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Product Carbon Footprint Analysis Report

Product: zpkmkngyfw

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

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Disclaimer: This report is generated based on available data, industry standards, and example values where specific input data was provided as placeholders. Actual results may vary with real-world primary data.

Product Carbon Footprint Analysis for zpkmkngyfw

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Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product zpkmkngyfw, manufactured by kuriegfxiw. The analysis adheres to the Greenhouse Gas (GHG) Protocol standards, including considerations for the 2026 Land Sector and Removals (LSR) Standard update and aiming for at least 95% coverage for Scope 3 emissions. As the Senior Sustainability Consultant, yfifqmhazu, this assessment provides a comprehensive overview of the product's environmental impact across its lifecycle, from material acquisition to end-of-life. The total Product Carbon Footprint for one functional unit of zpkmkngyfw is calculated to be approximately 69.19 kg CO₂e, with the use phase being the most significant contributor.

1. Define Scope

The scope of this Product Carbon Footprint (PCF) analysis is defined in accordance with the GHG Protocol's Product Life Cycle Accounting and Reporting Standard.

- **Functional Unit:** 1.0 unit of zpkmkngyfw. This unit serves as the reference basis for quantifying all

inputs and outputs throughout the product lifecycle.

- **System Boundary:** The analysis adopts a '\factory-gate\' to '\cradle-to-grave\' approach for a comprehensive lifecycle assessment. However, the initial primary data collection, particularly for manufacturing, is focused on the '\factory_gate\' boundary. The report encompasses all stages from raw material extraction, manufacturing, transportation, use, and end-of-life.
- **Geographic Scope:**
 - **Final Production Country:** China
 - **Supply Chain Focus:** Europe Focused (indicating key raw material sourcing and initial distribution might be from Europe, with final production in China).
- **Accounting Standard:** This report strictly adheres to the **GHG Protocol Product Life Cycle Accounting and Reporting Standard**, aligning emissions into Scope 1, Scope 2, and Scope 3 categories to provide a clear and comparable inventory.
- **Allocation:** Emissions are allocated based on physical causality where possible. For co-products or multi-functionality, mass allocation has been applied. End-of-life scenarios consider avoided burden (credits) for recycled materials where appropriate, reflecting circular economy principles.

2. Map Lifecycle (LCI Inventory Stages)

The lifecycle of zpkmkngyfw has been mapped into the following stages as per the GHG Protocol, enabling a

structured approach to data collection and emission calculation:

2.1. Material Acquisition & Pre-processing (Upstream)

This stage includes the extraction of raw materials, their initial processing, and the manufacturing of components used in zpkmkngyfw. Emissions arising here are categorized under Scope 3, Category 1 (Purchased Goods and Services).

2.2. Manufacturing (Core Production)

Encompasses all activities within the production facility where zpkmkngyfw is assembled and manufactured. This includes energy consumption, direct process emissions (if any), and waste generation at the factory. This covers Scope 1 (direct emissions from owned/controlled sources) and Scope 2 (indirect emissions from purchased electricity, heat, or steam).

2.3. Transport & Distribution

This stage accounts for the transportation of raw materials and components to the manufacturing facility (upstream transport - Scope 3, Category 4), and the distribution of the finished product from the factory to the end-user (downstream transport - Scope 3, Category 9).

2.4. Use Phase

Covers the emissions generated during the product's intended use by the consumer over its lifespan. For zpkmkngyfw, this includes energy consumption during operation. These are classified under Scope 3, Category 11 (Use of Sold Products).

2.5. End-of-Life (EoL)

Addresses emissions and potential avoided emissions (credits) associated with the disposal, recycling, or recovery of the product after its useful life. This falls under Scope 3, Category 12 (End-of-Life Treatment of Sold Products).

3. Collect Data

Data for this analysis was collected from provided parameters. Where parameters were provided as placeholders, example data consistent with industry averages and the specified format has been used to demonstrate the methodology. This report highlights these instances.

3.1. Detailed Bill of Materials (BOM) - Upstream Scope 3, Category 1

The provided BOM (pddqhpon) serves as the basis for calculating material impacts. As 'pddqhpon' is a placeholder, the following example BOM data is used, reflecting the specified format and assuming a product weight of 7.5 kg for calculation purposes:

ID	Description	Category	Process	Qty (kg)	Unit	Emission Factor (kgCO2e/unit_qty)	Total Carbon (kgCO2e)
1	Steel Alloy	Metal	Melting & Forming	5.0	kg	2.0	10.0
2	ABS Plastic	Plastic	Injection Molding	2.0	kg	3.5	7.0
3	Copper Wire	Metal	Drawing	0.5	kg	1.5	0.75

Total Material Impact (Upstream Scope 3, Category 1): 17.75 kg CO₂e per unit.

3.2. Production Energy Data - Scope 2

- **Energy Intensity (kWh/unit):** yuwifgtydo
(Example: 25 kWh/unit)
- **Renewable Energy Usage:** rrrlvwfxuq (Example: 60%)
- **Non-Renewable Electricity Used:** 25 kWh/unit *
(1 - 0.60) = 10 kWh/unit
- **Assumed Electricity Grid Emission Factor (China):** 0.7 kg CO₂e/kWh. This is an average factor used for calculation based on general industry data, acknowledging that specific regional or temporal factors within China could vary.

3.3. Logistics Data - Upstream & Downstream Scope 3, Categories 4 & 9

Assumed average product weight for transport: 7.5 kg (sum of BOM items).

- **Transport Mode (Upstream & Primary Downstream):** Select Mode (Example: Truck)
- **Transport Distance (Upstream, Supplier to Factory):** qywfuidltn (Example: 1500 km)
- **Transport Distance (Primary Downstream, Factory to Distribution Hub):** Example: 500 km
- **Last-Mile Delivery Channel:** Delivery Type (Example: Van Delivery)
- **Transport Distance (Last-Mile, Distribution Hub to Customer):** Example: 100 km
- **Assumed Truck Transport Emission Factor:** 0.06 kg CO₂e/tonne-km. This factor represents an industry average for heavy goods vehicles (HGVs) in road freight.

- **Assumed Van Delivery Emission Factor (allocated by weight):** 0.3 kg CO₂e/tonne-km (derived from an example LCV factor of 0.15 kg/km assuming a 0.5-tonne average load capacity).

3.4. Use Phase Data - Downstream Scope 3, Category 11

- **Product Lifespan:** dmyszfqiy (Example: 8 years)
- **Energy Consumption in Use:** emkrvkjypl (Example: 15 kWh/year)
- **Total Energy Consumption over Lifespan:** 15 kWh/year * 8 years = 120 kWh
- **Assumed Average Electricity Emission Factor (Use Phase, generic):** 0.4 kg CO₂e/kWh. This is a generic global average for consumer electricity use, as the specific use location was not provided.

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

- **Recyclability Percentage:** rhvxxjeuzw (Example: 85%)
- **Circular/Take-back Programs:** mkujpxhkmz (Example: Yes, active take-back program in place).
- **Total Product Weight for EoL:** 7.5 kg (from BOM).
- **Recycled Portion:** 7.5 kg * 0.85 = 6.375 kg
- **Disposed Portion (landfill/incineration):** 7.5 kg * 0.15 = 1.125 kg
- **Assumed Recycling Credit:** -1.0 kg CO₂e/kg of recycled material (representing avoided virgin material production). This is a common method in LCA to account for benefits of circularity.

- **Assumed Disposal Emission Factor (landfill):**
1.5 kg CO₂e/kg (for typical mixed waste to landfill).
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4. Calculate Emissions

Emissions are calculated using the formula: Activity Data × Emission Factor = CO₂e, and categorized according to the GHG Protocol.

4.1. Scope 1 Emissions (Direct Emissions)

For this 'factory_gate' system boundary and given the available parameters, direct emissions from owned or controlled sources (e.g., onsite fuel combustion for manufacturing processes) are assumed to be negligible or implicitly covered by Scope 2 electricity consumption if generated onsite from purchased fuel. No specific data for direct fuel combustion was provided, therefore, Scope 1 emissions are estimated as 0 kg CO₂e/unit for this product.

Total Scope 1: 0.00 kg CO₂e/unit

4.2. Scope 2 Emissions (Purchased Energy)

Emissions from purchased electricity for the manufacturing process:

- Non-Renewable Electricity: 10 kWh/unit
- Electricity Grid Emission Factor (China): 0.7 kg CO₂e/kWh
- Calculation: 10 kWh/unit * 0.7 kg CO₂e/kWh = 7.00 kg CO₂e/unit

Total Scope 2: 7.00 kg CO₂e/unit

4.3. Scope 3 Emissions (Value Chain Emissions)

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

Based on the provided example BOM, the total embodied carbon in raw materials and components:

- Total Carbon from BOM: 17.75 kg CO₂e/unit

Category 1 Total: 17.75 kg CO₂e/unit

4.3.2. Category 4: Upstream Transportation and Distribution

Transportation of raw materials from suppliers to the factory (example data):

- Product Weight: 0.0075 tonnes (7.5 kg)
- Distance: 1500 km (Truck)
- Emission Factor: 0.06 kg CO₂e/tonne-km
- Calculation: $0.0075 \text{ tonnes} * 1500 \text{ km} * 0.06 \text{ kg CO}_2\text{e/tonne-km} = 0.675 \text{ kg CO}_2\text{e/unit}$

Category 4 Total: 0.675 kg CO₂e/unit

4.3.3. Category 9: Downstream Transportation and Distribution

Transportation of the finished product from the factory to the end-user (example data):

- **Primary Distribution (Factory to Distribution Hub via Truck):**
 - Product Weight: 0.0075 tonnes (7.5 kg)
 - Distance: 500 km
 - Emission Factor: 0.06 kg CO₂e/tonne-km

- Calculation: $0.0075 \text{ tonnes} * 500 \text{ km} * 0.06 \text{ kg CO}_2\text{e/tonne-km} = 0.225 \text{ kg CO}_2\text{e/unit}$

- **Last-Mile Delivery (Distribution Hub to Customer via Van Delivery):**

- Product Weight: 0.0075 tonnes (7.5 kg)
- Distance: 100 km
- Emission Factor (allocated): 0.3 kg CO₂e/tonne-km
- Calculation: $0.0075 \text{ tonnes} * 100 \text{ km} * 0.3 \text{ kg CO}_2\text{e/tonne-km} = 0.225 \text{ kg CO}_2\text{e/unit}$

Category 9 Total: $0.225 + 0.225 = 0.45 \text{ kg CO}_2\text{e/unit}$

4.3.4. Category 11: Use of Sold Products

Emissions from energy consumption during the product's lifespan (example data):

- Total Energy Consumption: 120 kWh
- Average Electricity Emission Factor: 0.4 kg CO₂e/kWh
- Calculation: $120 \text{ kWh} * 0.4 \text{ kg CO}_2\text{e/kWh} = 48.00 \text{ kg CO}_2\text{e/unit}$

Category 11 Total: 48.00 kg CO₂e/unit

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

Net emissions considering recycling credits and disposal burdens (example data):

- **Recycling Credit:**
 - Recycled Portion: 6.375 kg
 - Recycling Credit Factor: -1.0 kg CO₂e/kg
 - Calculation: $6.375 \text{ kg} * (-1.0 \text{ kg CO}_2\text{e/kg}) = -6.375 \text{ kg CO}_2\text{e/unit}$

- **Disposal Emissions (Landfill):**
 - Disposed Portion: 1.125 kg
 - Disposal Emission Factor: 1.5 kg CO₂e/kg
 - Calculation: 1.125 kg * 1.5 kg CO₂e/kg = 1.6875 kg CO₂e/unit

Category 12 Total: 1.6875 + (-6.375) = -4.69 kg CO₂e/unit (Net carbon saving)

4.4. Total Product Carbon Footprint (PCF) Summary

Scope/Category	Emissions (kg CO ₂ e/unit)
Scope 1	0.00
Scope 2	7.00
Scope 3	
Category 1: Purchased Goods and Services	17.75
Category 4: Upstream Transportation and Distribution	0.68
Category 9: Downstream Transportation and Distribution	0.45
Category 11: Use of Sold Products	48.00
Category 12: End-of-Life Treatment of Sold Products	-4.69
Total Scope 3	62.19
TOTAL PRODUCT CARBON FOOTPRINT	69.19

5. Review & Report

5.1. Hotspots Analysis

Based on the calculations, the most significant hotspots in the lifecycle of zpkmkngyfw are:

- **Use Phase (Scope 3, Category 11):** This stage accounts for approximately 69% of the total PCF, primarily due to the product's energy consumption over its lifespan. This is the primary area for reduction efforts.
- **Material Acquisition (Scope 3, Category 1):** Constitutes about 26% of the total PCF, highlighting the importance of material selection and sourcing.
- **Manufacturing (Scope 2):** Represents about 10% of the total PCF, mainly from purchased electricity. Increasing renewable energy usage beyond the current 60% can further reduce this.
- **End-of-Life (Scope 3, Category 12):** The high recyclability and the active take-back program result in a net carbon saving for this stage, demonstrating the positive impact of circular economy initiatives.

5.2. Reliability and Data Quality

The calculations are based on the GHG Protocol and utilize industry-standard emission factors. However, the accuracy of the final PCF is directly dependent on the quality and specificity of the input data. In this report, several parameters were placeholders, and example values were used. For a truly high-accuracy PCF, primary data for all stages, including specific emission factors for each material, precise transport modes and distances, and actual energy mix for manufacturing and use, would be required.

To align with the proposed 2026 GHG Protocol Scope 3 revisions, which emphasize data disaggregation by type and higher data quality, future assessments should prioritize:

- Collecting supplier-specific primary data for all BOM items and upstream logistics.
- Obtaining direct energy consumption data for the use phase, ideally reflecting the energy mix of the typical user location.
- Detailed data on the efficiency of circular/take-back programs and actual end-of-life routes for the product.

5.3. GHG Protocol 2026 Land Sector and Removals (LSR) Standard Update

The 2026 LSR Standard, effective January 1, 2027, provides comprehensive guidance for accounting for land emissions and CO₂ removals. While the specific product `zpkmknfyfw` does not inherently suggest significant land-sector activities in its direct operations, the principles of the LSR Standard would be critical if any raw materials (e.g., bio-based materials, agricultural products) in the supply chain involve land-use change, deforestation, or carbon sequestration activities. As no such specific data was provided, direct application of the LSR Standard for calculations was not performed; however, its requirements for transparent reporting of land-related emissions and removals, if applicable, would be integrated into a full corporate GHG inventory. The standard also provides guidance for technological CO₂ removals.

5.4. Scope 3 Compliance (95% Coverage)

This analysis has focused on the most material Scope 3 categories for a manufactured product: Purchased Goods and Services (Category 1), Upstream

Transportation (Category 4), Downstream Transportation (Category 9), Use of Sold Products (Category 11), and End-of-Life Treatment of Sold Products (Category 12). These categories are generally recognized as significant for products of this nature and represent a substantial portion of the value chain emissions. By addressing these key categories, the report aims to achieve comprehensive coverage in line with the 95% threshold required by updated 2026 GHG Protocol Scope 3 guidance, demonstrating a robust effort to quantify indirect emissions across the value chain. Any further minor categories, if identified, would be assessed for materiality and included if contributing significantly.
