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 2

Thursday 26 June 2025 | 12:30-14:00 CET

Practical information

PROGRAMME

12:30 | Welcome & Introduction
12:35 | **Presentation of 3 LCA results**
13:05 | Q&A session
13:15 | **Presentation of 3 LCA results**
13:45 | Q&A session
13:55 | Final remarks
14:00 | End

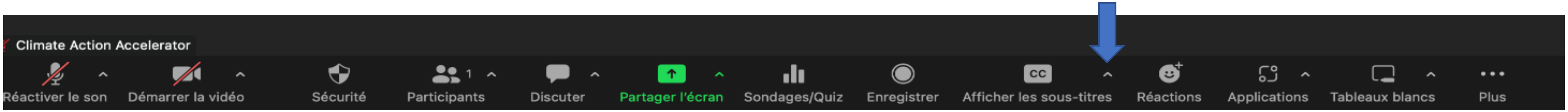
- This webinar is **recorded** and will be made available on **replay** on our website and YouTube channel.
- **Your audio and video is off by default.**
- To ask a question, please **write in the Q&A** section. The moderator will read out questions during the Q&A sessions.
- **Translation** to French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

Link to webinar page: climateactionaccelerator.org/events_and_webinars/

Translation

How to activate subtitles on Zoom ?

1) Click on « Show captions» or « Afficher les sous-titres » in the bottom bar (small arrow to the right).



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

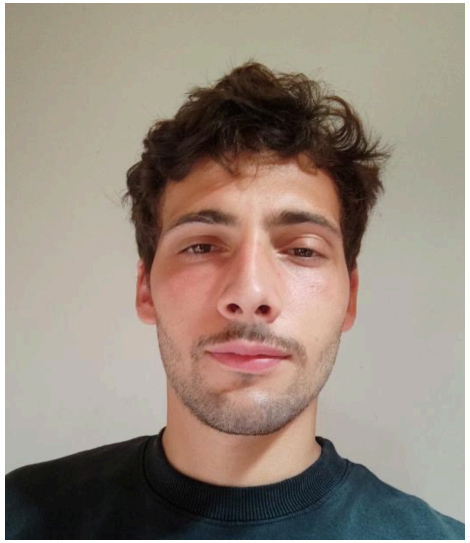
Build a global community of action, sharing climate solutions as a universal common good, to scale up their deployment.

34 partners on board

Today's speakers

Ashima Rajput

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



Paolo Sévègnes

Carbon Metrics Officer at the Climate Action Accelerator

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

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

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

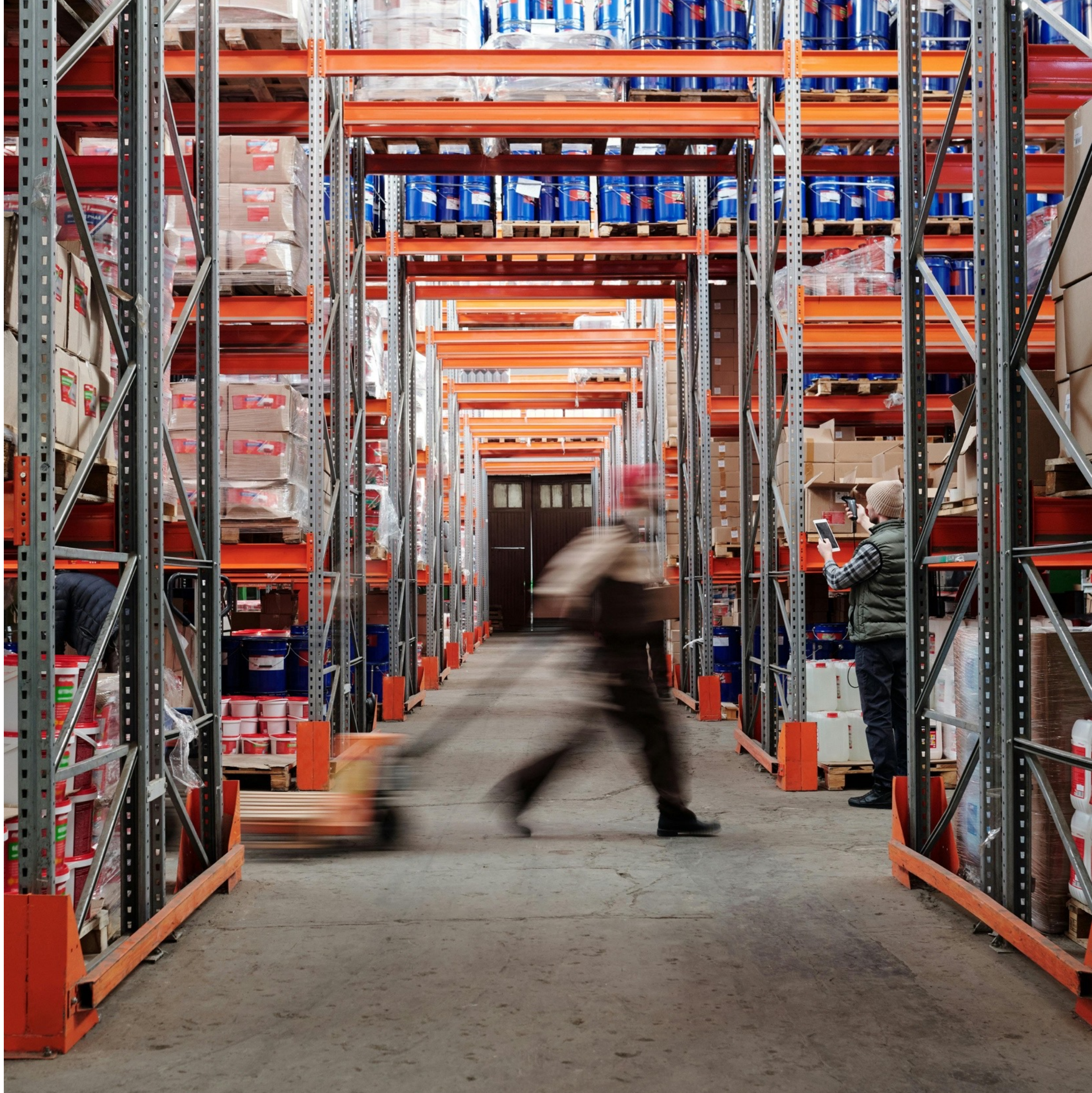
This project aims to estimate the mismanaged waste that may occur at the end of life of products distributed by humanitarian organisations.

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



Hygiene Kits

Key Product Parameters & Assumptions

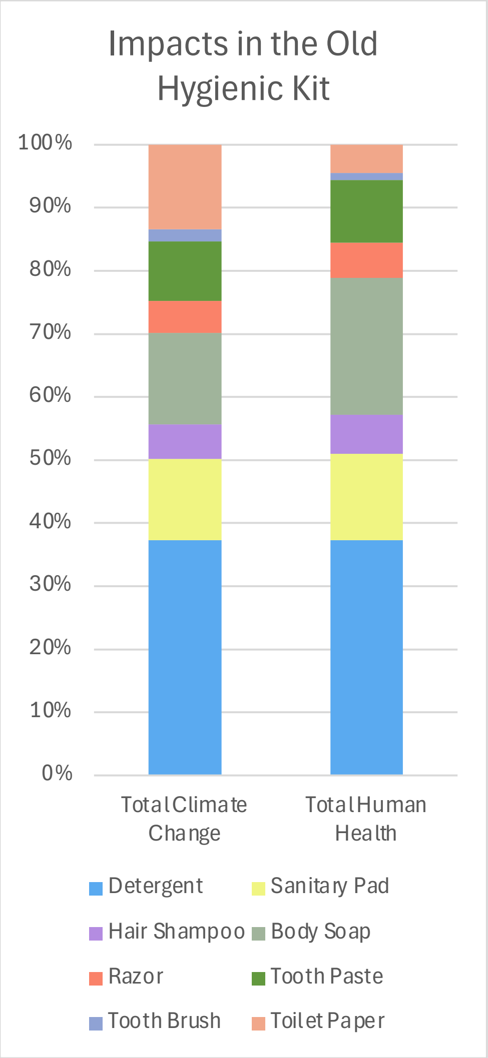
LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF PRODUCT
GENERAL	Field Context	The kits are assembled and sent to the field with the function of serving one person per kit **ICRC has updated the kit by increasing the quality of certain items, reducing the volume of some products by 40%, by switching to concentrated detergent and to shampoo bars, and reducing the amount of razors distributed. The analysis compares the old version of the kit with the new version.**
Raw Material	Bill of Materials	Varied
	Packaging	Plastic or laminated paper film
Production	Manufacturing Location	Spain
	Manufacturing Processes	Varied
Supply & Distribution	Transport Chain	TRUCK to European port SHIP to distribution port TRUCK to warehouse and/or distribution site
Use	Lifespan	Depending on usage (assumed)
	Usage Processes	Varied
Waste Management	Product Disposal Method	Varied
	Packaging Disposal Method	Open dumping

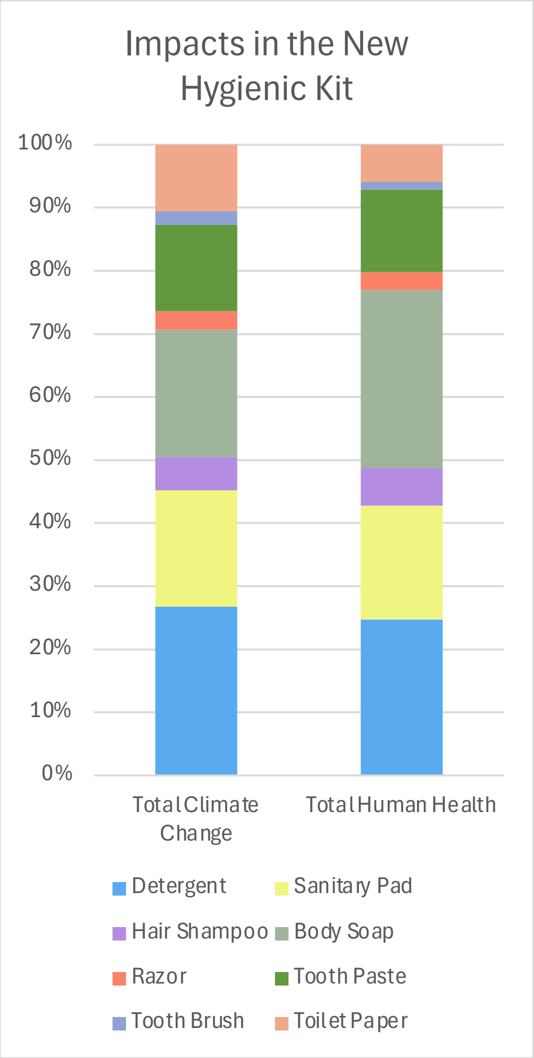
Hygienic Kit Contents

PRODUCT	OLD KIT	NEW KIT	DESCRIPTION (NEW KITS)
Washing Powder	1 x 450g in a plastic bag	1 x 225g concentrate detergent	Packed in laminated cardboard box
Sanitary Pad	1 x 10pcs in a plastic bag	No Change	
Hair Shampoo	1 x 275ml in a plastic bottle	1 x 70g solid shampoo	Packed in laminated paper bag
Body Soap	2 x 100g in plastic bags	Packed in laminated paper bag	
Razor	1 x 5 in one plastic bag	1 x 2 in one plastic bag	New razors are higher quality and therefore 2 new razors provide the same usage as the 5 older variants
Tooth Paste	1 x 75g plastic tube	No Change	
Tooth Brush	1 pce 100% PP in a plastic bag	1 pce 50% PP + 50% wheat straw	New version packed in laminated cardboard
Toilet Paper	2 rolls virgin tissue paper in plastic bag	2 rolls recycled, unbleached tissue paper in paper wrap	

Baseline Results

- Detergent is the biggest contributor of GHG emissions in the new kit, consisting of **27%** of the total GHG Emissions with soap being second at **20%.**
- Soap Bars, mainly due to their water consumption, are the biggest contributors for impact on human health, making up **28%** of the total impact on human health, with detergent being the second highest at **25%.**
- Other notably high impact items are sanitary pads, accounting for about **18%** of the impact in both the old and new kits

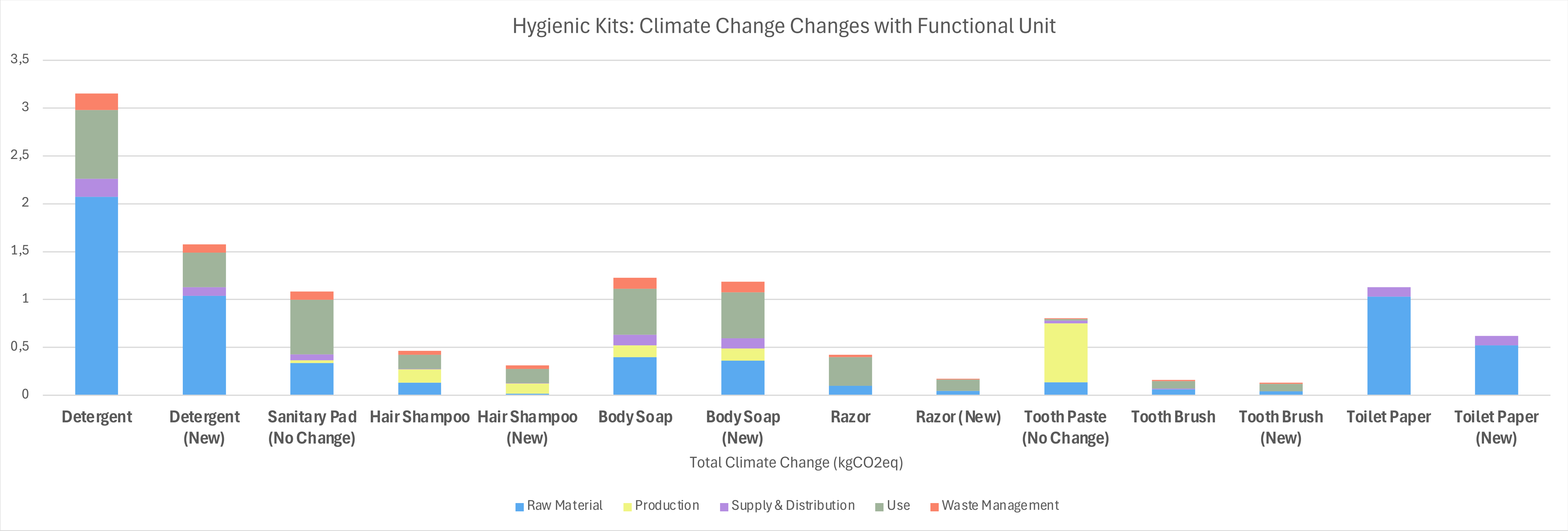




Emission factors (OLD)		Unit
Cradle-to-grave	8.4	kgCO2eq/unit
Cradle-to-gate	5.2	kgCO2eq/unit

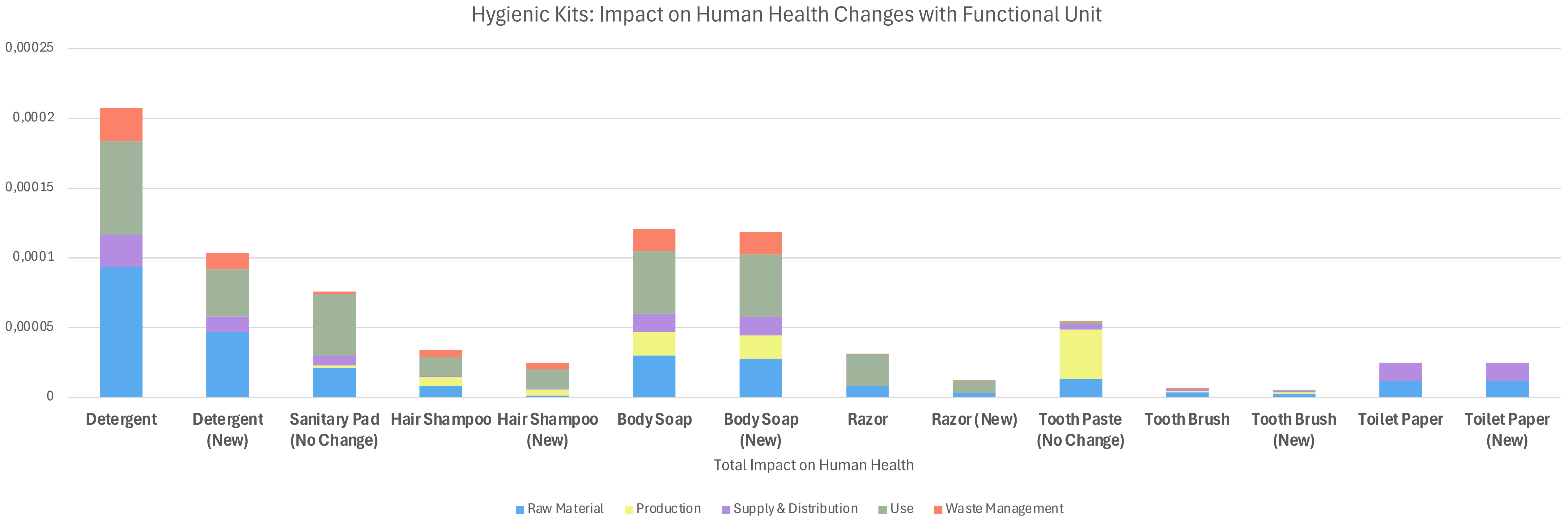
Emission factors (NEW)		Unit
Cradle-to-grave	5.9	kgCO2eq/unit
Cradle-to-gate	3.4	kgCO2eq/unit

Comparative Analysis



- **With the changes made to products inside the kit, the new hygiene kit has an overall 30% reduction in GHG Emissions as compared to the previous kit.** The greatest reduction in emissions on a product level was seen in razors (**59%**), detergent/washing powder (**50%**) and toilet paper (**45%**)
- ***NOTE:*** *These improvements assume that the extent of usage of the old and new hygiene kits is the same, for e.g. if the previous razor pack lasted the user for 15 shaves, then so will the new razor pack*

Comparative Analysis



- **With the changes made to products inside the kit, the new hygiene kit has an overall 24% reduction in impact on human health.** The greatest reduction in impact on human health on a product level was seen in razors (**61%**), detergent/washing powder (**50%**) and hair shampoo (**27%**)
- ***NOTE:*** *These improvements assume that the extent of usage of the old and new hygiene kits is the same, for e.g. if the previous razor pack lasted the user for 15 shaves, then so will the new razor pack*

Key conclusions of comparative analysis

- The changes made to the hygiene kit (see slide 11) had the below effect on its environmental impact according to the updated specifications
  - 🔻30% climate change
  - 🔻24% impact on human health
- While the study focuses on a singular hygienic kit, the reduction in volume causes a reduction of impacts related to transport at the level of a shipment which is out of scope of the analysis
- For further impact reduction for future revisions of the kit, additional impact reductions of the most impactful products within the hygiene kit would need to be addressed, such as
  - Washing powder or detergent
  - Soap bars
  - Sanitary pads

Face Masks

Key Product Parameters & Assumptions

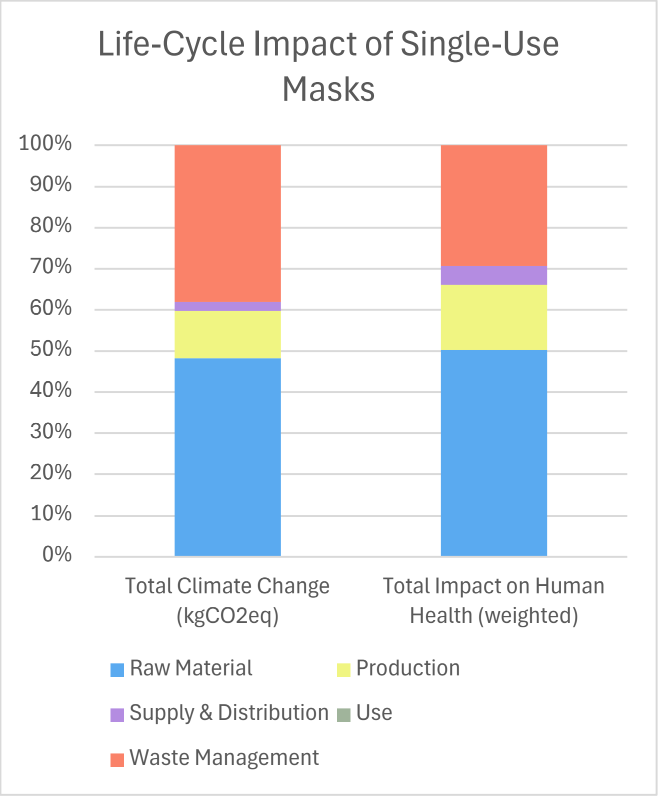
LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	5g polypropylene single use face mask (Type II) compared to a 110g cotton face mask (Type I). Both masks are intended for use in a Type I-compliant context, i.e. by patients or other individuals, rather than by healthcare professionals in medical settings.
Raw Material	Bill of Materials	Polypropylene, polyester and aluminium for single use and cotton, polyurethane and polyester for reusable one.
	Packaging	Neglected
Production	Manufacturing Location	China
	Manufacturing Processes	Modelled using energy use only (Literature)
Supply & Distribution	Transport Chain	TRUCK transport of materials to factor SEA shipping of product to regional distribution centre TRUCK transport to distribution location
Use	Lifespan	1 use for single-use face mask and 20 uses for cotton face mask.
	Usage Processes	Washing machine and drying (60°C) for cotton mask.
Waste	Product Disposal Method	Open Burning

Table 1 — Performance requirements for medical face masks

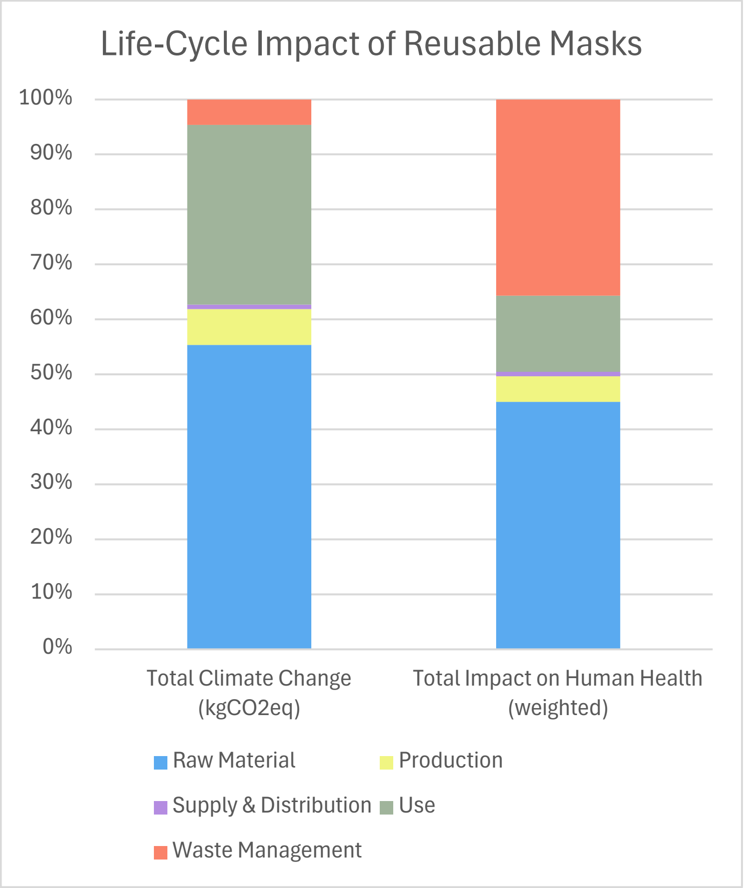
Test	Type I [a]	Type II	Type IIR
Bacterial filtration efficiency (BFE), (%)	≥ 95	≥ 98	≥ 98
Differential pressure (Pa/cm^2)	< 40	< 40	< 60
Splash resistance pressure (kPa)	Not required	Not required	≥ 16,0
Microbial cleanliness (cfu/g)	≤ 30	≤ 30	≤ 30

[a] Type I medical face masks should only be used for patients and other persons to reduce the risk of spread of infections particularly in epidemic or pandemic situations. Type I masks are not intended for use by healthcare professionals in an operating room or in other medical settings with similar requirements.

Baseline Results



- The impact distribution of the **single-use face mask** aligns with that of other single-use plastic products, with contributions spread across all life cycle stages.
- In contrast, the **reusable face mask** shows a more concentrated impact: for **climate change**, the main contributors are raw materials and the use phase; for **human health**, impacts are primarily driven by materials and end-of-life treatment.
- The **emission factor of the reusable mask is higher**, largely due to its **greater weight**.
- Plastic leakage: Leakage is avoided via incineration



Emission factors		Unit
Cradle-to-grave	33.2	gCO2eq/unit
Cradle-to-gate	20.0	gCO2eq/unit

Emission factors		Unit
Cradle-to-grave	196	gCO2eq/unit
Cradle-to-gate	121	gCO2eq/unit

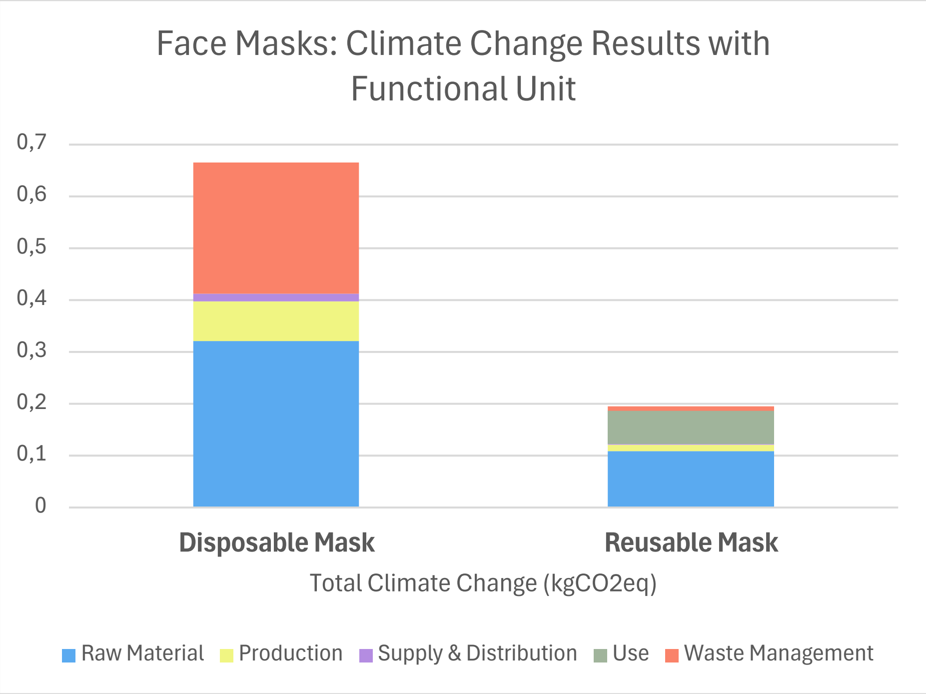
Variations per lifecycle stage

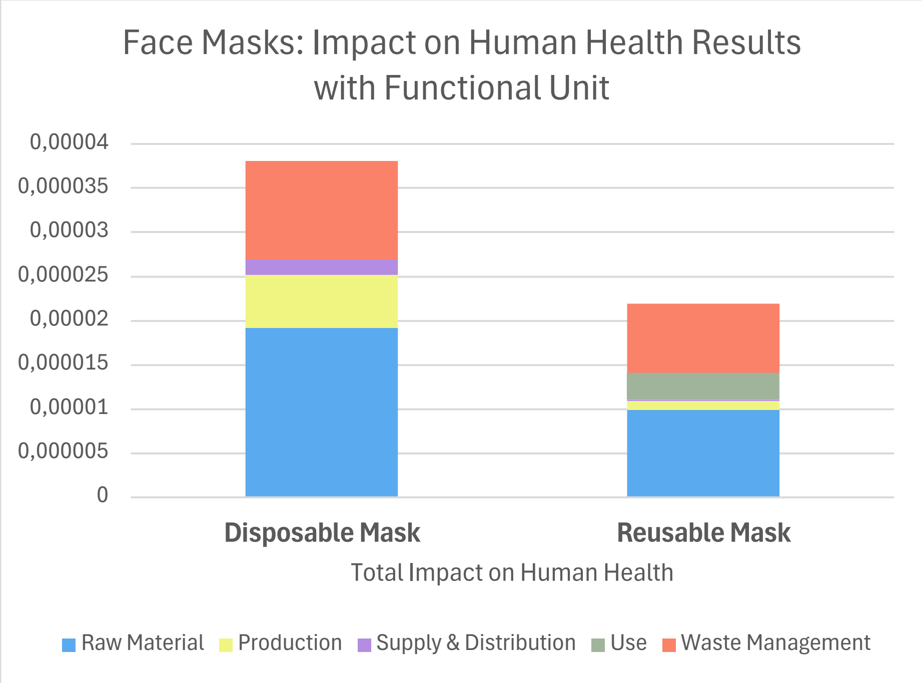
	Raw Material	Production	Use Life	Supply & Distribution	Waste Management
Baseline	Virgin PP materials	Made in China	0	International supply from China	Open burning
	Cotton materials		20 laundry washes		

Impact Assessment

- Switching from a disposable mask to a reusable face mask can reduce the climate change impact by **70%,** from about 670 grams of CO2e to 200 grams, to answer the functional unit of 20 uses. The impact on human health can be reduced by **42%.**

This assessment does not cover face masks used in surgical unit or medical contexts by health workers, but for the Type I face mask use case according to EN 14683:2019+AC:2019.





Key conclusions of comparative analysis

- To switch from single-use to multi-use masks can achieve significant impact reductions:
  - 🔻70% climate change
  - 🔻42% human health
- This solution applies **only to masks not used by healthcare workers**, where reuse is permitted.
- Deploying reusable masks at scale would require a **logistics system** to **collect, wash, and track** the number of uses for each mask throughout its lifespan.

Coveralls

Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL Single-Use Coverall	DESCRIPTION OF MODEL Multi-Use Coverall
GENERAL	Field Context	This analysis aims to compare two options for coverall suit for medical interventions –as used in EBOLA context.	
Raw Material	Bill of Materials	Virgin Polyester, Polypropylene, Rubber, PET	Virgin Polyurethane, Polyester, Rubber, PET
Production	Manufacturing Location	Manufactured from locally sourced materials in China and transported to the field by ship.	
Supply & Distribution	Transport Chain	TRUCK SEA TRUCK	
Use	Lifespan	1 use	100 uses
	Usage Processes	None	Washing with tap water, soap and chlorine after each use.
Waste Management	Product Disposal Method	Open burning	Open burning

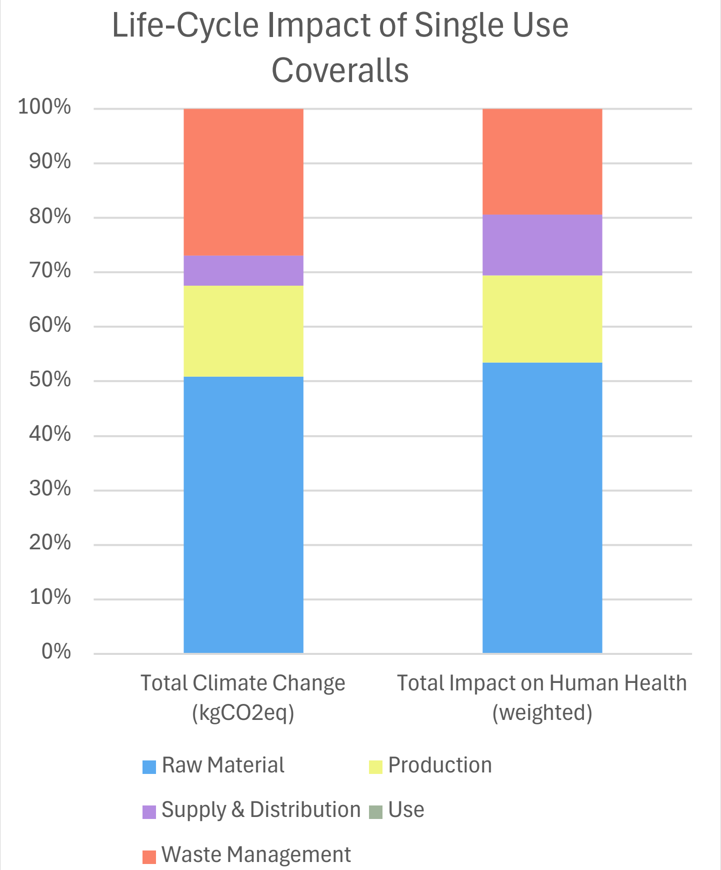
About the Smart PPE – Reusable Coverall

- The product was designed by the **EPFL EssentialTech Centre** and **Médecins Sans Frontières (MSF)** to replace single-use coveralls in the **Ebola response context**.
- This assessment focuses solely on the **suit component** of the PPE, not the full smart PPE system with the integrated air vent.
- The **filtration device** is considered equivalent across both single-use and smart PPE systems, and is therefore excluded from the comparative analysis.
- The **smart PPE** is **not yet available on the market**, but it is **ready for production**.
- Prior analysis has shown that using smart PPE instead of single-use PPE can **reduce the hourly cost of intervention by a factor of six**.
- For further information: https://www.essentialtech.ch/projects/smart-ppe

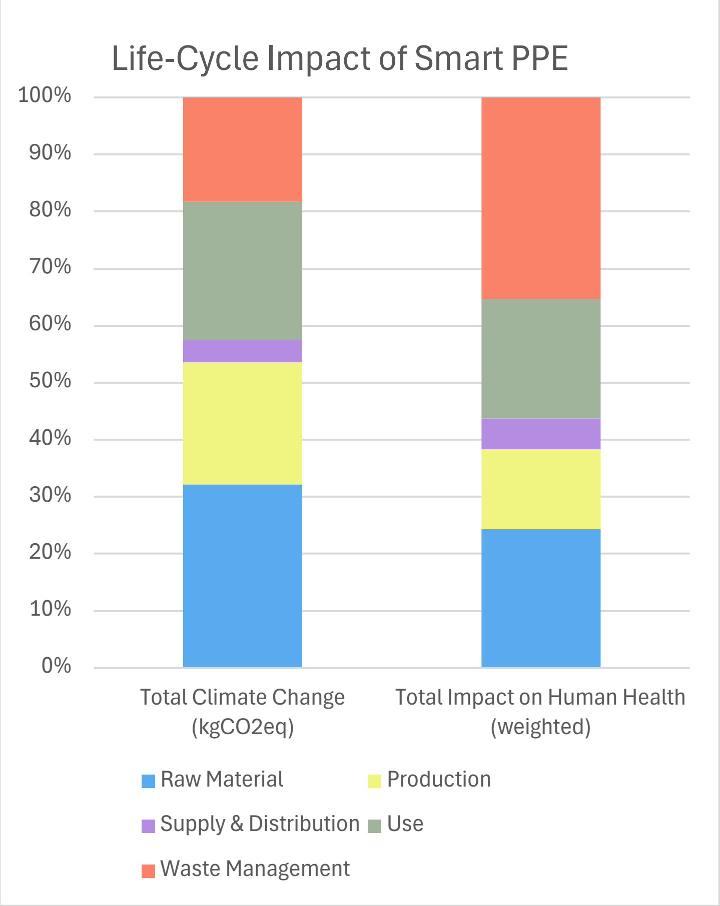
A detailed technical sheet, including a cost comparison with a single-use coverall is available upon request.

Please contact Grégoire Castella (gregoire.castella@epfl.ch) or the Climate Action Accelerator (contact@climateactionaccelerator.org)

Baseline Results



- As both are plastic-based products, raw materials contributes significantly to their impacts, accounting for **50%** of GHG emissions and **53%** of human health impacts in the single-use coverall and **32% and 24%,** respectively, in the reusable coverall.
- The reusable coverall includes a use phase, which contributes **24%** of total GHG emissions and **21%** of the impact on human health—a phase that does not exist for the single-use coverall.
- At end of life, both products are modelled to be disposed of by open-pit burning, due to their classification as medical waste. This accounts for **27%** of GHG emissions and **19% of** human health impacts for the single-use coverall, and **18% and 35%** , respectively, for the reusable coverall.
- Plastic leakage: Leakage is avoided via incineration.



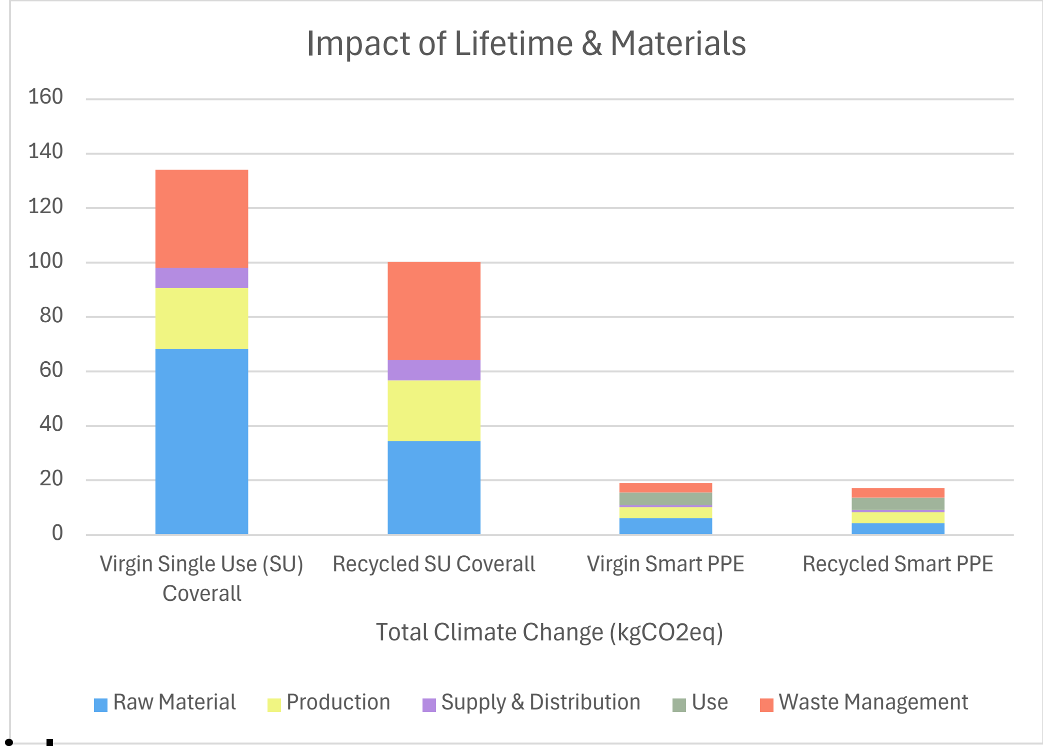
Emission factors		Unit
Cradle-to-grave	1.34	kgCO2eq/unit
Cradle-to-gate	0.918	kgCO2eq/unit

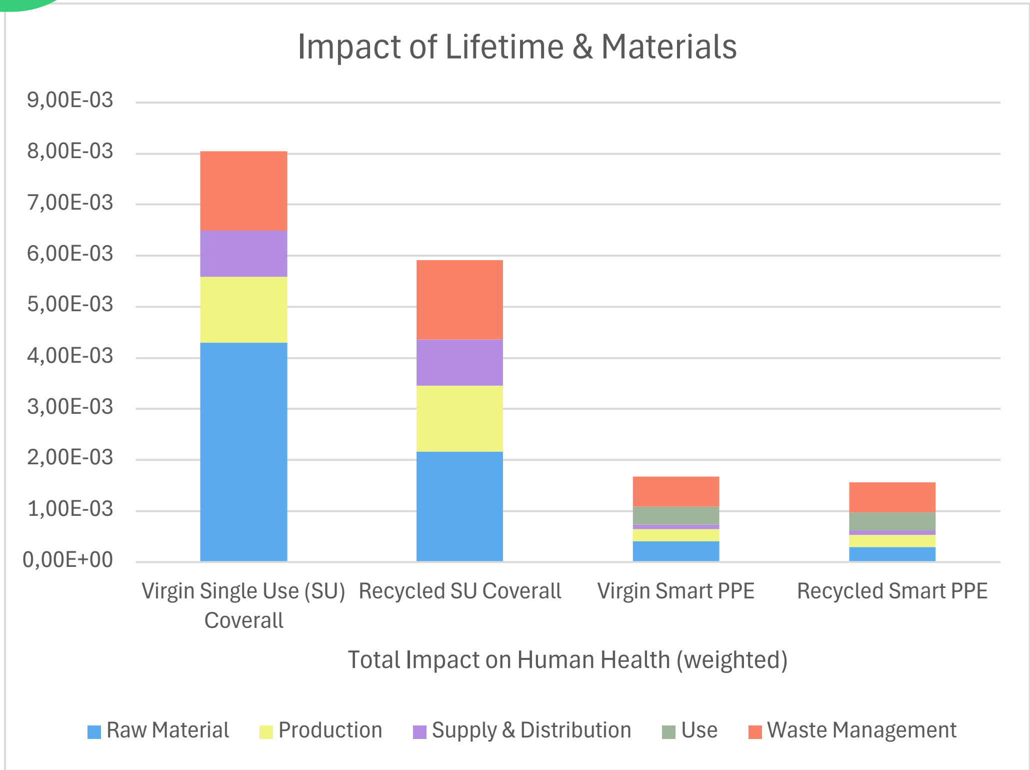
Emission factors		Unit
Cradle-to-grave	19.0	kgCO2eq/unit
Cradle-to-gate	10.3	kgCO2eq/unit

Variations per lifecycle stage

	Raw Material	Production	Use Life	Supply & Distribution	Waste Management
Baseline	Virgin PE Single Use Coverall	Average energy mix	No washing	TRUCK – SEA – TRUCK from China to sub-Saharan Africa	Open Burning
	Virgin PU & PE Reusable Coverall	Solar energy for production	Washing after each use with regular rap water		
	Recycled PE Single Use Coverall				

Lifetime & Materials

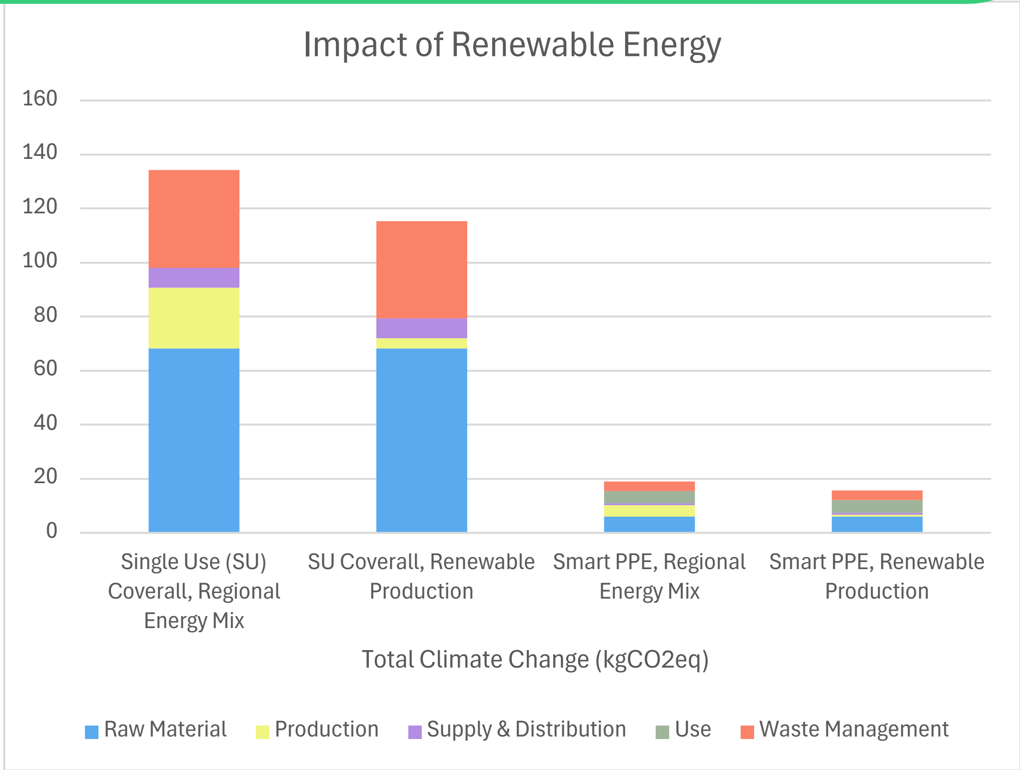


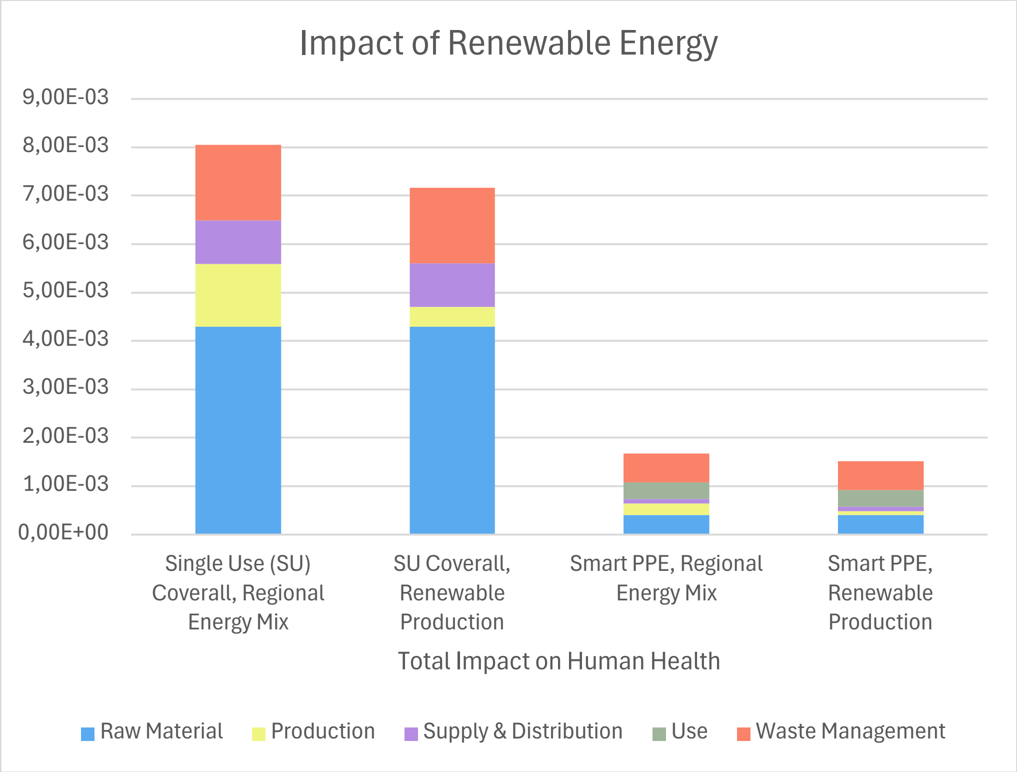


Materials

- When assuming 100 uses, **moving to reusable coverall** reduces GHG emissions by **86%** and human health impacts by **79%** compared to the single-use coverall.
- Substituting virgin material with recycled material for the single-use coverall can reduce impacts by up to **25–26%** in both GHG emissions and human health categories, assuming no loss in material quality and that the same number of coveralls is required to complete the intervention. For a reusable coverall, this would lead to a **9%** of reduction in GHG emissions and a **7%** in human health impacts, as raw materials represent a smaller share.

Energy Supply



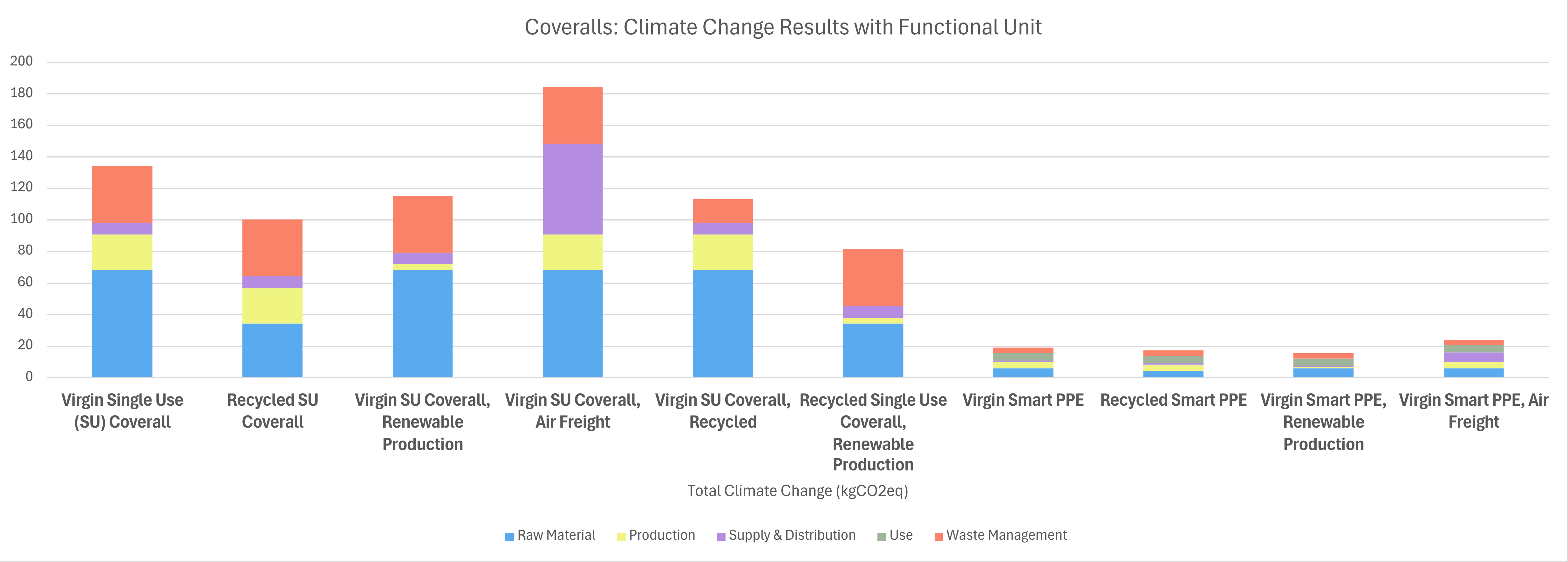


Energy Supply

- Switching the energy source for electricity or heat used during production can significantly reduce environmental impacts, especially when fossil fuel–intensive sources are replaced with renewable energy.
- For the single-use coverall, shifting from the average energy mix to solar energy reduces GHG emissions by **14%** and human health impacts by **11%**.
- When combined with other measures—such as using recycled materials—these reductions can be amplified, further lowering the overall environmental footprint.

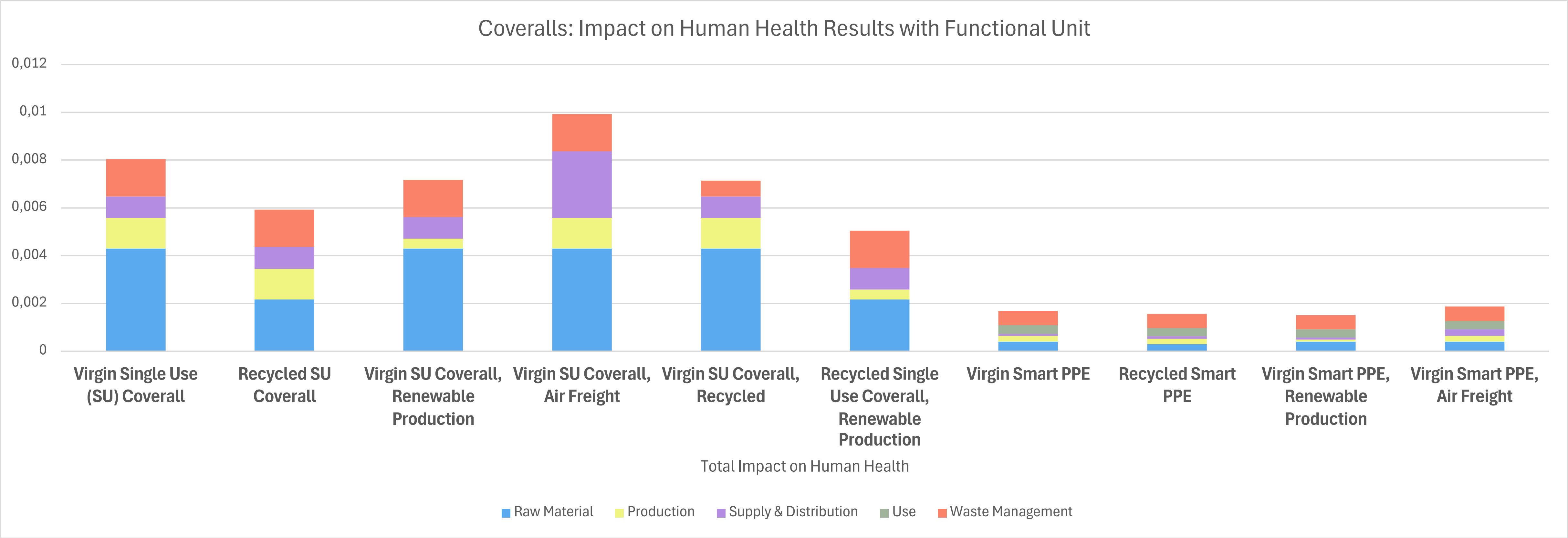
All Results: Climate Change

Functional Unit: 100 uses of coverall
Single use coverall needed: 100
Reusable PPE needed: 1



All Results: Impact on Human Health

Functional Unit: 100 uses of coverall
Single use coverall needed: 100
Reusable PPE needed: 1

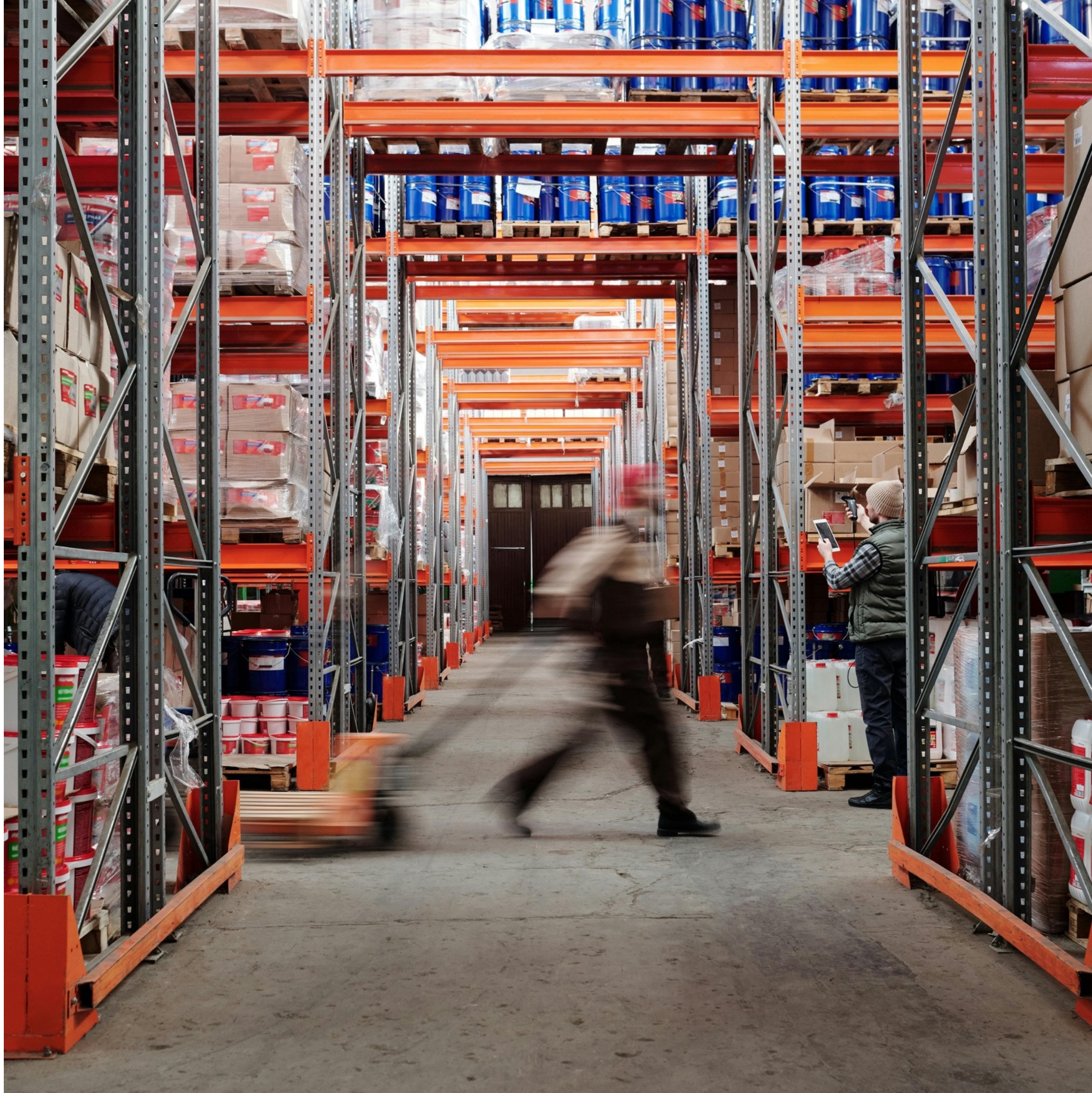


Key conclusions of comparative analysis

- To reduce the environmental impact of single-use coveralls, significant improvements can be made by focusing on raw materials and the energy used during manufacturing. However, the greatest reductions are possible by switching from single-use to reusable coveralls.
  - 🔻86% climate change
  - 🔻79% impact on human health
- It is important to highlight that this study focuses on two main indicators: climate change and human health. Other impact categories, such as ecosystem quality and water usage, are not covered. For example, the reusable coverall requires approximately **1,000 litres of water** for cleaning over its lifespan.

Q&A

LCA Results
Part II



Hygienic Pads

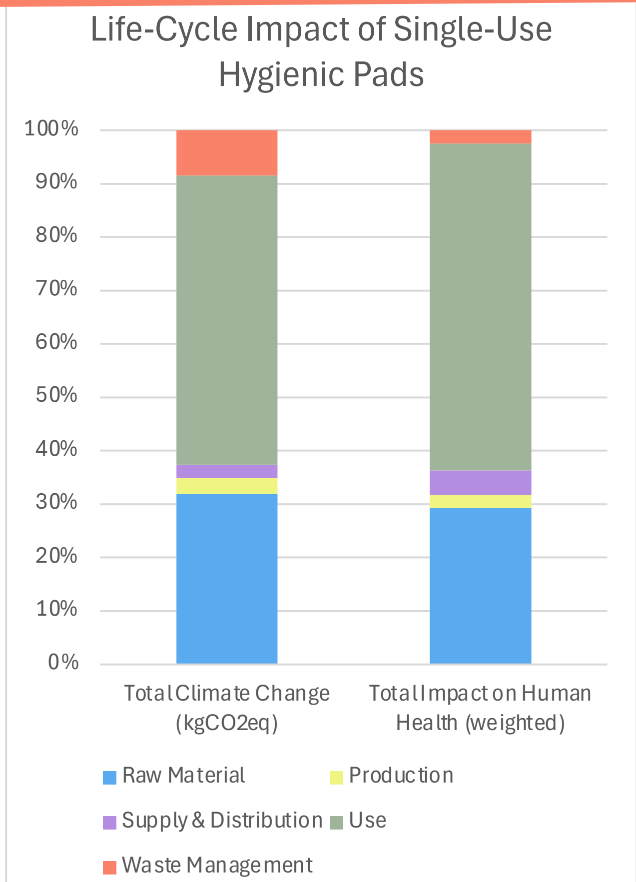
Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	11g net weight
Raw Material	Bill of Materials	Polyethylene, paper, glue, wood pulp
	Packaging	LDPE Film
Production	Manufacturing Location	Local to warehouse and distribution location (i.e. within 1,500 km)
	Manufacturing Processes	Modelled using energy and water use
Supply & Distribution	Transport Chain	TRUCK for procurement of materials (500 km) TRUCK to warehouse (1,500 km) & distribution (1,500 km)
Use	Utilization	10 pads per period (modelled low to represent scarcity)
	Usage Processes	Washing of hands after use of each pad (2L water & soap)
Waste Management	Product Disposal Method	Open Dumping + Wastewater
	Packaging Disposal Method	Open Dumping

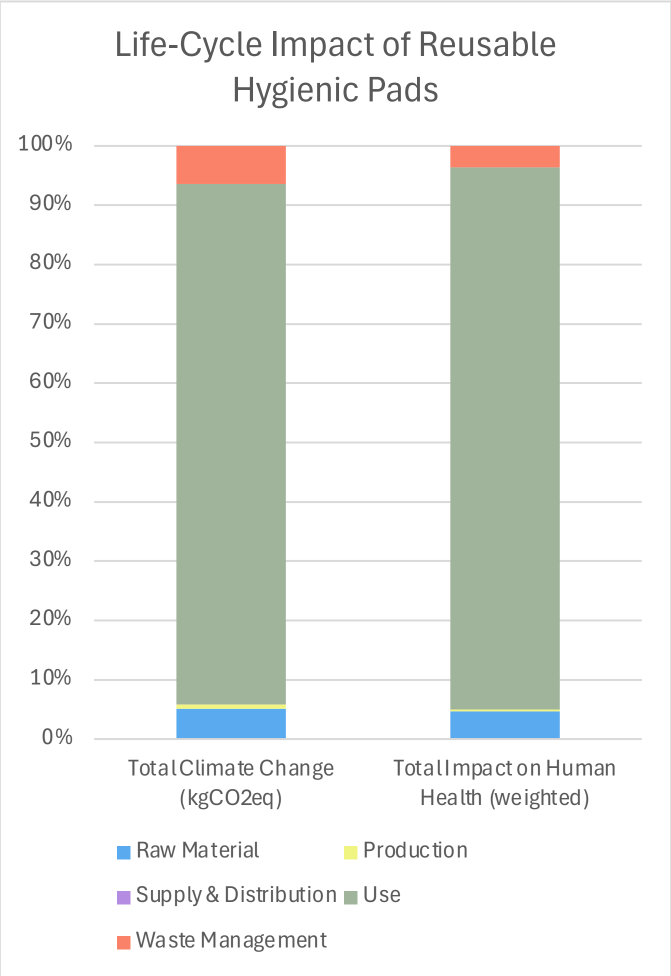
Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	43g net weight
Raw Material	Bill of Materials	Polyester, cotton
	Packaging	LDPE Film
Production	Manufacturing Location	India
	Manufacturing Processes	Modelled using energy use
Supply & Distribution	Transport Chain	TRUCK for procurement of materials (500 km) TRAIN to port (1,500 km), SEA to final location (10,000 km) TRUCK to warehouse (1,500 km) & distribution (1,500 km)
Use	Utilization	2 pads per year used interchangeably (5 times per period)
	Usage Processes	Washing of pad after each use (5L water + soap)
Waste Management	Product Disposal Method	Open Dumping + Wastewater
	Packaging Disposal Method	Open Dumping

Results



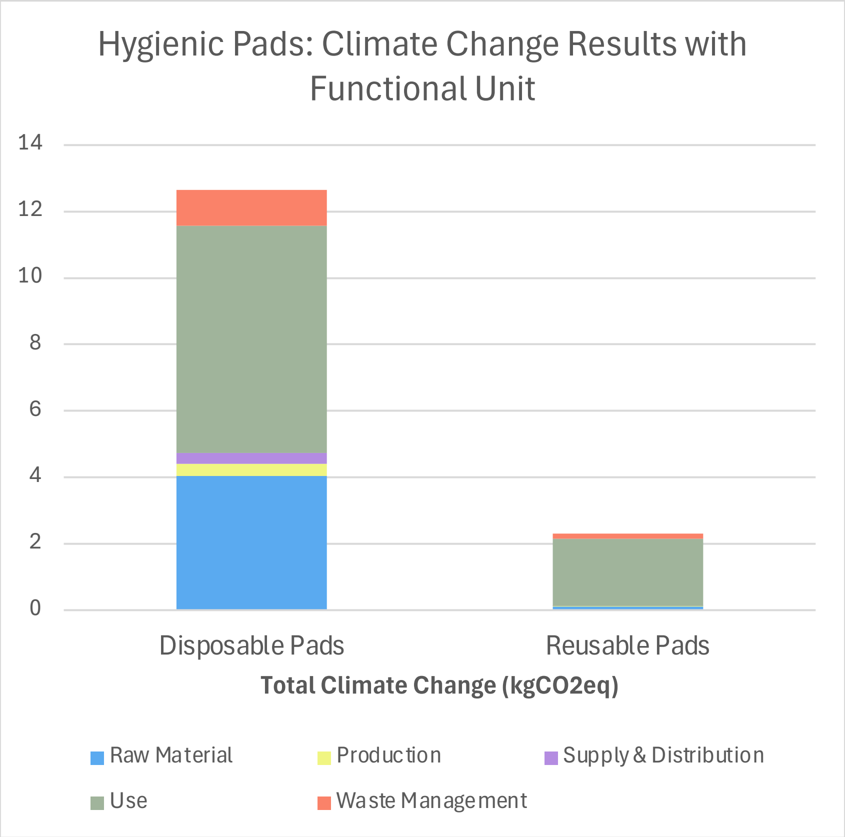
- For both types of pads, the largest share of impact is caused by the water during the use of the pads, consisting of handwashing for single-use pads and laundry for reusable pads
- For disposable hygienic pads it is **54%/61%** of GHG Emissions/impact on human health
- For reusable pads it is **88%/91%** of GHG Emissions/impact on human health
- Plastic leakage
  - All elements of this product cause plastic leakage due to the assumption of open dumping.

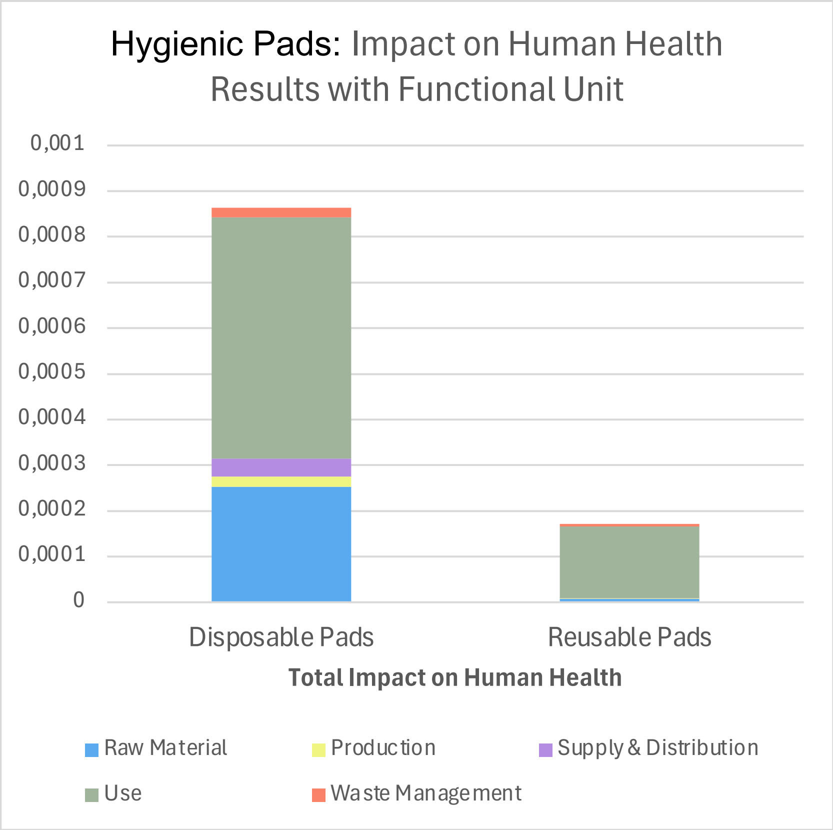


Emission factors		Unit
Cradle-to-grave	0.11	kgCO2eq/unit
Cradle-to-gate	0.04	kgCO2eq/unit

Emission factors		Unit
Cradle-to-grave	1.15	kgCO2eq/unit
Cradle-to-gate	0.07	kgCO2eq/unit

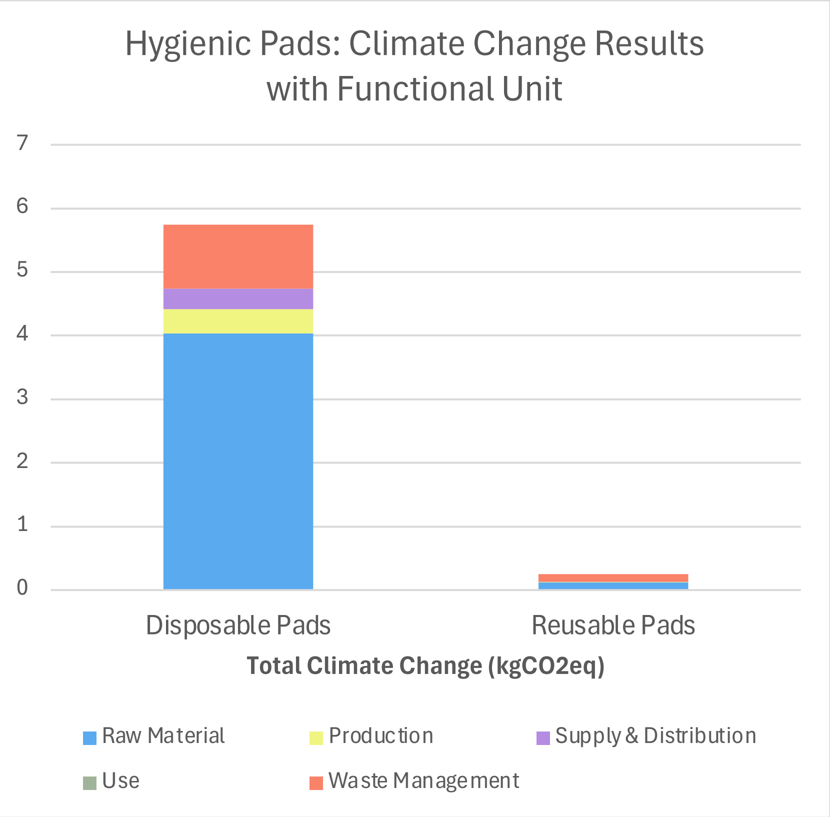
Comparative Results

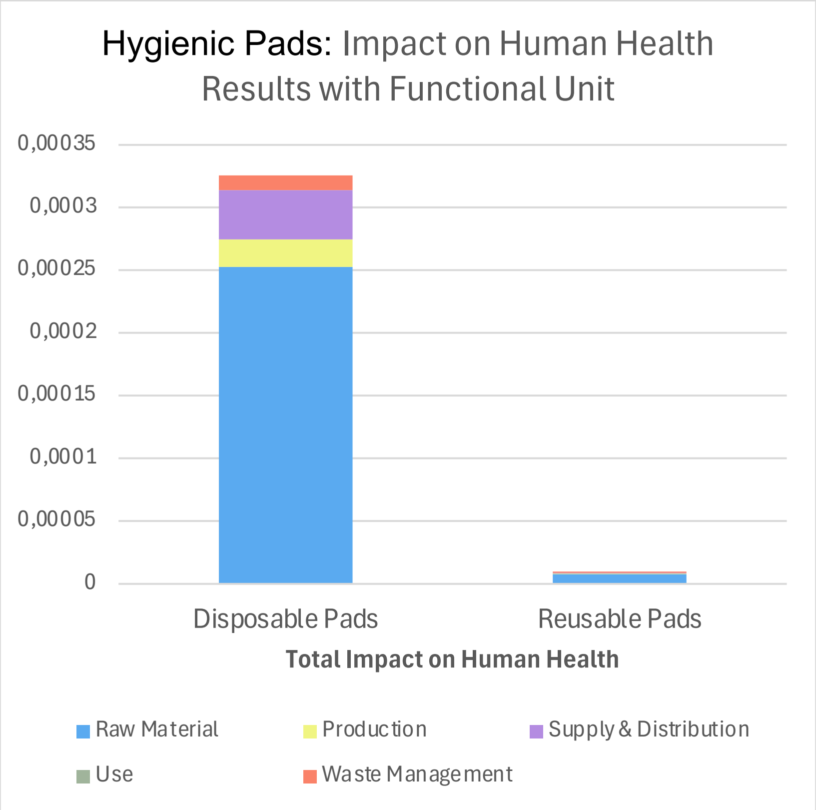




- The functional unit of this study is 12 periods. It was assumed that 120 disposable pads and 2 reusable pads are needed to fulfil this function.
- As a result, the comparative impact for 12 periods is significantly lower for reusable pads due to the lower amount of items needed, reducing the climate change impact by **82%** and impact on human health by **80%** for one year, primarily due to the water use

Comparative Results



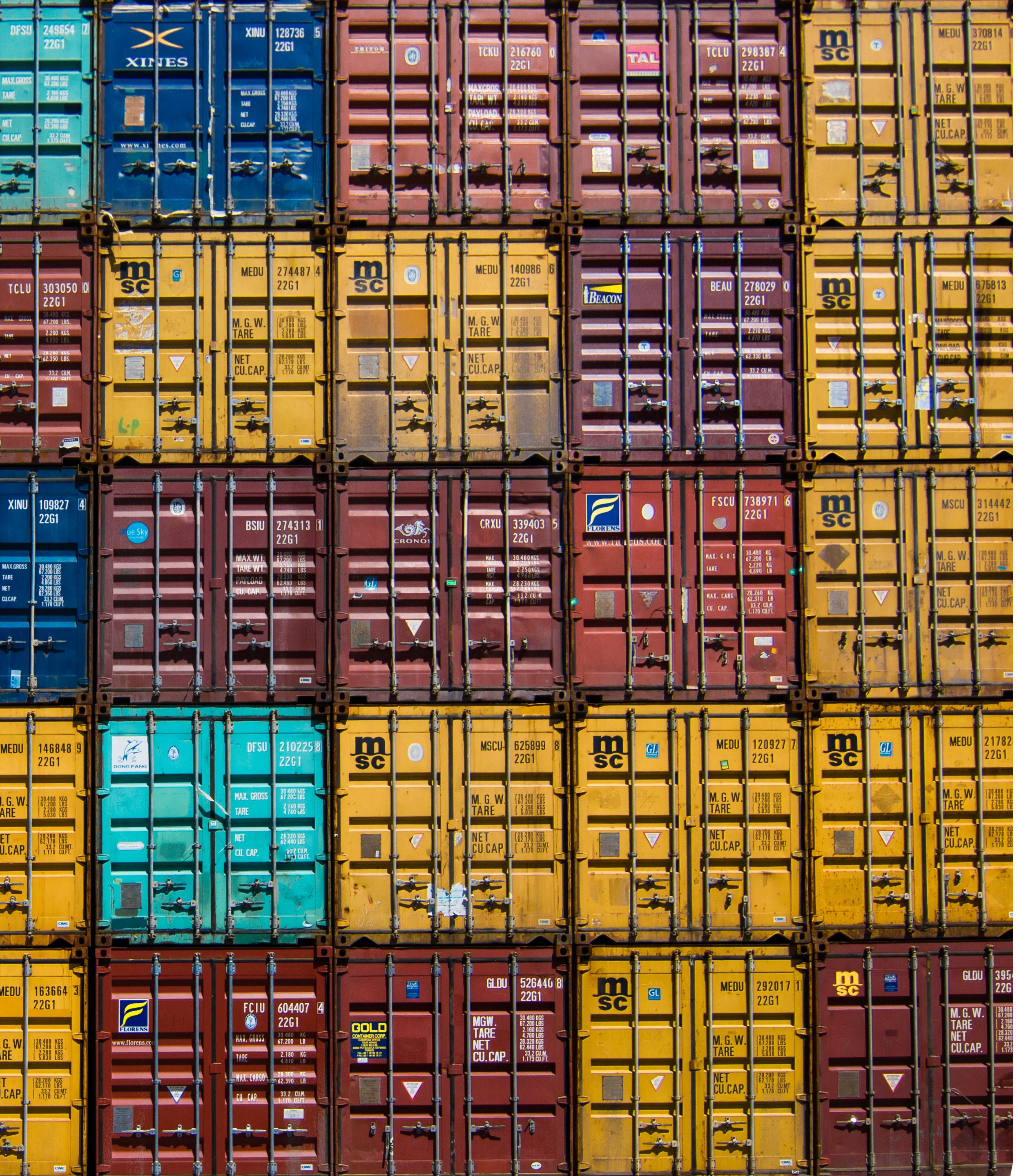


- If water was not considered, the reduction would be even higher, amounting to a net **96%** reduction in both categories due to a switch from 120 single-use pads to only 2 reusable pads
- Updating the reusable pads with ones produced with renewable energy changes the impact by **~1%** if the water is considered, and **7%/4%** if not considered

Key conclusions of comparative analysis

- Changing the type of hygienic pad used can significantly lower the impact of the item, when assuming effective reuse of the pad, in this case for 12 periods:
  - 🔻82% climate change
  - 🔻80% impact on human health
- The impacts to local ecosystems and water systems must be studied to expand on this result.

Mosquito Nets/LLINs



Acknowledgement

The project team warmly thanks UNITAID for generously sharing data and insights from the life cycle assessment of mosquito nets conducted as part of the report *"From Milligrams to Megatons."* The findings from this existing LCA served as a basis for the present analysis.

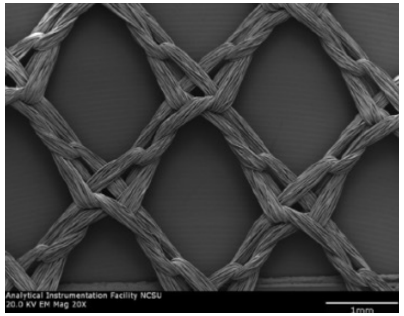
The content of this document is the sole responsibility of the project team.

https://unitaid.org/uploads/Report_From-milligrams-to-megatons_A-climate-and-nature-assessment-of-ten-key-health-products.pdf

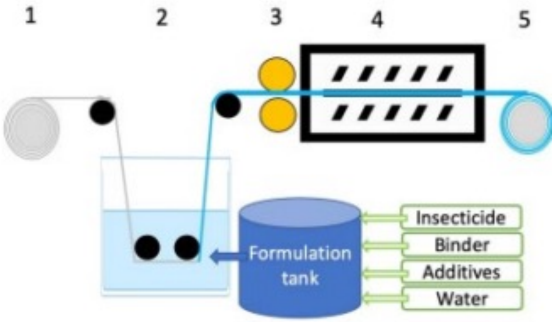
Key Product Parameters & Assumptions

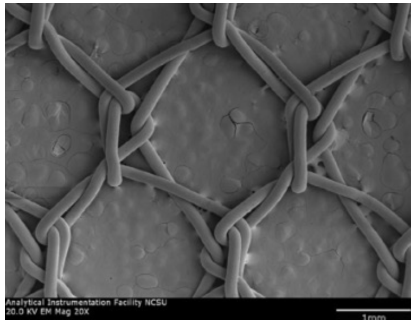
LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	Assessing the impact of the two main type of Long-Lasting Insecticide Nets (LLIN) distributed by humanitarian organisations and pre-qualified by WHO.
Raw Material	Bill of Materials	• Virgin PET (100 D) OR • Virgin PE (150 D) XL: 190*180*150 cm Insecticide: Alpha-Cypermethrin and Chlorfenapyr (6g/net)
	Packaging	PE Film with packing tape
Production	Manufacturing Location	China
	Manufacturing Processes	Modelled as electricity consumption
Supply & Distribution	Transport Chain	TRUCK at origin for materials and final product SEA shipping to regional DC in Africa TRUCK at destination for storage and distribution
Use	Lifespan	Virgin PET: 2 years (holes begin to emerge in the PET fabric) Virgin PE: 3 years (standard life of insecticides in the net)
	Usage Processes	None
Waste Management	Product Disposal Method	Open burning
	Packaging Disposal Method	Open burning

Key Product Parameters & Assumptions

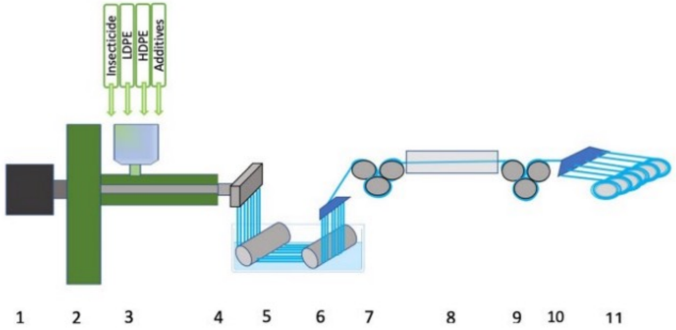


Polyester (Polyethylene Terephthalate, PET) LLINs are made from yarns composed of multiple filaments twisted together during the production process. In PET LLINs, the insecticide is applied as a surface coating.



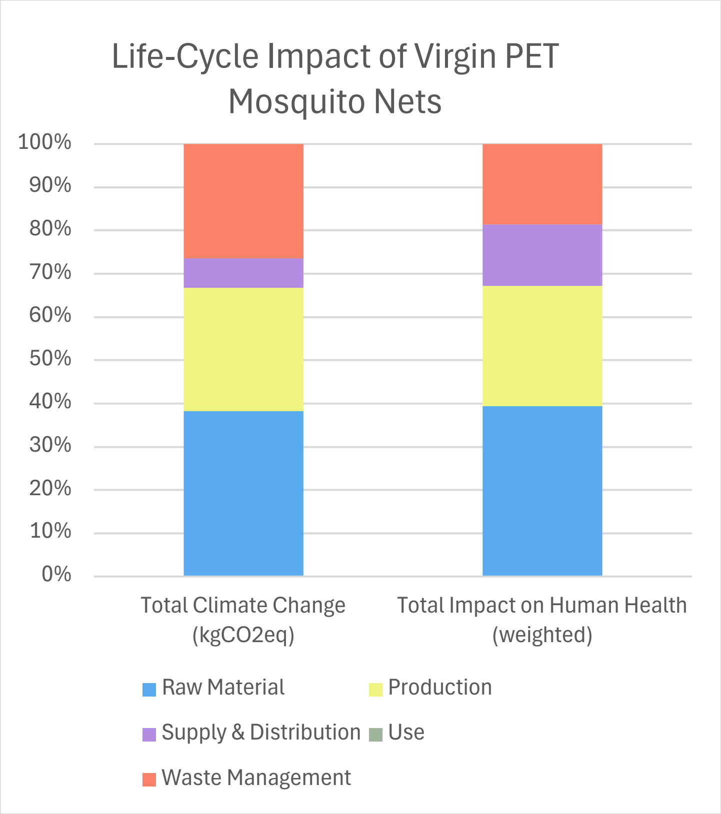


Polyethylene (PE) LLINs are typically made from single-filament yarns extruded with additives, colorants, and insecticide. As a result, the insecticide is distributed throughout the yarn, a process known as 'incorporation' technology.

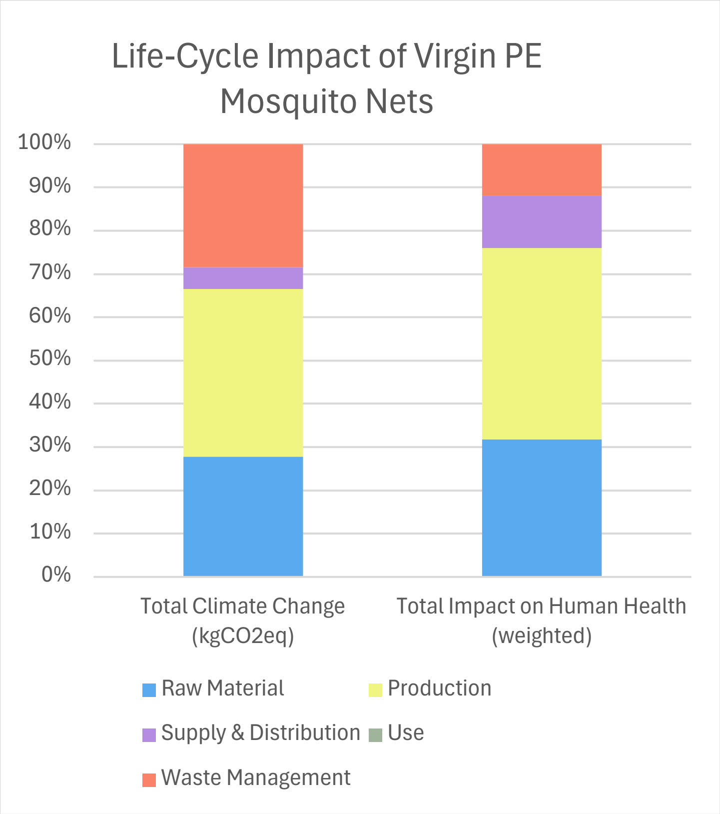


Source: https://www.unhcr.org/sites/default/files/2024-03/greening-opportunities-for-mosquito-nets.pdf

Baseline Results



- Both being polyethylene products, the distribution of impact is very similar between virgin PET and virgin PE mosquito nets.
- The emission factor is lower for virgin PE, whilst it also has a longer lifespan.
- Insecticides account for 2-3% of impacts (GHG and Human Health)
- Plastic leakage
  - It is assumed that nets are incinerated, thereby avoiding leakage for the product.
  - The packaging is assumed to be dumped/littered causing leakage for all scenarios.



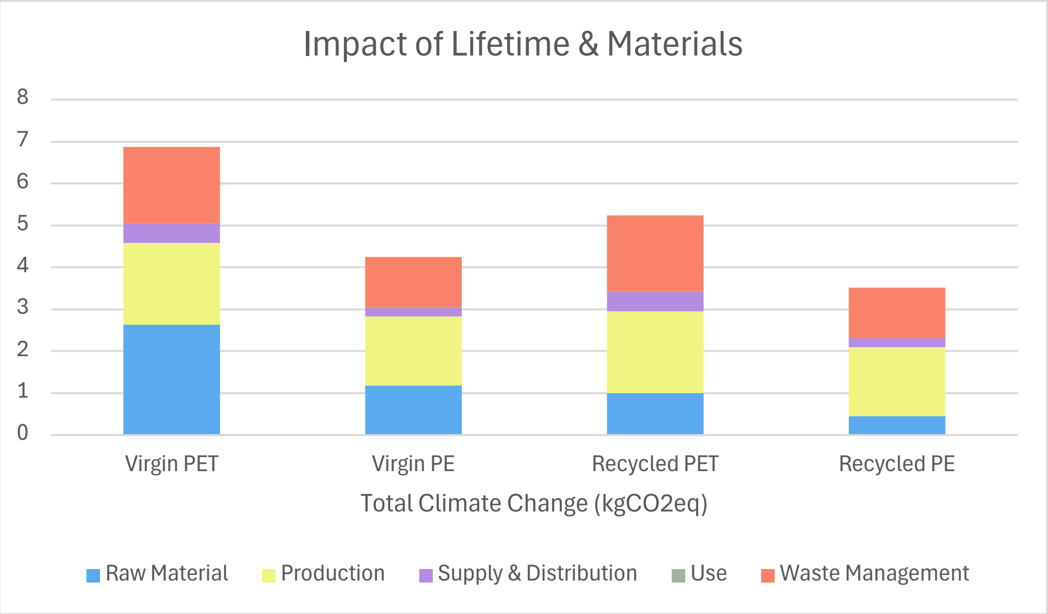
Emission factors		Unit
Cradle-to-grave	4.58	kgCO2eq/unit
Cradle-to-gate	3.10	kgCO2eq/unit

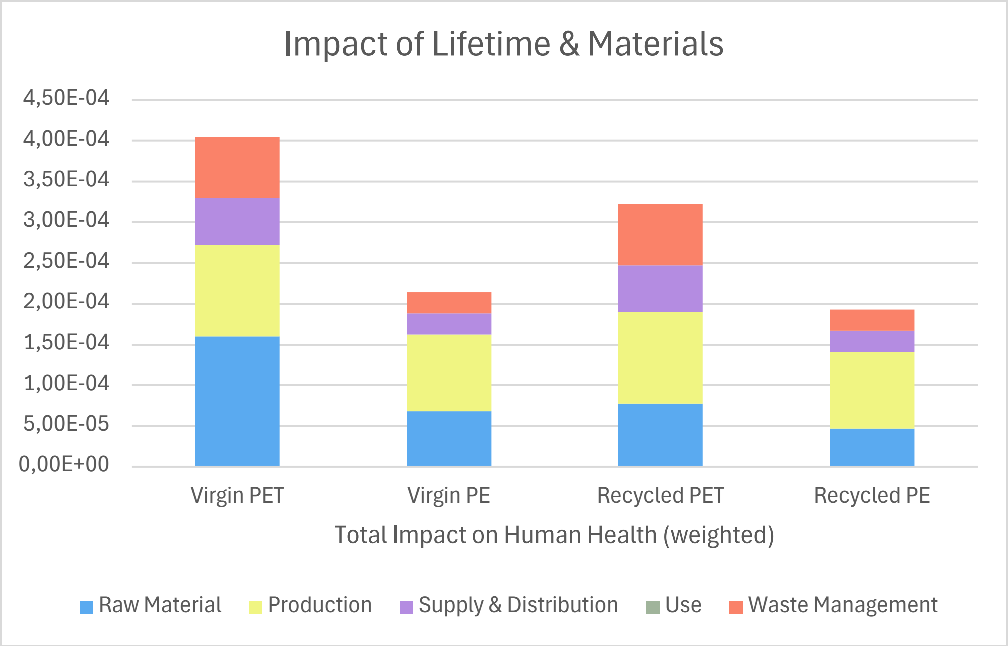
Emission factors		Unit
Cradle-to-grave	4.24	kgCO2eq/unit
Cradle-to-gate	2.85	kgCO2eq/unit

Variations per lifecycle stage

	Raw Material	Production	Use Life	Supply & Distribution	Waste Management
Baseline	Virgin PET	Average energy mix	No washing	TRUCK – SEA – TRUCK	Open Burning
	Virgin PE	Solar energy for production		TRUCK – AIR – TRUCK	Recycling in Europe
	Recycled PET				
	Recycled PE				

Materials



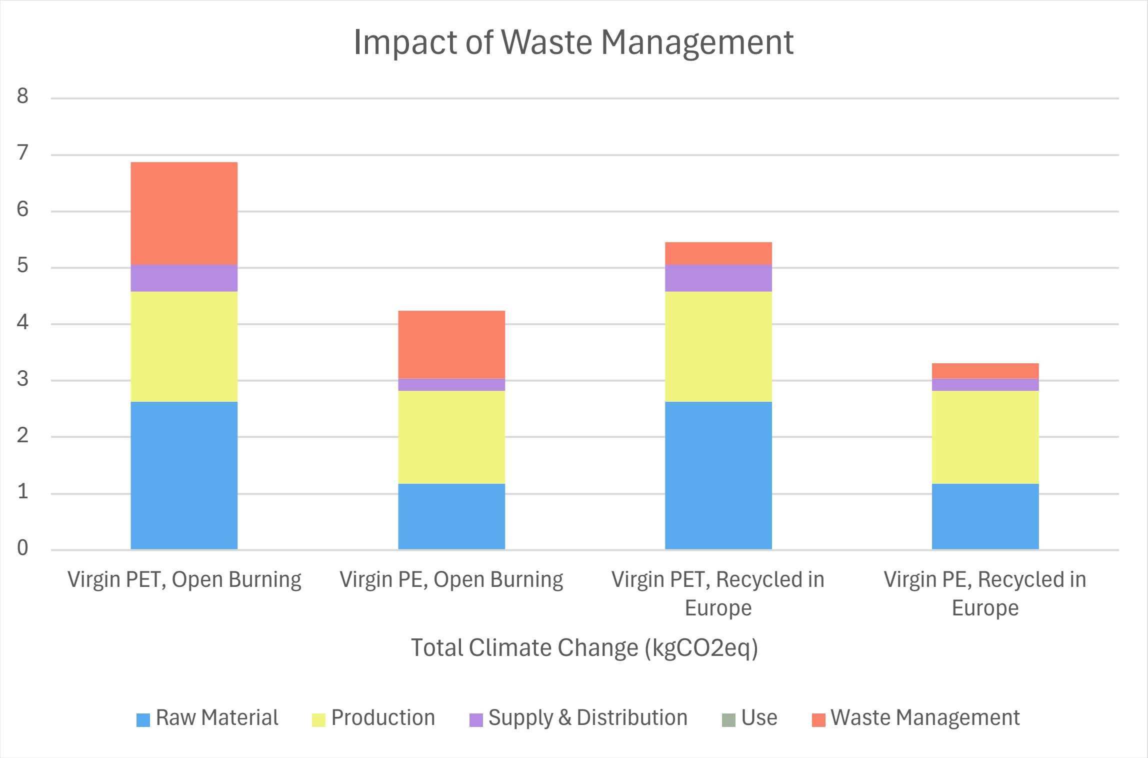


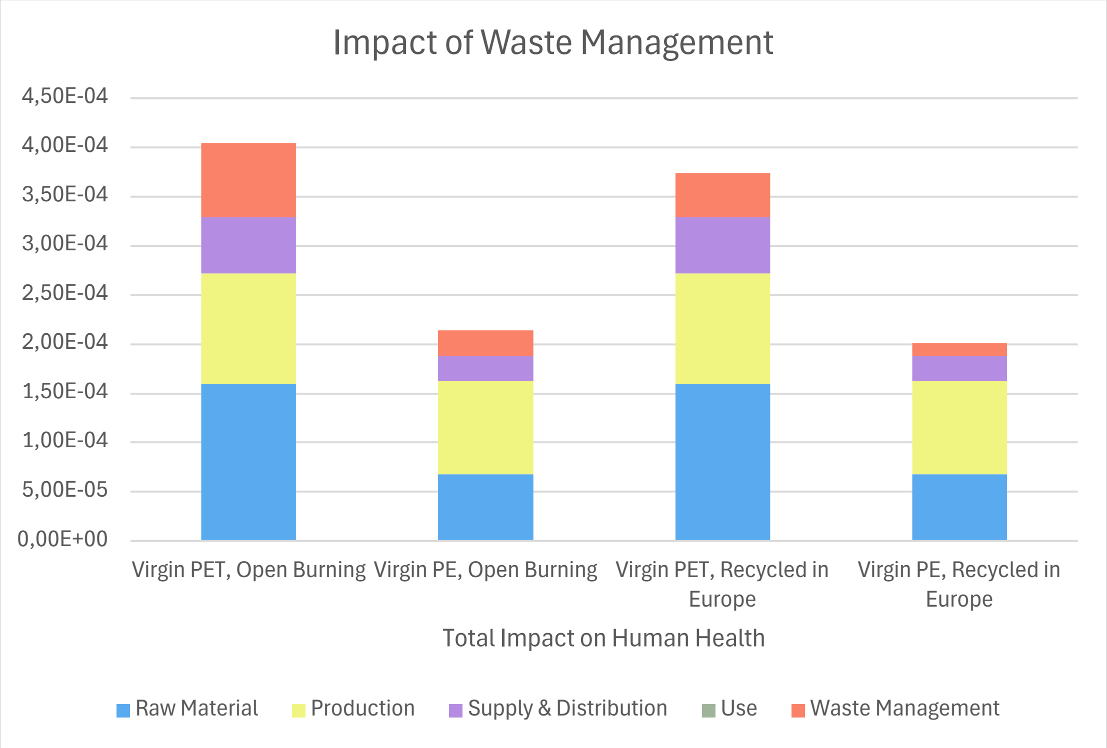
Lifetime and Materials

- While 100% recycled materials are not currently feasible, assessing their maximum theoretical impact helps illustrate the potential scale of this lever for LLINs.
- Using PE nets instead of PET nets, reduces the GHG emissions impact by **38%**, and human health impacts by **47%.**
- Comparing against their virgin plastic versions, we observe that for the defined functional unit (3 years of protection), switching to recycled plastics results in the following reductions:
  - Recycled PET: **24%** reduction in GHG emissions & **20%** reduction in impact on human health
  - Recycled PE: **17%** reduction in GHG emissions & **10%** reduction in impact on human health

Note: Since virgin PET nets have an assumed lifespan of only 2 years—after which holes begin to form in the fabric—this study compares 1.5 virgin PET nets with 1 virgin PE net, which lasts 3 years and meets the defined functional unit of 3 years.

Waste management

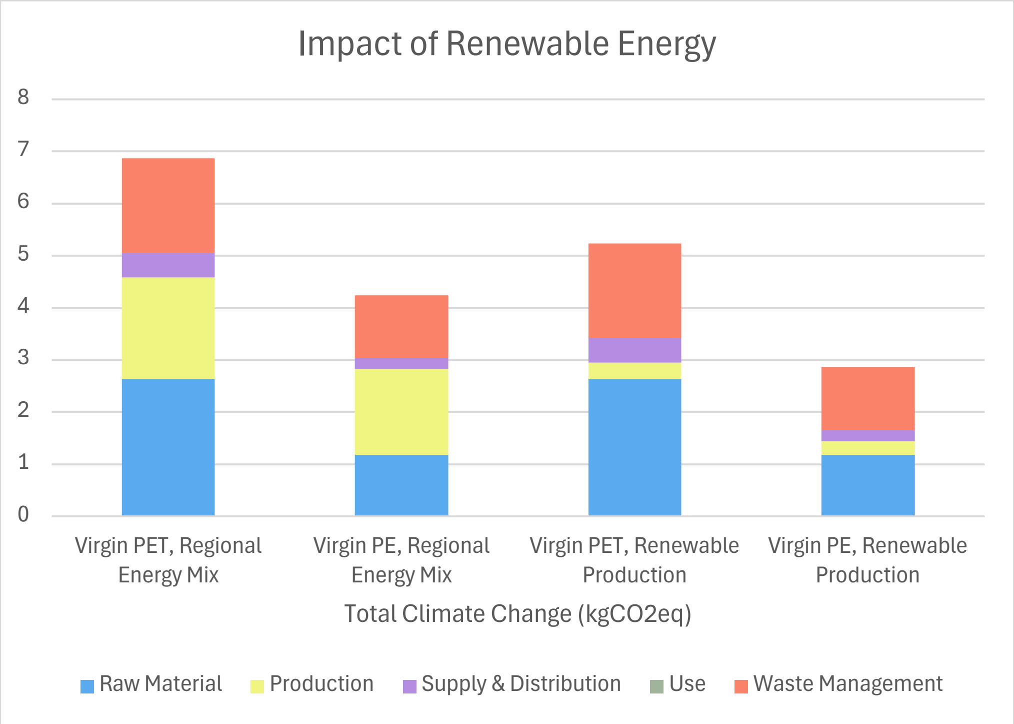


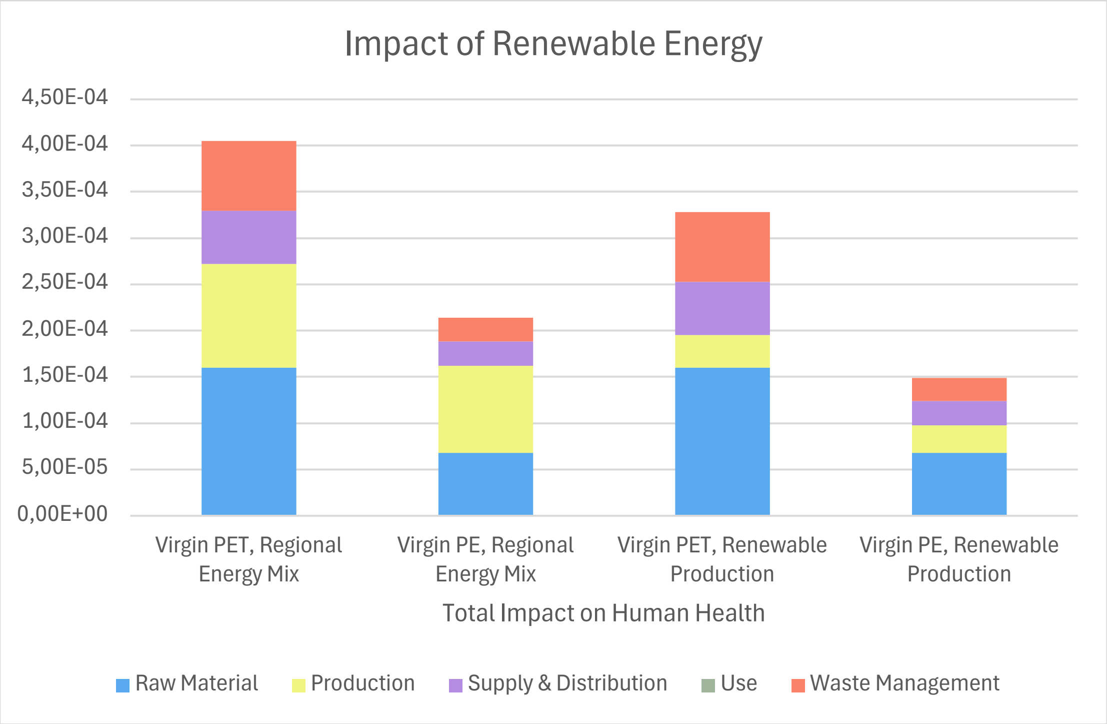


Waste Management

- At baseline, both product types are considered to be burnt in open pits at the end of their lives. To neutralise this impact, this study models an alternative scenario where, at the end of the 1st use life of the product, the items are collected and taken to Europe for polyethylene recycling. Even if it is also theoretical, it represents the maximum achievable reduction in this field.
- This results in a net reduction of **21%** of GHG emissions and **~6%** impact on human health for both variations of mosquito nets.

Energy for Production

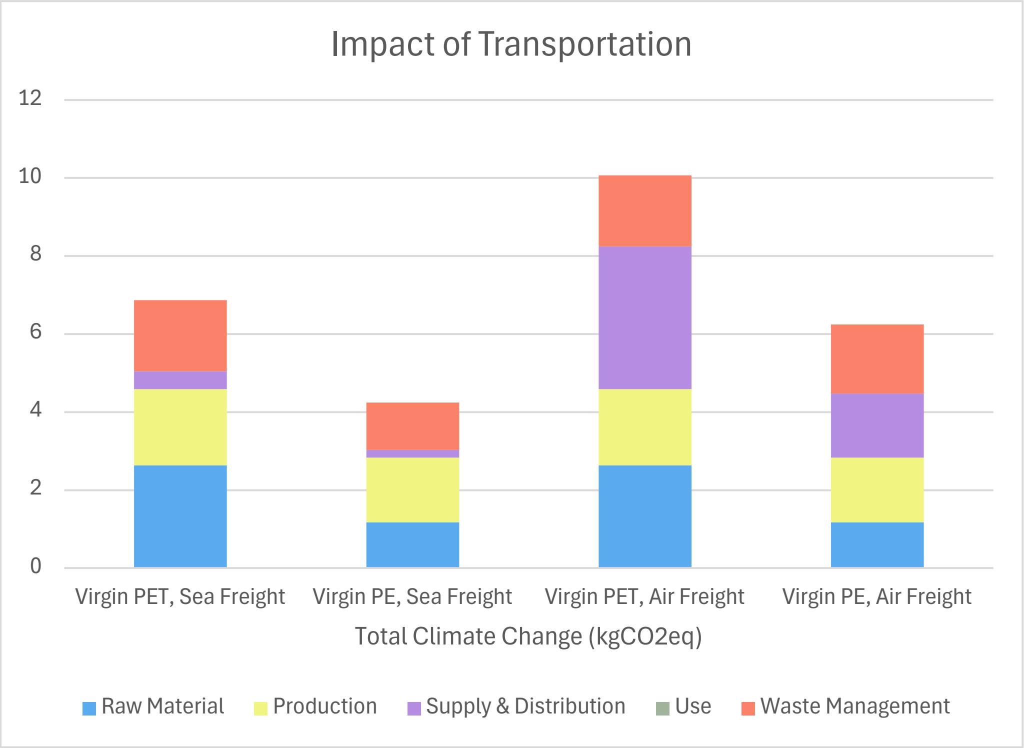


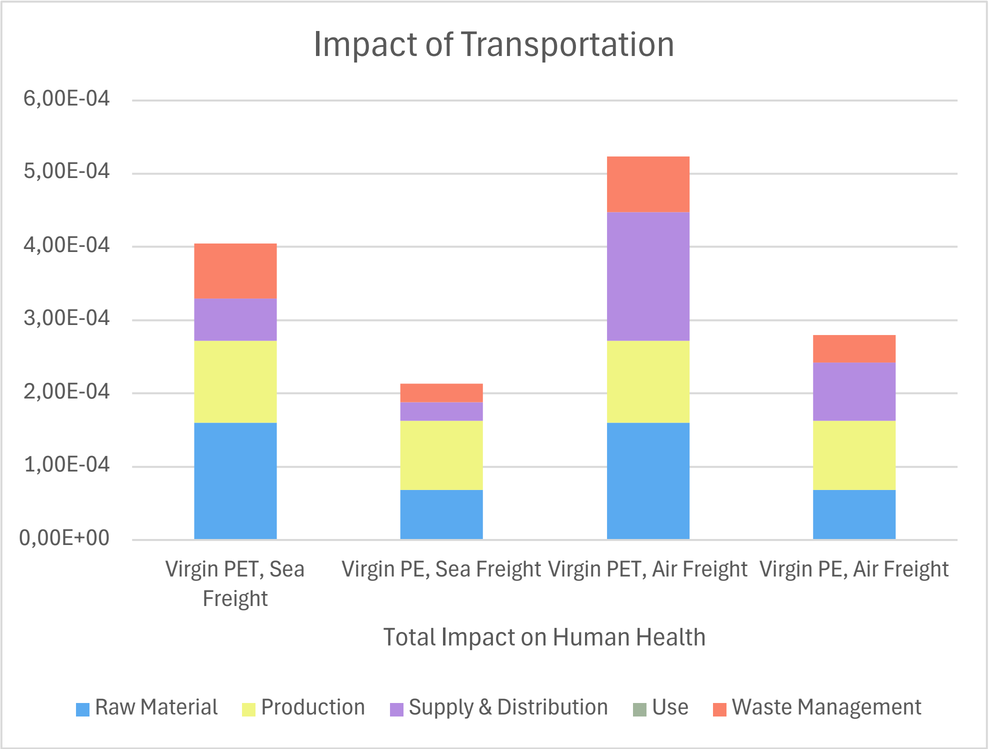


Energy for Production

- Switching the energy source of 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
- Comparing against their virgin versions, using solar panels to produce the electricity needed to manufacture the nets results in the following impact reductions:
  - Virgin PET: **24%/19%** reduction in GHG emissions & human health respectively
  - Virgin PE: **32%/30%** reduction in GHG emissions & human health respectively

Impact Assessment



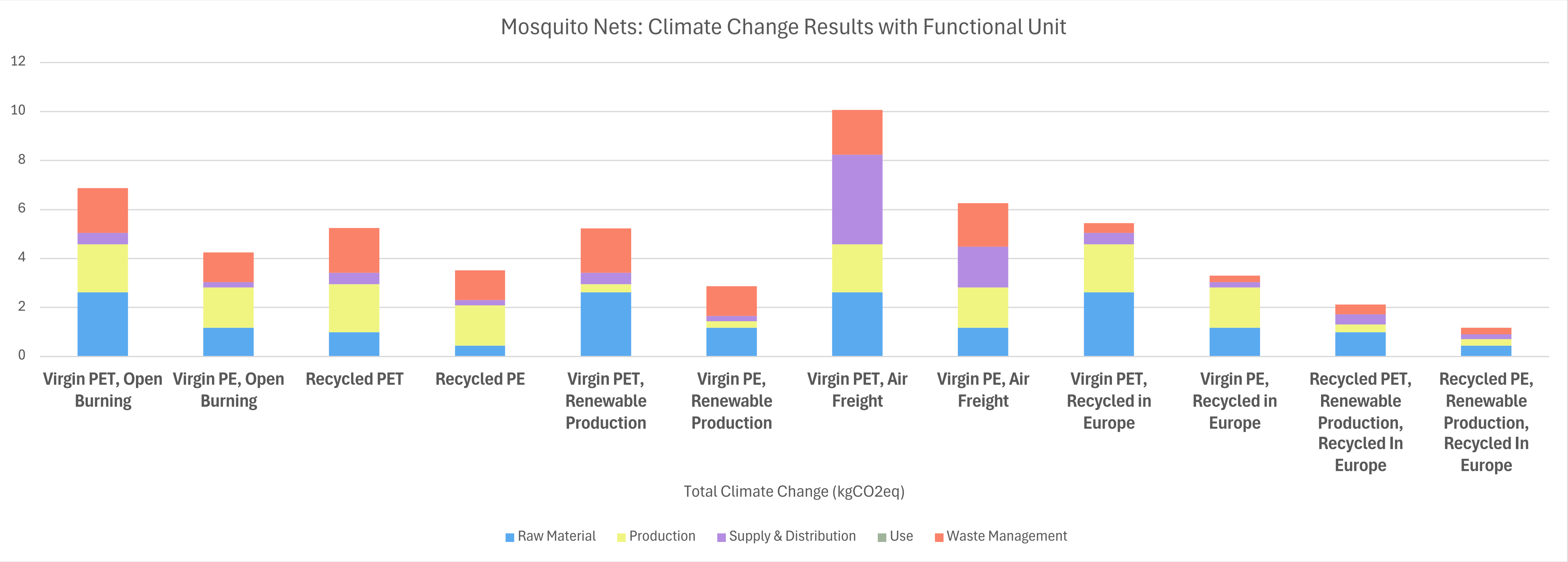


Transportation & Geography

- The nets are made in China and transported to Africa by sea freight. If this transport chain were replaced by air freight, impacts would increase significantly for both categories.
- Taking Virgin PET nets as a reference, switching from sea to air transport changes the impact as follows:
  - Virgin PET: **46%/29%** increase in GHG emissions & human health respectively
  - Virgin PE: **47%/31%** increase in GHG emissions & human health respectively

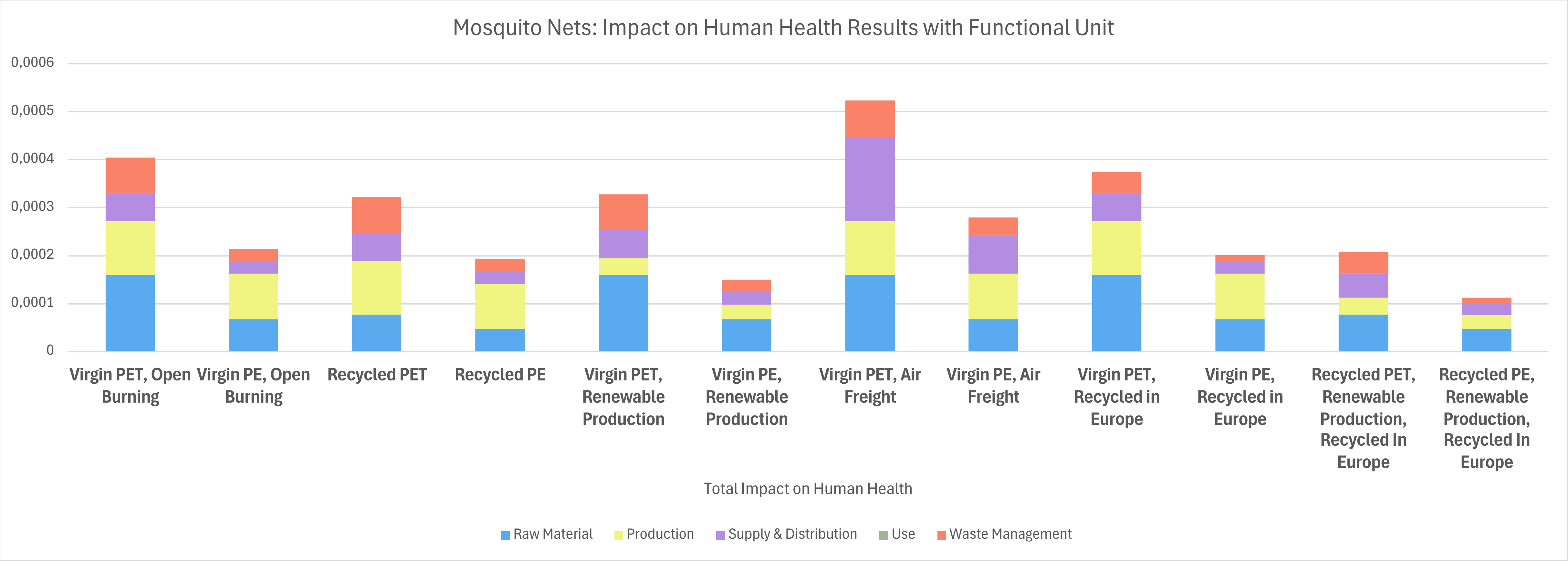
All Results: Climate Change

Functional Unit: 3 Years of Protection
Virgin PET nets needed: 1.5
Virgin PE nets needed: 1



All Results: Impact on Human Health

Functional Unit: 3 Years of Protection
Virgin PET nets needed: 1.5
Virgin PE nets needed: 1



Key conclusions

- Mosquito nets are made from either PET, with an assumed lifespan of 2 years, or PE, which are assumed to last 3 years.
- PE nets may seem less favourable due to their more impact-intensive production. However, they prove to be the better option from an environmental and human health perspective due to their longer lifespan and lighter in materials.
- Switching from PET to PE net may achieve a reduction of **38%** reduction in GHG emissions & **47%** reduction in impact on human health
- Most of the environmental impact is concentrated in the material and production phases, with around 60% of the impact coming from virgin material use.
- Switching to recycled plastics results in the following reductions (compared to the virgin net):
  - Recycled PET: **24%** reduction in GHG emissions & **20%** reduction in impact on human health
  - Recycled PE: **17%** reduction in GHG emissions & **10%** reduction in impact on human health
- Switching to renewable energy in the production process results in the following reductions (compared to the virgin PET net):
  - Virgin PET: **24%/19%** reduction in GHG emissions & human health respectively
  - Virgin PE: **33%/30%** reduction in GHG emissions & human health respectively

Key conclusions (continued)

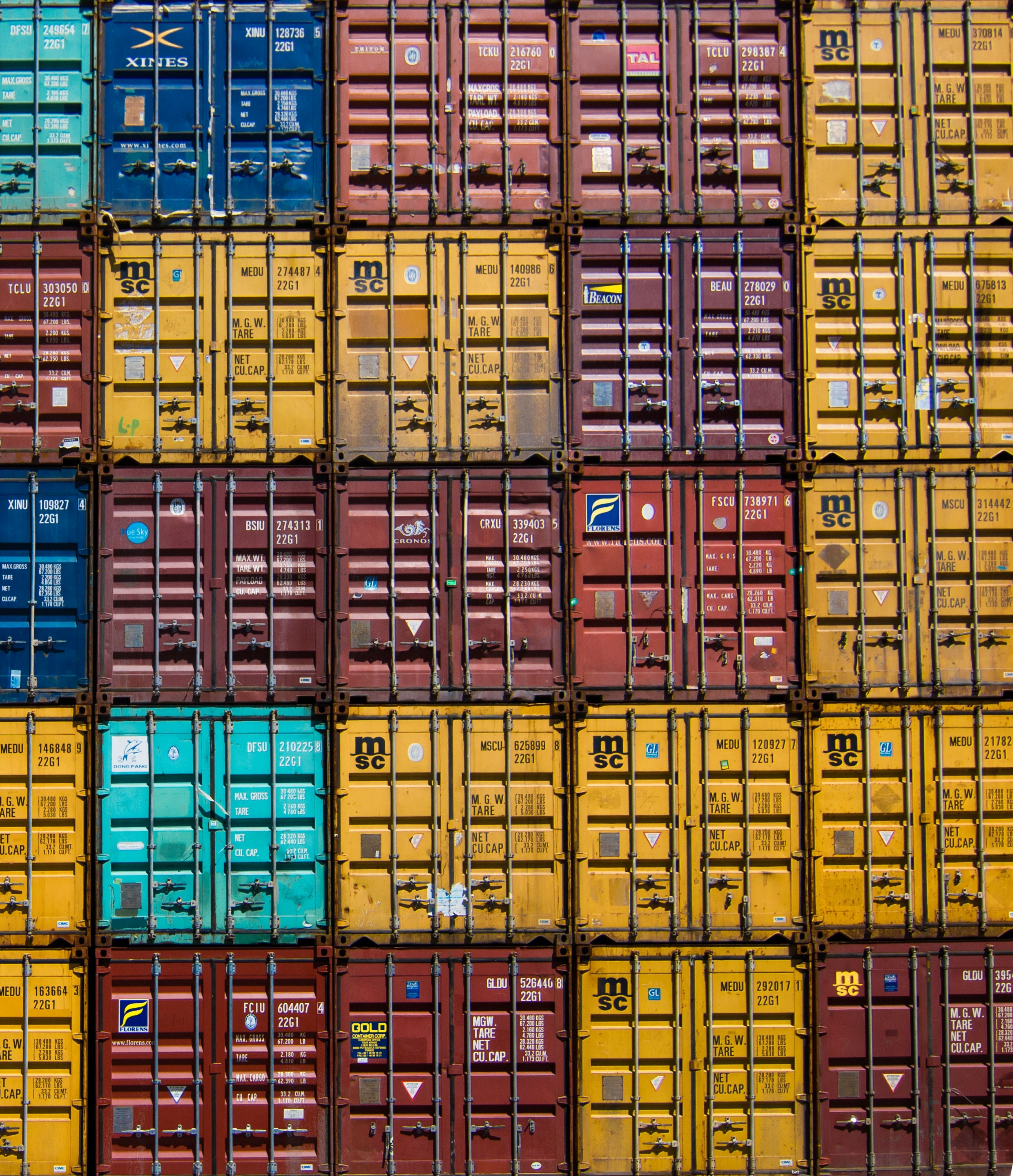
The use of recycled inputs should be approached carefully, as they often face limitations in terms of quality, cost, and availability.

This study did not consider the diversity of end-of-life pathways that exist for mosquito nets, as mosquito nets are frequently repurposed for uses such as fishing, fencing, or clothing before final disposal.

While the scenario of sending waste to Europe for recycling is rather hypothetical, it underscores the need to prioritise local infrastructure development to address plastic waste sustainably. Some manufacturers have piloted take-back or circular programs that could be leveraged and scaled in the future.

This study did not consider additional environmental or human health impacts of insecticides or dyeing processes.

RUTF



Acknowledgement

The project team warmly thanks Nutriset for sharing data and insights from their lifecycle analysis of RUTF. The findings from this existing LCA served as a basis for the present analysis. All data was anonymised to ensure that no sensitive information is disclosed.

The content of this document is the sole responsibility of the project team.

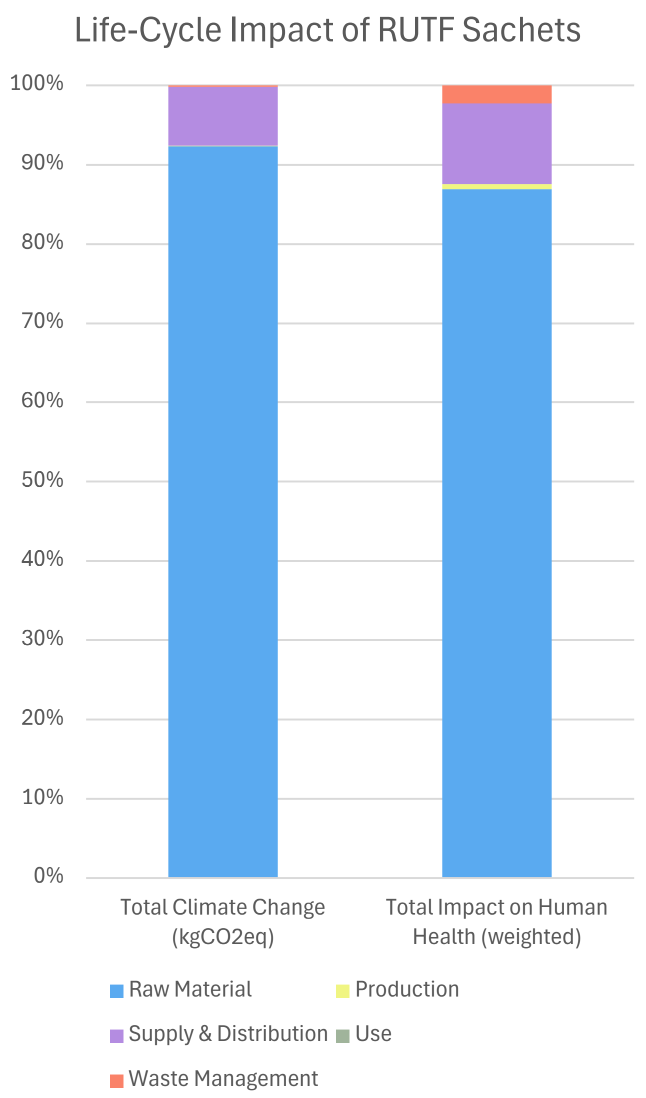
Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	92g net weight
Raw Material	Bill of Materials	Milk Powder, Peanut Paste, Vegetable Oil, Sugar, etc
	Packaging	PET, Aluminium Foil & Cardboard
Production	Manufacturing Location	France
	Manufacturing Processes	Modelled using energy use only
Supply & Distribution	Transport Chain	TRUCK transport of materials to factor SEA shipping of product to regional distribution centre TRUCK transport to distribution location
Use	Lifespan	-
	Usage Processes	None (consumable)
Waste Management	Product Disposal Method	None (consumable)
	Packaging Disposal Method	Open Burning

Baseline Results

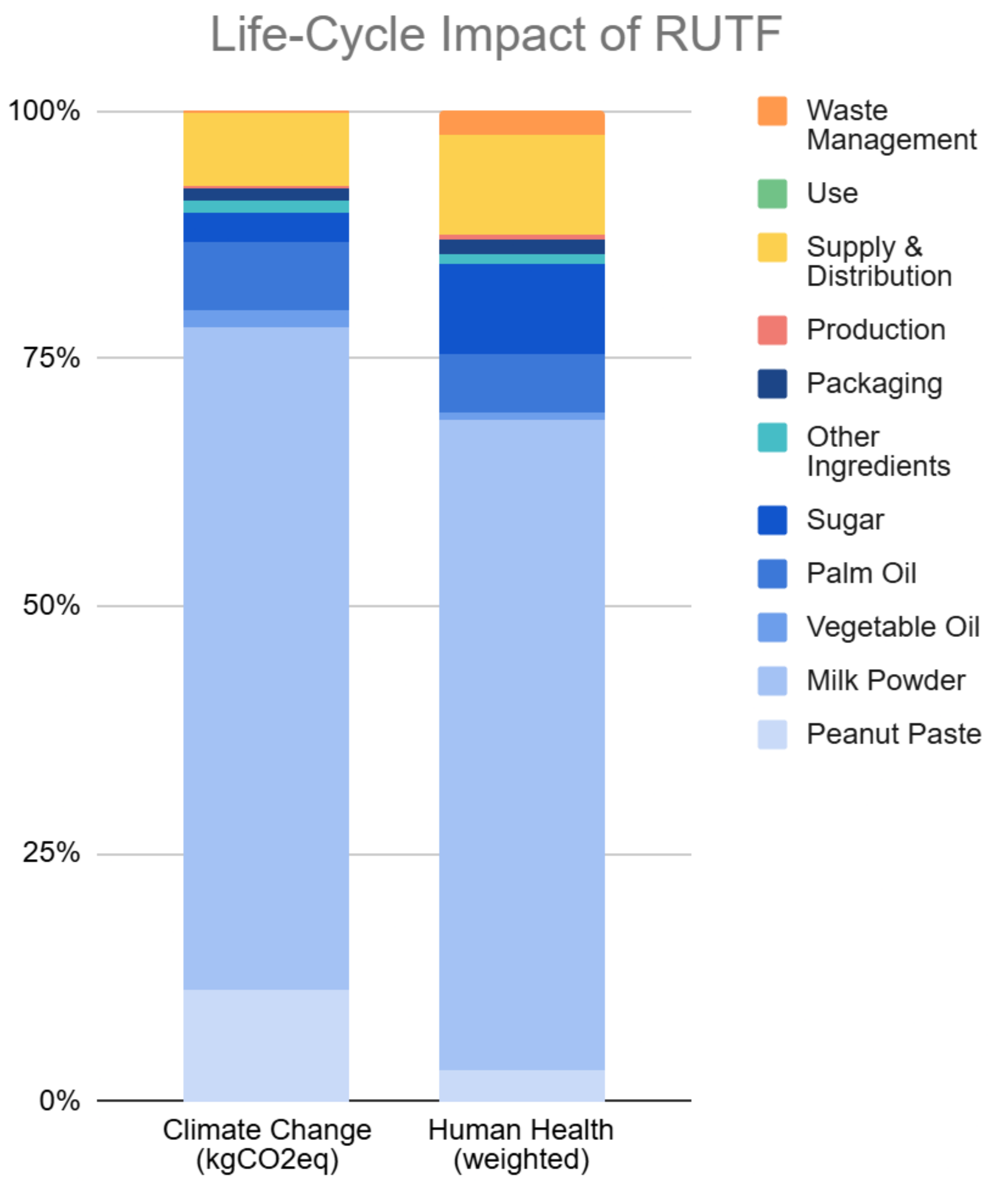
- Raw materials account for **92%** of the total GHG Emissions of the item, and **87%** of the total impact on human health.
- Milk protein alone accounts for **67%** of total GHG emissions and **66%** of the overall impact on human health.
- As the raw materials are imported from various locations, supply and distribution make up the next largest share of impact with **7%** of total GHG Emissions and **10%** of total impact on human health.
- The disposal of the RUTF packaging has very little impact on GHG Emissions, however it makes up **2%** of the impact on human health
- Plastic leakage
  - The packaging is considered as open-burned, causing no leakage for all scenarios

Emission factors per sachet (92g)		Unit
Cradle-to-grave	0.58	kgCO2eq/sachet
Cradle-to-gate	0.55	kgCO2eq/sachet



Baseline Results

- The graph illustrates the contribution of each raw material to overall impacts.
- Across ingredients, milk powder stands out as the dominant contributor across the entire lifecycle, followed by palm oil and peanut paste.



Variations per lifecycle stage

	Raw Material	Production	Use Life	Supply & Distribution	Waste Management
Baseline	Baseline Recipe (average procurement)	Made in France with energy from grid	-	International distribution from France to Central Africa	Open burning of packaging
	Baseline Recipe with Lower carbon milk Protein*	Made in Niger with energy from grid		Local distribution from Niger to adjacent locations (material imported)**	
		Made in France with renewable energy			

* Best avaialble factor in ecoinvent 3.11 on climate change.

** All raw mateirals are considered imported (milk from Europe, peanut from Argentina, …) for the Niger scenario while milk is considered as locally sourced in the France scenario.

Impact Assessment

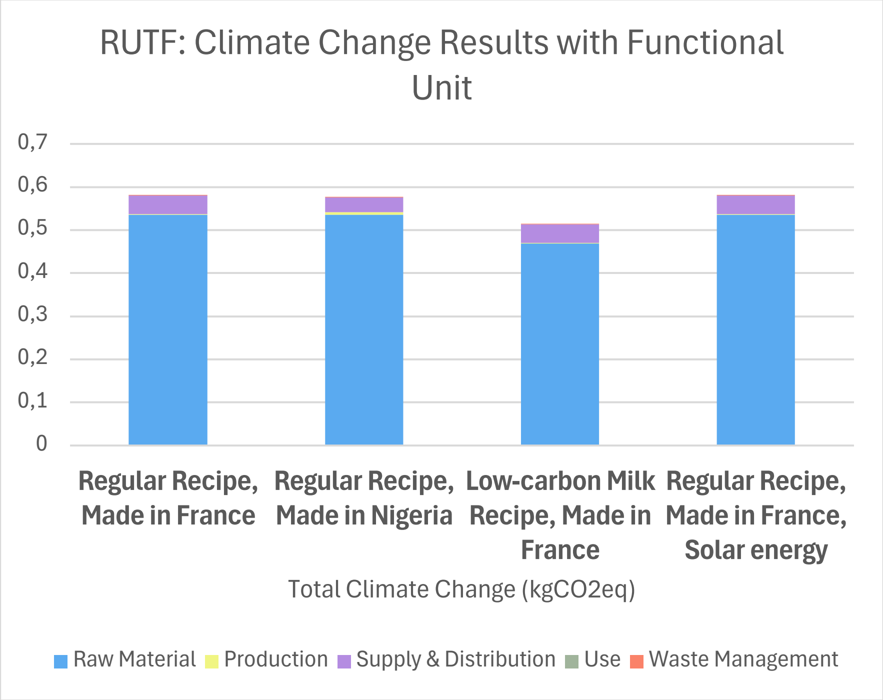
- Switching to locally produced RUTF might appear to be a promising strategy. However, when accounting for changes in ingredient sourcing, the potential reductions are limited—approximately **1%** for climate change impacts and **3%** for human health impacts.

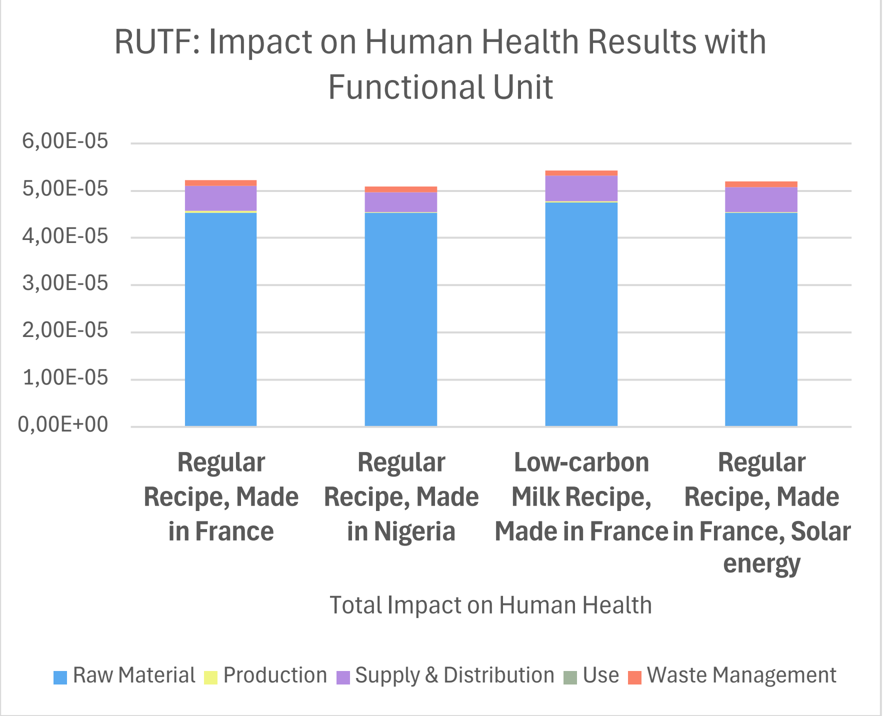
- To explore additional decarbonization strategies, a scenario was modelled in which average milk was replaced with a lower carbon impact alternative, sourced from pasture-fed cows with the lowest climate footprint. While this substitution could reduce the product's climate impact by **11%**, it would also lead to a **4%** increase in the impact on human health.*

- Producing with renewable energy would only have a limited impact, saving **0.01%** of climate change and **0.5%** of human health impacts. This is because energy represents a very small proportion of impacts, and the French baseline energy has a limited impact.

- These variation are not significant and are in the uncertainty areas, so no clear conclusion can be deducted.

- **Ultimately, this study underscores the substantial environmental impact of milk within the product's formulation.**





* This is not the "best" possible milk, but an example from South African milk calculated in ecoinvent that appears to be the less impactful regarding climate change

Key conclusions of comparative analysis

- To reduce the impact of RUTF, changing the location of the production has a relatively low impact:
  - 🔻1% climate change
  - 🔻3% impact on human health

- This study highlights the significant contribution of milk to the overall impact.
- Better agricultural practices can contribute to the reduction of the impact.*
- A key next step in assessing the decarbonization potential of RUTF involves exploring the possibilities of reducing the milk-based content in RUTF, while continuing to ensure optimal health outcomes for patients.
- Implementing such changes would require updates to the WHO Codex Alimentarius standards for RUTF.

Note: The calculations are based on impact factors from the ecoinvent 3.11 database. Several of these factors were recently updated, resulting in lower environmental impacts for certain raw materials. As a result, the current findings may differ from those of previous analyses.

* RSPO Palm oil, agroforestry practices ,… had not been integrated in the scenarios as impact assessment factors are not available for this study..

Q&A

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