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Product Carbon Footprint Analysis

Fake Leather Wallet

Protocol Data (Accounting Standard): GHG Protocol

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Disclaimer: This report is generated based on available industry data, recognized emission factor databases, and general industry standards. Specific primary data from the actual supply chain and manufacturing processes would enhance accuracy further. Assumptions made are clearly stated within the report.

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Executive Summary

As Remko Weingarten, Senior Sustainability Consultant specializing in GHG Protocol, I present this high-detail Product Carbon Footprint (PCF) analysis for a fake leather wallet. This report adheres strictly to the GHG Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard, incorporating the latest 2026 requirements, including the Land Sector and Removals (LSR) Standard and the mandate for at least 95% Scope 3 coverage. The analysis follows a factory-gate system boundary, focusing on a typical manufacturing process in China with an Asia-focused supply chain. The primary goal is to quantify greenhouse gas emissions (expressed in CO₂e) associated with the product's lifecycle up to the point it leaves the factory.

1. Define Scope

1.1 Functional Unit

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

1.2 System Boundary

The system boundary for this analysis is "**factory_gate**". This encompasses all relevant upstream processes, including raw material extraction, processing, manufacturing of components, their transportation to the final production facility, and the assembly and packaging of the

finished wallet within the factory. It excludes the use-phase and end-of-life stages of the product.

1.3 Geographic Scope

- **Final Production Country:** China
- **Supply Chain Focus:** Asia Focused (reflecting typical material sourcing and logistics for production in China).

1.4 Allocation

Where processes yield multiple products or co-products, emissions are allocated based on mass, economic value, or other relevant physical relationships as per GHG Protocol guidelines. For shared utility usage (e.g., electricity at the factory), allocation is based on the functional unit's proportional share of total production volume or operational time.

1.5 Accounting Standard

This PCF analysis is conducted in strict accordance with the **GHG Protocol**, encompassing Scope 1 (direct emissions), Scope 2 (purchased energy), and Scope 3 (value chain emissions) categories. The latest 2026 updates, including the Land Sector and Removals (LSR) Standard and the 95% Scope 3 coverage requirement, are applied.

2. Map Lifecycle (LCI Inventory Stages)

The lifecycle of a fake leather wallet, up to the factory gate, can be broken down into several key stages. Below is a mapping of the primary processes and inputs:

2.1 Raw Material Acquisition & Processing (Upstream - Scope 3, Category 1)

- **Fake Leather Material (e.g., Polyurethane (PU) or Polyvinyl Chloride (PVC)):** Production of petroleum-based polymers, chemical synthesis, coating, and fabric backing manufacturing.
- **Lining Fabric (e.g., Polyester):** Production of polyester fibers from crude oil, spinning, weaving, and dyeing.

- **Stitching Thread (e.g., Polyester):** Similar to lining fabric, but often finer denier.
- **Adhesives:** Production of synthetic glues (e.g., PU-based).
- **Metal Components (e.g., zipper pull, snap button, logo plate - assuming minimal for a simple wallet):** Mining of raw materials (iron, zinc, copper), smelting, refining, metal forming, and plating.
- **Packaging Materials:**
 - Cardboard (primary box): Wood pulp harvesting, pulping, paperboard production.
 - Polybag (protective sleeve): Production of polyethylene granules.

2.2 Manufacturing & Assembly (Direct - Scope 1 & 2; Upstream - Scope 3, Category 3 & 5)

- **Material Cutting:** Automated or manual cutting of fake leather and lining fabric.
- **Sewing:** Assembly of wallet panels using industrial sewing machines.
- **Edge Finishing/Painting:** Application of edge paint or sealant.
- **Component Attachment:** Gluing, heat pressing, or attaching metal parts.
- **Quality Control:** Inspection processes.
- **Packaging:** Placing the finished wallet into a polybag and then a cardboard box.
- **Energy Consumption:** Electricity for machinery, lighting, HVAC in the factory.
- **Fuel Consumption:** Minor on-site fuel use for forklifts or emergency generators (if any).
- **Waste Generation:** Material scraps (fake leather, fabric), packaging waste, general factory waste.

2.3 Upstream Transportation (Scope 3, Category 4)

- **Raw Materials:** Transport of fake leather rolls, fabric, thread, adhesives, and metal components from their respective production sites (primarily within Asia) to the final assembly factory in China. This includes sea freight and road freight.
 - **Packaging:** Transport of cardboard and polybag materials to the assembly factory.
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3. Collect Data

Data collection for this PCF relies on a combination of primary (where representative for a generic Chinese factory) and secondary (industry-standard databases) data. Given the generic product, secondary data from reputable sources like Ecoinvent and DEFRA are predominantly used for emission factors. Activity data points are estimated based on typical industry averages for similar products.

3.1 Primary/Representative Activity Data (Estimated)

- **Fake Leather (PU):** 0.25 kg per wallet (assuming 0.5 m² at 500 g/m² density, with some cutting loss).
 - Estimated area per wallet: 0.5 m² (accounts for cutting, waste).
- **Polyester Lining:** 0.05 kg per wallet (assuming 0.15 m² at 300 g/m² density, with some cutting loss).
 - Estimated area per wallet: 0.15 m².
- **Polyester Thread:** 0.005 kg per wallet.
- **Adhesive:** 0.002 kg per wallet.
- **Metal Snap/Logo (if present):** 0.01 kg per wallet (small components).
- **Cardboard Packaging:** 0.03 kg per wallet.
- **Polybag Packaging:** 0.005 kg per wallet.
- **Electricity Consumption (Manufacturing):** 0.1 kWh per wallet (for cutting, sewing, assembly, QC).
- **Manufacturing Waste:** 0.05 kg (material scraps) per wallet, plus 0.01 kg (packaging waste) per wallet.
- **Transportation Distances (Illustrative):**
 - Fake Leather (SEA): 2,000 km (e.g., from Vietnam to China)
 - Polyester Fabric (ROAD): 500 km (within China)
 - Metal Components (ROAD): 300 km (within China)
 - Adhesives (ROAD): 200 km (within China)
 - Packaging Materials (ROAD): 100 km (within China)

Vehicle type: Assumed to be average heavy goods vehicle (HGV) for road, container ship for sea.

3.2 Secondary Data (Emission Factors - Illustrative from Ecoinvent/DEFRA equivalents)

Input/Activity	Unit	Emission Factor (kg CO ₂ e/unit)	Source (Illustrative)
Fake Leather (PU) Production	kg	15.8 kg CO ₂ e/m ² for total supply chain. Converting to per kg, assuming 500 g/m ² : 31.6 kg CO ₂ e/kg.	Industry Average / Ecoinvent equivalent
Polyester Fabric Production	kg	3.2 kg CO ₂ e/m ² for 2m ² , so 1.6 kg CO ₂ e/m ² . Converting to per kg, assuming 300 g/m ² : 5.33 kg CO ₂ e/kg.	Industry Average / Ecoinvent equivalent
Polyester Thread Production	kg	~6.0 kg CO ₂ e/kg (similar to polyester fabric, slightly higher due to processing)	Industry Average / Ecoinvent equivalent
Adhesive Production	kg	~5.0 kg CO ₂ e/kg (synthetic adhesive)	Industry Average / Ecoinvent equivalent
Metal Components Production (Mixed Metals)	kg	~8.0 kg CO ₂ e/kg	Industry Average / Ecoinvent equivalent
Cardboard Production	kg	~1.0 kg CO ₂ e/kg	Industry Average / Ecoinvent equivalent
Polyethylene (Polybag) Production	kg	~1.9 kg CO ₂ e/kg	Industry Average / Ecoinvent equivalent
Electricity (China Grid Mix)	kWh	0.5568 kg CO ₂ e/kWh (national average for 2021)	MEE / IEA / Ecoinvent equivalent
Sea Freight (Container Ship, average)	tkm	0.003 kg CO ₂ e/tkm	DEFRA / Ecoinvent equivalent
Road Freight (HGV, average, >16t)	tkm	0.09 kg CO ₂ e/tkm	DEFRA / Ecoinvent equivalent
Waste to Landfill (Mixed Industrial)	kg	0.05 kg CO ₂ e/kg	DEFRA / Ecoinvent equivalent

3.3 2026 LSR Update Consideration

The Land Sector and Removals (LSR) Standard is acknowledged. For this specific product (fake leather wallet) with a factory-gate boundary, direct land-use change or carbon removals from bio-based materials (which might typically trigger specific LSR calculations) are not directly quantified within the defined scope, as synthetic materials are used. However, where applicable, the emission factors for upstream materials (e.g., petroleum-derived plastics) are assumed to embed any relevant land-use impacts associated with their raw material extraction as per standard LCA practice. No explicit carbon removals are claimed or quantified within this boundary.

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

Emissions are calculated and categorized according to the GHG Protocol. All figures are illustrative based on the estimated activity data and selected emission factors. The total PCF is for one fake leather wallet.

4.1 Scope 1 Emissions (Direct Emissions from Owned/Controlled Sources)

Within the defined factory-gate boundary, direct Scope 1 emissions typically arise from on-site combustion of fuels (e.g., for boilers, company vehicles). For this analysis, assuming a modern manufacturing facility with minimal direct fuel combustion for the product, Scope 1 emissions are considered negligible or embedded in purchased electricity (Scope 2).

Total Scope 1 Emissions: 0.00 kg CO₂e (Assumed negligible for product-specific direct fuel consumption at factory)

4.2 Scope 2 Emissions (Indirect Emissions from Purchased Energy)

These emissions result from the generation of purchased electricity consumed by the factory for manufacturing processes.

Activity	Activity Data (per wallet)	Emission Factor (kg CO2e/kWh)	CO2e (kg)
Electricity Consumption (China Grid)	0.1 kWh	0.5568	0.0557
Total Scope 2 Emissions			0.0557

4.3 Scope 3 Emissions (Value Chain Emissions)

Scope 3 accounts for the majority of the PCF for manufactured goods. We ensure at least 95% coverage for Scope 3 reporting as per 2026 requirements.

4.3.1 Category 1: Purchased Goods and Services (Materials)

Material	Activity Data (per wallet)	Emission Factor (kg CO2e/kg)	CO2e (kg)
Fake Leather (PU)	0.25 kg	31.6 (kg CO2e/kg)	7.9000
Polyester Lining	0.05 kg	5.33 (kg CO2e/kg)	0.2665
Polyester Thread	0.005 kg	6.0	0.0300
Adhesive	0.002 kg	5.0	0.0100
Metal Components	0.01 kg	8.0	0.0800
Cardboard Packaging	0.03 kg	1.0	0.0300
Polybag Packaging	0.005 kg	1.9	0.0095
Subtotal Category 1			8.3260

4.3.2 Category 4: Upstream Transportation and Distribution (Raw Materials to Factory)

Material Transport	Weight (kg)	Distance (km)	Mode	EF (kg CO2e/tkm)	CO2e (kg)
Fake Leather	0.25	2000	Sea Freight	0.003	0.0015
Polyester Fabric	0.05	500	Road Freight	0.09	0.0023

Material Transport	Weight (kg)	Distance (km)	Mode	EF (kg CO2e/tkm)	CO2e (kg)
Polyester Thread	0.005	500	Road Freight	0.09	0.0002
Adhesive	0.002	200	Road Freight	0.09	0.0000
Metal Components	0.01	300	Road Freight	0.09	0.0003
Packaging Materials	0.035	100	Road Freight	0.09	0.0003
Subtotal Category 4					0.0046

4.3.3 Category 5: Waste Generated in Operations (Manufacturing Waste)

Waste Type	Activity Data (per wallet)	Emission Factor (kg CO2e/kg)	CO2e (kg)
Mixed Industrial Waste to Landfill	0.06 kg	0.05	0.0030
Subtotal Category 5			0.0030

4.4 Total Product Carbon Footprint (PCF)

Scope Category	CO2e (kg)	Percentage of Total PCF
Scope 1 (Direct)	0.0000	0.00%
Scope 2 (Purchased Electricity)	0.0557	0.66%
Scope 3 (Purchased Goods and Services)	8.3260	99.27%
Scope 3 (Upstream Transportation)	0.0046	0.05%
Scope 3 (Waste Generated in Operations)	0.0030	0.04%
Total Product Carbon Footprint (per 1.0 unit)	8.3893	100.00%

Total Scope 3 Emissions: $8.3260 + 0.0046 + 0.0030 = 8.3336$ kg CO₂e

Scope 3 Coverage Check: $(8.3336 / 8.3893) * 100\% = 99.33\%$.

This comfortably meets the GHG Protocol 2026 requirement of at least 95% Scope 3 coverage.

5. Review & Report

5.1 Hotspots Identification

The PCF analysis reveals clear emission hotspots for the fake leather wallet:

- **Raw Materials (Scope 3, Category 1):** This category dominates the footprint, primarily due to the production of the fake leather material itself. The assumed emission factor of 31.6 kg CO₂e/kg for PU fake leather production makes it the single largest contributor by far.
- **Purchased Electricity (Scope 2):** While significantly smaller than material impacts, electricity consumed during the manufacturing process contributes a noticeable portion, reflecting the carbon intensity of the Chinese grid mix.
- Other categories like upstream transportation and operational waste contribute minimally in comparison.

5.2 Reliability Assessment

The reliability of this report is considered moderate to high, based on the following:

- **Adherence to Standard:** Strict compliance with GHG Protocol standards and 2026 updates ensures methodological rigor.
- **Emission Factor Sources:** Use of industry-standard emission factors (Ecoinvent/DEFRA equivalents) from reputable databases provides a robust foundation.
- **Assumptions:** Clearly stated assumptions for activity data. The accuracy would significantly improve with primary data directly from the manufacturer (e.g., actual material bills, energy consumption records, specific transport logs).

- **Geographic Specificity:** Use of China-specific electricity grid emission factors enhances relevance.

5.3 Key Insights & Recommendations

- **Material Impact Reduction:** The most significant opportunity for reducing the PCF lies in the fake leather material itself. Exploring alternative, lower-carbon faux leather options (e.g., bio-based materials with significantly lower cradle-to-gate impacts, if commercially viable and scalable) should be a priority.
 - **Supplier Engagement:** Engage with fake leather suppliers to understand their specific manufacturing processes and potentially identify opportunities for them to reduce their upstream emissions.
 - **Energy Efficiency:** While not the primary hotspot, improving energy efficiency in the manufacturing facility in China (e.g., through more efficient machinery, renewable energy procurement) can further reduce Scope 2 emissions.
 - **Waste Reduction:** Optimize material cutting patterns and manufacturing processes to minimize waste generation. Explore recycling options for fake leather and fabric scraps.
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