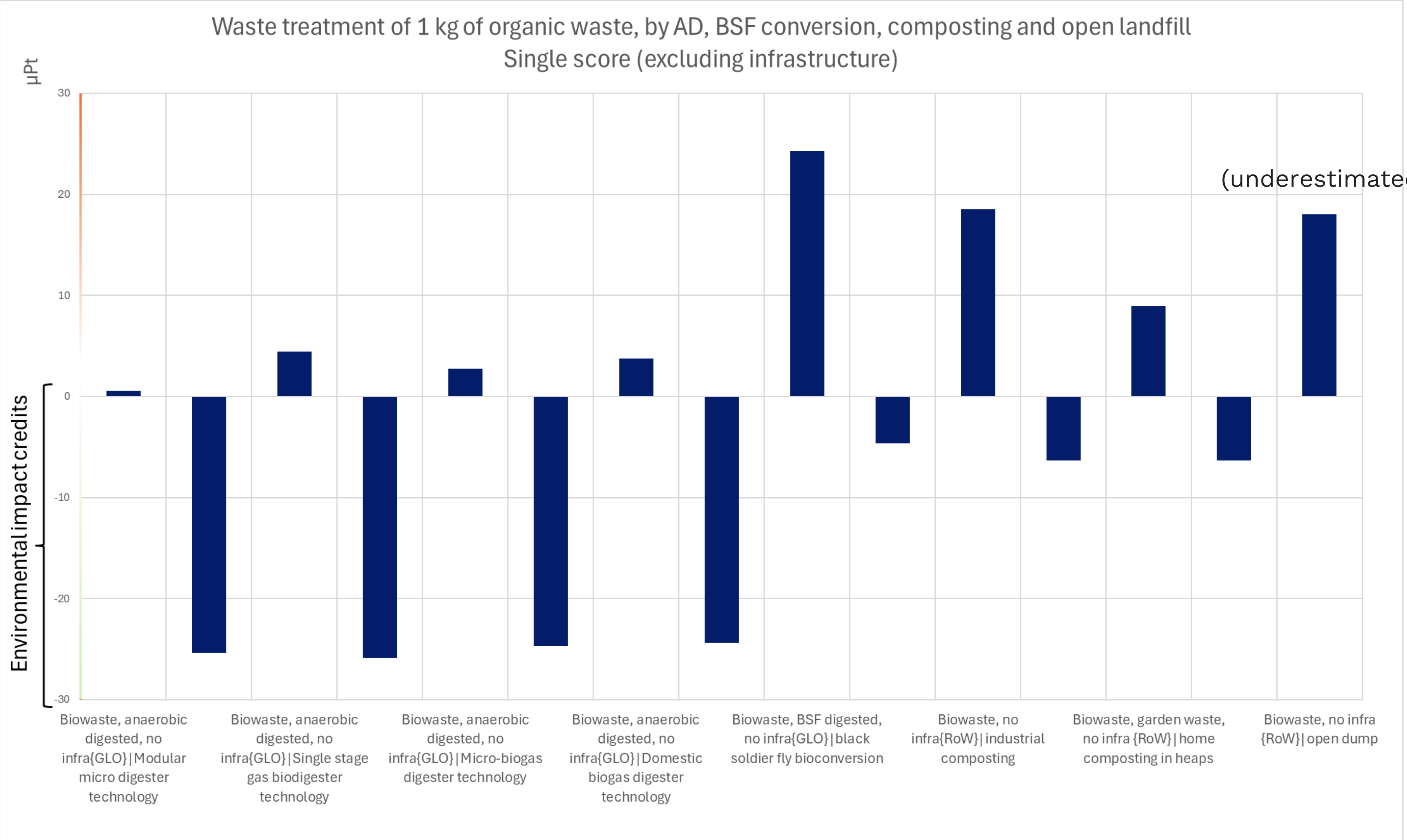
Comparative analysis



(underestimated)

- The impacts of identified treatment solutions are lower or equivalent to those of open landfilling
- The solutions each have benefits/credits

→ Environmental benefits
→ Economical benefits
→ Solution for : Biodegradable organic waste and plastic management

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How to reduce composting impact on climate change?

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Impact reduction measures	Why ?	Sources
Regular ventilation (turnover, correct humidity)	Humidity must be controlled (40–60%) and **oxygen** must be available throughout the compost (**aerobic**) → **prevents CH_4-producing** activity.	MDPI Live to Plant
Addition of structuring materials: alternating dry and wet waste	Straw, wood chips, sawdust, fibrous materials improve porosity and air circulation in the pile (**aerobic**)	MDPI
Addition of biochar (vegetable charcoal)	Biochar improves **aeration** + **compost structure**, and promotes conditions less favourable to methanogens (CH_4-producing bacteria), and methanotroph-friendly (**CH_4-consuming bacteria**).	EurekAlert! PMC

Some chemicals adapt pH or inhibit methanogens. Adjusting the C/N ratio can also be beneficial, but it must not be forgotten to account for the production impact of these chemicals.

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Conclusions

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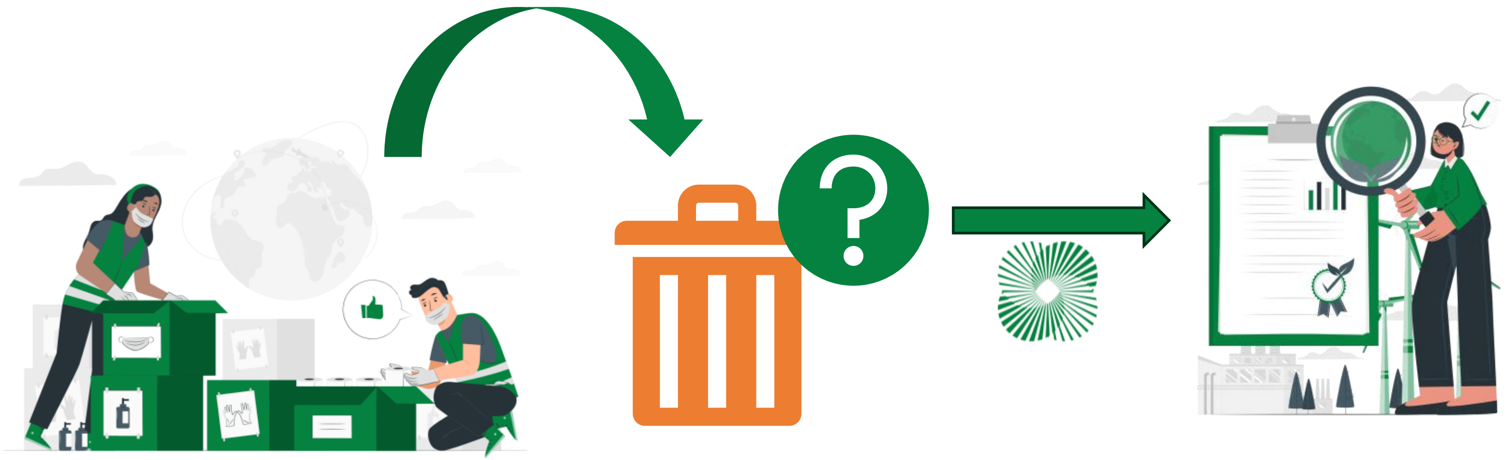

End of life = the main source of environmental impacts throughout the life cycle of humanitarian aid.

Bio-based and biodegradable solutions end-of-life can be managed by:

- → **Compost** (Industrial and household)
- → **Anaerobic digestion**(producing biogas)
- → **Black Soldier Fly** (BSF) **conversion**

Always preferable to the current end-of-life scenario (landfill and incineration), each with its advantages and disadvantages.

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Thank you!

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