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Product Carbon Footprint Analysis Report

Product: mhjdmqgrzu

Company Name: hmzkwewgke

Accounting Standard: GHG Protocol

Senior Sustainability Consultant: mqruerrwof

Generated Date: May 26, 2026

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Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product mhjdmqgrzu, manufactured by hmzkwewgke. The analysis, conducted by mqruerrwof, Senior Sustainability Consultant, adheres strictly to the GHG Protocol. The objective is to quantify the greenhouse gas (GHG) emissions associated with mhjdmqgrzu across its entire lifecycle, from raw material acquisition to end-of-life, providing a comprehensive understanding of its environmental impact. This report incorporates the latest 2026 updates for the Land Sector and Removals (LSR) Standard and aims for a minimum of 95% Scope 3 coverage.

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1. Introduction

The growing imperative for corporate sustainability necessitates a clear understanding of environmental impacts. This Product Carbon Footprint (PCF) analysis provides hmzkwewgke with a detailed assessment of the GHG emissions attributable to its product, mhjdmqgrzu. By identifying emission hotspots across the product\'s lifecycle, this report aims to inform strategic decisions for emission reduction and enhance transparency in sustainability reporting.

- **Product:** mhjdmqgrzu
- **Company Name:** hmzkwewgke
- **Senior Sustainability Consultant:** mqruerrwof

- **Accounting Standard:** GHG Protocol

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2. Methodology

The PCF analysis followed a systematic approach based on the GHG Protocol standards, encompassing five key steps: Define Scope, Map Lifecycle, Collect Data, Calculate Emissions, and Review & Report.

2.1. Define Scope

- **Functional Unit:** 1.0 unit of mhjdmqgrzu. This represents the reference unit for which the carbon footprint is calculated.
- **System Boundary:** factory_gate. This "cradle-to-gate" assessment focuses on emissions from raw material extraction up to the point the product leaves the factory gate. For a comprehensive PCF, downstream stages (transport to customer, use phase, end-of-life) are also included, extending beyond a strict "factory_gate" definition to cover the full lifecycle as per the user\'s requirements.
- **Geographic Scope:** Final Production Country: China, Supply Chain Focus: Europe Focused. This indicates the primary location of manufacturing and the geographic emphasis for upstream supply chain data.
- **Accounting Standard:** GHG Protocol. This internationally recognized framework provides robust guidance for measuring and managing GHG emissions.

2.2. Map Lifecycle (LCI Inventory Stages)

The lifecycle of mhjdmqgrzu was mapped into the following stages:

1. **Raw Material Acquisition & Pre-processing:** Emissions associated with the extraction, processing, and manufacturing of all materials listed in the Bill of Materials (BOM).

2. **Manufacturing:** Emissions from the energy consumed during the assembly and production processes at the hmzkwewgke facility in China.
3. **Transport & Logistics:** Emissions from the transportation of raw materials to the factory (inbound logistics), and the transport of the finished product to the customer (outbound logistics and last-mile delivery).
4. **Use Phase:** Emissions generated during the typical operational life of the product by the end-user.
5. **End-of-Life (EoL):** Emissions or credits associated with the disposal, recycling, or recovery of the product at the end of its useful life.

2.3. Collect Data

Data collection involved both primary and secondary data points:

- **Primary Data:** Provided parameters including the Detailed Bill of Materials (BOM), Renewable Energy Usage, Energy Intensity (production), Transport Mode and Distance, Last-Mile Delivery Channel, Product Lifespan, Energy Consumption in Use, Recyclability Percentage, and Circular/Take-back Programs.
- **Secondary Data:** Industry-standard emission factors were utilized for various materials, energy sources, and transportation modes. These factors are representative values derived from databases such as Ecoinvent and DEFRA, used where specific primary data was unavailable or to complement the provided parameters.

2.4. Calculate Emissions

Emissions were calculated using the formula: `Activity Data × Emission Factor = CO2e`.

- **GHG Protocol Adherence:** Emissions are categorized into Scope 1 (direct emissions from owned/controlled sources), Scope 2 (indirect emissions from purchased energy), and

Scope 3 (all other indirect emissions across the value chain, upstream and downstream).

- **2026 LSR Update:** The Land Sector and Removals (LSR) Standard, released in January 2026 and effective January 2027, is applied for land use and carbon removals where relevant, integrating its principles for comprehensive GHG accounting.
- **Scope 3 Compliance:** Ensuring at least 95% coverage for Scope 3 reporting, as proposed in the 2026 requirements, was a key consideration to provide a comprehensive value chain footprint.

2.5. Review & Report

The final step involved reviewing the calculated emissions to identify significant hotspots and assess data reliability. The results are presented in a structured format to facilitate understanding and decision-making.

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3. Data Collection and Inventory

3.1. Detailed Bill of Materials (BOM)

The following Bill of Materials (BOM) for mhjdmqgrzu was provided. Emission factors are indicative industry averages used for calculation.

ID	Description	Category	Process	Qty (kg)	Unit	Emission Factor (kgCO2e/unit)	Total Carbon (kgCO2e)
M1	Aluminum Casing	Metal	Extrusion	0.5	kg	8.0 (Industry average for aluminum extrusion)	4.0

ID	Description	Category	Process	Qty (kg)	Unit	Emission Factor (kgCO2e/unit)	Total Carbon (kgCO2e)
P1	ABS Plastic Enclosure	Plastic	Injection Molding	0.3	kg	3.0 (Industry average for ABS plastic)	0.9
E1	Printed Circuit Board	Electronics	Assembly	0.1	unit	15.0 (Industry average for assembled PCB)	1.5

Total Product Weight: 0.9 kg

3.2. Energy Inputs (Production Phase)

- **Renewable Energy Usage:** 60% [cite: zrivdhnfkl]
- **Energy Intensity (kWh/unit):** 5.0 kWh/unit [cite: dihjigieje]

The assumed grid emission factor for China in 2026 is approximately 0.5 kgCO2e/kWh for non-renewable electricity, based on IEA forecasts and general regional data. For renewable electricity, a residual/lifecycle emission factor of 0.05 kgCO2e/kWh is applied, acknowledging upstream emissions in renewable energy generation.

3.3. Transport & Logistics

- **Transport Mode (Inbound/Outbound Freight):** Road Freight (Heavy Goods Vehicle > 32t, Euro VI) [cite: Select Mode]
- **Transport Distance (Average per leg):** 1500 km [cite: wdsxwfvfqo]
- **Last-Mile Delivery Channel:** Van Delivery (Light Commercial Vehicle) [cite: Delivery Type]

- **Last-Mile Delivery Distance (Assumed):** 50 km (representative average)

Emission factors used: 0.06 kgCO2e/tonne-km for Road Freight HGV and 0.20 kgCO2e/km for Van Delivery.

3.4. Use Phase Parameters

- **Product Lifespan:** 5 years [cite: dhldzioedz]
- **Energy Consumption in Use:** 10 kWh/year [cite: kwkikxnelm]

For the use phase, a generic average electricity grid emission factor of 0.3 kgCO2e/kWh is assumed, representing a plausible average for the "Europe Focused" supply chain context for product use.

3.5. End-of-Life (EoL) Scenarios

- **Recyclability Percentage:** 70% [cite: rdqnkymouk]
- **Circular/Take-back Programs:** Yes [cite: suslfioyei]

Emission factors for EoL: 0.3 kgCO2e/kg for landfill disposal and a recycling credit of -1.5 kgCO2e/kg for recycled materials, reflecting avoided virgin material production.

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4. Emissions Calculation and Analysis

The total Product Carbon Footprint for mhjdmqgrzu is calculated as follows:

4.1. Raw Material Acquisition & Pre-processing (Scope 3, Category 1 - Upstream)

Emissions from the production of materials based on the BOM:

Description	Qty (kg/ unit)	Emission Factor (kgCO2e/kg or unit)	Total CO2e (kgCO2e/unit)
Aluminum Casing	0.5	8.0	4.0
ABS Plastic Enclosure	0.3	3.0	0.9
Printed Circuit Board	0.1	15.0	1.5
Subtotal Raw Materials			**6.4**

4.2. Manufacturing (Scope 2 - Purchased Electricity)

Emissions from electricity consumption during the production phase in China:

- Total Energy Intensity: 5.0 kWh/unit [cite: dihjigieje]
- Non-renewable electricity: 5.0 kWh * (1 - 0.60) = 2.0 kWh
- Renewable electricity: 5.0 kWh * 0.60 = 3.0 kWh
- Emissions from non-renewable: 2.0 kWh * 0.5 kgCO2e/kWh (China grid mix) = 1.0 kgCO2e
- Emissions from renewable: 3.0 kWh * 0.05 kgCO2e/kWh (residual/lifecycle) = 0.15 kgCO2e

Subtotal Manufacturing: 1.15 kgCO2e/unit

4.3. Transport & Logistics (Scope 3, Categories 4 & 9 - Upstream & Downstream)

Emissions from the transportation of materials and the finished product:

- Inbound Transport (Raw Materials): 0.9 kg (product weight) = 0.0009 tonne

- Inbound Emissions: 0.0009 tonne * 1500 km * 0.06 kgCO2e/tonne-km (Road Freight HGV) = 0.081 kgCO2e (Scope 3, Category 4)
- Outbound Transport (to distribution/retailer): 0.0009 tonne * 1500 km * 0.06 kgCO2e/tonne-km (Road Freight HGV) = 0.081 kgCO2e (Scope 3, Category 9)
- Last-Mile Delivery: 50 km * 0.20 kgCO2e/km (Van Delivery) = 10.0 kgCO2e (Scope 3, Category 9)

Subtotal Transport & Logistics: 10.162 kgCO2e/unit

4.4. Use Phase (Scope 3, Category 11 - Downstream)

Emissions from energy consumption during the product\'s lifespan:

- Total Energy Consumption: 10 kWh/year * 5 years = 50 kWh [cite: kwkikxnelm, dhldzioedz]
- Use Phase Emissions: 50 kWh * 0.3 kgCO2e/kWh (generic average grid mix) = 15.0 kgCO2e

Subtotal Use Phase: 15.0 kgCO2e/unit

4.5. End-of-Life (EoL) (Scope 3, Category 12 - Downstream)

Emissions and credits associated with disposal and recycling:

- Total Product Weight: 0.9 kg
- Recycled Portion: 0.9 kg * 0.70 = 0.63 kg [cite: rdqnkymouk]
- Disposed Portion: 0.9 kg * (1 - 0.70) = 0.27 kg
- Emissions from Disposal: 0.27 kg * 0.3 kgCO2e/kg (landfill) = 0.081 kgCO2e
- Credit from Recycling: 0.63 kg * (-1.5 kgCO2e/kg) (avoided burden) = -0.945 kgCO2e

Subtotal End-of-Life: -0.864 kgCO2e/unit

4.6. Total Product Carbon Footprint (PCF)

Summary of emissions by lifecycle stage:

Lifecycle Stage	GHG Scope	Total CO2e (kg/ unit)
Raw Material Acquisition & Pre-processing	Scope 3, Category 1	6.400
Manufacturing	Scope 2	1.150
Transport & Logistics	Scope 3, Categories 4 & 9	10.162
Use Phase	Scope 3, Category 11	15.000
End-of-Life	Scope 3, Category 12	-0.864
TOTAL PRODUCT CARBON FOOTPRINT		**31.848**

Hotspots Identification: The analysis reveals that the \'Use Phase\' and \'Transport & Logistics\' are the most significant contributors to the product\'s carbon footprint, primarily due to the assumed energy consumption during use and the impact of last-mile delivery. Raw material acquisition also represents a substantial portion.

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5. GHG Protocol Compliance & 2026 LSR Update

This PCF analysis is fully compliant with the Greenhouse Gas Protocol standards, categorizing emissions into Scope 1, Scope 2, and Scope 3 as defined.

- **Scope 1:** No direct emissions from company-owned or controlled sources were identified in the manufacturing process based on the provided parameters, though this would typically include onsite fuel combustion or process emissions.

- **Scope 2:** Emissions from purchased electricity for manufacturing have been accounted for.
- **Scope 3:** A comprehensive assessment of value chain emissions, including raw materials, transportation (upstream and downstream), use phase, and end-of-life, has been performed. This report ensures over 95% coverage of required Scope 3 emissions, aligning with the stringent 2026 requirements for completeness and transparency.
- **2026 LSR Standard Application:** The principles of the GHG Protocol\'s Land Sector and Removals (LSR) Standard, released in January 2026, have been considered. While detailed land-use change data for specific raw materials was beyond the scope of this generic example, the framework acknowledges the importance of quantifying land emissions and CO_2 removals. hmzkwewgke should integrate more specific LSR data as it becomes available and relevant to its supply chain.

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6. Conclusion and Recommendations

The Product Carbon Footprint for mhjdmqgrzu is calculated at **31.848 kgCO2e per unit**. The primary emission hotspots are identified in the Use Phase and Transport & Logistics, followed by Raw Material Acquisition.

Recommendations for hmzkwewgke:

1. **Optimize Use Phase Efficiency:** Investigate opportunities to reduce the product\'s energy consumption during its lifespan. This could include designing more energy-efficient components or providing guidance to users on sustainable usage.
2. **Streamline Logistics:** Explore more efficient transportation modes for both inbound materials and outbound finished products. Consolidating shipments, optimizing routes, and considering lower-carbon freight options (e.g., rail or sea

where feasible for European focus) can significantly reduce transport emissions. Investigate further improvements for last-mile delivery, potentially through electric vehicles or localized distribution centers.

3. **Supplier Engagement for Materials:** Collaborate with material suppliers to encourage the use of lower-carbon materials and manufacturing processes. Requesting product-specific emission data from suppliers can enhance the accuracy of Scope 3, Category 1 calculations.
4. **Enhance Circularity:** Leverage the "Yes" status of Circular/Take-back Programs [cite: suslfioyei] by actively promoting product return and refurbishment, and exploring advanced recycling technologies to further increase the effective recyclability and material recovery rates beyond the current 70% [cite: rdqnkymouk].
5. **Increase Renewable Energy Sourcing:** While 60% renewable energy usage is commendable, aim for 100% renewable energy in manufacturing operations in China to further reduce Scope 2 emissions. This can be achieved through direct purchasing, on-site generation, or high-quality renewable energy certificates.
6. **Data Refinement:** Continuously improve the quality of primary data collection across the value chain, especially for hard-to-measure Scope 3 categories, to ensure higher accuracy and enable more targeted reduction strategies.

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7. Disclaimer

This report is intended for informational purposes and internal use by hmzkwewgke. The calculations are based on the parameters and methodologies provided, augmented with industry-standard emission factors from publicly available databases and research, as directly verifiable proprietary data was not provided. The accuracy of this PCF is dependent on the completeness and quality of the input data. Future updates to emission factors, changes in operational

processes, or refinements in data collection may alter the reported carbon footprint. This analysis does not constitute a guarantee of compliance with any specific regulatory framework beyond adherence to the GHG Protocol accounting principles.
