EPFL EssentialTech Centre | ICRC | Climate Action Accelerator | LEURE

Public webinar

Reducing the impact of procurement: **Results from lifecycle analyses** of key items of the humanitarian sector

Part 1

Thursday 5 June 2025 | 10:30-12:30 CET

Practical information

PROGRAMME

10:30 | Welcome & Introduction
10:40 | **Presentation of 3 LCA results**
11:10 | Q&A session
11:30 | **Presentation of 3 LCA results**
12:00 | Q&A session
12:25 | Final remarks
12:30 | End

- This webinar is **recorded** and will be made available on **replay** on our website and YouTube channel.
- **Your audio and video is off by default.**
- To ask a question, please **write in the Q&A** section. The moderator will read out questions during the Q&A sessions.
- **Translation** to French is available via Zoom.

Link to webinar page: climateactionaccelerator.org/events_and_webinars/

Translation

How to activate subtitles on Zoom ?

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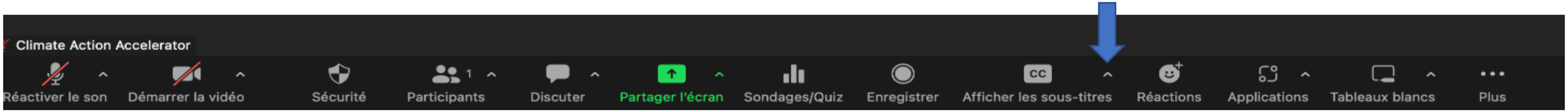


2) Select the spoken language and the language you want to translate into.

Who we are

The **Climate Action Accelerator** is a non-profit initiative based in Geneva that aims to mobilise a critical mass of high-social trust organisations around the world to scale up implementation of climate solutions within planetary boundaries, keep global warming well below 2°C and avoid the risk of dangerous drift.

The goal is to help move the aid, health and higher education sectors towards greater resilience and a radical transformation of their practices, pursuing emission reduction targets (-50% by 2030) and a 'net zero' trajectory, in line with the Paris Agreement.

AID

HEALTH

HIGHER EDUCATION & RESEARCH

Our pillars

EMPOWER

Empower organisations to at least halve their emissions by 2030 and prepare for greater resilience through a hub of expertise and resources.

CHAMPION

Transform them into ambassadors of change within their networks, capable of influencing their peers.

COMMUNITY

Build a global community of action, sharing climate solutions as a universal common good, to scale up their deployment.

34 partners on board

Today's speakers

Ashima Rajput

Computer Engineer and Environmental Analyst at the EPFL Laboratory of Environment and Urban Economics (LEURE)

Carmen García Duro

Sustainable Supply Chains Alliance Project Manager at the International Committee of the Red Cross (ICRC)

Sonja Schmid

Head, Solutions Team at the Climate Action Accelerator (Moderator)

In a nutshell

Designing methodologies and performing life cycle analyses of high-impact items to build a GHG emission factor and environmental impact database adapted to the humanitarian sector with the goal of identifying key strategies to reduce environmental impacts.

Scope: Cradle-to-grave system boundary for the assessment of impact across the life cycle

EPFL EssentialTech Centre

ICRC

Climate Action Accelerator

LEURE

Scientific expertise

EPFL | EssentialTech Centre

Harnessing science and technology to drive sustainable development, support humanitarian action and foster peace.

LEURE

Laboratory of Environmental and Urban Economics – LEURE at EPFL conducts research on the public and private management of the natural and built environment.

Climate Action Accelerator

Dr. Damien Friot, CAA associate expert; EPFL lecturer

Analysed items

Webinar 5 June

- High-thermal blankets
- Mattresses
- Soap bars
- Plastic floor mats
- Foldable Jerrycans vs buckets
- Solar Lamps

Webinar 26 June

- Hygienic pads
- Face masks
- Coveralls
- RUTF
- Hygiene kits
- Mosquito nets

Introduction

Methodology

The results are calculated following the Environmental Footprint 3.1 indicator system in two categories:

- **Climate Change**: Global Warming Potential (GWP100)
- **Impact on Human Health**:
    - Human Toxicity: Carcinogenic and Non-carcinogenic
    - Ionising Radiation
    - Particulate Matter Formation
    - Photochemical Oxidant Formation
  - Weighted using the approach detailed in the EF methodology – with a percentage assigned to each sub indicator (see reference)
  - Normalized for one citizen so as to aggregate and represent as a single score for human health

Plastic leakage: Experimental projection of the amount of plastic leaked into nature via mismanagement of waste

References:
"European Platform on LCA | EPLCA.". https://eplca.jrc.ec.europa.eu/EnvironmentalFootprint.html
Joint Research Centre (European Commission), Alessandro Kim Cerutti, Rana Pant, and Serenella Sala. 2018. Development of a Weighting Approach for the Environmental Footprint. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/945290

End-of-life

This study aims to model the impact differences between various waste management methods tailored closer to humanitarian contexts. The following end-of-life options were modelled in the analysis, as appropriate:

- **Open dump** (unmanaged)
- **Open burning** (unmanaged)
- **Unsanitary landfill** (minimal management)
- **Sanitary landfill** (managed site)
- **Municipal incineration** (managed plant)
- **Recycling** (as modelled)

For plastics, the differences in measured impact between each end-of-life scenario are similar. (For more info on the impacts and sources of end-of-life impact measurement please see annex.)

According to the LCA methodology, the analysis of greenhouse gas (GHG) emissions (Global Warming Potential)—is limited to a 100-year timeframe. As a result, any additional impact from plastic degradation in landfills occurring beyond this period is neither measured nor compared to other waste disposal methods.

Plastic leakage

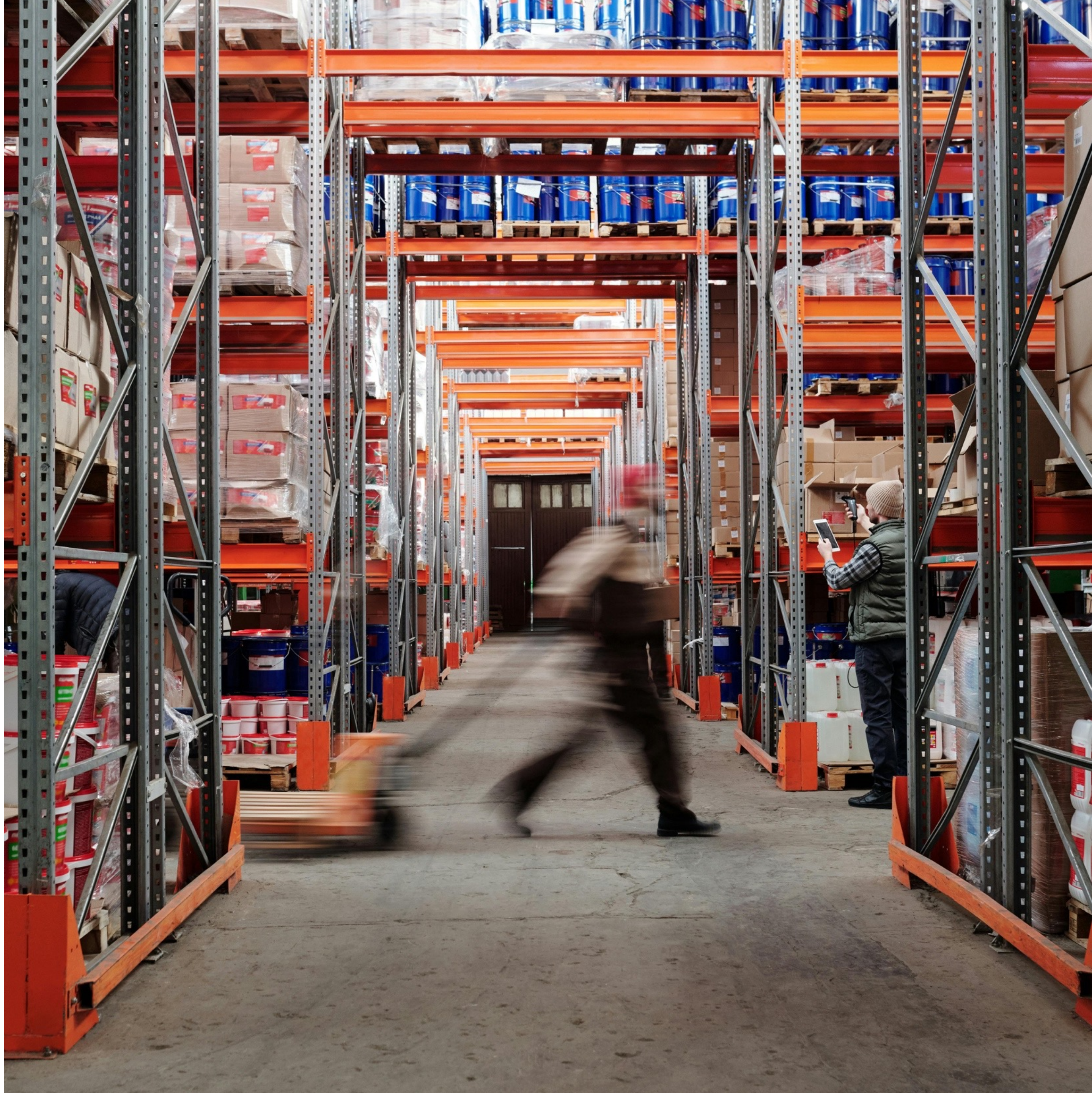
This project aims to estimate the mismanaged waste that may occur at the end of life of products distributed by humanitarian organisations.

The modelled scenarios are analysed for plastic leakage by selecting the waste management method that is modelled and calculating the projected leakage (or lack thereof) due to the same.

For more information, please refer to: "Global Plastic Environmental Analytics Platform." Plasteax. https://plasteax.earth/.

Source: EA – Earth Action

LCA Results Part I



Synthetic Blankets

Key Product Parameters & Assumptions

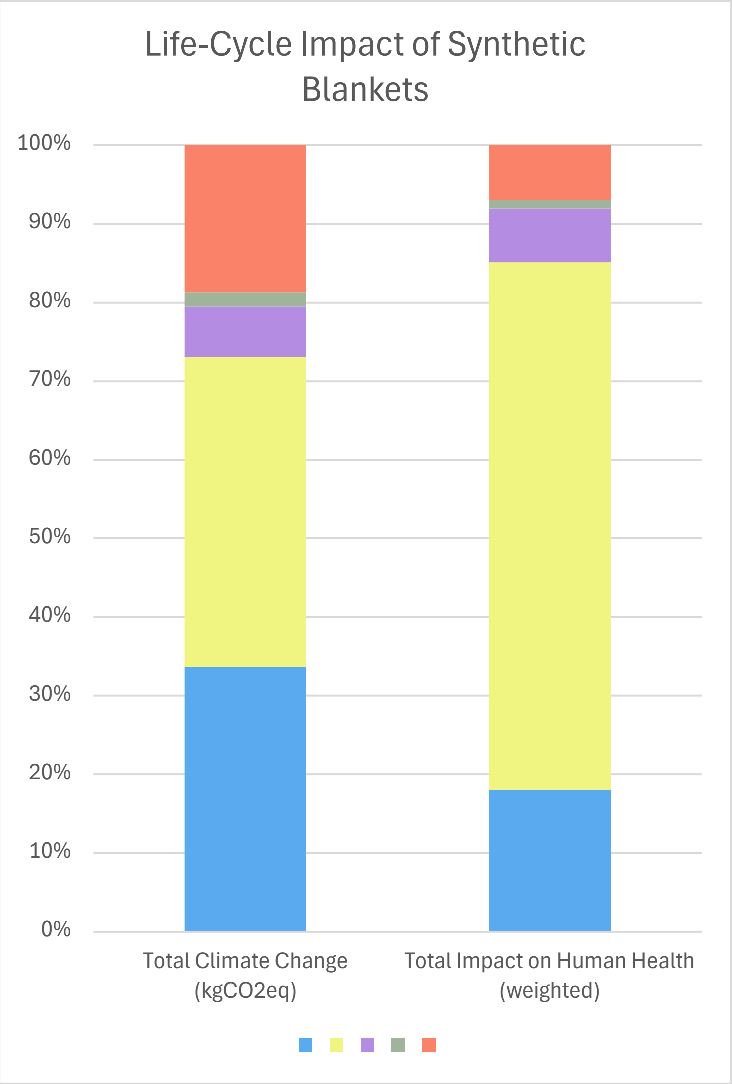
LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	The primary function is providing warmth but in humanitarian contexts it is known that people don't just use the blanket to sleep, they use it as shelter, clothing, etc and use it roughly and longer.
Raw Material	Bill of Materials	Virgin Polyester from PET granulate (2kg net weight)
	Packaging	LDPE Packaging Film (70g per blanket)
Production	Manufacturing Location	Panipat, India
	Manufacturing Processes	Polyester fibre production; fabric production; colouration & treatment, finishing laundry
Supply & Distribution	Transport Chain	TRUCK – SEA – TRUCK (to DC) TRUCK from DC to distribution
Use	Lifespan	5 years
	Usage Processes	Hand washed once a year
Waste Management	Product Disposal Method	Open burning in pits (100 km transport)
	Packaging Disposal Method	Open dumping (10 km transport transport)

Baseline Results

The production of the blanket, accounts for **40%** of the GHG emissions and is the main source of impacts on human health **(67%)**
Raw material is the second largest source of impact with **34%/18%** GHG Emissions/impact on human health respectively
Open burning at end-of-life accounts for **19%/7%** GHG Emissions/impact on human health respectively

- Plastic leakage
  - For the product, leakage is avoided via incineration
  - The packaging is dumped/littered causing leakage for all scenarios

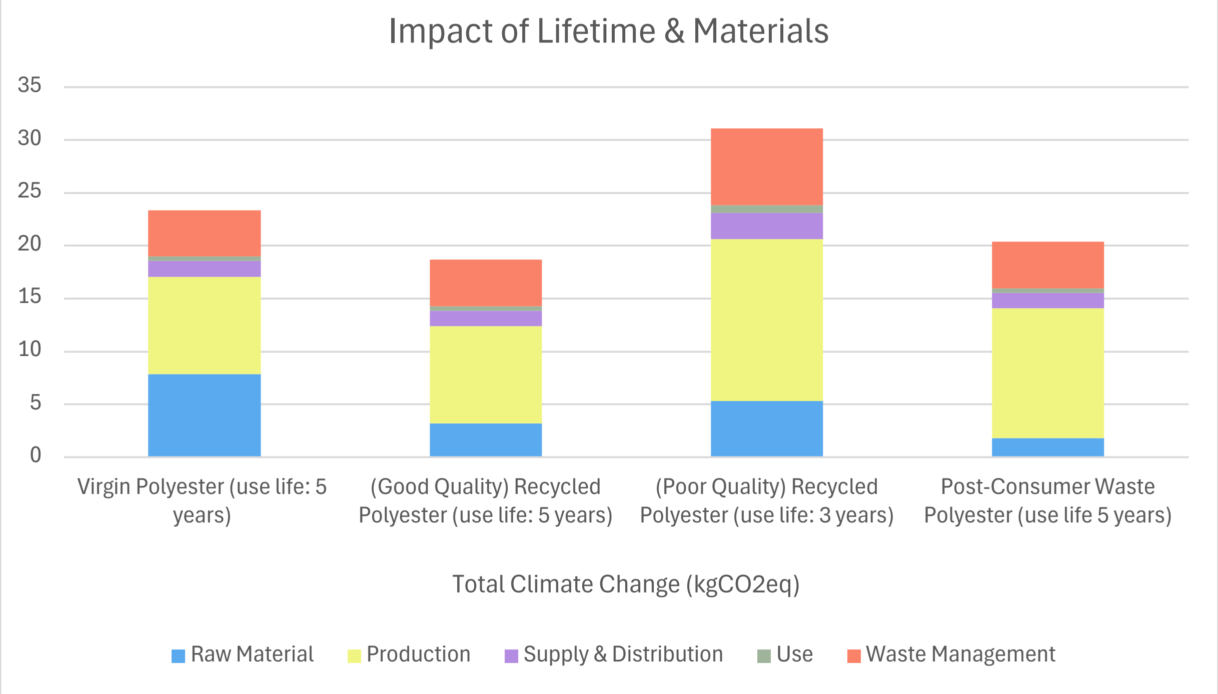
Emission factors		Unit
Cradle-to-grave	23.35	kgCO2eq/unit
Cradle-to-gate	17.07	kgCO2eq/unit

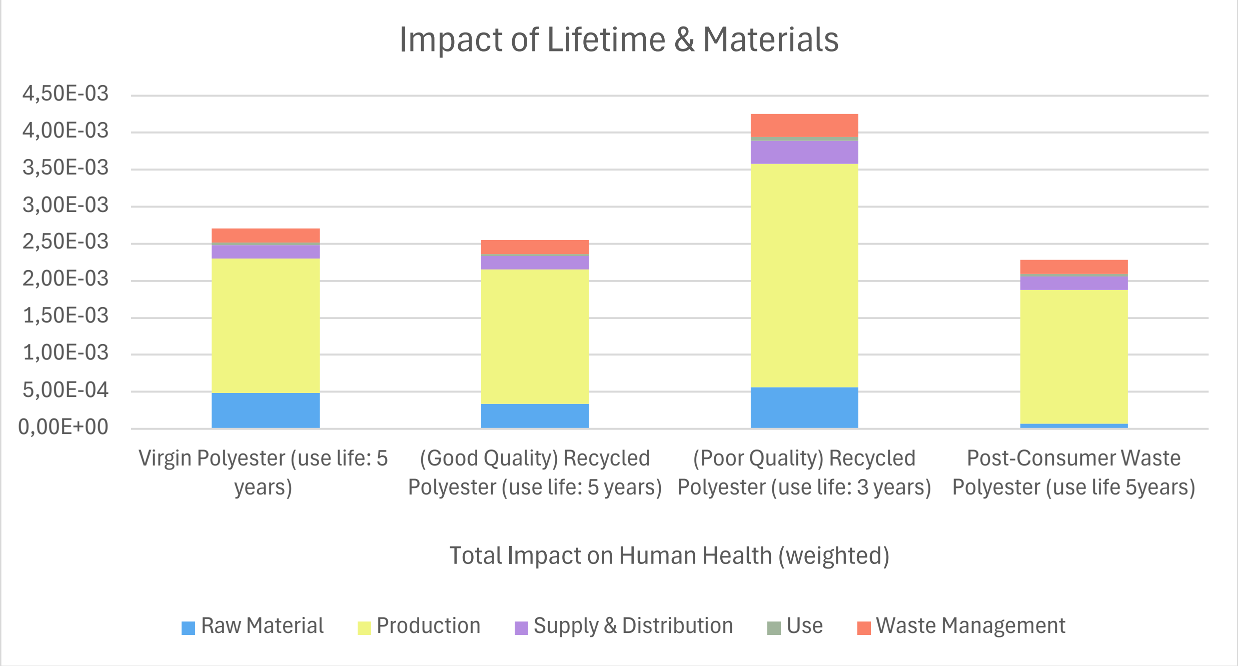


Variations per lifecycle stage

	Raw Material	Production	Use Life	Supply & Distribution	Waste Manageme nt
Baseline	Virgin Polyester	Regional energy mix	5 years, one hand wash per year	TRAIN-SEA-TRUCK	Open burning
	Good quality recycled Polyester	Solar Energy for Electricity + Heat	3 years, one hand wash per year	TRUCK-SEA-TRUCK	Sanitary Landfill
	Poor quality recycled Polyester	Solar Energy for Electricity, Natural Gas for Heat		TRUCK-AIR-TRUCK	Municipal Incineration
	Post-consumer Waste Polyester	Regional heat mix, Solar Energy for Electricity			
		Regional electricity mix, solar energy for heat			

Lifetime & Materials

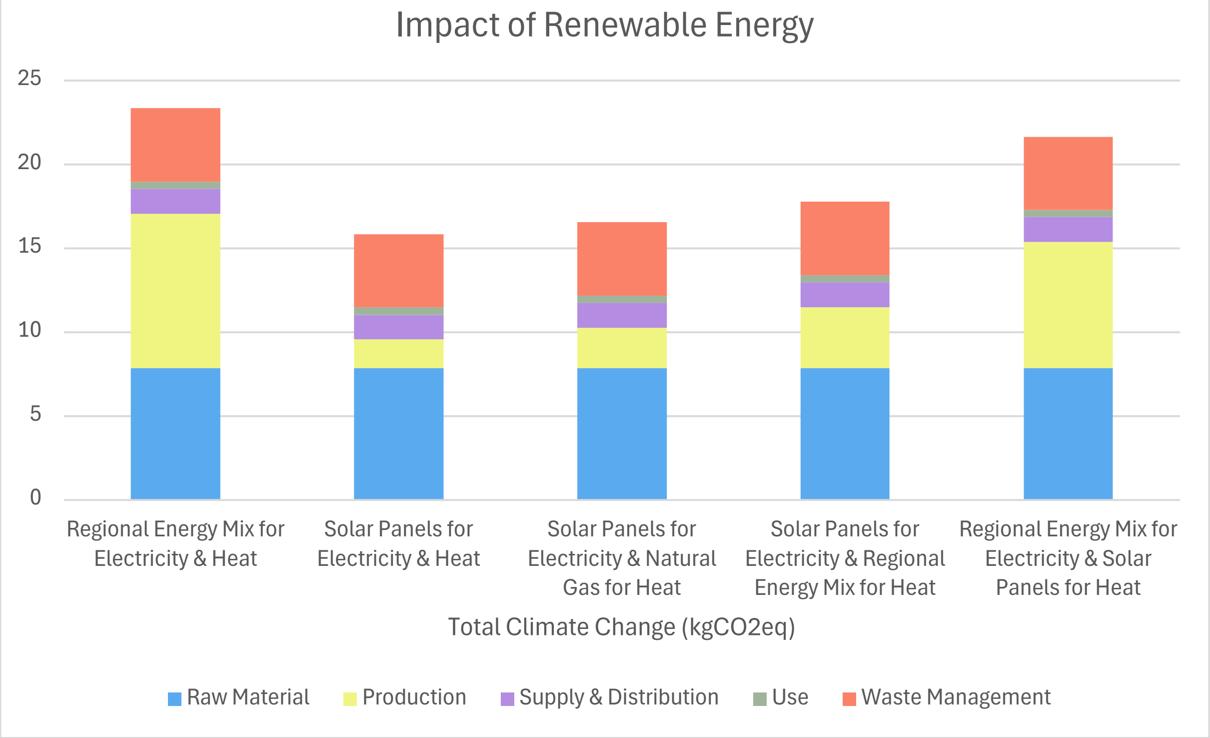


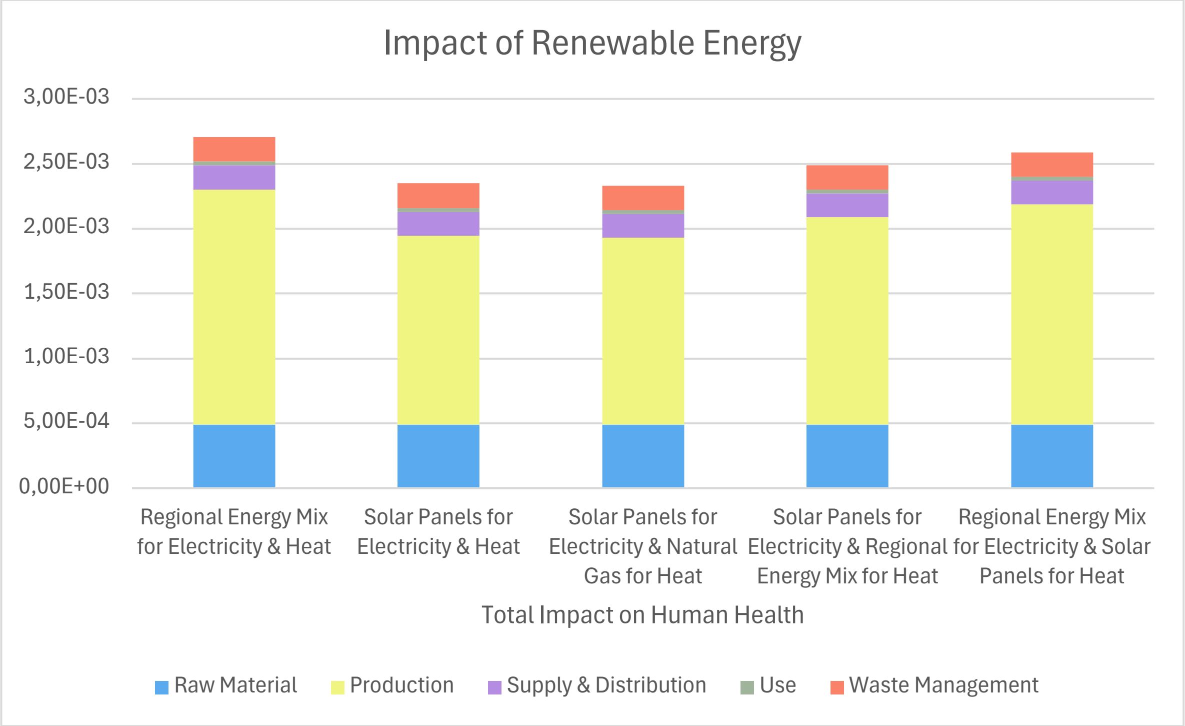


Lifetime and Materials

- Extending the lifetime of the product can lead to a significant reduction in environmental impact, which can be accomplished by improving product quality (by eco-design, etc.) and maintaining the product during the use phase.
- Using recycled PET instead of virgin PET to produce the polyester can reduce the impact of the raw material stage by 50% – however since the production phase is massively impactful, the overall reduction is approximately **20%** in climate change and **5%** impact on human health. However if the recycled PET compromises the lifespan of the blanket (e.g. 3 yrs lifetime instead of 5) the total impact can increase by **33%/57%** in climate change & human health respectively
- Using post-consumer waste textile reduces the impact of raw material stage by 75% -- however since it requires additional processes/yarn production, the overall reduction is lower than that of the good quality recycled PET polyester scenario: **13%/16%** reduction in climate change & human health respectively

Renewable Energy

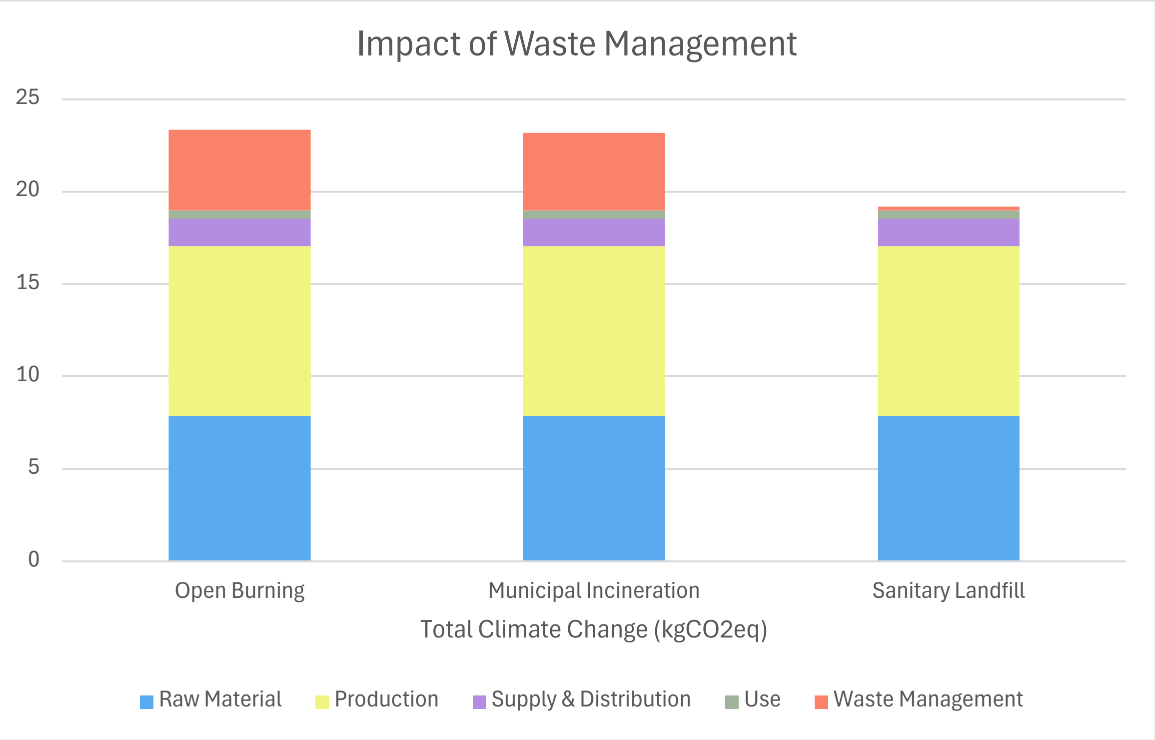


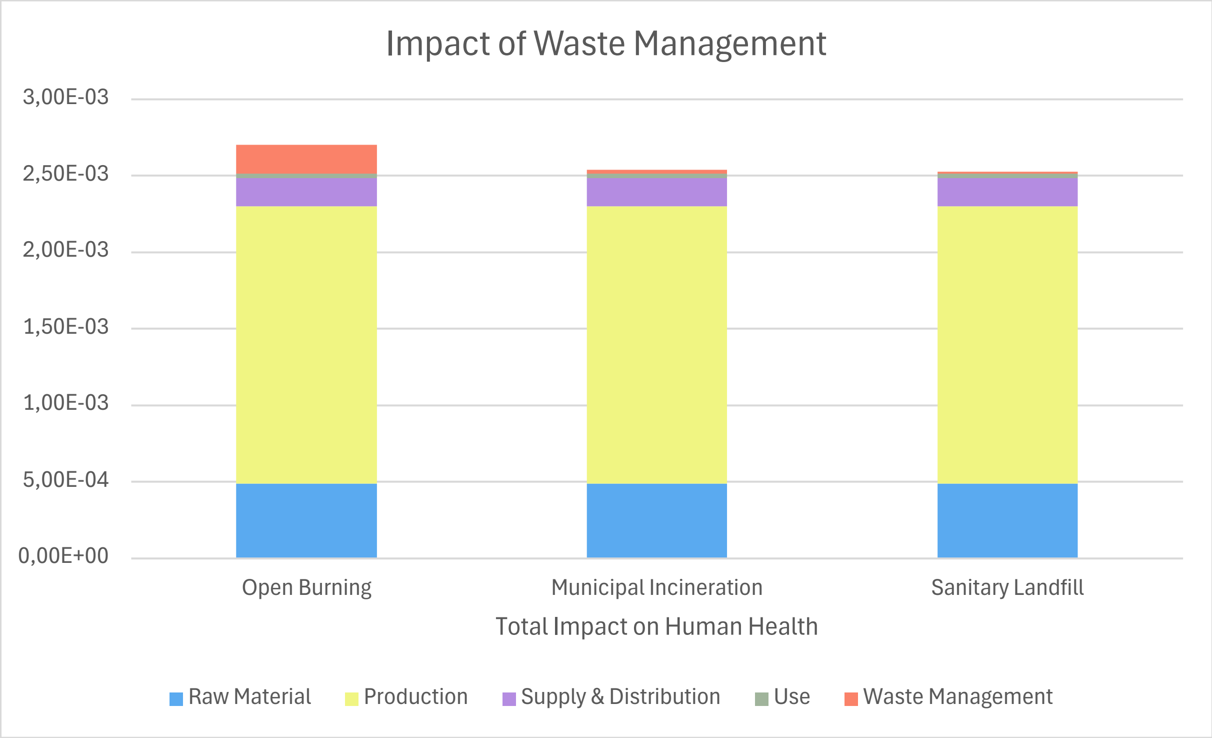


Energy for Production

- Switching the energy source used for electricity or heat during the production phase can significantly reduce environmental impacts—especially when fossil fuel–intensive sources are replaced with low-carbon alternatives.
- Producing blankets using solar power for **both electricity and heat** from an on-site photovoltaic (PV) installation, instead of the average Indian electricity mix (which consists of approximately 75% coal), reduces **32%** in GHG emissions and **13%** in human health impacts
- Using a mix of solar panels for electricity and natural gas for heat reduces **29%** in GHG emissions and **14%** in human health impacts
- Individually, replacing only electricity with solar power (and average heat production) shows **24%/8%** reduction in climate change & human health respectively, while replacing only heat production with solar power (with average grid electricity) shows **7%/4%** reduction in climate change & human health respectively

Waste Management





Waste Management

- Burning plastic waste in a municipal incineration plant rather than openly will not reduce GHG emissions but will reduce impacts on human health if the plant has the adequate filters.
- There is a small improvement when considering municipal incineration for climate change **(1%)** but larger for human health **(6%)**.
- A sanitary landfill achieves a greater reduction in climate change **(18%)** and has comparable reduction in human health to municipal incineration **(7%)**, making sanitary landfills the preferred waste management method within the scope of the LCA (see slide 6 for more information).

Key conclusions of comparative analysis

- The modelled scenarios show the following impact reductions (GHG emissions & impact on human health):
  - Virgin to good quality recycled PP: 20%/6%
  - Regional energy mix to solar energy for production: 32%/13%
  - Open burning to sanitary landfill: 18%/7%

Therefore, combining recycled polyester, renewable energy for electricity and heat at production phase, and landfill instead of open burning account for the impact reduction of the synthetic blanket as follows:

- 🔻70% climate change
- 🔻25% impact on human health

Plastic Mattresses

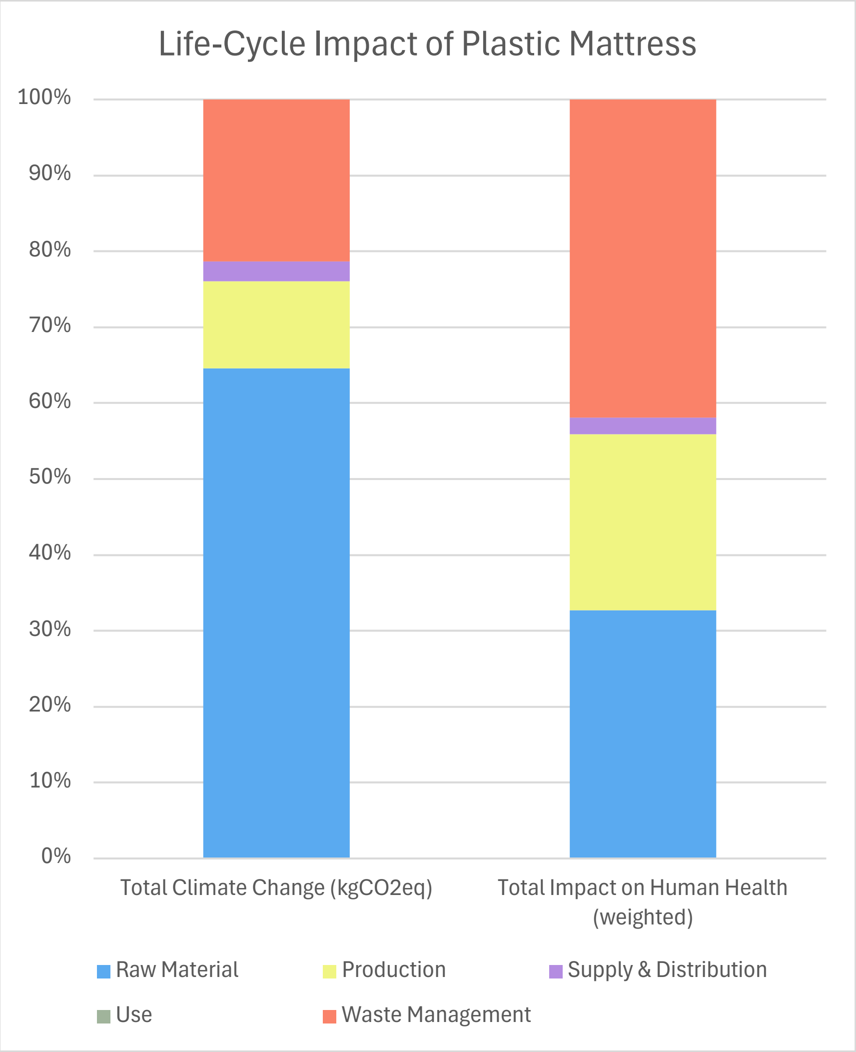
Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	The mattress studied is lighter than the mattresses known in Western contexts (~3 kg instead of the otherwise ~30kg, hence less than 10% of Western data models)
Raw Material	Bill of Materials	High density virgin polyurethane foam (2.80kg net weight)
	Packaging	Plastic, wood, steel and cardboard (total 400g net weight)
Production	Manufacturing Location	Local to Regional DCs in Africa
	Manufacturing Processes	Standard production
Supply & Distribution	Transport Chain	TRUCK Local material procurement TRUCK from DC to distribution site TRUCK Disposal transport for mattress, none for packaging
Use	Lifespan	10 years
	Usage Processes	Assumed to not be washed (field context of resource scarcity)
Waste Management	Product Disposal Method	Open burning
	Packaging Disposal Method	Open dumping

Baseline Results

- Considering a lifetime of 10 years, the raw material of the mattress accounts for **65%** of the total GHG Emissions and **33%** of the total impact on human health
- Waste management has a considerable impact on human health, accounting for **42%** of the total impact, which it is the second largest share of GHG emissions at **21%**
- Plastic leakage
  - For the product, leakage is avoided via incineration
  - The packaging is dumped/littered causing leakage for all scenarios

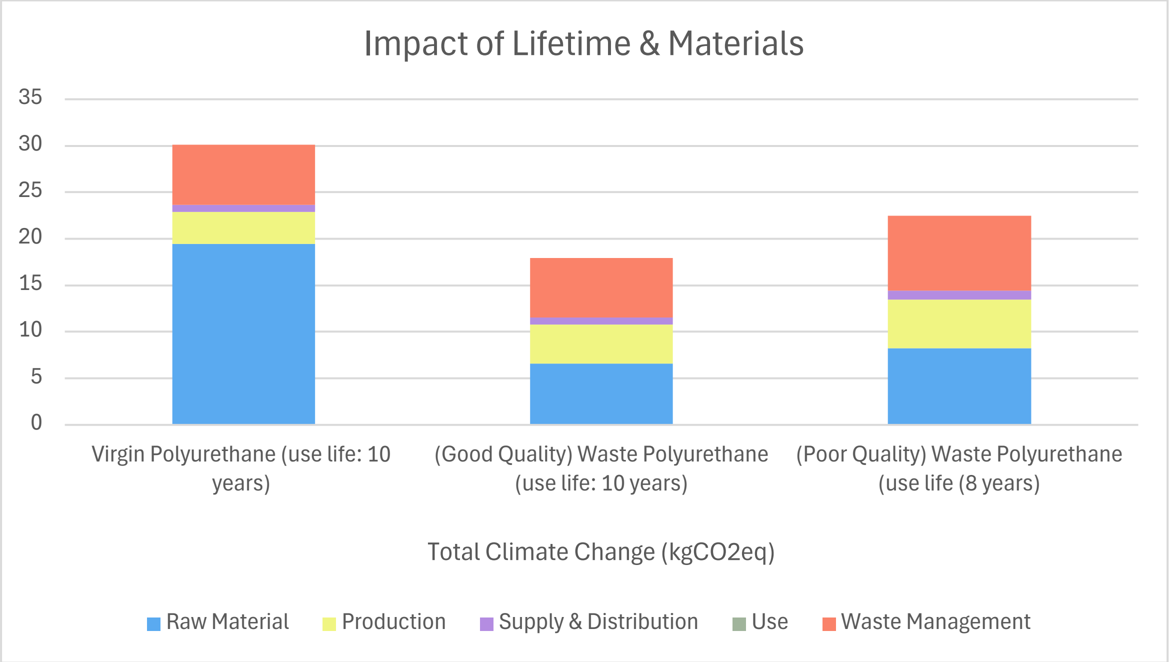
Emission factors		Unit
Cradle-to-grave	30.10	kgCO2eq/unit
Cradle-to-gate	22.88	kgCO2eq/unit

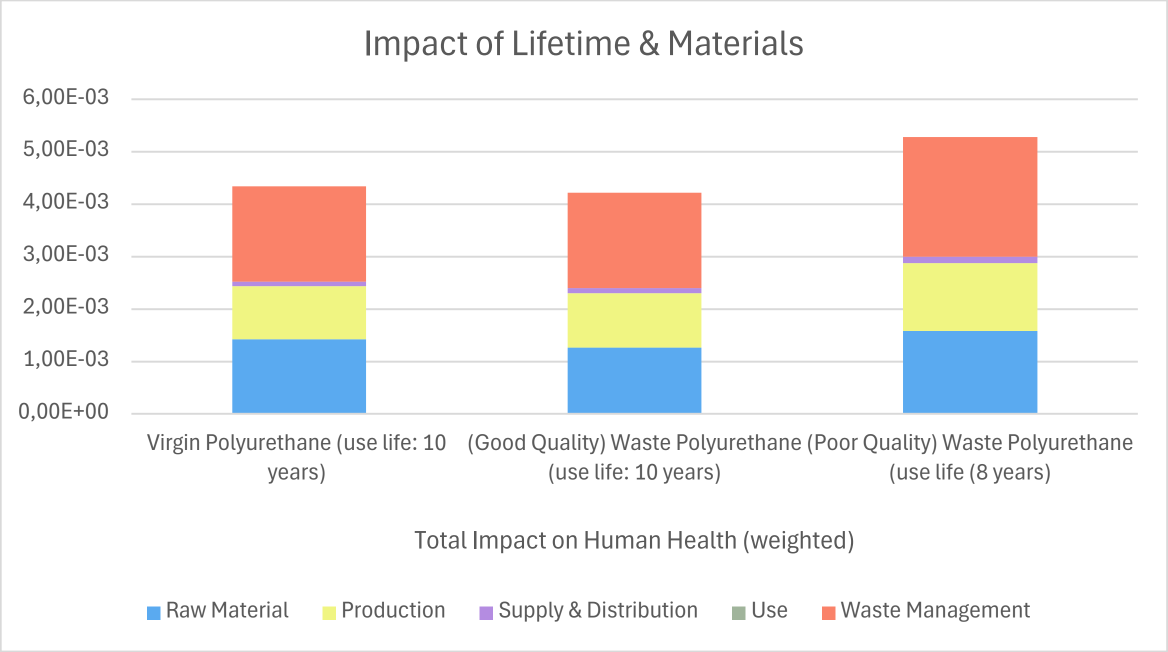


Variations per lifecycle stage

	Raw Material	Production	Use Life	Supply & Distribution	Waste Management
Baseline	Virgin PU	Average energy mix	10 years (virgin PU)	Local production and supply	Open burning
	Waste PU washed and reused	Electricity derived from solar panels	8 years (waste PU)		Sanitary Landfill
					Municipal Incineration

Lifetime & Materials

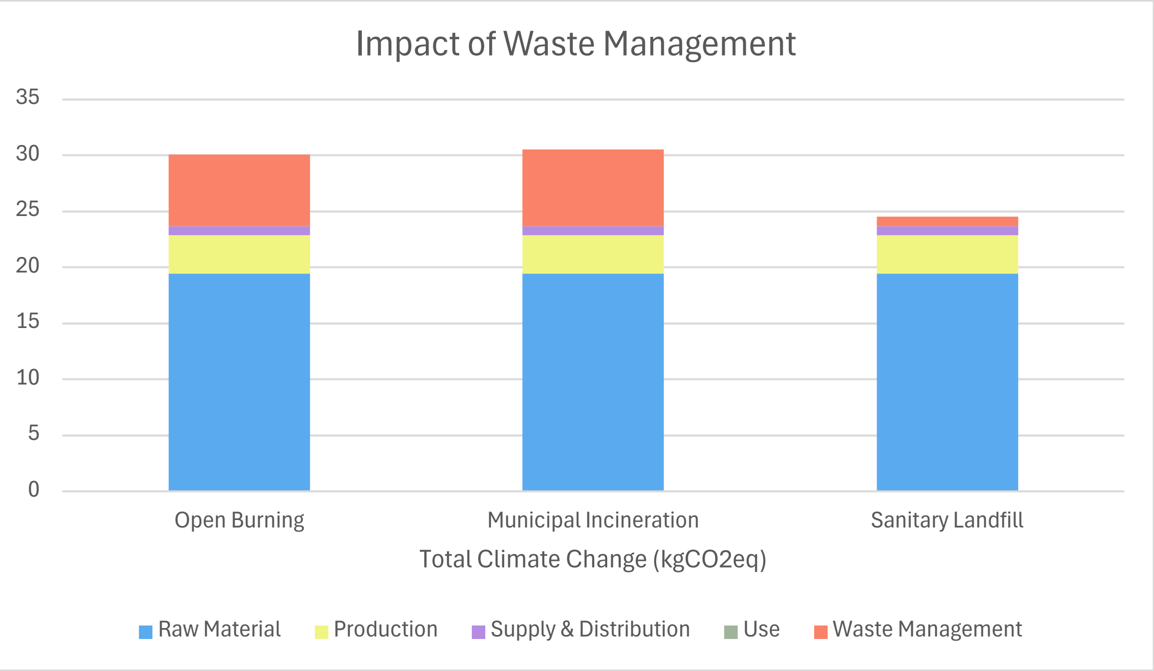


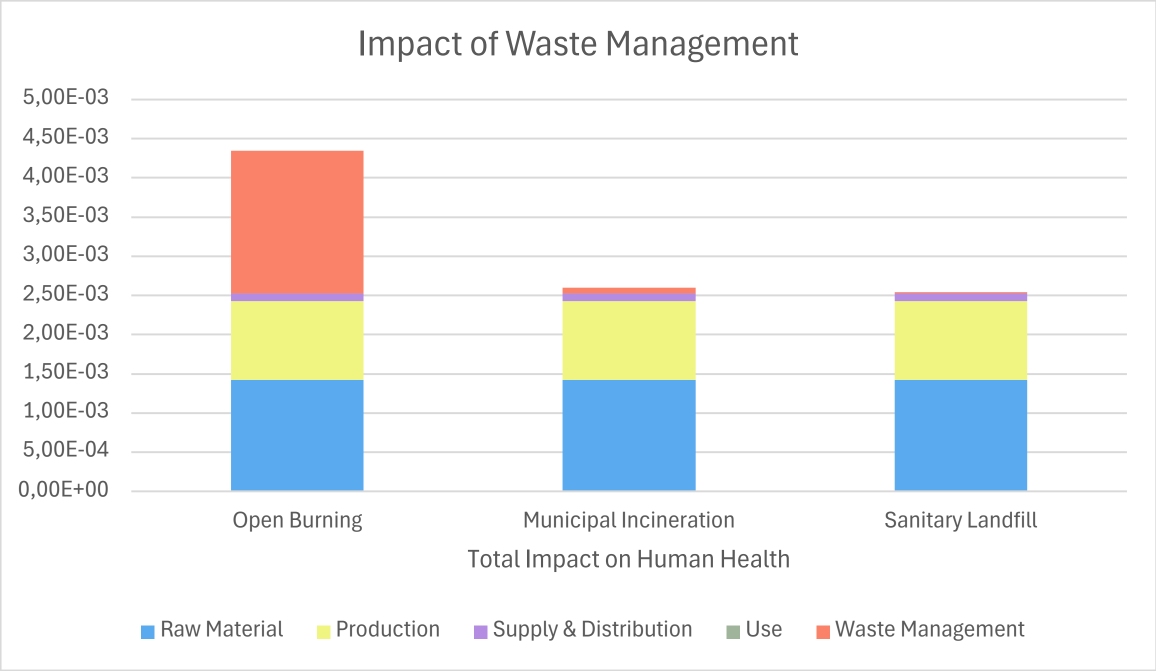


Lifetime and Materials

- This study models scenarios where waste polyurethane foam is used to replace virgin polyurethane foam for the manufacturing of the mattress. Changing this material reduces the GHG emissions at raw material stage by around 65%, but only reduces the impact of human health by around 11%
- The waste foam first needs to be washed/sanitized before it can be used, the modelling of which increases the impact at production, and therefore results in an overall impact reduction of **40%** in GHG emissions and **3%** in impact on human health – if the quality of the mattress is maintained.
- If the mattress has a reduced lifespan due to the use of waste foam – here assumed as a lifespan of 8 years instead of 10 – the overall impact is **25%** lower in GHG emissions, however the impact on human health in this case increases by **21%**

Waste Management





Waste Management

- Burning plastic waste in a municipal incineration plant rather than openly will not reduce GHG emissions but will reduce impacts on human health if the plant has the adequate filters. In this case, GHG emissions actually increase by **2%** but the impact on human health reduces by **40%** when switching to municipal incineration. This is mainly due to the disparate impacts of polyurethane foam across the impact categories
- There is a significant reduction in GHG emissions when moving from municipal incineration to sanitary landfill, however the impact on human health is similar. An overall reduction of **18%/41%** in GHG emissions/impact on human health can be seen when comparing open burning to sanitary landfill.

Key conclusions of comparative analysis

- Recycled materials and better waste management contribute to the impact reduction of the plastic mattress, with a strong dependence on quality and durability of the mattress
- For GHG Emissions it is more pertinent to focus on reducing the impact on the primary raw material: virgin polyurethane foam
- For impact on human health, the waste management methods make a more significant impact on the overall impact of the mattress.

Soap Bars

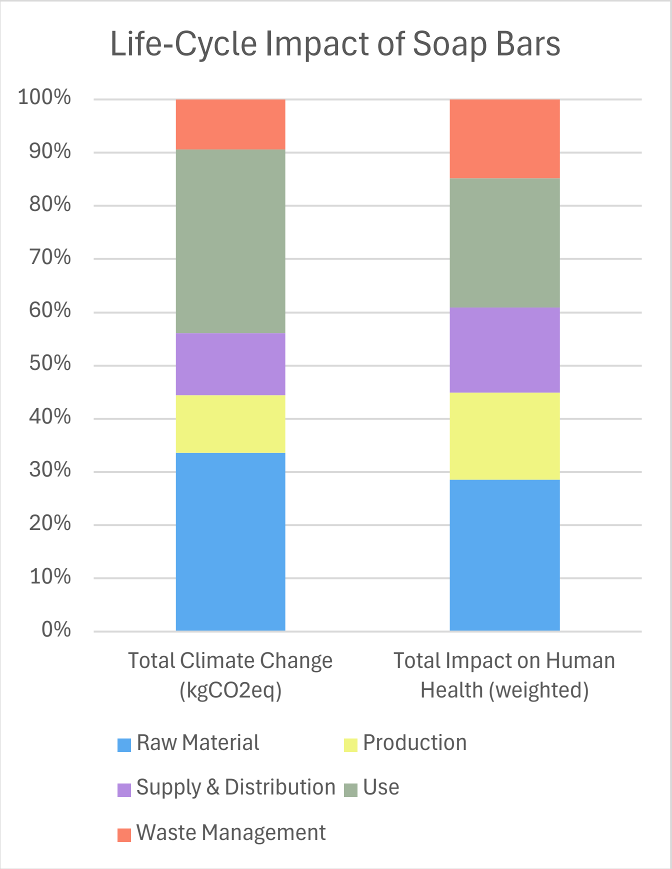
Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	Given their essential role in household hygiene and frequent inclusion in the initial phase of aid responses, soap bars are pre-stocked in regional distribution centres.
Raw Material	Bill of Materials	Crude Palm Oil, Sodium Chloride, Sodium Hydroxide (0.26 kg net weight)
	Packaging	PE film (10 g)
Production	Manufacturing Location	Local to DC
	Manufacturing Processes	Standard saponification
Supply & Distribution	Transport Chain	International oil procurement (10,000 km by sea) TRUCK for procurement of material, transport to DC, and transport to distribution location (500-1,500 km)
Use	Lifespan	50 uses with 10 litres of water per use
	Usage Processes	-

Baseline Results

- Considering the life-cycle of the product, the impacts are evenly distributed among several stages
- Raw material accounts for **(34%)** of the total GHG emissions and **(29%)** of total impact on human health
- The largest share of impact for GHG emissions comes from the use of tap water during the life of the soap bar **(34%)** while for impact on human health it is the second largest share of impact **(24%)** after raw material
- Plastic leakage
  - The product is non-plastic, hence causes no leakage
  - The packaging is dumped/littered causing leakage for all scenarios

Emission factors		Unit
Cradle-to-grave	1.50	kgCO2eq/unit
Cradle-to-gate	0.67	kgCO2eq/unit



Variations per lifecycle stage

Baseline

Raw Material
- Crude Palm Oil
- Refined Palm Oil
- Palm Kernel Oil
- Coconut Oil
- Without Packaging

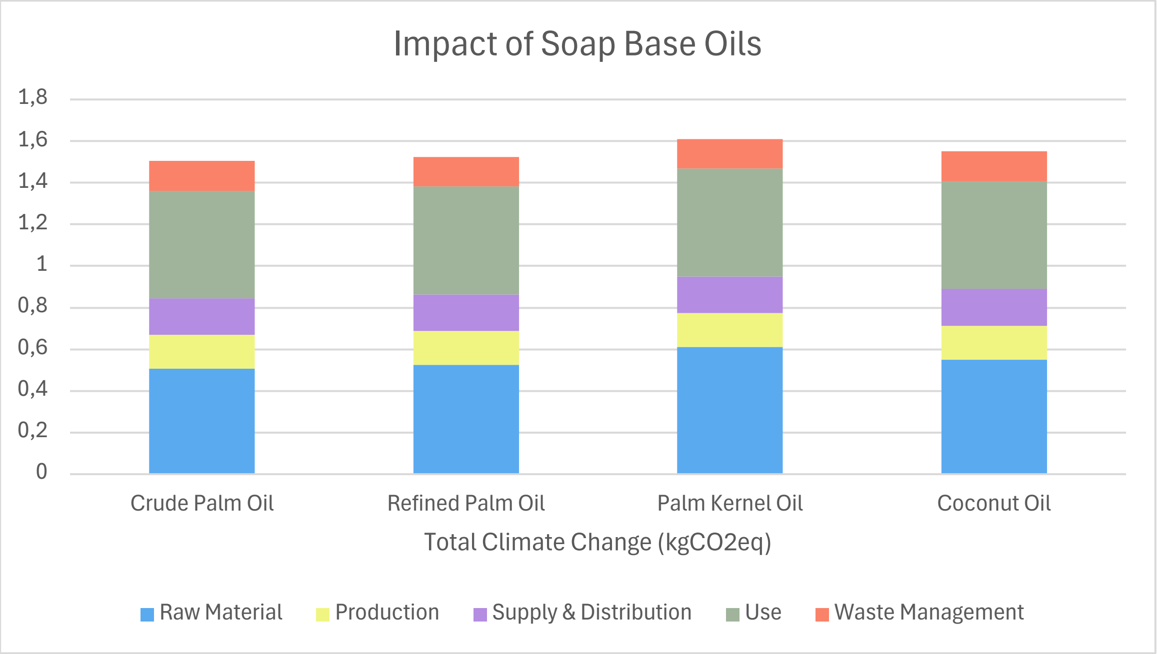
Production
- Heating from natural gas
- Heating from waste incineration

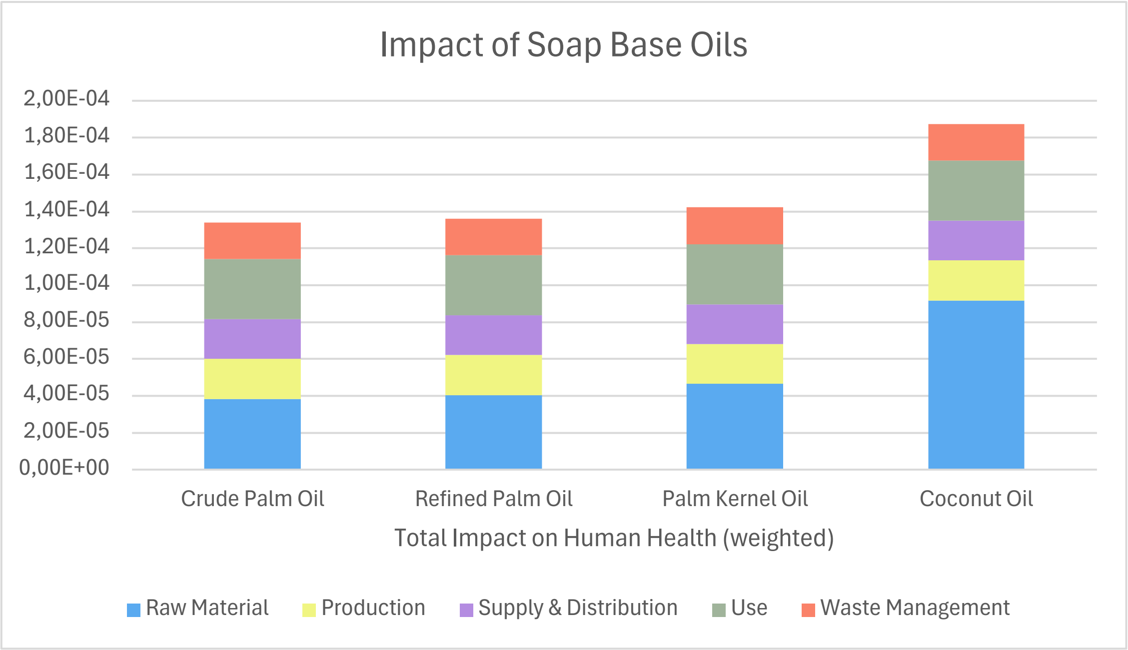
Use Life
- Tap Water
- Harvested rainwater

Supply & Distribution
- Local purchase with overseas procurement of oils

Waste Management
- Wastewater

Raw Material

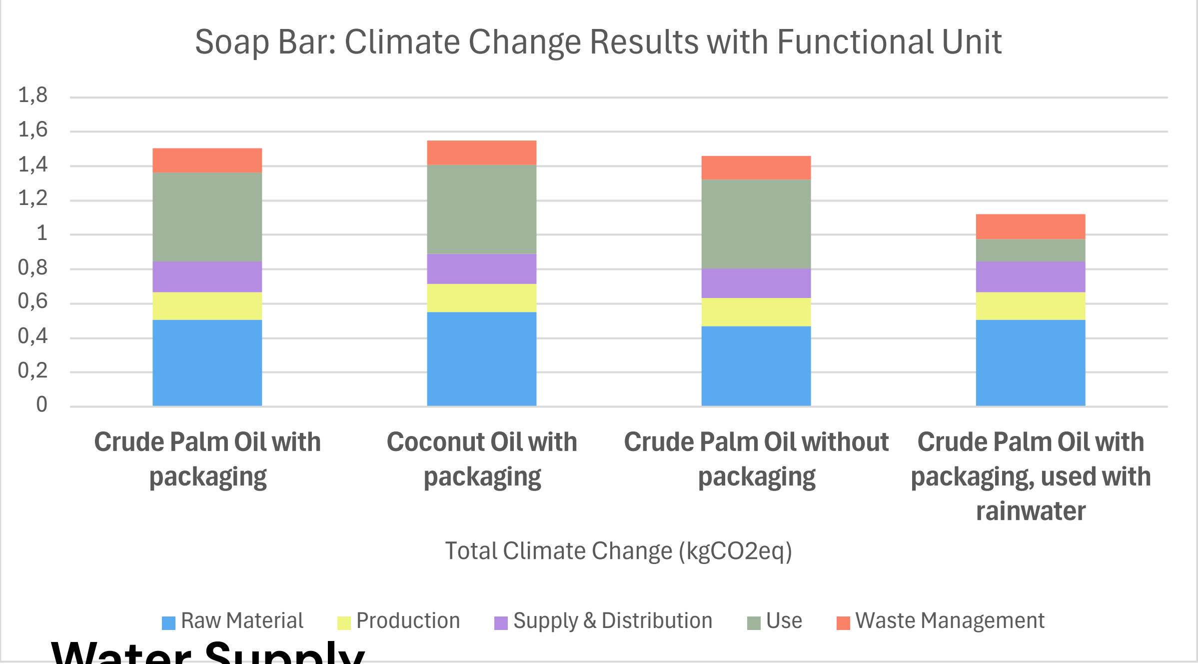


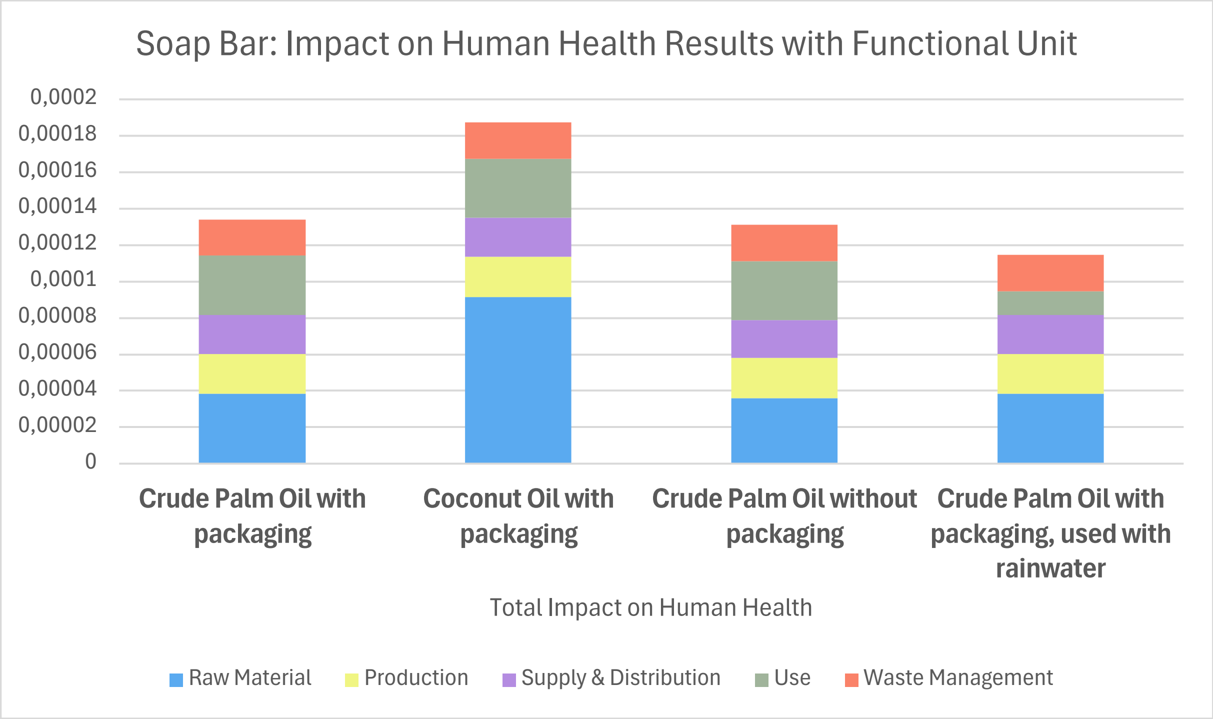


Materials

- This study revealed that varying the type of palm oil used – crude palm oil, refined palm oil, palm kernel oil – did not affect the impact of the soap bar significantly, with all scenarios changing the impacts between **1-7%** in both impact categories.
- However, replacing palm oil with cocount oil sees an increase in impact that is vastly different between the two categories – coconut oil (and the additional fatty acids added to the materials for its formulation) -- increases GHG emissions by **3%** but also increases impact on human health by **40%.**

Water & packaging





Water Supply

- Water use alongside soap contributes significantly to the overall impact in both categories. In the model using 'tap water', a substantial portion of this impact stems from the energy and resources required for water pumping, treatment, and distribution.
- To assess a scenario where water supply activities have a lower environmental burden, this study compares tap water (used in Scenarios 1, 2, and 3) with harvested rainwater. The latter results in a **26%** reduction in the soap's GHG emissions and a **15%** decrease in its impact on human health (Scenario 4).

Packaging

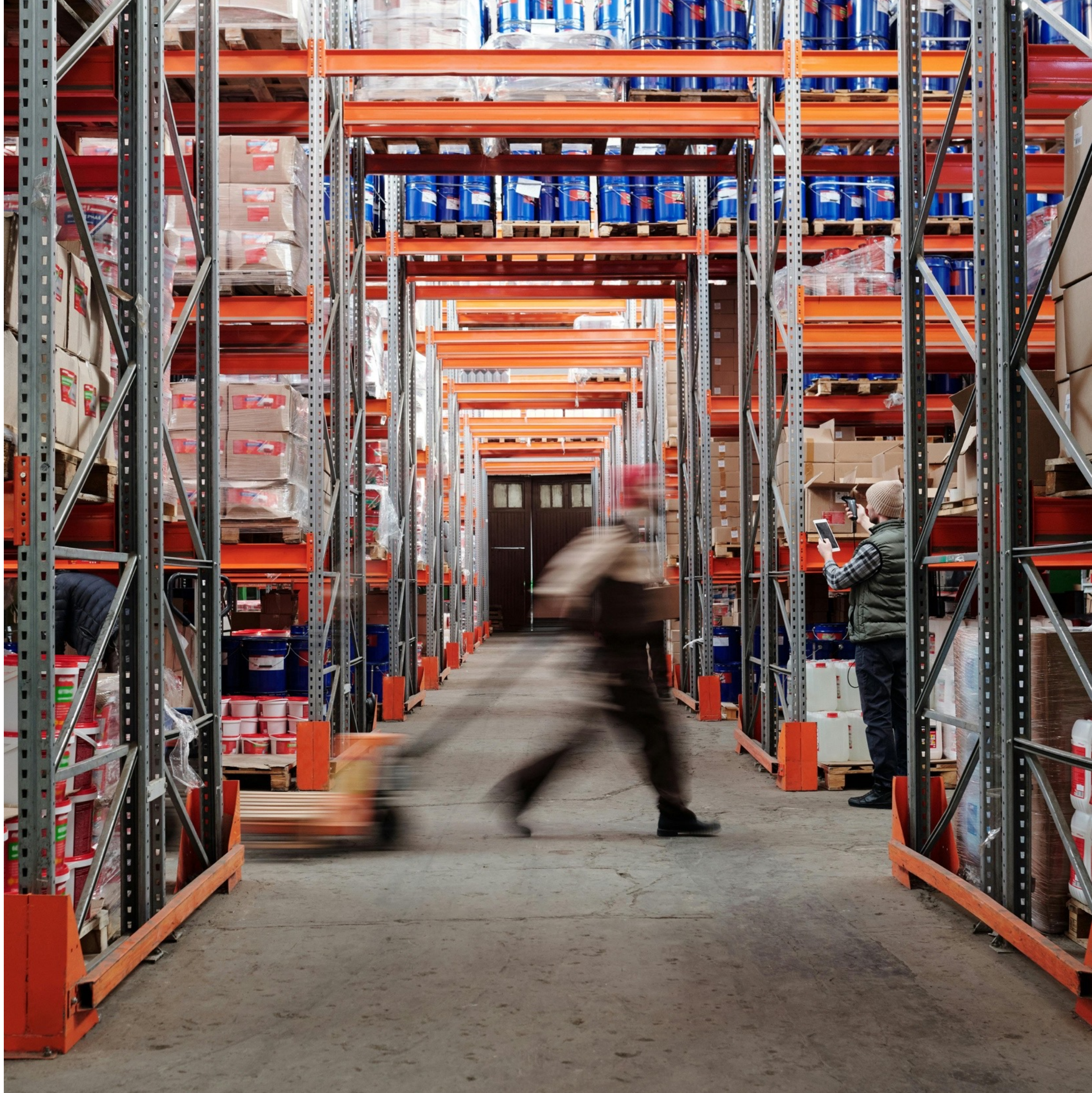
- Eliminating plastic packaging results in a reduction of no more than **2-3%** in impact across both categories. However, this could lead to the soap chipping or depleting more quickly, making it an inconclusive solution.

Key conclusions of comparative analysis

- The water usage during the use phase, as well as the raw material of the soap (i.e. vegetable oils) make up the majority of the impact of the soap.
- Improving water supply can lead to:
    - 🔻26% lower GHG emissions
    - 🔻15% lower impact on human health
- While palm oil is commonly used and remains an impact-efficient choice, it is important to consider its significant deforestation effects.
- For a more comprehensive conclusion on types of oil usage, the ecosystem/biodiversity impacts should be studied in further detail.

Q&A

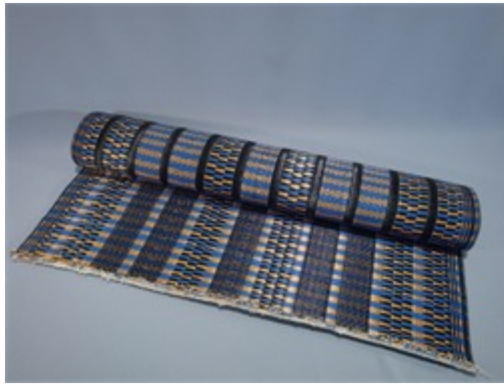
LCA Results Part II



Plastic Floor Mats

Key Product Parameters & Assumptions

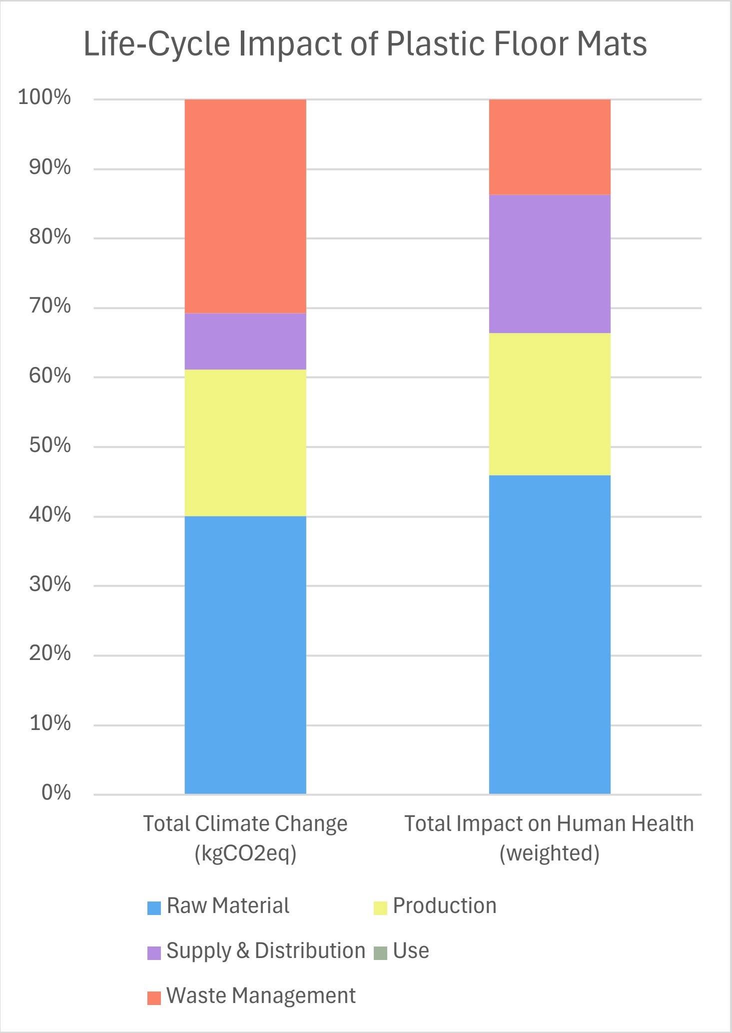
LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	Plastic floor mats are preferred in humanitarian contexts as mats made from natural fibres tend to rot and degrade faster than synthetic mats.
Raw Material	Bill of Materials	Pure virgin polypropylene (860g net weight)
	Packaging	LDPE Packaging Film (100g per mat)
Production	Manufacturing Location	Aurangabad, India
	Manufacturing Processes	Polypropylene fibre production & synthetic weaving
Supply & Distribution	Transport Chain	TRUCK – SEA – TRUCK (to DC) TRUCK from DC to distribution No disposal transport
Use	Lifespan	2 years
	Usage Processes	Assumed to not be washed, only wiping or dusting
Waste Management	Product Disposal Method	Open burning in pits (no transport)



Baseline Results

- Considering a lifetime of 2 years, the raw material accounts for almost half of the GHG emissions **(40%)** and is also the main source of impacts on human health **(46%)**
- Open burning at end-of-life is the second largest source of GHG emissions **(31%)**, the emissions being higher than that of producing the mat **(21%)**
- However, in terms of human health, the production phase **(20%)** and supply and distribution **(20%)** have a larger impact than open burning **(14%)**
- Plastic leakage
  - For the product, leakage is avoided via incineration
  - The packaging is dumped/littered causing leakage for all scenarios

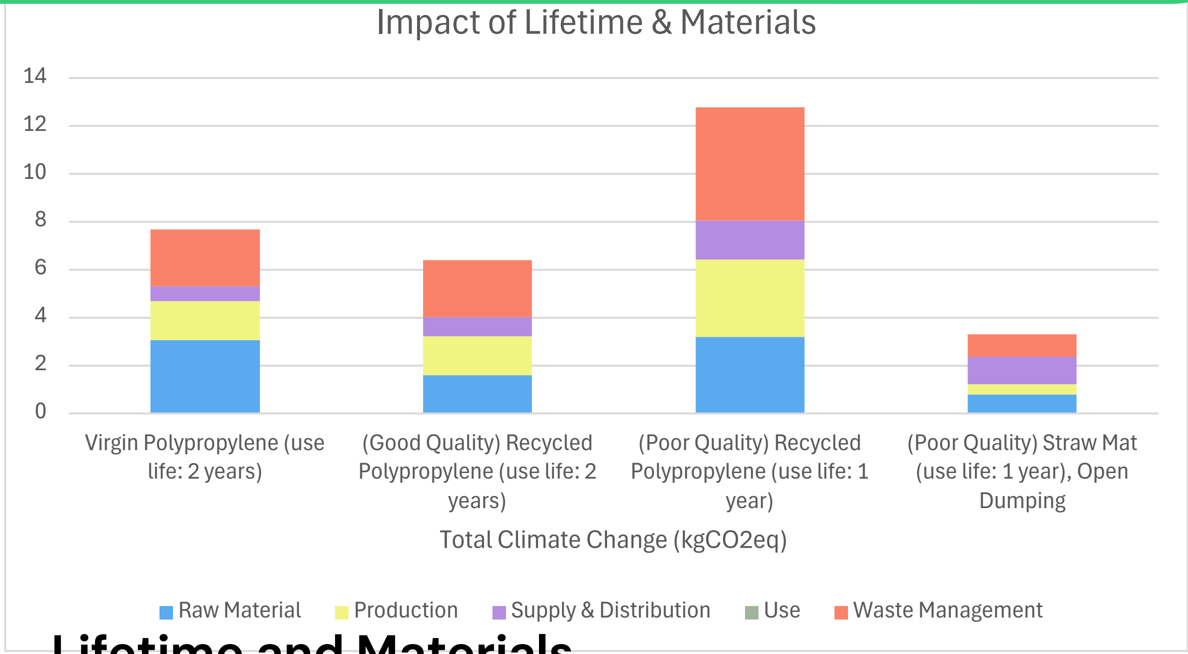
Emission factors		Unit
Cradle-to-grave	7.67	kgCO2eq/unit
Cradle-to-gate	4.69	kgCO2eq/unit

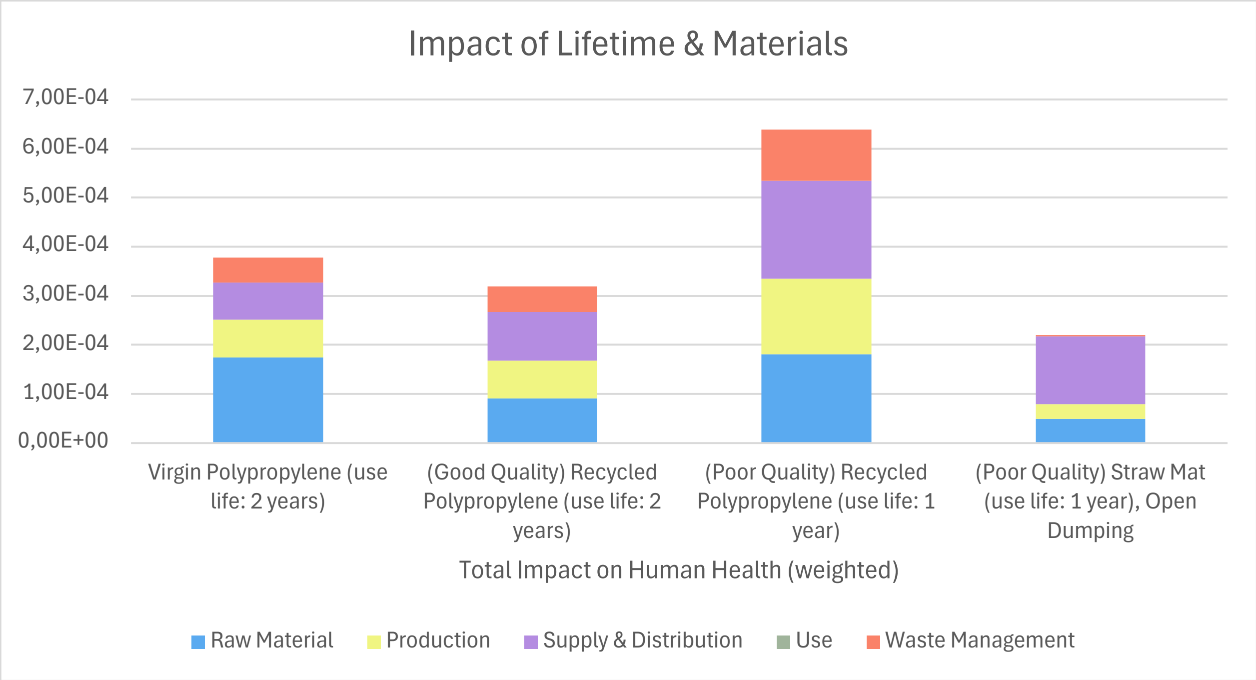


Variations per lifecycle stage

	Raw Material	Production	Use Life	Supply & Distribution	Waste Management
Baseline	Virgin PP	Average energy mix	2 years, no washing	International supply (via sea) and sourcing	Open burning
	Good quality recycled PP	Electricity derived from solar panels	1 year (poor quality PP and straw), no washing	Import of Recycled PP, international supply (via sea), and sourcing	Sanitary Landfill
	Poor quality recycled PP			Local production and supply	Municipal Incineration
	Straw				Biowaste (straw mat only)

Lifetime & Materials

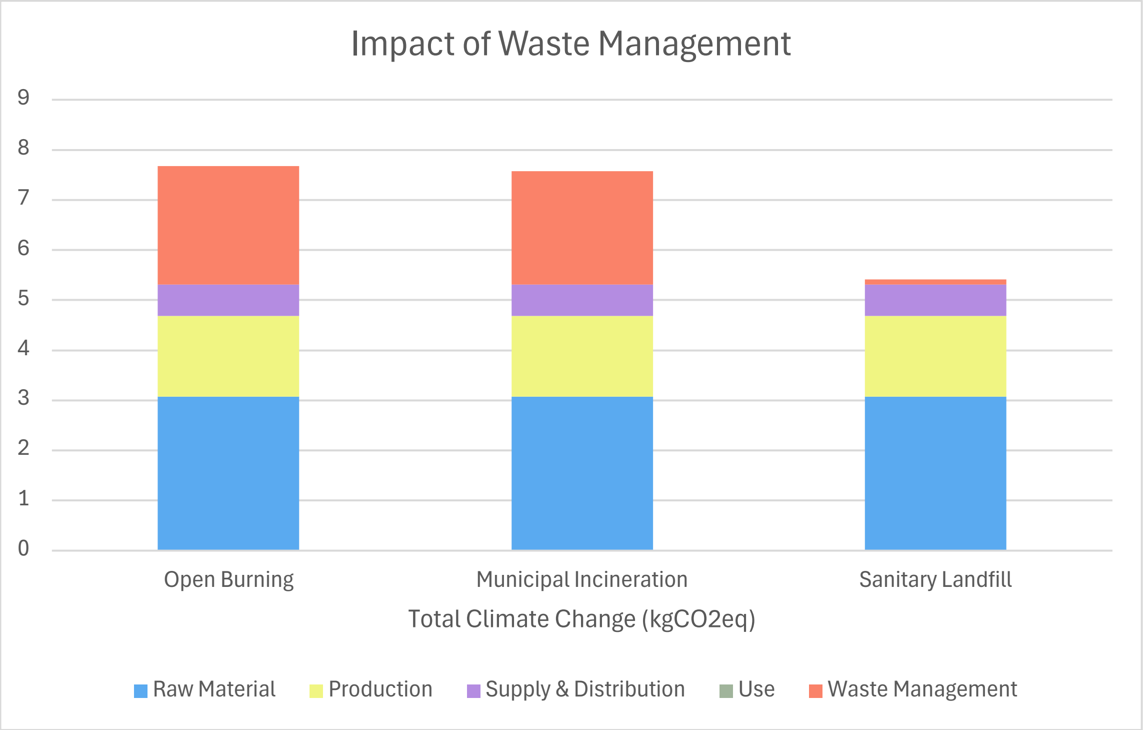


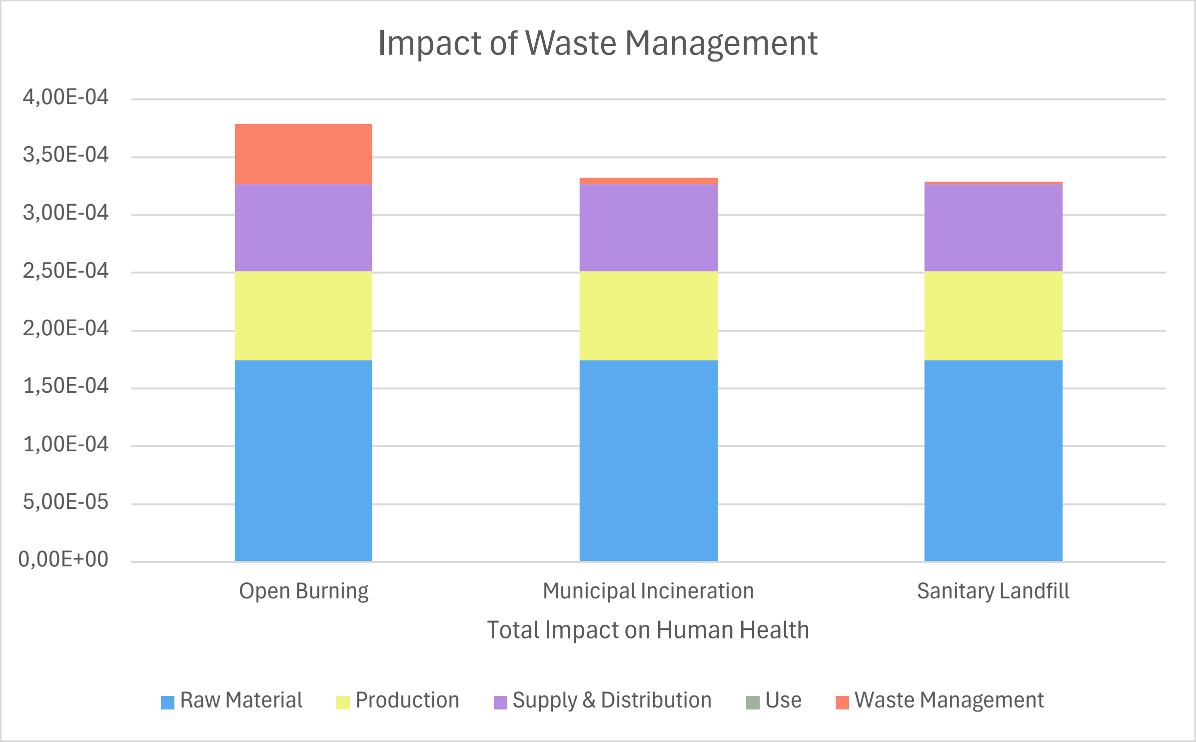


Lifetime and Materials

- Extending the lifetime of the product can lead to a significant reduction in environmental impact, which can be accomplished by improving product quality (by eco-design, etc.) and maintaining the product during the use phase.
- Using recycled polypropylene instead of virgin can reduce the impact of the raw material stage by 50% – however since the recycled PP has to be imported from Europe, the overall reduction is approximately **16%** in both climate change and impact on human health.
- **If the lifespan of the recycled polypropylene mat is shorter** (here assumed as 1 year instead of 2 years), the impact on climate change and human health increases by approximately 67% and 69%, respectively, due to the higher number of mats required to meet the 2-year functional unit.
- The impacts of using straw as raw material are provided in slide 17, yet assumptions regarding the lifespan of straw mats are uncertain and would need to be further studied in field contexts, together with feasibility.

Waste Management

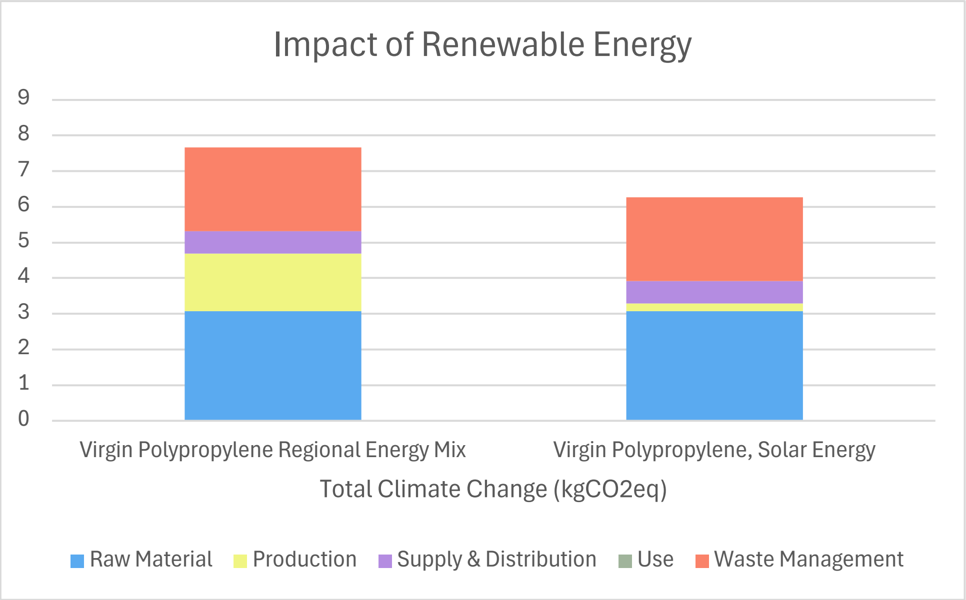


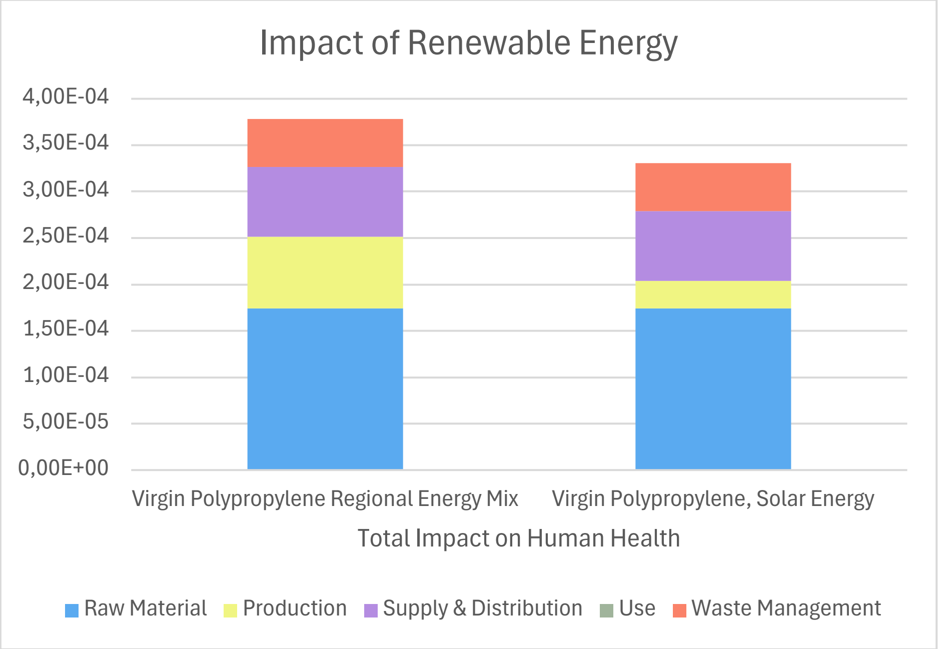


Waste Management

- Burning plastic waste in a municipal incineration plant rather than openly will not reduce GHG emissions but will reduce impacts on human health if the plant has the adequate filters.
- There is a small improvement when considering municipal incineration for climate change **(1%)** but larger for human health **(12%)**.
- A sanitary landfill achieves a greater reduction in climate change (30%) and has comparable reduction in human health to municipal incineration (14%), making sanitary landfills the preferred waste management method within the scope of the LCA (see slide 6 for more information).

Renewable Energy





Energy for Production

- Switching the energy source used for electricity or heat during the production phase can significantly reduce environmental impacts—especially when fossil fuel–intensive sources are replaced with low-carbon alternatives.
- Producing mats using solar electricity from an on-site photovoltaic (PV) installation, instead of the average Indian electricity mix (which consists of approximately 75% coal), reduces production-phase impacts by 86% for greenhouse gas (GHG) emissions and 62% for impacts on human health.
- Across the full life cycle, this results in an overall reduction of **18%** in GHG emissions and **13%** in human health impacts.

Key conclusions of comparative analysis

- The modelled scenarios show the following impact reductions (GHG emissions & impact on human health):
  - Virgin to good quality recycled PP: ~16% for both
  - Average energy mix to solar energy for production: 18%/13%
  - Open burning to sanitary landfill: 30%/13%

Therefore, combining recycled materials, renewable energy, and better waste management (scenario 6 in previous charts) account for the impact reduction of the plastic floor mat, with the below results

- 🔻64% climate change
- 🔻41% impact on human health

Straw mats, despite lasting shorter in our model, comparatively reduce

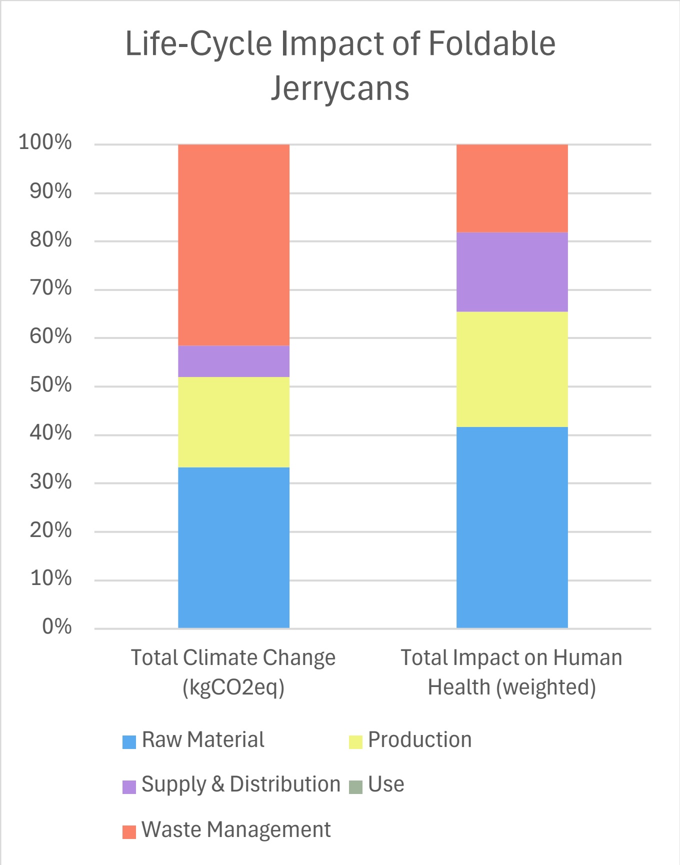
- 🔻57% climate change
- 🔻42% impact on human health
- However – the assumption of poor-quality straw mats lasting 1 year is

Foldable Jerrycans & Plastic Buckets

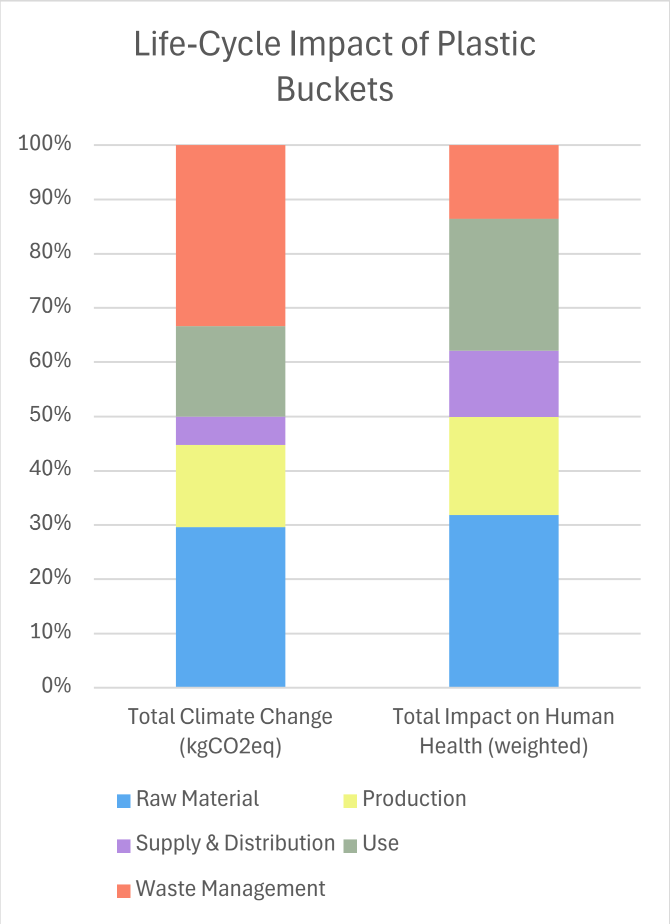
Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL FOLDABLE JERRYCANS	DESCRIPTION OF MODEL PLASTIC BUCKETS
GENERAL	Field Context	This analysis aims to compare two existing options for containers to transport water for drinking, cooking, and washing—foldable jerrycans and buckets, to be supplied in bulk during emergencies	
Raw Material	Bill of Materials	Virgin LDPE	Virgin HDPE
	Packaging	Carton & Duct Tape	Carton & Duct Tape
Production	Manufacturing Location	Manufactured from locally sourced materials in China and transported to the field by ship	
	Manufacturing Processes	Blow Moulding	Blow Moulding
Supply & Distribution	Transport Chain	TRUCK SEA TRUCK	
Use	Lifespan	3 months	5 years
	Usage Processes	None (lifespan too short)	Washing with tap water and soap twice a year
Waste Management	Product Disposal Method	Open burning	Open burning

Baseline Results



- Both being polyethylene products, the raw material is a significant share of impact in the two products, accounting for **33%/42%** of GHG emissions/impact on human health for Jerrycans and **30%/32%** of the same for Buckets, respectively
- Buckets have a use phase (**17%/24%** of overall GHG emissions/impact on human health) which doesn't exist for Jerrycans. Hence the other stages have a lesser distribution of impact for buckets.
- At end of life, both products are modelled to be burnt in open pits, this accounts for **42%/18%** of GHG emissions/impact on human health for Jerrycans and **34%/14%** of the same for Buckets, respectively.
- Plastic leakage
  - For the product, leakage is avoided via incineration
  - The packaging is dumped/littered causing leakage for all scenarios



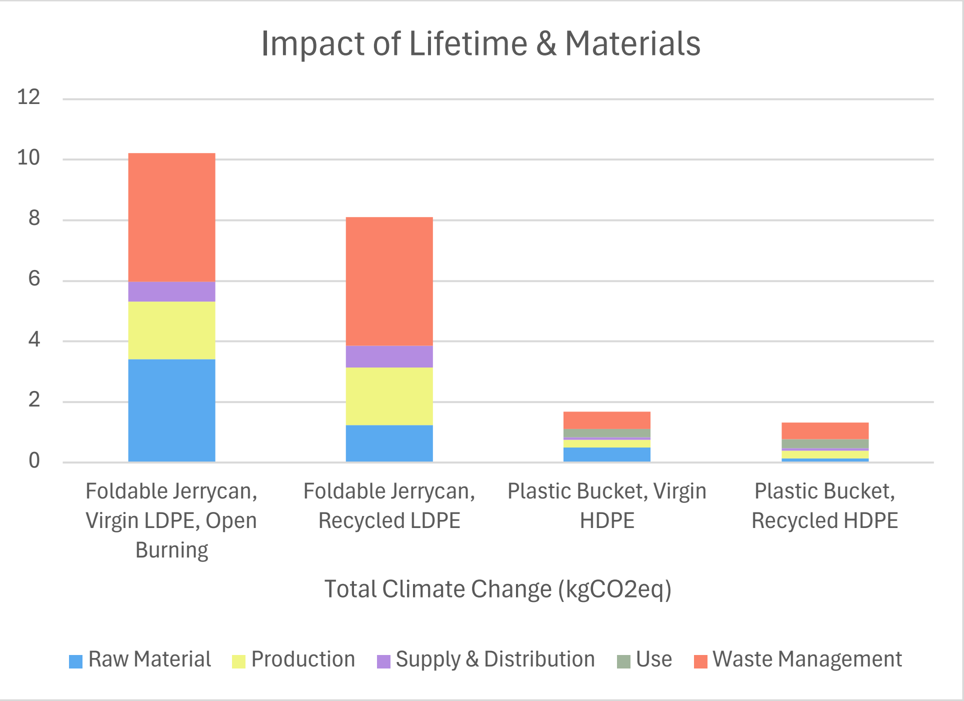
Emission factors		Unit
Cradle-to-grave	2.55	kgCO2eq/unit
Cradle-to-gate	1.33	kgCO2eq/unit

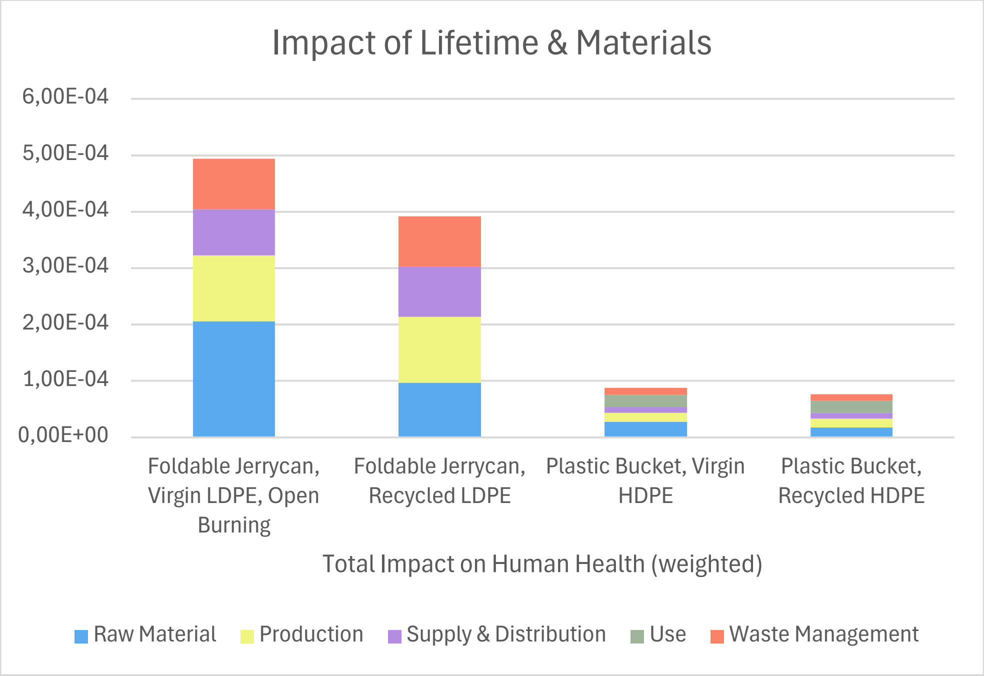
Emission factors		Unit
Cradle-to-grave	8.39	kgCO2eq/unit
Cradle-to-gate	3.76	kgCO2eq/unit

Variations per lifecycle stage

	Raw Material	Production	Use Life	Supply & Distribution	Waste Management
Baseline	Virgin LDPE (Jerrycans)	Average energy mix	No washing	TRUCK – SEA – TRUCK from China to sub-Saharan Africa	Open Burning
	Virgin HDPE (Buckets)				Municipal Incineration
	Recycled LDPE (Jerrycans)	Solar energy for production	Washing twice a year		Sanitary Landfill
	Recycled HDPE (Buckets)				Collection to recycle in Europe (Bucket)

Lifetime & Materials

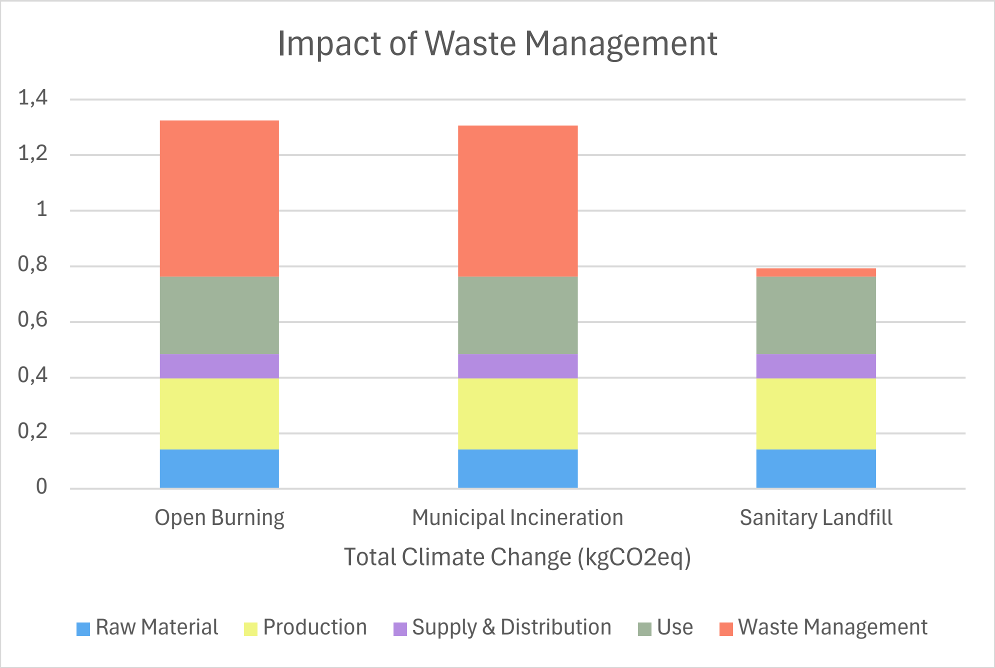


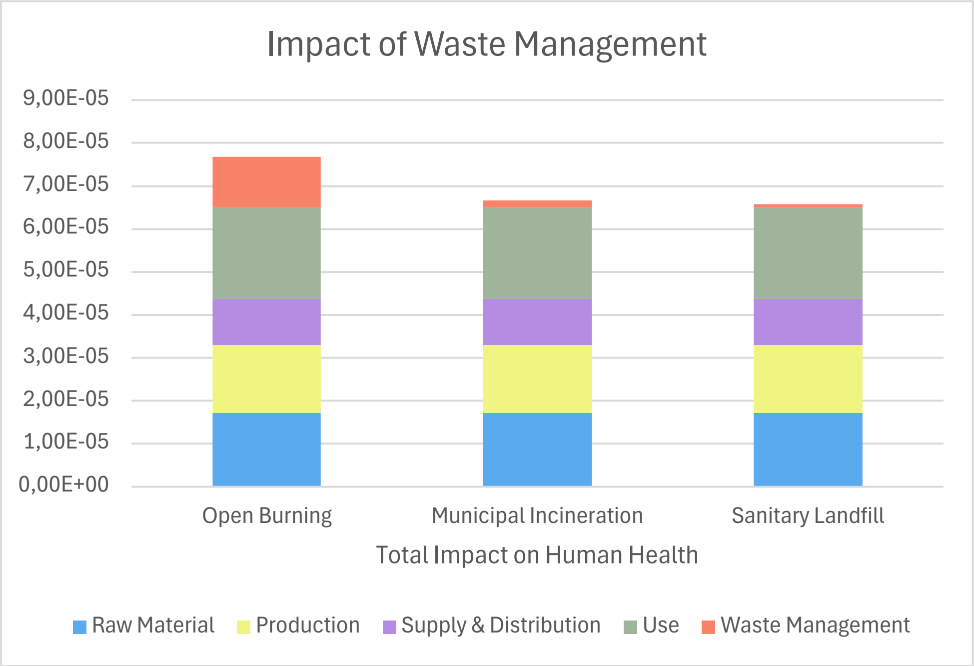


Lifetime and Materials

- The lifespan of the two products plays a big role in the analysis due to the fact that jerrycans last a very short time (3 months in our model) and buckets, made from sturdier material, last several years, the reduction in impact between the jerrycans and buckets when measuring for one year of use for carrying 20 litres of water (which requires 4 20L jerrycans or 1.43 14L buckets) is **84%/82%** in GHG emissions and impact on human health respectively.
- Substituting virgin material for recycled further shows a reduction of 2-5% for the buckets in both categories, while for jerrycans the substitution brings about a reduction of **~20%** in both categories
- In general, a durable product is more impact efficient, no matter the material.

Waste management

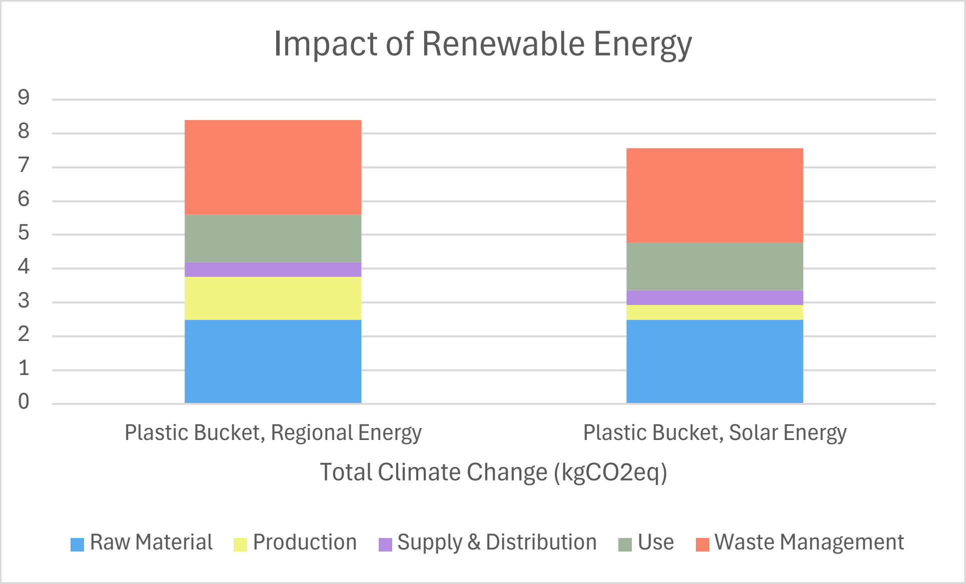


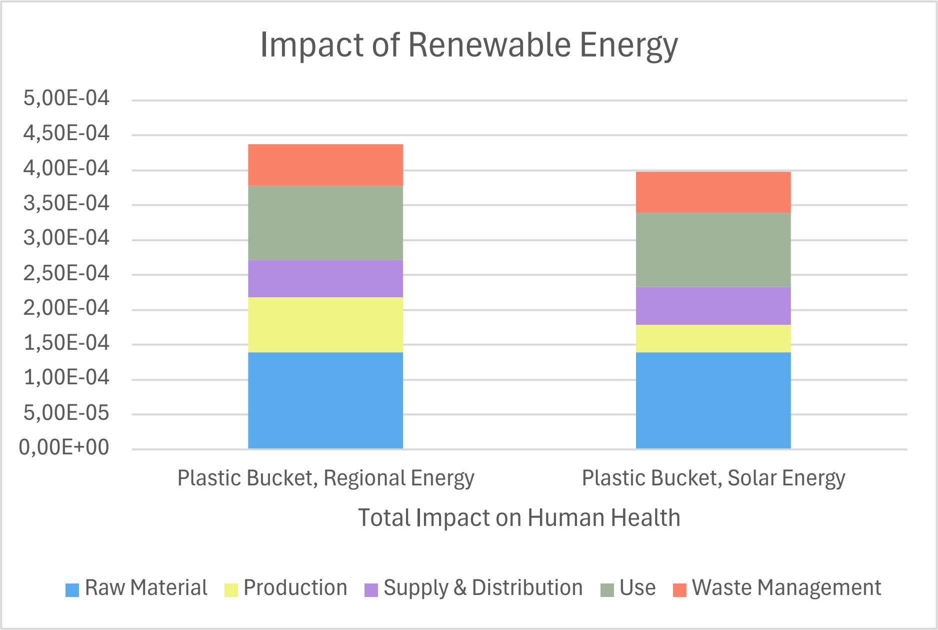


Waste Management

- Burning plastic waste in a municipal incineration plant rather than openly will not reduce GHG emissions but will reduce impacts on human health if the plant has the adequate filters - taking the improved product variation, i.e. Recycled HDPE Bucket, we can see a reduction of **~1%** in GHG emissions but a reduction of **~13%** in impact on human health
- Sanitary landfills however reduce **~40%** GHG emissions from the baseline model of open burning as well as **~14%** impact on human health, making sanitary landfills the preferred waste management method within the scope of the LCA (see slide 6 for more information).

Low-carbon energy





Energy for Production

- Switching energy source for the production of the electricity or the heat used during the production phase can lead to a reduction of environmental impacts. This is particularly the case when energy sources intensive in fossil fuel are replaced with renewable energy sources
- For HDPE Buckets, moving from average energy mix to solar energy reduces the impact by **10%/9%** in GHG emissions and impact on human health respectively – this is primarily due to the larger shares of impact going to raw material, use, and waste of the bucket
- Combining this benefit with other actions e.g. moving to recycled material can, however, compound the reduction

Key conclusions of comparative analysis

- For plastic buckets, combining the reduction from using good quality recycled HDPE, renewable energy for production, and sanitary landfill as a waste disposal method – provides the below impact reduction as compared to using virgin LDPE jerrycans.
  - 🔻94% climate change
  - 🔻88% impact on human health
- This cumulative impact reduction almost completely neutralizes the impact of the virgin LDPE jerrycan as a product.

Solar Lamps

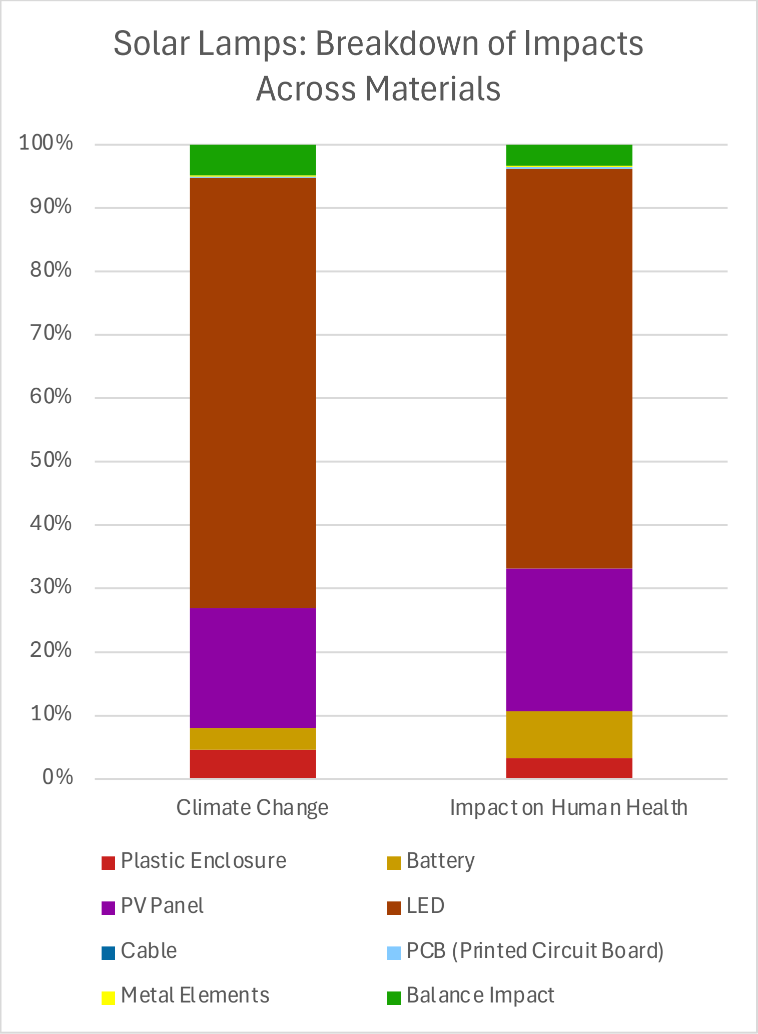
Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	The comparison of the older and newer models of the lamp aim to study the environmental impacts of the reduced volume and weight that has been achieved with higher lifespan
Raw Material	Bill of Materials	Old lamp: 670g net weight; New lamp 564g net weight Polypropylene, PV Panel, LED, PCB, Metal Frame, Wiring, etc.
	Packaging	Cardboard box, paper wrapping
Production	Manufacturing Location	Spain
Supply & Distribution	Transport Chain	Trucked to port (500 km) Shipped to African DCs (10,000 km) Trucked for warehousing (500 km) & distribution (1500 km)
Use	Utilization	N/A
	Usage Processes	N/A
Waste Management	Product Disposal Method	Unsanitary Landfill
	Packaging Disposal Method	Open Dumping

Results (New Lamp)

- The raw materials take **95%**, of the overall GHG emissions and **97%** of the overall impact on human health for the solar lamp
- Among these materials, the share of impact lies heavily on the LED, making up **68%** of the total climate change impact and **63%** of the total impact on human health despite its small share of weight (47g out of the total 564g) due to the impact intensive production process of this part
- The second highest impact is caused by the solar panel photovoltaic cell, making up **19%** of the total climate change impact and **23%** of the total impact on human health
- **As there was a very slight shift in net weight between the old and new lamp, the impacts remain very similar when compared without a function**
- Plastic Leakage: The packaging is dumped/littered causing leakage for all scenarios

Emission factors		Unit
Cradle-to-grave	17.27	kgCO2eq/unit
Cradle-to-gate	16.50	kgCO2eq/unit

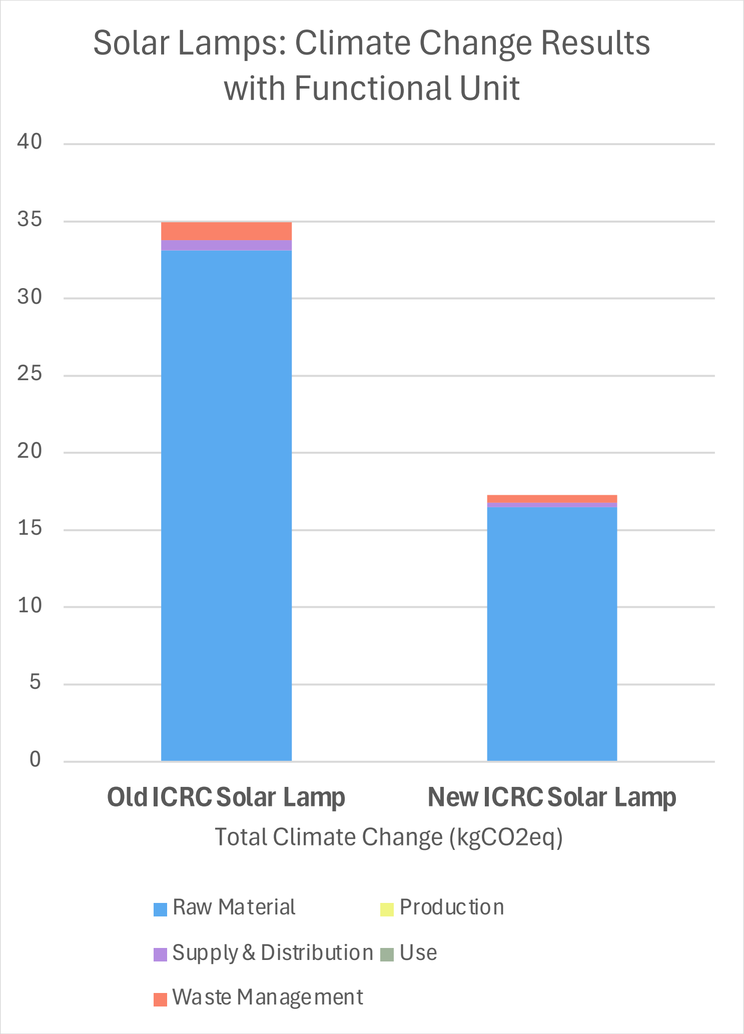


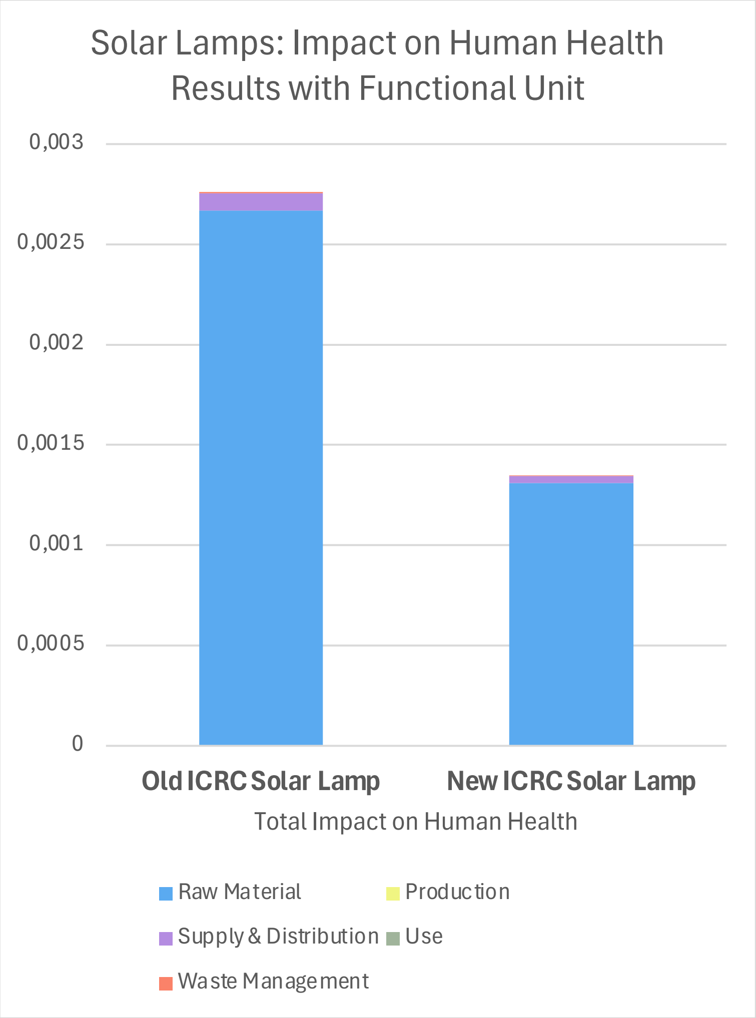
Impact of Increasing Lifespan

As the impacts of both lamps are very similar due to the net weights of components being similar, increasing the lifespan of the solar lamp linearly decreases the impacts when considered for the function of lighting a household for the increased amount of time.

Therefore, we consider the functional unit of 6 years, the old solar lamp lasts only 3 years and hence has double the impact of the new solar lamp.

More precisely a **50.61%** reduction in climate change and **50.80%** reduction in human health





Key conclusions of analysis

- If the components are not altered in a material way, the impact of the solar lamp reduces linearly as the lifespan is increased. In this case, doubling the lifespan results in reduction of
  - 🔻50% climate change
  - 🔻50% impact on human health
- The impacts to local environment due to the disposal of the components must be further studied to expand on this result.

Q&A

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