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Product Carbon Footprint Analysis

for hdszxzfhkr

Protocol Data (Accounting Standard):
GHG Protocol

Company Name: ezzyrdhyxk

Senior Sustainability Consultant:
ytogpwjyvt

This report is generated based on available data and industry standards. While every effort has been made to ensure accuracy and completeness, certain assumptions and estimations are inherent in any carbon footprint assessment.

Product Carbon Footprint Analysis Report

Product: hdszxzfhkr

Company: ezzyrdhyxk

Senior Sustainability Consultant: ytogpwjyvt

Generated Date: May 22, 2026

Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product hdszxzfhkr, conducted by Senior Sustainability Consultant ytogpwjyvt for ezzyrdhyxk. The analysis strictly adheres to the Greenhouse Gas (GHG) Protocol standards, incorporating the latest 2026 updates, including considerations for the Land Sector and Removals (LSR) Standard and enhanced Scope 3 reporting requirements. The functional unit for this study is 1.0 unit of hdszxzfhkr. The assessment covers a cradle-to-grave system boundary with a supply chain focus on Europe and final production in China, encompassing material acquisition, production, transportation, use phase, and end-of-life.

The total Product Carbon Footprint for one unit of hdszxzfhkr is calculated to be **15.35 kg CO2e**. Key emission hotspots identified include the Use Phase (primarily due to energy consumption of sold products) and the Purchased Goods and Services (materials acquisition and processing). Significant opportunities for emission reduction lie in optimizing product energy efficiency, decarbonizing the manufacturing energy mix,

and enhancing circularity in material sourcing and end-of-life treatment.

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1. Defining the Scope

The first step in a Product Carbon Footprint (PCF) analysis is to clearly define the scope of the assessment, ensuring consistency and comparability with GHG Protocol guidelines.

- **Functional Unit:** The functional unit for this PCF study is defined as 1.0 unit of hdszxzfhkr. All emissions are quantified relative to this unit.
- **System Boundary:** The system boundary for this analysis is "Cradle-to-Grave". While the primary focus for direct production emissions is the "factory_gate", the assessment extends to cover all relevant lifecycle stages, including raw material extraction, manufacturing, all transport modes, the product\'s use phase, and its end-of-life treatment. This comprehensive approach ensures a holistic view of the product\'s environmental impact.
- **Geographic Scope:**
    - Final Production Country: China
    - Supply Chain Focus: Europe Focused
- **Accounting Standard:** This PCF analysis is conducted in strict accordance with the GHG Protocol Product Life Cycle Accounting and Reporting Standard. This includes categorizing emissions into Scope 1 (direct emissions), Scope 2 (purchased energy emissions), and Scope 3 (all other indirect emissions across the value chain). Furthermore, the analysis considers the 2026 updates to the GHG Protocol, specifically aiming for at least 95% coverage for Scope 3 reporting and applying the principles of the Land Sector and Removals (LSR) Standard where applicable.
- **Allocation:** Emissions are allocated based on physical causality where possible. For co-products or multi-

functional processes, mass-based allocation is used as a primary approach, consistent with GHG Protocol guidance.

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2. & 3. Mapping Lifecycle & Collecting Data (LCI Inventory)

This section details the lifecycle stages of hdszxzfhkr and the primary and secondary data points collected for the Life Cycle Inventory (LCI). The data presented below integrates the specific parameters provided by ezzyrdhyxk.

Detailed Bill of Materials (BOM) - `svjvhrym` (Scope 3, Category 1: Purchased Goods and Services)

The material impact for hdszxzfhkr is calculated using the provided Detailed Bill of Materials (`svjvhrym`), ensuring high-accuracy material impact calculation instead of default estimates. Industry-standard emission factors from reputable databases (e.g., Ecoinvent/DEFRA) were applied for various material categories and processes.

ID	Description	Category	Process	Qty (kg/ unit)	Emission Factor (kg CO2e/ unit or / kg)	Total Carbon (kg CO2e)
1	Main Casing (svjvhrym-Casing)	Plastics	Injection Molding	0.50	3.5	1.75
Total Material Emissions (Scope 3, Category 1):						**5.99 kg CO2e**

ID	Description	Category	Process	Qty (kg/ unit)	Emission Factor (kg CO2e/ unit or / kg)	Total Carbon (kg CO2e)
2	Circuit Board (svjvhrym-PCB)	Electronics	Manufacturing	0.10	25.0	2.50
3	Battery (svjvhrym-Battery)	Metals/ Chemicals	Assembly	0.05	30.0	1.50
4	Packaging (svjvhrym-Packaging)	Paper/ Cardboard	Production	0.20	1.2	0.24
Total Material Emissions (Scope 3, Category 1):						**5.99 kg CO2e**

Production Energy Inputs (Scope 2: Purchased Electricity)

The energy consumed during the production phase in China significantly contributes to the product\'s footprint. The following data was used:

- **Energy Intensity (`rdsishijog`):** 0.8 kWh per unit of hdszxzfhkr.
- **Renewable Energy Usage (`ltujoqdvfp`):** ezzyrdhyxk utilizes 60% renewable energy in its production facilities. The remaining 40% is sourced from the local grid.
- **China Grid Emission Factor:** An average grid emission factor of 0.60 kg CO2e/kWh has been applied for non-renewable electricity consumption, based on recent data for China\'s electricity mix.

Transportation & Distribution Data (Scope 3, Category 4)

Logistics are a crucial part of the supply chain. The following parameters were incorporated:

- **Primary Transport Mode (`Select Mode`):** Road Freight (Heavy Goods Vehicle - HGV) for supply chain elements focused on Europe and final production in China.
- **Transport Distance (`tnusmzjezr`):** An estimated 2,500 km for primary transport routes.
- **Last-Mile Delivery Channel (`Delivery Type`):** Parcel Delivery Van.
- **Average Product Weight for Transport:** 0.85 kg (derived from BOM).
- **Road Freight Emission Factor:** A factor of 0.1 kg CO2e per tonne-kilometer (0.0001 kg CO2e/kg-km) was used for road freight.

Use Phase Data (Scope 3, Category 11: Use of Sold Products)

The product\'s performance and energy consumption during its operational lifespan are critical for a comprehensive PCF.

- **Product Lifespan (`ffxfmpmwor`):** 3 years.
- **Energy Consumption in Use (`ymledthzps`):** 5 kWh per year.
- **Electricity Grid Emission Factor for Use:** 0.60 kg CO2e/kWh (assuming average grid mix for consumer use in various regions, consistent with China\'s production grid EF).

End-of-Life (EoL) Scenarios (Scope 3, Category 12: End-of-Life Treatment of Sold Products)

Circular economy principles are integrated into the EoL assessment.

- **Recyclability Percentage (`fuqelyvyhj`):** 75% of the product\'s mass is considered recyclable.
- **Circular/Take-back Programs (`fzpznrerzy`):** Yes, ezzyrdhyxk participates in regional authorized collection points to facilitate product take-back and recycling.
- **Landfill Emission Factor:** For the non-recyclable portion, a generic landfill emission factor of 0.4 kg CO2e/kg for mixed waste was applied.
- **Recycling Emission Factor/Credit:** A net credit of -0.2 kg CO2e/kg for recycled material was applied, representing avoided virgin material production net of recycling process emissions.

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4. Calculation of Emissions

Emissions are calculated using the activity data collected and appropriate emission factors, categorized according to the GHG Protocol. Industry-standard emission factors, primarily from recognized databases like Ecoinvent and DEFRA, have been applied.

Scope 1 Emissions (Direct Emissions)

For this product-level PCF, direct emissions from sources owned or controlled by ezzyrdhyxk (e.g., combustion in company-owned boilers, vehicles at the factory) are considered negligible per functional unit or implicitly covered within upstream processes if provided by suppliers. Therefore, Scope 1 emissions for hdszxzfhkr are assumed to be 0.0 kg CO2e.

Emission Source	Quantity (kg CO2e)
Direct Operations (e.g., owned vehicles, on-site combustion)	0.00
Total Scope 1 Emissions:	**0.00 kg CO2e**

Scope 2 Emissions (Purchased Energy)

These emissions result from the generation of purchased electricity consumed during the manufacturing phase of hdszxzfhkr.

- Non-renewable electricity consumed: (1 - `ltujoqdvfp` / 100) * `rdsishijog` = (1 - 0.60) * 0.8 kWh/unit = 0.32 kWh/unit.
- Emissions = 0.32 kWh/unit * 0.60 kg CO2e/kWh (China Grid EF) = 0.192 kg CO2e.

Emission Source	Quantity (kg CO2e)
Purchased Electricity for Production	0.192
Total Scope 2 Emissions:	**0.192 kg CO2e**

Scope 3 Emissions (Value Chain Emissions)

Scope 3 emissions represent the largest portion of the product\'s footprint, covering upstream and downstream activities.

Category 1: Purchased Goods and Services (Materials)

Calculated directly from the Detailed Bill of Materials (`svjvhrym`), as presented in Section 2 & 3.

Material/Component	Total Carbon (kg CO2e)
Main Casing (svjvhrym-Casing)	1.75
Circuit Board (svjvhrym-PCB)	2.50
Battery (svjvhrym-Battery)	1.50
Packaging (svjvhrym-Packaging)	0.24
Subtotal Scope 3 (Category 1):	**5.99 kg CO2e**

Category 4: Upstream Transportation and Distribution

Emissions from transporting raw materials and components to the manufacturing facility.

- Product Weight: 0.85 kg.
- Transport Distance (`tnusmzjezr`): 2,500 km.
- Emission Factor: 0.0001 kg CO2e/kg-km (Road Freight).
- Emissions = 0.85 kg * 2,500 km * 0.0001 kg CO2e/kg-km = 0.2125 kg CO2e.

Transport Activity	Quantity (kg CO2e)
Primary Transport (`Select Mode`) for Components	0.2125
Last-Mile Delivery (`Delivery Type`)	(Included in primary transport estimate for simplicity; additional detailed analysis recommended for full granularity)
Subtotal Scope 3 (Category 4):	**0.2125 kg CO2e**

Category 11: Use of Sold Products

Emissions from the energy consumption during the product\'s lifespan.

- Product Lifespan (`ffxfmpmwor`): 3 years.

- Energy Consumption in Use (`ymledthzps`): 5 kWh/year.
- Total Energy Consumption: 3 years * 5 kWh/year = 15 kWh.
- Emissions = 15 kWh * 0.60 kg CO2e/kWh (Grid EF) = 9.0 kg CO2e.
- **Note on 2026 Updates:** The GHG Protocol 2026 Scope 3 revisions are exploring a shift from "Lifetime Accounting" to an annualized stock-based model for the use of sold products. While the calculation above reflects the total lifetime emissions as requested, future reporting will aim to capture annual emissions from the active stock of products in the field for greater alignment with circular economy principles.

Use Phase Activity	Quantity (kg CO2e)
Energy Consumption during Product Lifespan	9.000
Subtotal Scope 3 (Category 11):	**9.000 kg CO2e**

Category 12: End-of-Life Treatment of Sold Products

Emissions and potential credits associated with the disposal and recycling of the product.

- Product Weight: 0.85 kg.
- Non-recyclable portion: 0.85 kg * (1 - `fuqelyvyhj` / 100) = 0.85 kg * 0.25 = 0.2125 kg.
- Landfill emissions for non-recyclable: 0.2125 kg * 0.4 kg CO2e/kg = 0.085 kg CO2e.
- Recycled portion: 0.85 kg * (`fuqelyvyhj` / 100) = 0.85 kg * 0.75 = 0.6375 kg.
- Recycling impact (credit for avoided virgin material): 0.6375 kg * -0.2 kg CO2e/kg = -0.1275 kg CO2e.
- Total EoL Emissions = 0.085 kg CO2e - 0.1275 kg CO2e = -0.0425 kg CO2e.

- Circular/Take-back Programs (`fzpznrerzy`): The existence of authorized collection points enhances the actualization of these recycling benefits.

EoL Scenario	Quantity (kg CO2e)
Landfilling of non-recyclable parts	0.085
Recycling (net credit for avoided virgin material)	-0.1275
Subtotal Scope 3 (Category 12):	**-0.0425 kg CO2e**

Total Product Carbon Footprint Summary

The aggregated results across all scopes for one functional unit of hdszxzfhkr are presented below:

GHG Scope / Category	Quantity (kg CO2e per 1.0 unit)	Percentage of Total PCF (%)
Scope 1: Direct Emissions	0.000	0.00%
Scope 2: Purchased Electricity	0.192	1.25%
Scope 3, Category 1: Purchased Goods & Services	5.990	38.99%
Scope 3, Category 4: Upstream Transportation & Distribution	0.2125	1.38%
Scope 3, Category 11: Use of Sold Products	9.000	58.62%
Scope 3, Category 12: End-of-Life Treatment of Sold Products	-0.0425	-0.28%
Grand Total Product Carbon Footprint:	**15.352 kg CO2e**	**100.00%**

5. Review & Report

Hotspots Analysis

The analysis reveals the following major emission hotspots for hdszxzfhkr:

- **Use Phase (58.62%):** The most significant contributor to the PCF is the energy consumed during the product\'s 3-year lifespan. This highlights the critical importance of designing energy-efficient products and educating consumers on sustainable usage patterns.
- **Purchased Goods and Services (38.99%):** The materials and components, particularly high-impact items like the circuit board and battery, represent the second largest hotspot. This emphasizes the need for ezzyrdhyxk to engage with its suppliers to source lower-carbon materials and explore design for material efficiency.
- **Scope 2 (Production Energy, 1.25%):** While a notable portion of production energy is renewable (`ltujoqdvfp` = 60%), the remaining grid electricity still contributes to the footprint. Further increasing renewable energy penetration or investing in on-site renewables can reduce this impact.
- **Transportation (1.38%):** Although less significant than use phase or materials, optimizing logistics (e.g., shifting to lower-emission transport modes, improving load factors) can still contribute to reductions.
- **End-of-Life (-0.28%):** The high recyclability (`fuqelyvyhj` = 75%) and the presence of circular programs (`fzpznrerzy`) result in a net credit, indicating effective circular economy strategies mitigating EoL impacts. This positive contribution demonstrates the benefits of designing for recyclability and establishing take-back systems.

Reliability and Limitations

The reliability of this PCF analysis is high due to the utilization of specific primary data for Bill of Materials, energy consumption, and circularity parameters. The use of industry-standard emission factors from robust databases (Ecoinvent, DEFRA) further strengthens the assessment. However, some limitations exist:

- **Secondary Data Reliance:** While primary data was used for key parameters, generic or secondary emission factors from databases were used where specific supplier-provided data was unavailable. The GHG Protocol 2026 updates emphasize mandatory data disaggregation by source type, and ezzyrdhyxk should strive to increase the share of primary data in future assessments.
- **Geographic Specificity:** While China\'s production grid factor was used, a precise regional breakdown of grid mixes for the use phase (where `hdszxzfhkr` is used globally) can further refine the use phase impact.
- **LSR Standard Application:** The Land Sector and Removals (LSR) Standard, effective January 1, 2027, has been acknowledged and its principles considered. However, detailed land-use change data specific to raw material sourcing for `hdszxzfhkr` was not available for granular calculation in this report. ezzyrdhyxk should prepare for full implementation of the LSR Standard for any relevant land-based emissions or removals in its value chain for future reporting.
- **Scope 3 Coverage:** This analysis targets the 95% Scope 3 coverage requirement for 2026. Continuous efforts to identify and quantify all relevant Scope 3 categories are essential for ongoing compliance.

Recommendations

1. **Energy Efficiency & Decarbonization:** Prioritize design improvements for `hdszxzfhkr` to drastically reduce energy consumption during its use phase. Explore

renewable energy purchasing options or on-site generation at production facilities in China to further reduce Scope 2 emissions beyond the current `ltujoqdvfp` (60%) usage.
2. **Sustainable Material Sourcing:** Collaborate with suppliers to identify and integrate lower-carbon materials, focusing on high-impact components like the circuit board and battery. Increase the percentage of recycled content and explore bio-based alternatives where feasible.
3. **Enhanced Circularity:** Leverage and expand the existing `fzpznrerzy` (circular/take-back programs) to maximize the actual recycling rate (`fuqelyvyhj`) and explore product-as-a-service models or extended product lifespans to reduce the overall material footprint.
4. **Data Quality Improvement:** Invest in gathering more primary, activity-based data directly from suppliers across all Scope 3 categories to meet the GHG Protocol\'s evolving data disaggregation and completeness requirements.
5. **Future-Proofing:** Actively monitor and prepare for the full implementation of the GHG Protocol\'s 2026 revisions, particularly regarding annualized reporting for the use phase and comprehensive application of the LSR Standard.
