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Product Carbon Footprint Analysis

Product: eequotipvo

Company Name: txezxiwyfn

Protocol Data (Accounting Standard): GHG
Protocol

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This report is generated based on available data and industry standards. While efforts have been made to ensure accuracy and comprehensive coverage, actual emissions may vary depending on specific operational conditions and data precision.

Product Carbon Footprint Report

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Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for **eequotipvo**, a product manufactured by **txezxiwyfn**. The analysis, conducted by rtgyvumnlr, Senior Sustainability Consultant specializing in GHG Protocol, follows a cradle-to-grave approach, encompassing raw material extraction, manufacturing, transportation, use phase, and end-of-life treatment. The primary objective is to quantify the greenhouse gas (GHG) emissions associated with the product's lifecycle, identify key emission hotspots, and ensure compliance with the GHG Protocol, including considerations for the 2026 Land Sector and Removals (LSR) Standard update and stringent Scope 3 reporting requirements.

1. Methodology and Scope Definition

The Product Carbon Footprint (PCF) for eequotipvo has been calculated in accordance with the **GHG Protocol** standards. This rigorous framework ensures a comprehensive and transparent assessment of greenhouse gas emissions across the product's lifecycle.

1.1. Functional Unit

- **Functional Unit:** 1.0 unit of eequotipvo.

1.2. System Boundary

The analysis adopts a comprehensive cradle-to-grave system boundary. While the initial focus for the production stage is '\factory_gate\' , the assessment extends to include all subsequent lifecycle stages as specified by the parameters, thereby covering:

- Raw Material Acquisition and Processing
- Manufacturing and Production
- Distribution and Logistics
- Product Use Phase
- End-of-Life Treatment

1.3. Geographic Scope

- **Final Production Country:** China
- **Supply Chain Focus:** Europe Focused (implying distribution and use in Europe)

1.4. Allocation

Emissions are directly allocated to the functional unit (1.0 unit of eequotipvo) based on mass and energy inputs. For shared processes (e.g., transport), allocation is done proportionally by the mass of eequotipvo.

1.5. Accounting Standard

- **Accounting Standard:** GHG Protocol. Emissions are categorized into Scope 1 (direct), Scope 2 (purchased energy), and Scope 3 (value chain).
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2. Lifecycle Mapping and Data Collection

This section details the inventory stages and the primary and secondary data points collected for the PCF analysis of eequotipvo.

2.1. Detailed Bill of Materials (BOM)

The following Bill of Materials (BOM) for eequotipvo (Product ID: riqipemo) was used to determine the material-related emissions. The 'Total Carbon (kg CO2e)' values provided in the BOM were directly incorporated into the calculations.

ID	Description	Category	Process	Qty	Unit	Emission Factor (kg CO2e/unit)	Total Carbon (kg CO2e)
1	ABS Plastic Casing	Plastics	Injection Molding	0.2	kg	3.0	0.60
2	Printed Circuit Board (PCB)	Electronics	Manufacturing & Assembly	0.05	kg	15.0	0.75
3	Lithium-Ion Battery	Energy Storage	Battery Production	0.1	kg	18.0	1.80
4	Copper Wiring	Metals	Metal Processing	0.02	kg	4.0	0.08
5	Silicon Chipset	Electronics	Semiconductor Fab	0.01	kg	50.0	0.50
6	Cardboard Packaging	Paper & Pulp	Pulp & Paper Production	0.08	kg	1.0	0.08
Total Material Footprint:							3.81

The total mass of the product (equotipvo) based on the BOM is approximately 0.46 kg, which will be used for transport calculations where mass is relevant.

2.2. Production Energy Inputs (Manufacturing in China)

- **Energy Intensity (kWh/unit):** 20 kWh/unit [cite: ndgyhotfof]
- **Renewable Energy Usage:** 60% [cite: ypeeuvmwpt]
- **Non-Renewable Energy:** $20 \text{ kWh} * (1 - 0.60) = 8 \text{ kWh/unit}$
- **Renewable Energy:** $20 \text{ kWh} * 0.60 = 12 \text{ kWh/unit}$
- **China Grid Emission Factor:** 0.60 kg CO₂e/kWh (Average for 2021-2022)

2.3. Transport Logistics

- **Product Weight for Transport:** 0.5 kg (Approximation based on BOM total mass)
- **Transport Mode (Long-Haul):** Ocean Freight (Container Ship) from China to Europe, followed by Road Freight (Heavy Goods Vehicle - HGV) within Europe.
- **Transport Distance (Ocean Freight):** 15,000 km [cite: lvgofvzhmt]
- **Transport Distance (Road Freight - HGV):** 500 km [cite: lvgofvzhmt]
- **Ocean Freight Emission Factor:** 0.016 kg CO₂e/tonne-km
- **Road Freight (HGV) Emission Factor:** 0.085 kg CO₂e/tonne-km (Average)
- **Last-Mile Delivery Channel:** Light Commercial Vehicle (LCV) [cite: Delivery Type]
- **Last-Mile Delivery Distance:** 50 km [cite: lvgofvzhmt]
- **LCV Emission Factor (per km):** 0.15 kg CO₂e/km

2.4. Use Phase

- **Product Lifespan:** 3 years [cite: ofmvlfqkyq]

- **Energy Consumption in Use:** 5 kWh/year [cite: reypweuqem]
- **Total Energy Consumption (Use Phase):** 5 kWh/year * 3 years = 15 kWh
- **European Grid Emission Factor:** 0.25 kg CO₂e/kWh (Average)

2.5. End-of-Life (EoL) Scenarios

- **Recyclability Percentage:** 75% [cite: ktgpsfhpv]
 - **Circular/Take-back Programs:** txezxiwyfn operates an active take-back program for end-of-life products, aiming to maximize material recovery and reuse. [cite: sqythhjtue]
 - **Disposed Product Weight:** 0.5 kg (total product weight) * (1 - 0.75) = 0.125 kg
 - **Landfill Emission Factor (Mixed Waste, for disposed portion):** 1.0 kg CO₂e/kg
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3. Calculation of Emissions (CO₂e)

Emissions are calculated for each lifecycle stage and categorized according to the GHG Protocol Scopes.

3.1. Scope 1 Emissions

Based on the provided parameters, txezxiwyfn does not have direct emissions (e.g., from owned boilers or vehicles) for the production of eequotipvo. Therefore, Scope 1 emissions for this product are assumed to be 0 kg CO₂e.

3.2. Scope 2 Emissions (Purchased Electricity)

These emissions arise from the generation of purchased electricity for the manufacturing process in China.

- Non-Renewable Electricity Used: 8 kWh/unit

- China Grid Emission Factor: 0.60 kg CO₂e/kWh
- **Scope 2 Emissions:** 8 kWh/unit * 0.60 kg CO₂e/kWh = **4.80 kg CO₂e/unit**

3.3. Scope 3 Emissions (Value Chain)

Scope 3 emissions cover all indirect emissions occurring in the company's value chain, both upstream and downstream. This analysis aims for at least 95% coverage as per 2026 requirements.

3.3.1. Category 1: Purchased Goods and Services (Materials)

This category includes emissions from the extraction, production, and transportation of raw materials and components for the product.

- Total Material Footprint (from BOM): 3.81 kg CO₂e/unit
- **Scope 3, Category 1 Emissions: 3.81 kg CO₂e/unit**

3.3.2. Category 3: Fuel- and Energy-Related Activities (Upstream for Renewable Electricity)

This category covers upstream emissions associated with fuel and energy not included in Scope 1 or 2. While direct renewable electricity use has zero operational emissions (Scope 2), the upstream emissions from its generation and infrastructure are Scope 3. Given the parameters, specific factors for these upstream renewable emissions are not provided, hence they are acknowledged but not quantified in detail within this report.

3.3.3. Category 4: Upstream Transportation and Distribution (Inbound Logistics)

This includes the transportation of materials and components to the manufacturing facility in China.

Assuming the majority of materials are consolidated for inbound shipping. For simplicity and based on parameters, the main outbound logistics calculation from China to Europe represents the most significant transport leg, which will be treated as part of Category 9 (Downstream T&D) but acknowledges its upstream nature for the final product delivered. For inbound materials to the China factory, general upstream transport is covered under Category 1 (Purchased goods and services) as implied by the "Total Carbon" in the BOM for each component.

3.3.4. Category 9: Downstream Transportation and Distribution (Outbound Logistics)

This covers the transportation of the finished product from the factory in China to the customer in Europe, including last-mile delivery.

- **Ocean Freight (China to Europe):**
 - Product Weight: 0.0005 tonnes (0.5 kg)
 - Distance: 15,000 km
 - Emission Factor: 0.016 kg CO₂e/tonne-km
 - Emissions: $0.0005 \text{ tonnes} * 15,000 \text{ km} * 0.016 \text{ kg CO}_2\text{e/tonne-km} = \mathbf{0.12 \text{ kg CO}_2\text{e/unit}}$
- **Road Freight (HGV - Port to Distribution Center in Europe):**
 - Product Weight: 0.0005 tonnes (0.5 kg)
 - Distance: 500 km
 - Emission Factor: 0.085 kg CO₂e/tonne-km
 - Emissions: $0.0005 \text{ tonnes} * 500 \text{ km} * 0.085 \text{ kg CO}_2\text{e/tonne-km} = \mathbf{0.02125 \text{ kg CO}_2\text{e/unit}}$
- **Last-Mile Delivery (LCV - within Europe):**
 - Distance: 50 km
 - Emission Factor: 0.15 kg CO₂e/km
 - Emissions: $50 \text{ km} * 0.15 \text{ kg CO}_2\text{e/km} = \mathbf{7.50 \text{ kg CO}_2\text{e/unit}}$
- **Total Scope 3, Category 9 Emissions:** $0.12 + 0.02125 + 7.50 = \mathbf{7.64125 \text{ kg CO}_2\text{e/unit}}$

3.3.5. Category 11: Use of Sold Products

Emissions from the energy consumption during the product's lifespan by the end-user in Europe.

- Total Energy Consumption: 15 kWh/unit
- European Grid Emission Factor: 0.25 kg CO₂e/kWh
- **Scope 3, Category 11 Emissions:** 15 kWh/unit * 0.25 kg CO₂e/kWh = **3.75 kg CO₂e/unit**

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

This accounts for emissions from the disposal of the product after its use phase.

- Product Weight: 0.5 kg
- Recyclability: 75%
- Portion disposed (non-recycled): 0.5 kg * (1 - 0.75) = 0.125 kg
- Assumed Disposal Method: Landfill (representing a common end-of-life pathway for non-recycled electronic waste components)
- Landfill Emission Factor: 1.0 kg CO₂e/kg (for mixed waste, representing plastics/electronics components)
- **Scope 3, Category 12 Emissions:** 0.125 kg * 1.0 kg CO₂e/kg = **0.125 kg CO₂e/unit**

The company's circular/take-back programs (such as) for 75% recyclability significantly mitigate the overall end-of-life impact by avoiding virgin material production. While these avoided emissions are not quantified as negative emissions in this direct EoL calculation as per standard GHG Protocol practice, their positive environmental contribution is recognized.

4. Total Product Carbon Footprint (PCF)

The total PCF for one unit of eequotipvo is the sum of emissions across all scopes and categories.

GHG Scope/ Category	Description	Emissions (kg CO2e/unit)
Scope 1	Direct Emissions from Owned/ Controlled Sources	0.00
Scope 2	Purchased Electricity (Production in China)	4.80
Scope 3 - Value Chain Emissions		
Category 1	Purchased Goods and Services (Materials)	3.81
Category 3	Fuel- and Energy-Related Activities (Upstream for Renewable - Acknowledged, not quantified)	(N.Q.)
Category 4	Upstream Transportation and Distribution (Inbound - Covered under Cat 1)	(N.Q.)
Category 9	Downstream Transportation and Distribution (Outbound Logistics)	7.64
Category 11	Use of Sold Products (Energy Consumption)	3.75
Category 12	End-of-Life Treatment of Sold Products	0.13
Total Product Carbon Footprint		20.13

Total PCF for one unit of eequotipvo: 20.13 kg CO2e

5. Review and Reporting

5.1. Emission Hotspots and Reliability

The analysis reveals that the most significant emission hotspots for eequotipvo are:

- **Downstream Transportation (Category 9):** With 7.64 kg CO₂e, particularly dominated by last-mile delivery, this represents a major area for potential reduction.
- **Production Energy (Scope 2):** 4.80 kg CO₂e from non-renewable electricity in China highlights the impact of grid mix and the importance of renewable energy sourcing.
- **Purchased Goods and Services (Category 1):** The materials themselves contribute 3.81 kg CO₂e, indicating that material selection and design for lower impact are crucial.
- **Use Phase (Category 11):** The energy consumed during the product's lifespan accounts for 3.75 kg CO₂e, emphasizing the need for energy-efficient product design.

The reliability of this report is high, leveraging specific primary data for BOM, energy consumption, and logistics where available. Secondary data from industry-standard emission factors (e.g., averages from Ecoinvent/DEFRA equivalents) has been applied conservatively for areas where primary data was not specified.

5.2. Adherence to GHG Protocol and 2026 LSR Update

This report strictly adheres to the GHG Protocol Corporate Standard and Corporate Value Chain (Scope 3) Accounting and Reporting Standard. All relevant emissions are categorized into Scope 1, 2, and 3.

The **2026 Land Sector and Removals (LSR) Standard** is recognized as a critical update, taking effect January 1, 2027. While eequotipvo, being an electronic product, may not have direct land-based emissions, the LSR Standard\'s principles are relevant for upstream raw materials, especially if they involve bio-based components or processes with significant land-use change impacts. Further detailed analysis with supplier-specific data would be required to fully quantify LSR-related emissions and removals for materials. txezxiwyfn should prepare to integrate the LSR Standard fully into its GHG accounting practices for relevant value chain activities as guidance becomes available in Q2 2026.

5.3. Scope 3 Compliance

This analysis has focused on the most material Scope 3 categories: Purchased Goods and Services (Category 1), Downstream Transportation and Distribution (Category 9), Use of Sold Products (Category 11), and End-of-Life Treatment of Sold Products (Category 12). By covering these significant contributors, the report aims to achieve at least 95% coverage for Scope 3 reporting, aligning with stringent 2026 requirements. Other Scope 3 categories (e.g., capital goods, business travel) may exist but are considered less material for the product\'s footprint compared to the direct value chain impacts quantified here.

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