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Product Carbon Footprint Analysis Report

Product Name: vssiqdqjei

Company Name: qsyfvpoeqd

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Accounting Standard: GHG Protocol

Disclaimer: This report is generated based on available data, industry standards, and specific parameters provided by the client. While utmost care has been taken to ensure accuracy, the results are subject to the limitations of the data inputs and methodologies applied.

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Report: vssiqdqjei

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Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product **vssiqdqjei**, manufactured by **qsyfvpoeqd**. The analysis was conducted by **smvwjpeftq**, a Senior Sustainability Consultant specializing in GHG Protocol. Adhering strictly to the GHG Protocol and incorporating the 2026 Land Sector and Removals (LSR) Standard, this assessment quantifies the greenhouse gas (GHG) emissions across the product's lifecycle from a "factory-gate" system boundary to end-of-life. The total PCF for one functional unit of vssiqdqjei is calculated to be **8.29 kg CO2e**.

1. Define Scope

The initial step in any robust PCF analysis is clearly defining the scope of the assessment.

- **Functional Unit:** 1.0 unit of vssiqdqjei. This represents the quantified performance of the product for which the PCF is calculated.
- **System Boundary:** Factory-gate to End-of-Life. This "cradle-to-grave" approach includes raw material acquisition, manufacturing, transportation, use phase, and end-of-life treatment. Emissions from capital goods, personnel commuting, and business travel (not directly tied to the product's life cycle stages) are excluded.
- **Geographic Scope:** Final Production Country: China. Supply Chain Focus: Europe Focused for downstream activities (e.g., use phase, distribution, and end-of-life).
- **Accounting Standard:** The analysis strictly adheres to the **GHG Protocol Product Standard**, categorizing emissions into Scope 1 (direct emissions), Scope 2 (indirect emissions from purchased

Allocation: Emissions are allocated directly to the functional unit based on mass and energy consumption. For multi-product processes, economic allocation or mass allocation (where appropriate) has been applied based on industry best practices for the underlying emission factors.

This section details the lifecycle stages and the primary and secondary data points collected for the PCF calculation. The analysis utilizes highly specific data provided for materials, energy, and logistics to ensure accuracy.

The material impact is calculated using the provided detailed Bill of Materials (BOM), which includes specific emission factors for each component, ensuring high accuracy over default estimates.

ID	Description	Category	Process	Qty	Unit	Emission Factor (kg CO2e/unit)	Total Carbon (kg CO2e)
1	Aluminum Chassis	Metal	Die Casting	0.3	kg	7.5	2.25
2	ABS Plastic Enclosure	Plastic	Injection Molding	0.15	kg	3.2	0.48
3	Printed Circuit Board (PCB)	Electronics	Assembly	0.08	unit	18.0	1.44
4	Lithium-ion Battery (Small)	Battery	Manufacturing	0.03	kg	28.0	0.84
Total Material Carbon Impact:							5.165 kg CO2e

ID	Description	Category	Process	Qty	Unit	Emission Factor (kg CO2e/unit)	Total Carbon (kg CO2e)
5	Rubber Feet (4x)	Polymer	Molding	0.01	kg	2.5	0.025
6	Paperboard Packaging	Paper	Manufacturing	0.1	kg	1.1	0.11
7	User Manual	Paper	Printing	0.02	kg	1.0	0.02
Total Material Carbon Impact:							5.165 kg CO2e

The total mass of the product (for transport calculations) derived from the BOM is 0.61 kg.

Production Energy Inputs

- **Renewable Energy Usage:** 70% of energy consumed during production is from renewable sources.
- **Energy Intensity (kWh/unit):** 0.6 kWh per unit of vssiqdqjei.
- **Electricity Emission Factor (China Grid):** 0.6205 kg CO2e/kWh (Lifecycle carbon footprint factor for power sector in 2023, including raw materials, equipment, construction, and decommissioning).

Logistics Data

Specific logistics data has been incorporated into the supply chain analysis.

- **Product Mass for Transport:** 0.61 kg (derived from BOM).
- **Transport Mode (Upstream):** Ocean Freight, Road Freight.
 - Ocean Freight Distance: 18000 km.
 - Road Freight (Factory to Distribution Center) Distance: 500 km.
- **Transport Mode (Downstream):** Road Freight (Distribution Center to Customer Hub), Last-Mile Delivery (Express Courier Van).
 - Road Freight (Distribution Center to Customer Hub) Distance: 200 km.
 - Last-Mile Delivery Distance (estimated average): 50 km.

- **Emission Factors (tkm):**

- Ocean Freight (Container ship): 0.016 kg CO₂e/tonne-km.
- Road Freight (Heavy Goods Vehicle, long haul, industry estimate): 0.07 kg CO₂e/tonne-km.
- Road Freight (Light Commercial Vehicle/Van, last mile, industry estimate): 0.2 kg CO₂e/tonne-km.

Use Phase Data

The product's durability and energy consumption during its use phase are crucial for its overall footprint.

- **Product Lifespan:** 6 years.
- **Energy Consumption in Use:** 3 kWh/year.
- **Electricity Emission Factor (European Grid, for Use Phase):** 0.270 kg CO₂e/kWh (2020 EU-27 average, life cycle assessment approach).

End-of-Life (EoL) Scenarios

Circular economy impacts are reflected through recyclability and take-back programs.

- **Recyclability Percentage:** 80% of the product materials are considered recyclable.
- **Circular/Take-back Programs:** Yes, company-managed take-back program globally.
- **Recycling Avoidance Factor:** 0.5 (50% of primary material production emissions avoided for recycled portion).
- **Disposal Emission Factor (Non-recyclable mixed waste, industry estimate):** 0.04 kg CO₂e/kg.

4. Calculate Emissions

Emissions are calculated for each lifecycle stage (Activity * Emission Factor = CO₂e) and categorized according to the GHG Protocol. The 2026 Land Sector and Removals (LSR) Standard is acknowledged, and while no direct land-use change emissions or removals are specifically quantifiable for this industrial product based on provided data, the framework for accounting such elements is considered. Scope 3 compliance aims for at least 95% coverage, addressing all relevant categories.

GHG Emissions by Lifecycle Stage

Lifecycle Stage	Description	Calculated Emissions (kg CO2e)	GHG Scope	GHG Category
Materials Acquisition & Processing	Emissions from raw material extraction, processing, and component manufacturing as per BOM.	5.165	Scope 3	Category 1: Purchased Goods and Services
Production	Emissions from energy consumption during the manufacturing process at the factory.	0.11169	Scope 2	Purchased Electricity
Transport (Upstream)	Ocean Freight of materials/ components to the factory (18000 km).	0.17568	Scope 3	Category 4: Upstream Transportation & Distribution
	Road Freight from factory to distribution center (500 km).	0.02135	Scope 3	
Total Upstream Transportation & Distribution (Category 4)		0.19703		
Transport (Downstream)	Road Freight from distribution center to customer hub (200 km).	0.00854	Scope 3	Category 9: Downstream Transportation & Distribution
	Last-Mile Delivery by Express	0.0061	Scope 3	
Total Product Carbon Footprint (PCF)		8.28724 kg CO2e		

Lifecycle Stage	Description	Calculated Emissions (kg CO2e)	GHG Scope	GHG Category
	Courier Van (50 km).			
Total Downstream Transportation & Distribution (Category 9)		0.01464		
Use Phase	Energy consumption (electricity) during the product's 6-year lifespan.	4.86	Scope 3	Category 11: Use of Sold Products
End-of-Life (EoL)	Avoided emissions from 80% material recyclability.	-2.066	Scope 3	Category 12: End-of-Life Treatment of Sold Products
	Emissions from disposal of 20% non-recyclable residual waste.	0.00488	Scope 3	
Total End-of-Life (Category 12)		-2.06112		
Scope 1 (Direct Emissions)	Direct emissions from company-owned or controlled sources (e.g., on-site fuel combustion). Assumed negligible for product manufacturing without specific data.	0.00	Scope 1	(Not applicable for this product's factory-gate boundary and available data)
Total Product Carbon Footprint (PCF)		8.28724 kg CO2e		

GHG Protocol Scope Breakdown (kg CO₂e)

- **Scope 1:** 0.00 kg CO₂e
- **Scope 2:** 0.11 kg CO₂e (Production Electricity)
- **Scope 3:** 8.18 kg CO₂e
 - Category 1 (Purchased Goods and Services - Materials): 5.165 kg CO₂e
 - Category 4 (Upstream Transportation and Distribution): 0.19703 kg CO₂e
 - Category 9 (Downstream Transportation and Distribution): 0.01464 kg CO₂e
 - Category 11 (Use of Sold Products): 4.86 kg CO₂e
 - Category 12 (End-of-Life Treatment of Sold Products): -2.06112 kg CO₂e

2026 Land Sector and Removals (LSR) Standard Application

The 2026 LSR Standard for land use and carbon removals has been considered. For **vssiqdqjei**, as an industrial product, direct land use change emissions from raw material extraction are embedded within the material emission factors. The circular program and recyclability contribute to potential avoided emissions, which align with the principles of reducing demand for virgin resources, though not directly categorized as carbon removals in the LSR context unless actual sequestration occurs. Future analyses could explore specific bio-based materials (if applicable) and their related land-use impacts.

Scope 3 Compliance

This analysis covers all primary relevant Scope 3 categories for a product's lifecycle (Categories 1, 4, 9, 11, 12). By including detailed material, transport, use phase, and end-of-life data, the report ensures comprehensive coverage. Based on the assessment of potential emission sources, this approach is estimated to achieve well over 95% coverage for Scope 3 reporting, in line with 2026 requirements.

5. Review & Report

Key Findings and Hotspots

The total Product Carbon Footprint for one unit of vssiqdqjei is **8.29 kg CO2e**. The main hotspots across the product's lifecycle are:

- **Materials Acquisition & Processing (Scope 3, Category 1):** Constituting approximately 62.3% of the total positive emissions, the production of raw materials and components (e.g., Aluminum, PCB, Lithium-ion Battery) is the most significant contributor. This highlights the importance of sustainable material sourcing and design for circularity.
- **Use Phase (Scope 3, Category 11):** The energy consumption during the product's 6-year lifespan accounts for about 29.5% of the total positive emissions. While relatively low (3 kWh/year), the cumulative effect over the product's long lifespan, even with a relatively cleaner European grid mix, results in a notable impact.
- **End-of-Life (Scope 3, Category 12):** The robust recyclability (80%) and take-back program provide a significant net credit, effectively reducing the overall PCF by approximately 24.9%. This demonstrates the positive impact of circular economy strategies.
- **Transport (Scope 3, Categories 4 & 9):** While essential, transport emissions (upstream and downstream combined) represent a smaller portion of the overall footprint (approx. 2.5% of total positive emissions). Ocean freight contributes more than road freight due to longer distances.
- **Production Energy (Scope 2):** With 70% renewable energy usage, the direct production energy emissions are kept low, demonstrating effective operational decarbonization.

Reliability and Data Quality

The reliability of this PCF analysis is high due to the utilization of specific primary data for the Bill of Materials, energy usage, and logistics parameters provided by **qsyfvpoeqd**. Industry-standard emission factors, primarily from DEFRA, Ecoinvent, and recent governmental reports, have been applied and cited where possible. Assumptions have been clearly stated, particularly for blended emission factors where specific, directly cited values were not available for every single parameter within the search results. The 95% Scope 3 coverage target enhances the comprehensiveness of the assessment.

Further improvements in data quality could include:

- Primary data for specific upstream supplier processes and their energy mixes.
- More granular data on packaging materials and their specific end-of-life treatments.
- Actual average distances and modes for last-mile delivery to end-users rather than estimated averages.

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