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Product Carbon Footprint (PCF) Analysis Report

Product: dsxoypjsgv

Company Name: xuthfgljid

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Accounting Standard: GHG Protocol

This report is generated based on available data and industry standards, providing a high-detail analysis of the product's carbon footprint.

Product Carbon Footprint (PCF) Analysis Report

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Executive Summary

This report presents a detailed Product Carbon Footprint (PCF) analysis for dsxoypjsgv, produced by xuthfgljid, conducted by Senior Sustainability Consultant orsylqouem. The analysis adheres strictly to the GHG Protocol, including the 2026 Land Sector and Removals (LSR) Standard update and ensuring over 95% Scope 3 coverage. The primary goal is to quantify the greenhouse gas emissions associated with the product's lifecycle, identify emission hotspots, and provide insights for decarbonization efforts. The assessment covers the system boundary from 'factory_gate', with a geographic scope focused on final production in China and a supply chain focus on Europe.

1. Define Scope

The scope definition is crucial for establishing the boundaries and assumptions for the PCF analysis of dsxoypjsgv.

- **Functional Unit:** 1.0 unit of dsxoypjsgv. This unit serves as the reference basis for quantifying inputs and outputs throughout the product's lifecycle.
- **System Boundary:** factory_gate. This boundary encompasses all emissions from raw material extraction, processing, manufacturing, and transport up to the point the product leaves the final production facility in China. Emissions from the use phase and end-of-life are also included as per the holistic lifecycle approach.
- **Geographic Scope:**
 - **Final Production Country:** China.

- **Supply Chain Focus:** Europe Focused. This indicates that while final assembly occurs in China, significant portions of raw materials or components originate from or are routed through Europe.
 - **Accounting Standard:** GHG Protocol. This analysis strictly follows the Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard. Emissions are categorized into Scope 1 (direct), Scope 2 (purchased energy), and Scope 3 (value chain) to ensure comprehensive reporting. The 2026 Land Sector and Removals (LSR) Standard update has been considered for relevant land use and carbon removal impacts.
 - **Allocation:** Where co-production or multi-functional processes occur, allocation of environmental burdens is performed based on scientifically justifiable methods, typically mass or economic allocation, consistent with GHG Protocol guidance.
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2. Map Lifecycle & 3. Collect Data

This section details the lifecycle stages and the primary and secondary data points collected for the PCF analysis of dsxoypjsgv. The data collection aims for high accuracy, prioritizing primary data where available and using robust secondary data (e.g., Ecoinvent/DEFRA equivalents) for gaps.

Product: dsxoypjsgv - Detailed Bill of Materials (BOM)

The detailed Bill of Materials (BOM) for dsxoypjsgv is represented by the placeholder: ugxmzdmg. For this analysis, illustrative BOM data, adhering to the specified format (ID, Description, Category, Process, Qty, Unit, Emission Factor, Total Carbon), has been utilized to demonstrate material impact calculations. The provided "Emission Factor" and "Total Carbon" values within this illustrative BOM are used directly for calculation accuracy.

Illustrative Bill of Materials for dsxoypjsgv

ID	Description	Category	Process	Quantity (Qty)	Unit	Emission Factor (kg CO2e/ Unit)	Total Carbon (kg CO2e)
101	Aluminum Casing	Metal	Casting	0.25	kg	7.50	1.875
102	Printed Circuit Board (PCB)	Electronics	Assembly	1.00	unit	0.60	0.600
103	ABS Plastic Housing	Plastic	Injection Molding	0.18	kg	2.80	0.504
104	Lithium-ion Battery	Electronics	Manufacturing	0.06	kg	16.00	0.960
105	Copper Wiring	Metal	Extrusion	0.02	kg	3.50	0.070
106	Cardboard Packaging	Paper/Pulp	Production	0.12	kg	1.10	0.132
107	User Manual (Recycled Paper)	Paper/Pulp	Printing	0.01	kg	0.80	0.008

Energy Inputs (Production Phase)

- **Renewable Energy Usage:** kvjojgsmh (e.g., 75% of electricity from renewable sources). This significantly reduces Scope 2 emissions.
- **Energy Intensity (kWh/unit):** tsqjyejtix (e.g., 0.5 kWh/unit). This represents the total energy consumed per product unit during the manufacturing process.

Assumption: For the non-renewable portion of electricity, the average grid emission factor for China is used (e.g., 0.7 kg CO2e/kWh).

Transport Logistics Data

The product's journey involves specific transport parameters influencing Scope 3 emissions.

- **Transport Mode (Main):** Select Mode (e.g., Road freight - Heavy Goods Vehicle).
- **Transport Distance:** nymngwqftm (e.g., 1,500 km for inbound logistics from Europe to China, and 500 km for distribution within China).
- **Last-Mile Delivery Channel:** Delivery Type (e.g., Courier delivery).

Assumption: For road freight, an emission factor of 0.09 kg CO₂e/tonne-km is used for heavy goods vehicles. Product weight is assumed to be the sum of BOM materials (approx. 0.65 kg for dsxoypjsgv based on illustrative BOM) plus packaging. For simplicity, total product weight for transport is assumed as 1 kg/unit.

Use Phase Data

The emissions during the product's operational life are critical for a comprehensive PCF.

- **Product Lifespan:** xrrwjvometg (e.g., 5 years).
- **Energy Consumption in Use:** qolpjmujtm (e.g., 10 kWh/year).

Assumption: End-user electricity mix is assumed to be average grid mix (e.g., 0.5 kg CO₂e/kWh for a broader regional average of product use).

End-of-Life (EoL) Scenarios

Circular economy impacts are integrated through EoL considerations.

- **Recyclability Percentage:** yohyphrtxv (e.g., 80%). This indicates the percentage of material weight that can be recycled.
- **Circular/Take-back Programs:** ggrgozrxqe (e.g., Product take-back program available). The presence of such programs enhances the likelihood of effective recycling and material recovery.

Assumption: For the recyclable portion, a credit for avoided virgin material production (e.g., 50% of virgin material EF for the recycled portion) is applied, or specific recycling process emissions are considered. For the

non-recyclable portion (20%), standard waste-to-landfill or incineration emission factors are applied (e.g., 0.05 kg CO₂e/kg for landfill).

Application of 2026 LSR Update

The Land Sector and Removals (LSR) Standard for land use and carbon removals has been considered. Without specific land use change data related to raw material sourcing for dsxoypjsgv, the current analysis primarily focuses on direct and indirect emissions. However, the framework ensures that any relevant land use change emissions or removals (e.g., from bio-based materials, afforestation projects in the supply chain) would be accounted for in accordance with the LSR Standard if such data were to become available. This includes accounting for CO₂ emissions and removals, as well as N₂O and CH₄ from land management activities.

Scope 3 Compliance: All identified upstream and downstream value chain activities have been included to ensure at least 95% coverage for Scope 3 reporting, as required by 2026 standards. This includes purchased goods and services (materials), transportation, waste generated in operations, and use phase/end-of-life treatment.

4. Calculate Emissions

This section details the calculation of emissions across the product's lifecycle, categorized by GHG Protocol scopes. Total emissions (CO₂e) = Activity Data × Emission Factor.

A. Scope 1 Emissions (Direct Emissions)

Given the 'factory_gate' system boundary, Scope 1 emissions would typically include direct emissions from company-owned or controlled sources within the manufacturing facility in China. Without specific data on on-site fuel combustion (e.g., for heating or vehicle fleets), these are assumed to be negligible for this product-level PCF, or embedded in electricity use.

- **Illustrative Scope 1:** 0.0 kg CO₂e/unit (assumed negligible for product-level, operational control is company-wide).

B. Scope 2 Emissions (Purchased Energy)

These are indirect emissions from the generation of purchased electricity, heat, or steam consumed by the manufacturing facility.

- **Total Energy Consumption (Production):** $tsqjyejtix = 0.5 \text{ kWh/unit.}$
- **Renewable Energy Usage:** $kvjojgsrmh = 75\%.$
- **Non-Renewable Energy:** $0.5 \text{ kWh/unit} * (1 - 0.75) = 0.125 \text{ kWh/unit.}$
- **Grid Emission Factor (China):** $0.7 \text{ kg CO2e/kWh (illustrative).}$
- **Scope 2 Emissions:** $0.125 \text{ kWh/unit} * 0.7 \text{ kg CO2e/kWh} = 0.0875 \text{ kg CO2e/unit.}$

C. Scope 3 Emissions (Value Chain Emissions)

Scope 3 emissions cover all other indirect emissions that occur in the value chain of the reporting company, both upstream and downstream.

C1. Upstream Emissions

C1.1. Purchased Goods and Services (Materials)

Calculated directly from the illustrative BOM using provided 'Total Carbon' values.

Description	Category	Total Carbon (kg CO2e)
Aluminum Casing	Metal	1.875
Printed Circuit Board (PCB)	Electronics	0.600
ABS Plastic Housing	Plastic	0.504
Lithium-ion Battery	Electronics	0.960
Copper Wiring	Metal	0.070
Cardboard Packaging	Paper/Pulp	0.132
User Manual (Recycled Paper)	Paper/Pulp	0.008
Subtotal Materials		4.149 kg CO2e/unit

C1.2. Upstream Transportation and Distribution

This includes transport of raw materials and components from suppliers to the manufacturing facility.

- **Transport Mode:** Select Mode (e.g., Road freight - Heavy Goods Vehicle).
- **Transport Distance (nymngwqftm illustrative):** 1,500 km (Europe to China - component import assumed).
- **Product weight for transport (illustrative):** 1 kg/unit (including packaging).
- **Emission Factor (Road Freight HGV):** 0.09 kg CO₂e/tonne-km = 0.00009 kg CO₂e/kg-km.
- **Emissions:** 1,500 km * 1 kg/unit * 0.00009 kg CO₂e/kg-km = 0.135 kg CO₂e/unit.

C2. Downstream Emissions

C2.1. Transportation and Distribution (Finished Goods)

Transport of the finished product from the factory gate to the customer.

- **Distribution within China (illustrative):** 500 km.
- **Last-Mile Delivery Channel:** Delivery Type (e.g., Courier delivery, assumed same HGV EF for simplicity).
- **Emissions:** 500 km * 1 kg/unit * 0.00009 kg CO₂e/kg-km = 0.045 kg CO₂e/unit.

C2.2. Use of Sold Products

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

- **Product Lifespan (xrrwjvmtg):** 5 years.
- **Energy Consumption in Use (qolpjmujtm):** 10 kWh/year.
- **Total Energy Use:** 5 years * 10 kWh/year = 50 kWh/unit.
- **End-user Electricity Mix (illustrative):** 0.5 kg CO₂e/kWh.
- **Emissions:** 50 kWh/unit * 0.5 kg CO₂e/kWh = 25.0 kg CO₂e/unit.

C2.3. End-of-Life Treatment of Sold Products

Emissions and potential avoided emissions from disposal or recycling at the end of the product's life.

- **Product Weight (illustrative):** 1 kg/unit (total materials + packaging).
- **Recyclability Percentage (yohyphrtxv):** 80%.
- **Circular Programs (ggrgozrxqe):** Product take-back program available. This supports the assumed high recyclability.
- **Non-recyclable portion:** $1 \text{ kg} * (1 - 0.80) = 0.2 \text{ kg/unit}$.
- **Emissions from non-recyclable waste (landfill illustrative):** $0.2 \text{ kg/unit} * 0.05 \text{ kg CO}_2\text{e/kg} = 0.01 \text{ kg CO}_2\text{e/unit}$.
- **Recycling Benefit/Burden (simplified avoided emissions):** A benefit is often associated with recycling. For this analysis, we assume the emissions associated with recycling processes are lower than virgin production, leading to a net reduction. For illustrative purposes, we focus on the burden of the non-recycled portion. Advanced models would use specific EoL factors or avoided burden factors.
- **Illustrative EoL Emissions:** 0.01 kg CO₂e/unit.

Total Product Carbon Footprint Summary

GHG Scope Category	Emissions (kg CO ₂ e/unit)
Scope 1 (Direct Emissions)	0.000
Scope 2 (Purchased Energy - Production)	0.088
Scope 3.1: Purchased Goods and Services (Materials)	4.149
Scope 3.2: Upstream Transportation and Distribution	0.135
Scope 3.3: Downstream Transportation and Distribution	0.045
Scope 3.4: Use of Sold Products	25.000
Scope 3.5: End-of-Life Treatment of Sold Products	0.010

GHG Scope Category	Emissions (kg CO2e/unit)
TOTAL PRODUCT CARBON FOOTPRINT	29.427 kg CO2e/unit

Note: All calculations are based on the illustrative data and assumptions outlined above.

5. Review & Report

Emission Hotspots

Based on the calculations, the primary emission hotspots for dsxoypjsgv are:

- **Use Phase (25.0 kg CO2e/unit):** This category represents by far the largest contributor to the total PCF (approximately 85%), primarily due to the energy consumption of the product over its 5-year lifespan. This highlights that product design for energy efficiency is paramount.
- **Purchased Goods and Services (4.149 kg CO2e/unit):** Material production accounts for the second-largest share (approximately 14%). Specific materials like aluminum and lithium-ion batteries show higher impacts per kg, indicating opportunities for material substitution, lightweighting, or increased recycled content.
- **Production Energy (Scope 2):** While partially offset by high renewable energy usage, the non-renewable portion still contributes. Further increasing renewable energy sourcing or improving production efficiency can reduce this.
- **Transportation (Upstream & Downstream):** These contributions are relatively minor in comparison to the use phase and materials, but still warrant optimization, such as optimizing logistics routes or using lower-emission transport modes.

Reliability

The reliability of this PCF analysis is contingent upon the accuracy and completeness of the input data.

- **Strength:** Adherence to GHG Protocol ensures a structured and comparable methodology. The explicit use of a detailed BOM format (even with illustrative data) enhances material impact accuracy compared to generic estimates. The consideration of the 2026 LSR Standard and 95% Scope 3 coverage ensures comprehensive reporting.
- **Limitations:** The analysis relies on placeholder values (e.g., for `ugxmzdmg`, `Select Mode`, `nymngwqftm`, `kvjojgsrmh`, `tsqjyejtix`, `xrrwjvmtg`, `qolpjmujtm`, `yohyphrtxv`, `ggrgozrxqe`) and general industry emission factors for transportation, grid electricity, and end-of-life processes where specific primary data was not provided. A more precise assessment would benefit from company-specific primary data for all parameters, especially actual energy mixes for production and use, detailed transport logs, and specific EoL treatment scenarios.
- **Future Improvements:**
 - Obtain actual primary data for all parameters to reduce reliance on assumptions.
 - Conduct a deeper dive into the supply chain to identify specific material origins and transport modes.
 - Model different EoL scenarios to capture the full impact of circularity initiatives (e.g., closed-loop recycling, remanufacturing).
 - Explore design changes for energy efficiency to drastically reduce use-phase emissions.
 - Investigate material alternatives with lower embedded carbon for high-impact components.