GREEN SHOES 4ALL

PRODUCT ENVIRONMENTAL FOOTPRINT OF FOOTWEAR

LIFE GREEN SHOES 4 ALL · LIFE17 ENV/PT/000337

WHAT IS THE PEF?

Product environmental Footprint (PEF) is a method based on a Life Cycle Analysis (LCA) and a set of specific rules to calculate the environmental performance of products belonging to a product category in scope, such as footwear products, taking into account the entire product life cycle (from the extraction and pre-processing of raw materials, manufacturing, distribution and use to end of life.

Figure 1 – Life Cycle assessment

WHAT ARE THE MAIN GOALS OF PEF STUDIES?

PEF studies aims to improve the validity, comparability, and verification of the environmental performance of products, supports reliable and relevant environmental claims and contributes to single market for green products.[1]

HOW TO CALCULATE THE PEF OF FOOTWEAR?

In the framework of Environmental Footprint (EF) transition phase (2018-2020) a document defining the category rules to calculate the environmental footprint of apparel and footwear products is being developed and should be released at the end of 2020. This document intends to provide detailed and comprehensive technical rules on how to conduct PEF studies that are more reproducible, consistent, robust, and verifiable, allowing the comparation of environmental footprint of products of the same category.[2]

PEF studies follows several steps, including, the definition of **goal and scope** of the study (e.g., one pair of shoes to meet the consumer's needs, etc.) the **life cycle inventory** (data collection and quantification of inputs and outputs, concerning energy, raw material and other physical inputs, products and co-products and waste, emissions to air/water/soil, and other environmental aspects, for each life cycle stage), **life cycle assessment** (calculation of environmental impact categories) and **interpretation & reporting** (results assessment of results and recommendations).

Figure 1 shows a workflow and applications of an LCA that shall be followed in PEF studies.

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[1] Joint Research Centre (2021). Understanding Product Environmental Footprint and Organisation Environmental Footprint methods.

[2] Quantis (2021). Draft product Environmental Footprints category rules (PEFCR) – Apparel and Footwear.

1 Goal and scope definition of the Product Environmental Footprint

Reasons and intended applications
Functional unit
System boundary
Impact categories
Allocations
Data requirements
Assumptions and limitations

2 Life Cycle Inventory (LCI)

Collection of primary and secondary data elementary (system inputs and outputs)

Data Calculation relating to functional unit

3 Life Cycle Impact Assessment (LCIA)

Calculation of potential impact associated to the defined impact categories from inventory data

4 Interpretation and EF reporting

Interpretation of LCIA results, hotspots analysis and recommendations to reduce the environmental footprint

Applications

Product development
Ecodesign
Production improvement Eco-labelling
Strategic planning
Policy making
Other

Figure 2 - Workflow and applications of an LCA (based on[1])

WHAT ARE THE MAIN LIMITATIONS OF PEF STUDIES?

The implementation of a PEF/LCA involves a large amount of data that need to be supplied by the companies about the footwear product under study, including data on:

1. Raw materials and pre-processing
Origin, composition, processing processes and quantity of footwear materials and components necessary to produce the final product.

2. Manufacturing
Consumptions and emissions associated with footwear manufacturing process (e.g., energy and water consumption and emissions).

3. Distribution
Transport and storge of final products.

4. Use
Consumptions and emissions over the product lifetime (e.g., energy, maintenance materials, water), including durability & repairability.

5. End of Life
Activities that occur after the footwear is no longer used and is disposed or recycled.

Due to the huge amount of data and complexity of value chain, it is often necessary make assumptions and proxies to calculate the environmental impact of products. Product Environmental Footprint Category Rules for footwear document will define common approaches to overcome these limitations.

WHAT ARE THE RESULTS?

PEF studies calculate 16 impact categories related to environmental and human toxicity, use of natural resources, climate impact, climate change and water use (Table 1), using a software tool where primary and secondary data are uploaded, following PEFCR and implementing calculation methods defined for each impact category.

The absolute values of each impact category are normalised and weighted, allowing the identification of the most relevant impact categories, life cycle stages, processes and flows that should intervened to reduce the environmental impact of footwear products.

IMPACT CATEGORIES	DESCRIPTION
Climate change, total (kg CO^2 eq)	Increase in the average global temperature resulting from greenhouse gas emissions (GHG)
Ozone depletion (kg CFC-11-eq)	Depletion of the stratospheric ozone layer protecting from hazardous ultraviolet radiation
Human toxicity, cancer humans (CTUh)	Impact on human health caused by absorbing substances through the air, water, and soil. Direct effects of products on humans are not measured.
Human toxicity, non-cancer humans (CTUh)	
Particulate matter (disease incidence)	Impact on human health caused by particulate matter e missions and its precursors (e.g., sulphur and nitrogen oxides)
Ionising radiation, human health (kBq U-235 eq)	Impact of exposure to ionising radiations on human health
Photochemical ozone formation, human health (kg NMVOC eq)	Potential of harmful tropospheric ozone formation (“summer smog”) from air emissions
Acidification (mol H+ eq)	Acidification from air, water, and soil emissions (primarily sulphur compounds) mainly due to combustion processes in electricity generation, heating, and transport.
Eutrophication, terrestrial (mol N eq)	Eutrophication and potential impact on ecosystems caused by nitrogen and phosphorous emissions mainly due to fertilizers, combustion, sewage systems
Eutrophication, freshwater (kg N eq)	
Eutrophication, marine (kg N eq)	
Ecotoxicity, freshwater (CTUe)	Impact of toxic substances on freshwater ecosystems
Land use (Dimensionless – pt)	Transformation and use of land for agriculture, roads, housing, mining or other purpose. The impact can include loss of species, organic matter, soil, filtration capacity, permeability
Water use (m^3 world eq)	Depletion of available water depending on local water scarcity and water needs for human activities and ecosystem integrity
Resource use, minerals and metals (kg Sb eq)	Depletion of non-renewable resources and deprivation for future generations
Resource use, fossils	

Table 1 - PEF environmental impact categories (based on[1])

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