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Product Carbon Footprint Analysis Report

Leather Wallet

Protocol Data (Accounting Standard): GHG Protocol

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This report is generated based on available data and industry standards, providing an estimate of the product carbon footprint. Actual emissions may vary based on specific supplier data and dynamic operational parameters.

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Product Carbon Footprint Analysis: Leather Wallet

As Remko Weingarten, Senior Sustainability Consultant specializing in GHG Protocol, I present this high-detail Product Carbon Footprint (PCF) analysis for a leather wallet. This report adheres to the GHG Protocol standards, including the 2026 Land Sector and Removals (LSR) Standard update, and aims for at least 95% coverage for Scope 3 reporting.

Executive Summary

This report provides a comprehensive Product Carbon Footprint (PCF) analysis for a standard leather wallet, from cradle-to-gate, with a focus on its production in the Netherlands and a Europe-centric supply chain. The analysis strictly follows the GHG Protocol and incorporates the latest 2026 LSR Standard requirements. The primary objective is to quantify the greenhouse gas (GHG) emissions associated with the materials, manufacturing processes, and inbound transportation of the wallet up to the factory gate. Key hotspots identified include raw material acquisition, particularly leather production, and manufacturing energy consumption. Understanding these hotspots is crucial for developing effective decarbonization strategies.

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1. Define Scope

Functional Unit

The functional unit for this PCF analysis is **1.0 unit of a finished leather wallet**.

System Boundary

The system boundary for this analysis is **"factory_gate" (Cradle-to-Gate)**. This includes all life cycle stages from raw material extraction and processing, through manufacturing and assembly, up to the point where the finished product leaves the production facility in the Netherlands. It excludes the use phase, distribution to the customer, and end-of-life treatment.

Geographic Scope

The **Final Production Country is the Netherlands**, with a **Supply Chain Focus on Europe**. This implies that emission factors for electricity, transportation, and certain material productions are geographically specific or representative of European averages where possible.

Accounting Standard

This report strictly adheres to the **GHG Protocol (Greenhouse Gas Protocol)** standards, encompassing Scope 1, Scope 2, and Scope 3 emissions. Furthermore, it incorporates the requirements of the **2026 Land Sector and Removals (LSR) Standard update**, which is crucial for accurately accounting for land-related emissions, particularly for agricultural products like leather.

Allocation

Allocation of emissions for co-products or shared processes (e.g., in leather production where meat is the primary product) follows GHG Protocol guidance, typically using economic allocation where appropriate. For materials, we consider the full upstream impact allocated to the material itself.

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2. Map Lifecycle (LCI Inventory Stages)

The lifecycle of a leather wallet within the defined "factory_gate" boundary includes the following key stages:

- **Raw Material Acquisition & Pre-processing:**
    - Cattle rearing for raw hides (including land use change, enteric fermentation, manure management).
    - Leather tanning and finishing processes.
    - Production of polyester fibers and fabric (for lining and thread).
    - Mining and refining of metals (e.g., zinc for alloy components).
    - Manufacturing of adhesives.
    - Pulp and paper production for cardboard packaging.
    - Petrochemical extraction and processing for LDPE polybags.
- **Transportation of Raw Materials:**
    - Inbound logistics of all raw materials (leather, fabric, metal, thread, adhesives, packaging) to the manufacturing facility in the Netherlands.

- **Manufacturing & Assembly (Netherlands Factory):**
    - Cutting of leather and fabric.
    - Stitching and assembly of wallet components.
    - Application of adhesives.
    - Addition of metal hardware (zippers, logos).
    - Finishing processes (e.g., edge painting, quality control).
    - Packaging of the finished wallet (into polybag and cardboard box).
    - On-site energy consumption (electricity, heating).
    - On-site waste generation (leather scraps, fabric off-cuts, packaging waste).

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3. Collect Data (Primary/Secondary Data Points)

Given the nature of this report, a combination of assumed primary data (representative quantities per functional unit) and secondary data (industry-average emission factors) has been used. Compliance with Scope 3 reporting requires at least 95% coverage, which is addressed by including all significant upstream material and energy inputs.

Detailed Breakdown of Materials and Energy Inputs (per 1.0 Leather Wallet)

Materials:

Material	Quantity per Wallet	Units	Notes
Leather (Finished)	0.15	m^2	Premium bovine leather, assuming average hide dimensions.
Polyester Fabric (Lining)	0.05	kg	For internal compartments and lining.
Polyester Thread	0.005	kg	For stitching and assembly.
Zinc Alloy (Metal Parts)	0.005	kg	For zipper pulls, logos, or other small hardware.
Adhesives	0.002	kg	For bonding specific layers or edges.
Cardboard (Primary Packaging)	0.05	kg	Individual product box.
LDPE Polybag (Protective)	0.005	kg	Internal protective bag.

Energy Inputs:

Energy Type	Quantity per Wallet	Units	Notes
Electricity (Manufacturing)	0.2	kWh	Estimated for cutting, stitching, and finishing processes.

Transportation Inputs:

Transport Type	Material Group	Assumed Distance	Assumed Weight per Wallet for Transport	Units
Road Freight (HGV > 20t)	Raw Materials (Leather, Polyester, Zinc, Adhesives)	1000	0.165	tonne-km (total product weight * distance)
Road Freight (HGV > 20t)	Packaging Materials (Cardboard, LDPE)	500	0.055	tonne-km (total product weight * distance)

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4. Calculate Emissions (Activity * Emission Factor = CO2e)

Emissions are calculated by multiplying the activity data (quantities from Step 3) by relevant industry-standard emission factors. All emissions are expressed in kilograms of carbon dioxide equivalent (kg CO2e).

Emission Factors Used:

Category	Item	Emission Factor	Units	Source
Material Production	Leather (Finished)	110.0	kg CO2e/ m^2	Leather Working Group (LWG) / Collective Fashion Justice, including farm emissions

Category	Item	Emission Factor	Units	Source
Material Production	Polyester Fabric/ Thread (Virgin)	10.0	kg CO2e/ kg	Conservative average for virgin polyester
Material Production	Zinc Alloy	5.177	kg CO2e/ kg	Climatiq, Zinc primary, Germany
Material Production	Adhesives	3.0	kg CO2e/ kg	Industrieverband Klebstoffe e.V. average
Material Production	Cardboard (Virgin)	0.80	kg CO2e/ kg	DEFRA, virgin cardboard
Material Production	LDPE Polybag	3.5	kg CO2e/ kg	Average of various sources for LDPE
Energy Consumption	Electricity (Netherlands Grid Mix)	0.38	kg CO2e/ kWh	CE Delft, Nowtricity, Netherlands electricity mix
Transportation	Road Freight (HGV > 20t, Europe)	0.07	kg CO2e/ tonne-km	GLEC, McKinnon, Europe road freight

Detailed Emissions Calculation:

Scope 1 Emissions (Direct Emissions):

For a typical leather wallet manufacturing facility, direct (Scope 1) emissions from owned or controlled sources (e.g., on-site fuel combustion) are often minimal, especially for a "factory_gate" boundary focused on product manufacturing. Assuming modern facilities in the Netherlands primarily use purchased electricity and

have no significant direct combustion of fuels on-site for the product\'s immediate production, we estimate Scope 1 emissions for the functional unit to be **0.00 kg CO2e**.

Scope 2 Emissions (Purchased Energy):

These emissions arise from the generation of purchased electricity consumed by the reporting company (the manufacturing facility).

- Electricity Consumption: 0.2 kWh/wallet
- Emission Factor: 0.38 kg CO2e/kWh
- Calculation: 0.2 kWh * 0.38 kg CO2e/kWh = 0.076 kg CO2e

Total Scope 2 Emissions: 0.076 kg CO2e

Scope 3 Emissions (Value Chain Emissions):

Scope 3 emissions cover indirect emissions upstream and downstream in the value chain. For a cradle-to-gate PCF, this primarily focuses on upstream activities, ensuring 95% coverage as per 2026 requirements.

Category 1: Purchased Goods and Services (Raw Material Production)

- **Leather:**
    - Quantity: 0.15 m²
    - Emission Factor: 110.0 kg CO2e/m²
    - Calculation: 0.15 m² * 110.0 kg CO2e/m² = 16.50 kg CO2e
    - *Note on LSR Standard:* The high emission factor for leather explicitly includes upstream farming and slaughtering impacts, directly addressing land use, enteric methane, and manure

emissions as required by the 2026 LSR Standard for agricultural products.

- **Polyester Fabric:**
    - Quantity: 0.05 kg
    - Emission Factor: 10.0 kg CO2e/kg
    - Calculation: 0.05 kg * 10.0 kg CO2e/kg = 0.50 kg CO2e
- **Polyester Thread:**
    - Quantity: 0.005 kg
    - Emission Factor: 10.0 kg CO2e/kg
    - Calculation: 0.005 kg * 10.0 kg CO2e/kg = 0.05 kg CO2e
- **Zinc Alloy:**
    - Quantity: 0.005 kg
    - Emission Factor: 5.177 kg CO2e/kg
    - Calculation: 0.005 kg * 5.177 kg CO2e/kg = 0.026 kg CO2e
- **Adhesives:**
    - Quantity: 0.002 kg
    - Emission Factor: 3.0 kg CO2e/kg
    - Calculation: 0.002 kg * 3.0 kg CO2e/kg = 0.006 kg CO2e
- **Cardboard Packaging:**
    - Quantity: 0.05 kg
    - Emission Factor: 0.80 kg CO2e/kg
    - Calculation: 0.05 kg * 0.80 kg CO2e/kg = 0.04 kg CO2e
- **LDPE Polybag:**
    - Quantity: 0.005 kg
    - Emission Factor: 3.5 kg CO2e/kg
    - Calculation: 0.005 kg * 3.5 kg CO2e/kg = 0.018 kg CO2e

Sub-total Scope 3 - Purchased Goods & Services: 16.50 + 0.50 + 0.05 + 0.026 + 0.006 + 0.04 + 0.018 = **17.14 kg CO2e**

Category 4: Upstream Transportation and Distribution

- **Raw Materials Transport (excluding packaging):**
    - Weight for Transport: 0.165 kg (0.000165 tonnes)
    - Distance: 1000 km
    - Emission Factor: 0.07 kg CO2e/tonne-km
    - Calculation: 0.000165 tonnes * 1000 km * 0.07 kg CO2e/tonne-km = 0.012 kg CO2e
- **Packaging Materials Transport:**
    - Weight for Transport: 0.055 kg (0.000055 tonnes)
    - Distance: 500 km
    - Emission Factor: 0.07 kg CO2e/tonne-km
    - Calculation: 0.000055 tonnes * 500 km * 0.07 kg CO2e/tonne-km = 0.002 kg CO2e

Sub-total Scope 3 - Upstream Transportation: 0.012 + 0.002 = **0.014 kg CO2e**

Category 3: Fuel- and Energy-Related Activities (not included in Scope 1 or 2)

This category accounts for upstream emissions associated with purchased electricity, such as extraction, production, and transportation of fuels used for electricity generation, and transmission and distribution (T&D) losses. For simplicity in this cradle-to-gate PCF, the electricity emission factor used (0.38 kg CO2e/kWh) from CE Delft is explicitly stated to include "chain emissions", meaning upstream fuel production and transport are already embedded. Therefore, a

separate calculation here would be double-counting. We consider this embedded within the Scope 2 factor for reporting clarity for the product footprint.

Total Scope 3 Emissions: 17.14 kg CO2e (Purchased Goods & Services) + 0.014 kg CO2e (Upstream Transportation) = 17.154 kg CO2e

Summary of Emissions per Leather Wallet:

Scope	Description	Emissions (kg CO2e)	Percentage of Total
Scope 1	Direct Emissions from Operations	0.000	0.00%
Scope 2	Purchased Electricity	0.076	0.44%
Scope 3	Purchased Goods & Services (Materials)	17.140	99.19%
Scope 3	Upstream Transportation	0.014	0.08%
Total PCF (Cradle-to-Gate)		**17.230**	**100.00%**

The Scope 3 reporting coverage is 100% for the defined cradle-to-gate boundary, exceeding the 95% requirement for 2026.

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5. Review & Report

Hotspots Analysis:

The primary emissions hotspot for the leather wallet is overwhelmingly in **Scope 3, Category 1: Purchased Goods and Services**, specifically related to the production of **leather** itself. Accounting for 16.50 kg CO2e out of a total of 17.23 kg CO2e, leather production constitutes approximately 95.76% of the total product carbon footprint up to the factory gate. This significant impact is largely due to the upstream farming processes associated with cattle (enteric methane, manure management, and land use change), as highlighted by the LSR Standard.

Other material inputs and manufacturing electricity contribute much smaller percentages, demonstrating the critical importance of addressing the raw material stage for this product.

Reliability and Limitations:

- **Secondary Data Reliance:** This analysis heavily relies on secondary (average) emission factors from databases like LWG, DEFRA, Climatiq, and other published studies. While these are industry standards, actual emissions could vary based on specific supplier data, specific processing technologies, and regional energy mixes.
- **Assumed Quantities:** The material and energy quantities per wallet are expert estimates. Real-world variations in product design, manufacturing efficiency, and waste rates will affect the actual footprint.
- **Geographic Specificity:** While efforts were made to use European or Netherlands-specific

data, some emission factors might be global averages or from other regions due to data availability.

- **LSR Standard Application:** The LSR Standard is still very new (takes effect Jan 1, 2027). While the leather emission factor used incorporates upstream agricultural impacts, a more granular, traceable approach as encouraged by the LSR Standard would require direct engagement with leather suppliers for primary data on land management practices.

Recommendations for Emissions Reduction:

1. **Source Lower-Impact Leather:** Investigate suppliers offering leather with demonstrably lower carbon footprints, such as those employing advanced manure management, sustainable grazing practices, or innovative tanning methods. Prioritize suppliers providing primary data on their land-related emissions in line with the LSR Standard.
2. **Explore Alternative Materials:** While challenging for a \'leather\' wallet, research and consider incorporating certified recycled content (e.g., recycled polyester for lining and thread) or innovative bio-based or synthetic leather alternatives with lower footprints, if they meet quality and durability standards.
3. **Optimize Manufacturing Efficiency:** Reduce electricity consumption per unit through energy-efficient machinery, lean manufacturing principles, and renewable energy procurement for the manufacturing facility.
4. **Optimize Logistics:** Work with logistics providers to optimize transportation routes and modes (e.g., shifting from road to rail or sea where

feasible for longer distances within Europe) to minimize transportation emissions for raw materials.

5. **Supplier Engagement:** Engage with key raw material suppliers (especially leather tanneries) to encourage their own GHG emission reductions and improve data transparency.

This report provides a robust initial assessment of the leather wallet\'s PCF. Continuous monitoring, collection of primary data, and engagement with the supply chain will be essential for further refinement and effective emission reduction strategies.