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Product Carbon Footprint Report

for Product: **EcoWidget 5000**

Company: **hgetpimuyh**

Accounting Standard: **GHG Protocol**

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Disclaimer: This report is generated based on available data and industry standards. While every effort has been made to ensure accuracy, the actual environmental impacts

Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product "EcoWidget 5000" manufactured by hgetpimuyh. The analysis was conducted by psnzgssisl, a Senior Sustainability Consultant specializing in the GHG Protocol. The primary objective is to quantify the greenhouse gas (GHG) emissions across the product\'s lifecycle, from raw material acquisition to end-of-life, adhering strictly to the GHG Protocol\'s Corporate Value Chain (Scope 3) Accounting and Reporting Standard, including the 2026 Land Sector and Removals (LSR) Standard updates, and aiming for at least 95% Scope 3 coverage. The total carbon footprint of one functional unit of EcoWidget 5000 is calculated to be **XX.XX kg CO2e**. The main hotspots identified are in the material acquisition and processing phase, followed by the use phase due to energy consumption.

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1. Scope Definition

The scope of this Product Carbon Footprint (PCF) analysis for EcoWidget 5000 is defined as follows:

- **Functional Unit:** 1.0 unit of EcoWidget 5000.
- **System Boundary:** Cradle-to-gate with inclusion of use phase and end-of-life, specifically "factory_gate" for production, extending to cover downstream stages.
- **Geographic Scope:** Final Production Country: China, with a Supply Chain Focus on Europe.
- **Accounting Standard:** The analysis strictly adheres to the GHG Protocol, categorizing emissions into Scope 1 (direct), Scope 2 (purchased energy), and Scope 3 (value chain).
- **Allocation:** Emissions are allocated directly to the functional unit based on mass and energy consumption. For multi-product processes, allocation is based on relevant physical parameters (e.g., mass, volume).

The analysis incorporates updates relevant to the 2026 GHG Protocol framework, specifically the Land Sector and Removals (LSR) Standard and

the enhanced requirements for Scope 3 reporting, including the 95% coverage rule.

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2. Lifecycle Mapping and 3. Data Collection

The lifecycle of EcoWidget 5000 has been mapped into the following stages, with primary and secondary data points collected for each as per the GHG Protocol methodology.

2.1 Material Acquisition and Pre-processing (Scope 3, Category 1: Purchased goods and services)

This stage covers the extraction, processing, and manufacturing of raw materials until they reach the hgetpimuyh production facility. High-accuracy material impact calculation is based on the provided Detailed Bill of Materials (BOM), utilizing specific emission factors and total carbon values.

Detailed Bill of Materials (dhvmzgvg)

The following table details the materials, quantities, and their associated carbon emissions as provided:

ID	Description	Category	Process	Quantity	Unit	Emission Factor (kg CO2e/ unit)	Tot Ca (kg CO
M1	Steel_Frame	Metal	Fabrication	10	kg	2.0	20
M2	Polymer_Casing	Plastic	Injection_Molding	3	kg	2.5	7.5
M3	Electronics_Module	Electronics	Assembly	0.5	unit	15.0	7.5
M4	Manual	Paper	Printing	0.1	kg	1.2	0.1

ID	Description	Category	Process	Quantity	Unit	Emission Factor (kg CO2e/ unit)	Tot Ca (kg CO
M5	Packaging	Cardboard	Forming	0.2	kg	1.0	0.2

Total Material Carbon from BOM: 35.32 kg CO2e.

Note on 2026 LSR Update: For upstream raw materials, particularly those derived from agriculture or forestry (e.g., paper/cardboard), the GHG Protocol\'s Land Sector and Removals (LSR) Standard, effective January 1, 2027, provides guidance for quantifying, reporting, and tracking land emissions and CO2 removals. While specific land use data for each raw material in the BOM is beyond the scope of this product-level analysis, the principles of accounting for biogenic carbon flows and land-use change are acknowledged and would be integrated in a more comprehensive corporate-level inventory. The accompanying guidance for the LSR Standard is expected in Q2 2026, offering more practical direction for implementation.

2.2 Production Phase (Scope 1: Direct Emissions, Scope 2: Energy Indirect, Scope 3: Energy-related activities)

This phase covers the energy consumption and associated emissions at the hgetpimuyh manufacturing facility in China.

- **Renewable Energy Usage (kkfhsyeodo):** 70%
- **Energy Intensity (whqjgywqte):** 150 kWh/unit

Assumed Emission Factors:

- Chinese Grid Electricity: 0.60 kg CO2e/kWh
- Renewable Electricity: 0.03 kg CO2e/kWh

Scope 1 Emissions: Direct emissions from on-site fuel combustion are assumed to be negligible for this product-specific analysis without further data.

2.3 Transport and Distribution (Scope 3, Category 4: Upstream and Downstream transportation and distribution)

This includes transportation of materials to the factory (inbound) and finished products to the customer (outbound and last-mile).

- **Transport Mode (Select Mode):** Road Freight (HGV > 20t)
- **Transport Distance (jynnuruvor):** 2000 km
- **Last-Mile Delivery Channel (Delivery Type):** Standard Van
- **Total Product Weight:** Sum of BOM quantities = 13.8 kg

Assumed Emission Factors:

- Road Freight (HGV > 20t, well-to-wheel, Europe Focused): 0.092 kg CO2e/tonne-km (or 0.000092 kg CO2e/kg-km)
- Last-Mile Delivery (Standard Van): 0.154 kg CO2e/km (average for loaded van). A conservative distance of 100 km is assumed for the last-mile segment of the total transport distance.

2.4 Use Phase (Scope 3, Category 11: Use of sold products)

This phase considers the energy consumed by the product during its lifespan.

- **Product Lifespan (wvzdlqygqp):** 7 years
- **Energy Consumption in Use (sointfuoye):** 20 kWh/year

Assumed Emission Factor:

- Electricity for end-user (assuming grid electricity): 0.60 kg CO2e/kWh (China grid mix as proxy for global average where product is used, for consistency)

2.5 End-of-Life (EoL) Phase (Scope 3, Category 12: End-of-life treatment of sold products)

This phase accounts for the disposal and recycling of the product at the end of its useful life, reflecting circular economy impacts.

- **Recyclability Percentage (dvmwrseqdt):** 75%
- **Circular/Take-back Programs (fqtkgozwty):** Yes, with 40% return rate

Assumed Emission Factors/Benefits:

- Landfill Emission Factor: 0.05 kg CO2e/kg (simplified average for mixed materials)
- Recycling Benefit: An avoided emissions factor equivalent to 50% of the virgin material\'s cradle-to-gate emissions is assumed for recycled material.

Compliance with 95% Scope 3 Coverage (2026 Requirement): The GHG Protocol\'s 2026 updates emphasize a mandatory 95% completeness threshold for total relevant Scope 3 emissions. This report covers major Scope 3 categories: purchased goods and services (materials), upstream transportation and distribution, downstream transportation and distribution, use of sold products, and end-of-life treatment of sold products. The detailed BOM and specific operational parameters enable a high level of coverage for these significant categories. Data disaggregation by source type (primary vs. secondary) is also a key update, and the use of the detailed BOM provides a robust foundation for primary data for material impacts.

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4. Emissions Calculation

Emissions are calculated using the formula: **Activity Data × Emission Factor = CO2e**. Industry-standard emission factors (e.g., Ecoinvent/ DEFRA equivalents) are applied where specific values were not provided in the parameters.

4.1 Material Acquisition and Pre-processing (Scope 3, Category 1)

The total carbon for this stage is directly taken from the \'Total Carbon\' column in the Detailed Bill of Materials (BOM).

Emissions: 35.32 kg CO2e

4.2 Production Phase (Scope 2 & Scope 3)

Emissions from purchased electricity.

Electricity Consumption: 150 kWh/unit

Renewable Energy Portion: 150 kWh * 0.70 = 105 kWh (Renewable)
Grid Electricity Portion: 150 kWh * (1 - 0.70) = 45 kWh (Grid)

Emissions from Renewable Electricity: 105 kWh * 0.03 kg CO2e/kWh = 3.15 kg CO2e **Emissions from Grid Electricity:** 45 kWh * 0.60 kg CO2e/kWh = 27.00 kg CO2e

Total Production (Scope 2) Emissions: 3.15 + 27.00 = 30.15 kg CO2e

4.3 Transport and Distribution (Scope 3, Category 4)

The total product weight is 13.8 kg (0.0138 tonnes). The total transport distance is 2000 km.

For simplicity, we consider the total distance for both inbound materials and outbound product, assuming the majority of transport is primary freight. A separate last-mile calculation is included for the final delivery segment.

Primary Transport (Road Freight): Total kg-km = Product Weight (kg) × Transport Distance (km) = 13.8 kg × 2000 km = 27,600 kg-km Emissions = 27,600 kg-km × 0.000092 kg CO2e/kg-km = 2.54 kg CO2e

Last-Mile Delivery (Standard Van): Assumed Last-Mile Distance: 100 km (part of the 2000 km total) Emissions = Assumed Last-Mile Distance (km) × Last-Mile EF (kg CO2e/km) = 100 km × 0.154 kg CO2e/km = 15.40 kg CO2e

Total Transport (Scope 3) Emissions: 2.54 + 15.40 = 17.94 kg CO2e

4.4 Use Phase (Scope 3, Category 11)

Total Energy Consumption over Lifespan: 20 kWh/year × 7 years = 140 kWh **Emissions:** 140 kWh × 0.60 kg CO2e/kWh = 84.00 kg CO2e

Total Use Phase (Scope 3) Emissions: 84.00 kg CO2e

4.5 End-of-Life (EoL) Phase (Scope 3, Category 12)

Total product weight for EoL = 13.8 kg

Recyclability: 75% **Non-Recyclable/Landfill Portion:** (1 - 0.75) = 0.25 **Material going to Landfill:** 13.8 kg × 0.25 = 3.45 kg **Emissions from Landfill:** 3.45 kg × 0.05 kg CO2e/kg = 0.17 kg CO2e

Circular/Take-back Programs: 40% return rate on the remaining 25% (0.25 * 0.40 = 0.10, or 10% of total product weight is additionally recovered). This means an additional 10% of the total product weight avoids landfill and potentially achieves recycling benefits. Effective portion recycled = 0.75 (initial) + 0.10 (from take-back) = 0.85 (85%) Effective portion landfilled = 1 - 0.85 = 0.15 (15%)

Recalculating with effective recyclability: **Material going to Landfill:** 13.8 kg × 0.15 = 2.07 kg **Emissions from Landfill:** 2.07 kg × 0.05 kg CO2e/kg = 0.10 kg CO2e

Recycling Benefit: Effectively Recycled Material: 13.8 kg × 0.85 = 11.73 kg To calculate benefit, we estimate initial material emissions for the recycled portion. Total Material Carbon (initial) = 35.32 kg CO2e (for 13.8 kg) Average Material EF = 35.32 kg CO2e / 13.8 kg = 2.56 kg CO2e/kg Avoided Emissions = Effectively Recycled Material (kg) × Average Material EF (kg CO2e/kg) × 0.50 (50% reduction factor) Avoided Emissions = 11.73 kg × 2.56 kg CO2e/kg × 0.50 = 15.01 kg CO2e (as a credit/negative emission)

Total End-of-Life (Scope 3) Emissions: 0.10 kg CO2e (landfill) - 15.01 kg CO2e (recycling benefit) = -14.91 kg CO2e

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5. Review & Report

5.1 Total Product Carbon Footprint

The aggregated Product Carbon Footprint for one functional unit of EcoWidget 5000 is summarized below:

Lifecycle Stage	GHG Scope	CO2e (kg)	Percentage of Total (%)
Material Acquisition & Pre-processing	Scope 3 (Category 1)	35.32	26.9%
Production (Electricity)	Scope 2	30.15	23.0%
Transport & Distribution	Scope 3 (Category 4)	17.94	13.7%
Use Phase	Scope 3 (Category 11)	84.00	64.0%
End-of-Life (Net)	Scope 3 (Category 12)	-14.91	-11.4%
Total Product Carbon Footprint		**132.50**	**100.0%**

Note: Percentages are calculated based on the sum of positive emissions, with the End-of-Life benefit applied as a reduction from the total positive emissions.

The total carbon footprint of one EcoWidget 5000 unit is **132.50 kg CO2e**.

5.2 Hotspots and Reliability

Identified Hotspots:

- **Use Phase (64.0%):** The most significant hotspot is the energy consumption during the product\'s 7-year lifespan. This highlights the importance of energy-efficient design and promoting renewable energy sources for end-users.
- **Material Acquisition & Pre-processing (26.9%):** The upstream emissions from raw materials, particularly the steel and electronics

module, contribute substantially. This emphasizes the need for sustainable sourcing and material efficiency.

- **Production (23.0%):** Despite 70% renewable energy usage, the remaining grid electricity still contributes a notable portion, indicating further opportunities for decarbonization of the manufacturing process.

Data Reliability:

The reliability of this PCF analysis is enhanced by the use of detailed primary-like data for the Bill of Materials and specific operational parameters (renewable energy usage, energy intensity, lifespan, consumption). Industry-standard emission factors from reputable sources (e.g., IEA, GLEC) have been applied for transport, grid electricity, and end-of-life scenarios. The 2026 GHG Protocol Scope 3 requirement for data disaggregation (primary vs. secondary data) has been considered by prioritizing specific input data.

Assumptions were made for generic emission factors and certain distances where specific primary data was not available (e.g., specific last-mile distance, exact global average grid mix for use phase). Future iterations could benefit from more granular, supplier-specific data for all upstream activities and a detailed breakdown of the electricity mix at the consumer level.

The inclusion of circular economy elements, such as high recyclability and take-back programs, significantly reduces the overall footprint, demonstrating the positive impact of such initiatives.
