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# Product Carbon Footprint Analysis

## For tjqzfyssgi

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**Accounting Standard:** GHG Protocol

This report is generated based on available data and industry standards, providing a high-level assessment of the product\'s carbon footprint. Specific primary data would enhance accuracy further.

# Product Carbon Footprint Analysis: tjqzfyssgi

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## Executive Summary

This Product Carbon Footprint (PCF) analysis, conducted by ejvozksjmt, Senior Sustainability Consultant for oplgdhfnei, quantifies the greenhouse gas (GHG) emissions associated with the product tjqzfyssgi throughout its lifecycle. Adhering to the GHG Protocol\'s Corporate Value Chain (Scope 3) Accounting and Reporting Standard, including considerations for the 2026 Land Sector and Removals (LSR) Standard update, this report provides a detailed breakdown of emissions across material acquisition, manufacturing, transportation, product use, and end-of-life stages. The analysis focuses on a functional unit of 1.0 unit of tjqzfyssgi, with a system boundary set at \'factory_gate\' for the manufacturing process, and a geographic scope primarily focused on China for final production and Europe for the supply chain. The total estimated cradle-to-grave carbon footprint for one unit of tjqzfyssgi is **45.48 kg CO2e**. The use phase represents the most significant emission hotspot.

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# 1. Methodology and Scope Definition

This PCF analysis for tjqzfyssgi follows a structured methodology to ensure accuracy and adherence to the GHG Protocol standards.

## 1.1. Defined Scope

- **Functional Unit:** 1.0 unit of tjqzfyssgi. This serves as the reference unit for all quantified inputs and outputs.
- **System Boundary:** Factory Gate. This encompasses all processes from raw material extraction and processing (cradle) through manufacturing (gate). Upstream transportation of materials, manufacturing energy, downstream transportation to the customer, product use, and end-of-life are also included, effectively extending to a \'cradle-to-grave\' perspective for a comprehensive PCF.
- **Geographic Scope:** Final Production Country: China. Supply Chain Focus: Europe Focused. This influences the selection of regional emission factors for electricity and transportation.
- **Accounting Standard:** GHG Protocol. Emissions are categorized into Scope 1 (direct emissions from owned or controlled sources), Scope 2 (indirect emissions from the generation of purchased energy), and Scope 3 (all other indirect emissions that occur in the value chain). This report incorporates recent GHG Protocol updates, including aspects of the 2026 LSR Standard and a commitment to 95% Scope 3 coverage.
- **Allocation:** Mass-based allocation is primarily used where specific data is available for material

inputs. For generic processes, standard allocation approaches are applied.

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# 2. & 3. Lifecycle Mapping and Data Collection

The lifecycle of tjqzfyssgi has been mapped to identify all relevant stages contributing to its carbon footprint. Data collection involved utilizing provided specific parameters, supplemented by industry-average emission factors where primary data was not available, consistent with Ecoinvent and DEFRA databases.

## 2.1. Detailed Bill of Materials (BOM) Analysis

The following materials constitute the detailed Bill of Materials (BOM) for tjqzfyssgi. The emission factors and total carbon values provided in the BOM (uqhwvlqq) have been used directly for material impact calculation.

| ID | Description | Category | Process | Quantity | Unit | Emission Factor (kg CO2e/ unit or kg) | Total Carbon (kg CO2e) |
|---|---|---|---|---|---|---|---|
| 1 | Aluminum Casing | Metals | Extrusion | 0.2 | kg | 8.0 | 1.60 |
| 2 | Circuit Board | Electronics | Assembly | 0.05 | unit | 15.0 | 0.75 |
| 3 | Plastic Connectors | Plastics | Injection Molding | 0.01 | kg | 3.0 | 0.03 |
| 4 | Copper Wire | Metals | Drawing | 0.03 | kg | 4.5 | 0.14 |
| **Sub-total Material CO2e (Scope 3, Category 1):** | | | | | | | **2.64** |

| ID | Description | Category | Process | Quantity | Unit | Emission Factor (kg CO2e/ unit or kg) | Total Carbon (kg CO2e) |
|---|---|---|---|---|---|---|---|
| 5 | Packaging Cardboard | Paper | Pulping & Forming | 0.1 | kg | 1.2 | 0.12 |
| **Sub-total Material CO2e (Scope 3, Category 1):** | | | | | | | **2.64** |

## 2.2. Energy Inputs (Manufacturing)

- **Energy Intensity (kWh/unit):** ezyomyjsof (15 kWh/unit)
- **Renewable Energy Usage:** kndjlzxyee (70%)
- **Non-renewable Electricity Consumption:** 15 kWh/unit * (1 - 0.70) = 4.5 kWh/unit
- **Renewable Electricity Consumption:** 15 kWh/unit * 0.70 = 10.5 kWh/unit
- **Assumed Electricity Grid Emission Factor (China):** 0.60 kg CO2e/kWh (illustrative)
- **Assumed Renewable Energy Emission Factor:** 0.0 kg CO2e/kWh (for certified green energy)

## 2.3. Logistics Data

- **Transport Mode (Upstream & Downstream):** Select Mode (Assumed: Road Freight, Heavy Duty Truck)
- **Transport Distance:** srhmexurlo (Assumed: 1000 km for upstream, 500 km for downstream)
- **Last-Mile Delivery Channel:** Delivery Type (Assumed: Light Commercial Vehicle)
- **Assumed Road Freight Emission Factor:** 0.08 kg CO2e/tonne-km (0.00008 kg CO2e/kg-km) (illustrative, DEFRA-based)

- **Assumed Light Commercial Vehicle Emission Factor (Last Mile):** 0.2 kg CO2e/package (illustrative)

### 2.4. Use Phase Data

- **Product Lifespan:** gierelnjhp (5 years)
- **Energy Consumption in Use:** omrsrlejlr (20 kWh/year)
- **Assumed Use Phase Electricity Grid Emission Factor (Global Average):** 0.40 kg CO2e/kWh (illustrative)

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

- **Recyclability Percentage:** zpirwywwuv (80%)
- **Circular/Take-back Programs:** qjsxiduher (Yes, active take-back program)
- **Assumed EoL Emission Factor (Landfill):** 0.40 kg CO2e/kg (illustrative)
- **Assumed EoL Avoided Emissions (Recycling):** -0.50 kg CO2e/kg (illustrative net saving for mixed materials)

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## 4. Calculation of Emissions by GHG Protocol Scopes

Emissions have been calculated by multiplying activity data with relevant emission factors, then categorized according to the GHG Protocol\'s Scope 1, Scope 2, and Scope 3 definitions. This analysis aims for at least 95% coverage for Scope 3 reporting, as per 2026 requirements.

## 4.1. Scope 1 Emissions (Direct Emissions)

Scope 1 emissions arise from direct GHG emissions from sources owned or controlled by oplgdhfnei. For a Product Carbon Footprint with a \'factory_gate\' boundary, direct emissions typically include on-site fuel combustion. In the absence of specific data for direct combustion for tjqzfyssgi\'s manufacturing, these emissions are considered negligible for this product-level analysis.

- **Estimated Scope 1 Emissions:** 0.00 kg CO2e

## 4.2. Scope 2 Emissions (Energy Indirect Emissions)

Scope 2 emissions account for indirect GHGs from the generation of purchased electricity consumed by oplgdhfnei for manufacturing tjqzfyssgi.

- **Non-renewable Electricity Emissions:** 4.5 kWh/unit * 0.60 kg CO2e/kWh = 2.70 kg CO2e
- **Renewable Electricity Emissions:** 10.5 kWh/unit * 0.00 kg CO2e/kWh = 0.00 kg CO2e
- **Total Estimated Scope 2 Emissions:** 2.70 kg CO2e

## 4.3. Scope 3 Emissions (Other Indirect Emissions - Value Chain)

Scope 3 emissions are the indirect emissions that occur in the value chain of oplgdhfnei, both upstream and downstream. These typically represent the largest portion of a product\'s carbon footprint.

#### 4.3.1. Upstream Scope 3 Categories

- **Category 1: Purchased Goods and Services (Materials)**
    - **Total Materials CO2e:** 2.64 kg CO2e (from BOM analysis)
- **Category 4: Upstream Transportation and Distribution**
    - Assumed material weight for transport: 1.0 kg/unit
    - Distance: 1000 km
    - **Upstream Transport Emissions:** 1.0 kg * 1000 km * 0.00008 kg CO2e/kg-km = 0.08 kg CO2e

#### 4.3.2. Downstream Scope 3 Categories

- **Category 4: Downstream Transportation and Distribution**
    - Product weight for outbound: 0.5 kg/unit (illustrative)
    - Distance (Factory to Distribution/ Consumer): 500 km
    - **Downstream Transport Emissions:** 0.5 kg * 500 km * 0.00008 kg CO2e/kg-km = 0.02 kg CO2e
- **Last-Mile Delivery Emissions:**
    - **Last-Mile Delivery Channel:** Delivery Type (Light Commercial Vehicle)
    - **Last-Mile Delivery Emissions:** 1 unit * 0.2 kg CO2e/package = 0.20 kg CO2e
- **Category 11: Use of Sold Products**
    - Lifespan: 5 years
    - Energy Consumption in Use: 20 kWh/year
    - Use Phase Electricity EF: 0.40 kg CO2e/ kWh

        - **Use Phase Emissions:** 5 years * 20 kWh/year * 0.40 kg CO2e/kWh = 40.00 kg CO2e
- **Category 12: End-of-Life Treatment of Sold Products**
    - Total product weight: 0.5 kg/unit (illustrative)
    - Recycled portion: 0.5 kg * 80% = 0.4 kg
    - Disposed portion: 0.5 kg * 20% = 0.1 kg
    - Avoided Emissions from Recycling: 0.4 kg * -0.50 kg CO2e/kg = -0.20 kg CO2e
    - Emissions from Disposal: 0.1 kg * 0.40 kg CO2e/kg = 0.04 kg CO2e
    - **Net End-of-Life Emissions:** -0.20 kg CO2e + 0.04 kg CO2e = -0.16 kg CO2e (Net Carbon Removal)

## 4.4. 2026 Land Sector and Removals (LSR) Standard Update

The GHG Protocol\'s Land Sector and Removals (LSR) Standard, released in January 2026 and effective January 1, 2027, provides requirements and guidance for accounting for land sector emissions and carbon removals. This standard is particularly relevant for entities with significant land-based activities in their operations or value chain, such as those involved in agriculture, food, fiber, and bioenergy. While tjqzfyssgi\'s direct operational impacts may not include land-use change, its upstream material sourcing (Category 1) could be influenced by this standard, particularly if agricultural or forestry-derived materials were present in the BOM. Given the industrial nature of the provided BOM and the \'factory_gate\' boundary, direct land-use emissions and removals for tjqzfyssgi itself are not primarily quantified here, but the principle of accounting for land-related impacts within the supply chain is acknowledged. The accompanying guidance for the LSR Standard is expected in Q2 2026.

## 4.5. Summary of Emissions by Scope

| GHG Scope | Category | Description | Estimated Emissions (kg CO2e per 1.0 unit) |
|---|---|---|---|
| **Scope 1** | Direct Emissions | On-site fuel combustion, process emissions | 0.00 |
| **Scope 2** | Purchased Energy | Electricity for manufacturing (non-renewable portion) | 2.70 |
| **Scope 3** | Category 1 | Purchased Goods and Services (Materials production) | 2.64 |
| | Category 4 (Upstream) | Upstream Transportation and Distribution (Materials to factory) | 0.08 |
| | Category 4 (Downstream) | Downstream Transportation and Distribution (Factory to distribution/ consumer) | 0.02 |
| | Last-Mile Delivery | Last-Mile Delivery to customer | 0.20 |
| | Category 11 | Use of Sold Products (Energy consumption during lifespan) | 40.00 |
| | Category 12 | End-of-Life Treatment of Sold Products (Disposal | -0.16 |
| **Total Product Carbon Footprint (PCF):** | | | **45.48** |

| GHG Scope | Category | Description | Estimated Emissions (kg CO2e per 1.0 unit) |
|---|---|---|---|
| | | and recycling credits) | |
| **Total Product Carbon Footprint (PCF):** | | | **45.48** |

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# 5. Review & Report

## 5.1. Emission Hotspots

The primary emission hotspot for tjqzfyssgi is identified in the **Use Phase (Scope 3, Category 11)**, accounting for approximately 88% of the total PCF (40.00 kg CO2e). This indicates that the energy efficiency of the product during its operational lifespan is critical for reducing its overall environmental impact.

Other significant contributions come from **Manufacturing (Scope 2)** and **Material Acquisition (Scope 3, Category 1)**, highlighting the importance of optimizing production processes with renewable energy and selecting low-carbon materials.

## 5.2. Reliability and Data Quality

This analysis leverages specific data provided for BOM materials (uqhwvlqq), energy intensity (ezyomyjsof), renewable energy usage (kndjlzxyee), product lifespan (gierelnjhp), energy consumption in use (omrsrlejlr), recyclability (zpirwywwuv), and circular programs (qjsxiduher). For transportation modes (Select Mode, Delivery Type) and distances (srhmexurlo), illustrative yet industry-representative values were used to perform calculations. Emission factors were sourced illustratively

from commonly accepted databases such as Ecoinvent and DEFRA, reflecting industry standards.

To enhance data quality and achieve the highest level of accuracy, future analyses would benefit from:

- Collecting primary, supplier-specific emission data for all BOM items.
- Obtaining actual fuel consumption and load factors for specific transport routes and modes.
- Detailed regional electricity grid mixes for product use in target markets.
- Specific data on the energy savings/emissions associated with the stated circular/take-back programs.

## 5.3. Recommendations for Reduction

Based on this PCF analysis, oplgdhfnei should focus on the following areas for emission reduction for tjqzfyssgi:

1. **Use Phase Optimization:** Prioritize increasing the energy efficiency of tjqzfyssgi during its operational life. Explore lower power consumption components, software optimizations, or design for passive cooling.
2. **Renewable Energy Integration:** Continue to increase renewable energy sourcing for manufacturing operations beyond the current kndjlzxyee (70%) to further reduce Scope 2 emissions.
3. **Sustainable Material Sourcing:** Investigate and prioritize materials with lower inherent carbon footprints, engaging with suppliers to understand and reduce their upstream emissions.
4. **Logistics Efficiency:** Optimize transportation routes, explore lower-emission transport modes (e.g., rail, sea freight over long distances), and enhance vehicle utilization to reduce Scope 3 transport emissions.

5. **Circular Economy Advancement:** Further strengthen and promote circular/take-back programs (qjsxiduher) and explore design for disassembly and material recovery to maximize end-of-life benefits and achieve greater carbon savings through recycling (zpirwywwuv).

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