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# Product Carbon Footprint Analysis Report

For Product: **ejhjqqkkjo**

Company: **muljeveiwe**

Protocol Data (Accounting Standard): **GHG Protocol**

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# Product Carbon Footprint Report

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## Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for **ejhjqqkkjo**, manufactured by **muljeveiwe**. The analysis adheres to the **GHG Protocol** standards, including considerations for the 2026 Land Sector and Removals (LSR) update and stringent Scope 3 coverage requirements. The total cradle-to-grave carbon footprint for one functional unit of **ejhjqqkkjo** is calculated to be **223.54 kg CO2e**. The use phase of the product has been identified as the most significant hotspot, accounting for the vast majority of emissions.

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## 1. Introduction

This Product Carbon Footprint (PCF) report outlines the greenhouse gas (GHG) emissions associated with the lifecycle of **ejhjqqkkjo**. The assessment follows the **GHG Protocol Product Standard**, providing a transparent and comprehensive overview of environmental impacts from raw material acquisition through to end-of-life.

### 1.1. Purpose and Scope

- **Purpose:** To quantify the carbon footprint of **ejhjqqkkjo** to identify emission hotspots, inform design improvements, and support sustainability reporting for **muljeveiwe**.

- **Methodology:** The analysis follows the five-step approach: Define Scope, Map Lifecycle, Collect Data, Calculate Emissions, and Review & Report.
- **Accounting Standard:** The assessment strictly adheres to the **GHG Protocol**, categorizing emissions into Scope 1 (direct), Scope 2 (purchased energy), and Scope 3 (value chain).
- **2026 LSR Update:** The Land Sector and Removals (LSR) Standard was released on January 30, 2026, and is set to take effect on January 1, 2027. The principles of this standard have been considered, particularly for any land-use related emissions or removals, although specific data points were not detailed in the provided parameters. No direct land use change emissions have been explicitly quantified without specific data.
- **Scope 3 Compliance:** The GHG Protocol released a March 2026 progress update outlining proposed revisions to its Scope 3 Standard, introducing a 95% inclusion threshold for Scope 3 emissions. Significant efforts have been made to achieve comprehensive Scope 3 coverage, aiming for at least 95% reporting by including upstream material, transport, and downstream use-phase and end-of-life impacts.

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## 2. Scope Definition

The defined parameters for this PCF analysis are as follows:

- **Functional Unit:** 1.0 unit of **ejhjqqkkjo**. This represents the reference flow to which all inputs and outputs are related.
- **System Boundary:** While the formal parameter specified "factory_gate" for the production boundary, the comprehensive data requirements for transport, use phase, and end-of-life necessitate a broader, predominantly "cradle-to-grave" approach to encompass all relevant Scope 3 emissions. Therefore, the analysis covers raw material acquisition, manufacturing, distribution, use, and end-of-life stages

in line with GHG Protocol guidance for product lifecycle assessment.

- **Geographic Scope:** Final Production Country: **China**. Supply Chain Focus: **Europe Focused** (for upstream components and potential downstream market). Emission factors for electricity and transportation have been selected to reflect these regions.
- **Allocation:** Emissions are allocated directly to the functional unit of **ejhjqqkkjo** based on mass, energy consumption, and distance traveled, consistent with GHG Protocol guidelines for transportation allocation.

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## 3. Lifecycle Mapping (LCI Inventory Stages) & Data Collection

This section details the critical inputs across the lifecycle of **ejhjqqkkjo**, drawing upon the provided specific parameters and representative industry data for emission factors.

### 3.1. Material Inputs (Detailed Bill of Materials - BOM)

The following table details the Bill of Materials (BOM) for **ejhjqqkkjo**, including quantities, associated emission factors, and calculated total carbon emissions for each component. These values are directly incorporated from the provided **swefkmld** data.

| ID | Description | Category | Process | Qty (kg) | Unit | Emission Factor (kg CO2e/ unit) | Total Carbon (kg CO2e) |
|---|---|---|---|---|---|---|---|
| M1 | Aluminum Casing | Metals | Primary Production | 0.1 | kg | 8.0 | 0.8 |
| M2 | Copper Wire | Metals | Refining and Drawing | 0.05 | kg | 4.0 | 0.2 |
| **Total Material Emissions (Scope 3 - Upstream)** | | | | | | | **4.125** |

| ID | Description | Category | Process | Qty (kg) | Unit | Emission Factor (kg CO2e/ unit) | Total Carbon (kg CO2e) |
|---|---|---|---|---|---|---|---|
| M3 | ABS Plastic Housing | Plastics | Injection Molding | 0.2 | kg | 2.5 | 0.5 |
| M4 | Lithium-ion Battery | Electronics | Battery Manufacturing | 0.08 | kg | 20.0 | 1.6 |
| M5 | Printed Circuit Board | Electronics | PCB Fabrication | 0.03 | kg | 15.0 | 0.45 |
| M6 | Silicon Chip | Electronics | Semiconductor Production | 0.005 | kg | 100.0 | 0.5 |
| M7 | Packaging Cardboard | Paper/ Wood | Pulp and Paper Production | 0.05 | kg | 1.5 | 0.075 |
| **Total Material Emissions (Scope 3 - Upstream)** | | | | | | | **4.125** |

### 3.2. Energy Inputs (Production Phase)

Energy consumption during the production of **ejhjqqkkjo** in China is customized based on the provided parameters:

- **Energy Intensity (kWh/unit): 10 kWh/unit**
- **Renewable Energy Usage: 50%**

The remaining 50% of electricity is sourced from the Chinese national grid. A representative emission factor for the Chinese grid mix is assumed to be 0.577 kg CO2e/kWh.

### 3.3. Logistics Data (Transport and Delivery)

Transportation plays a crucial role in the supply chain. The following parameters were used:

- **Primary Inbound Transport (Components to Factory in China):**
  - Mode: **Road freight**

    - Distance: **1500 km** (representing initial European component transport)
    - Additional assumed: Ocean freight from Europe to China (approx. 10,000 km)

- **Outbound Transport (Finished Product from China to Market):**
    - Assumed: Ocean freight from China to Europe (approx. 10,000 km)
    - Assumed: Road freight for European distribution (approx. 500 km)

- **Last-Mile Delivery Channel: Van delivery** (diesel)

Industry-standard emission factors were applied for each transport mode: road freight (long-haul truck) at 0.105 kg CO2e/tkm, ocean freight (container ship) at 0.016 kg CO2e/tkm, and van delivery at 0.24934 kg CO2e/km.

## 3.4. Use Phase Data

The energy consumption during the product\'s lifespan is a critical factor, especially for electronic devices, falling under GHG Protocol Scope 3 Category 11.

- **Product Lifespan: 5 years**
- **Energy Consumption in Use: 0.5 kWh/day**

A representative European average electricity emission factor of 0.238 kg CO2e/kWh is used for the use phase, reflecting the potential market of the product.

## 3.5. End-of-Life (EoL) Scenarios

Circular economy impacts are incorporated based on the following:

- **Recyclability Percentage: 70%** of the product\'s material by mass is considered recyclable.
- **Circular/Take-back Programs: Yes, established take-back scheme**, indicating a structured approach to material recovery.

A recycling credit is applied for the recycled portion, calculated as a percentage of the avoided virgin material production. Emissions from the disposal of the non-recycled 30% are accounted for using a representative landfill emission factor of 0.7 kg CO2e/kg.

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## 4. Emissions Calculation (Activity * Emission Factor = CO2e)

This section details the calculated emissions categorized by GHG Protocol scopes. All calculations are based on the data and assumptions outlined above.

### 4.1. Scope 1 Emissions (Direct Emissions)

For this product-level PCF, direct emissions from sources owned or controlled by **muljeveiwe** (e.g., on-site fuel combustion for manufacturing **ejhjqqkkjo**) are considered negligible as the primary manufacturing energy source is purchased electricity and transport is outsourced.

**Total Scope 1 Emissions: 0.00 kg CO2e**

### 4.2. Scope 2 Emissions (Purchased Electricity for Production)

These emissions result from the generation of purchased electricity consumed during the manufacturing process of **ejhjqqkkjo** in China.

- Total Production Energy: **10 kWh/unit**
- Renewable Energy Usage: **50%**
- Non-renewable energy: 10 kWh/unit * (1 - 0.50) = 5 kWh/unit
- Chinese Grid Emission Factor: 0.577 kg CO2e/kWh
- **Calculated Emissions:** 5 kWh/unit * 0.577 kg CO2e/kWh = **2.885 kg CO2e**

**Total Scope 2 Emissions: 2.885 kg CO2e**

## 4.3. Scope 3 Emissions (Value Chain Emissions)

Scope 3 emissions cover all other indirect emissions that occur in the value chain, both upstream and downstream. This category represents the most significant portion of the total PCF for **ejhjqqkkjo**.

### 4.3.1. Upstream Emissions

- **Materials (Raw Material Acquisition & Production):** Directly from the BOM analysis.
    - Total Material Emissions: **4.125 kg CO2e**
- **Transport (Inbound Logistics):** From component suppliers to the manufacturing facility in China. This falls under Scope 3, Category 4: Upstream Transportation and Distribution.
    - Product Total Mass: 0.515 kg
    - Road Freight (Europe - **1500 km**): 0.515 kg * 1500 km * (0.105 kg CO2e/tkm) / 1000 = 0.0810 kg CO2e
    - Ocean Freight (Europe to China - 10,000 km assumed): 0.515 kg * 10000 km * (0.016 kg CO2e/tkm) / 1000 = 0.0824 kg CO2e
    - Total Inbound Transport: **0.1634 kg CO2e**

**Total Upstream Scope 3 Emissions: 4.125 + 0.1634 = 4.2884 kg CO2e**

### 4.3.2. Downstream Emissions

- **Transport (Outbound Logistics):** From the manufacturing facility in China to the market (e.g., Europe). This also falls under Scope 3, Category 9: Downstream Transportation and Distribution.
    - Product Total Mass: 0.515 kg
    - Ocean Freight (China to Europe - 10,000 km assumed): 0.515 kg * 10000 km * (0.016 kg CO2e/tkm) / 1000 = 0.0824 kg CO2e

    - Road Freight (European distribution - 500 km assumed): 0.515 kg * 500 km * (0.105 kg CO2e/tkm) / 1000 = 0.0270 kg CO2e
    - Total Outbound Transport: **0.1094 kg CO2e**

- **Last-Mile Delivery:** Final delivery to the customer. This is part of Downstream Transportation and Distribution (Category 9).
    - Mode: **Van delivery**
    - Van Emission Factor: 0.24934 kg CO2e/km
    - Assumed average last-mile distance: 50 km per delivery, with 100 units per van for allocation.
    - Calculated Emissions per unit: (0.24934 kg CO2e/km * 50 km) / 100 units = **0.1247 kg CO2e**

- **Use Phase:** Energy consumption during the product\'s lifespan, falling under Scope 3, Category 11: Use of Sold Products.
    - Product Lifespan: **5 years**
    - Energy Consumption in Use: **0.5 kWh/day**
    - Total Energy Consumption: 0.5 kWh/day * 365 days/year * 5 years = 912.5 kWh
    - European Grid Emission Factor (assumed): 0.238 kg CO2e/kWh
    - Calculated Emissions: 912.5 kWh * 0.238 kg CO2e/kWh = **217.175 kg CO2e**

- **End-of-Life (EoL):** Impacts from disposal and recycling, falling under Scope 3, Category 12: End-of-Life Treatment of Sold Products.
    - Product Total Mass: 0.515 kg
    - Recyclability Percentage: **70%**
    - Total Material Emissions (from BOM): 4.125 kg CO2e
    - Recycling Credit (assumed 40% of original material impact for 70% recycled portion): - (0.70 * 0.40 * 4.125 kg CO2e) = -1.155 kg CO2e

    - Disposal Burden (for 30% non-recycled; 0.1545 kg * 0.7 kg CO2e/kg for landfilling): 0.1545 kg * 0.7 kg CO2e/kg = 0.1082 kg CO2e
    - Net End-of-Life Impact: -1.155 + 0.1082 = **-1.0468 kg CO2e** (Net Credit)

**Total Downstream Scope 3 Emissions: 0.1094 + 0.1247 + 217.175 - 1.0468 = 216.3623 kg CO2e**

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## 5. Review & Report

### 5.1. Summary of Carbon Footprint by Scope

The total Product Carbon Footprint for one functional unit of **ejhjqqkkjo** is:

| GHG Protocol Scope | Emissions (kg CO2e) | Percentage of Total |
|---|---|---|
| Scope 1 (Direct Emissions) | 0.00 | 0.0% |
| Scope 2 (Purchased Electricity) | 2.885 | 1.3% |
| Scope 3 (Value Chain) | 220.65 | 98.7% |
| **Total PCF** | **223.54** | **100.0%** |

### 5.2. Hotspots and Reliability

- **Use Phase Dominance:** The most significant hotspot by far is the **Use Phase**, contributing **217.18 kg CO2e** (approximately 97% of the total footprint). This is common for electronic products with prolonged operational lifespans and continuous energy consumption.
- **Material Production:** Upstream material production is the second largest contributor, at **4.13 kg CO2e**, highlighting the importance of sustainable material sourcing and design.

- **Transport:** While contributing less than the use phase or materials, total transport emissions (inbound, outbound, last-mile) are approximately **0.39 kg CO2e**.
- **End-of-Life Credit:** The established take-back scheme and high recyclability provide a **net credit of -1.05 kg CO2e**, demonstrating the positive impact of circular economy initiatives.
- **Reliability:** The calculations are based on the provided specific parameters and representative industry-average emission factors (similar to Ecoinvent/DEFRA equivalents) where specific data was not available. The reliability is high for the given input data, but can be further enhanced with primary data collection for all supply chain stages, which is emphasized in the GHG Protocol Scope 3 revisions.

### 5.3. Recommendations for **muljeveiwe**

- **Focus on Use Phase Efficiency:** Given its overwhelming impact, **muljeveiwe** should prioritize reducing the energy consumption of **ejhjqqkkjo** during its use phase. This could involve optimizing power modes, using more energy-efficient components, or exploring alternative power sources.
- **Renewable Energy for Production:** While 50% renewable energy is commendable, increasing this percentage at the China production facility would further reduce Scope 2 emissions.
- **Material Optimization:** Continue to explore lower-carbon materials and optimize material usage in design to further reduce upstream Scope 3 impacts.
- **Supply Chain Engagement:** Engage with suppliers to collect primary data on material production and transport to refine emission factors and identify opportunities for reduction, aligning with upcoming GHG Protocol Scope 3 data quality requirements.
- **Strengthen Circularity:** Leverage the existing take-back scheme and explore further opportunities to close material loops, potentially increasing the recyclability

rate beyond 70% or promoting product reuse/ refurbishment.