

carboncalcpcf.com

Product Carbon Footprint Analysis Report

****Product:**** gkfvgxsyzf

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

****Name of the Company:**** zrtwltvrlw

****Senior Sustainability Consultant:**** iqligvehih

This report is generated based on available data and industry standards. While efforts have been made to ensure accuracy, the results are indicative and subject to data limitations and evolving methodologies.

Confidential - Internal Use Only

Product Carbon Footprint (PCF) Analysis Report for gkfvngxsyzf

Generated Date: June 4, 2026

Senior Sustainability Consultant: iqligvehih

Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product gkfvngxsyzf, manufactured by zrtwltvrlw. The analysis was conducted by iqligvehih, a Senior Sustainability Consultant, adhering strictly to the GHG Protocol accounting standard. The primary goal was to quantify the greenhouse gas (GHG) emissions associated with gkfvngxsyzf across its entire lifecycle, from raw material acquisition to end-of-life, providing insights into emission hotspots and potential reduction opportunities.

The total Product Carbon Footprint for one functional unit of gkfvngxsyzf is calculated to be **22.287 kgCO₂e**. The largest contributions to this footprint stem from the Use Phase (62.8%), followed by the Materials Acquisition & Manufacturing (30.6%) and Production Energy (19.8%). Notably, the End-of-Life phase shows a significant negative emission (avoided emissions) due to high recyclability and established circular programs.

Methodology

The Product Carbon Footprint (PCF) analysis for gkfvngxsyzf followed a systematic five-step methodology as per industry best practices and GHG Protocol guidelines:

Confidential - Internal Use Only

1. Define Scope

- **Functional Unit:** The study quantifies the environmental impact per 1.0 unit of gkfvngxsyzf.
- **System Boundary:** The analysis adopted a "cradle-to-grave" approach, encompassing all stages from raw material extraction, manufacturing, transportation, use, and end-of-life. While the primary production boundary focus was 'factory_gate', the full lifecycle was assessed as per requirements to incorporate use phase and end-of-life impacts.
- **Geographic Scope:** Final production occurs in China, with a supply chain focus on Europe for raw material sourcing and distribution. The Use Phase and End-of-Life scenarios are modeled for a European context.
- **Allocation:** For simplicity and given the single product focus, direct allocation of emissions was applied where possible. No specific co-product allocation methods were required.

2. Map Lifecycle (LCI Inventory Stages)

The lifecycle of gkfvngxsyzf was broken down into the following key stages for detailed inventory mapping:

1. **Raw Material Acquisition & Processing (Upstream):** Extraction and initial processing of all components listed in the Bill of Materials (BOM).
2. **Manufacturing (Core Production):** Energy consumption and direct emissions during the assembly and fabrication of gkfvngxsyzf at the manufacturing facility.
3. **Transportation (Upstream & Downstream):** Inbound logistics for raw materials, and outbound logistics for the finished product to the distribution hub and last-mile delivery.
4. **Use Phase:** Energy consumption of the product during its lifespan.
5. **End-of-Life (EoL):** Emissions and avoided emissions from disposal, recycling, and circular economy initiatives.

Confidential - Internal Use Only

The detailed Bill of Materials (BOM) for gkfvngxsyzf, which forms the basis for material impact calculations, is presented below. These specific values, including the provided Emission Factor and Total Carbon for each item, were used directly in the analysis.

Detailed Bill of Materials (BOM) for gkfvngxsyzf: domfrpym

ID	Description	Category	Process	Qty	Unit	Emission Factor (kgCO2e/unit)	Total Carbon (kgCO2e)
BOM001	Aluminum Alloy	Metal	Die Casting	0.5	kg	7.0	3.5
BOM002	ABS Plastic	Plastic	Injection Molding	0.3	kg	3.0	0.9
BOM003	Copper Wire	Metal	Drawing	0.1	kg	2.5	0.25
BOM004	PCB Assembly	Electronics	Fabrication	1.0	unit	2.0	2.0
BOM005	Packaging Cardboard	Paper	Manufacturing	0.2	kg	0.8	0.16
Total Material Emissions (kgCO2e)							6.81

3. Collect Data (Primary/Secondary Data Points)

Primary data points specific to zrtwltvrlw\'s operations and the product gkfvngxsyzf were incorporated where available. Secondary data, including industry-average emission factors, were sourced from reputable databases (e.g., Ecoinvent, DEFRA, EPA) to fill data gaps and ensure robust calculations.

Energy and Logistics Data Summary

Parameter	Value	Unit/Description
	Confidential - Internal Use Only	
	dqodkqosvn (40%)	

Parameter	Value	Unit/Description
Renewable Energy Usage (Production)		Percentage of electricity from renewable sources
Energy Intensity (Production)	zvuiqsios (12)	kWh per unit of product
Transport Mode (Inbound/ Outbound)	Select Mode (Ocean Freight, Road Freight HGV)	Primary modes of transport for materials and finished goods
Transport Distance (Total)	zxezpotods (e.g., Inbound Ocean: 15,000 km; Outbound Ocean: 18,000 km; Last-Mile Road: 100 km)	Total distance covered in supply chain
Last-Mile Delivery Channel	Delivery Type (Road Freight LCV)	Mode for final delivery to customer

Use Phase and End-of-Life Data Summary

Parameter	Value	Unit/Description
Product Lifespan	itseqpvrpm (7)	Years
Energy Consumption in Use	pmmyfqewde (8)	kWh per year
Recyclability Percentage	xufdengpek (60%)	Percentage of product material designed for recycling
Circular/Take-back Programs	sklegpnmly (Yes, actively promoting component recovery and remanufacturing.)	Availability of programs to recover product at EoL

4. Calculate Emissions (Activity * Emission Factor = CO2e)

Emissions were calculated by multiplying the activity data (e.g., kg of material, kWh of energy, tonne-km of transport) by relevant, industry-standard emission factors. These emissions were categorized according to the GHG Protocol's Scope 1, 2, and 3 classifications.

Emission Factors Used (Illustrative)

The following emission factors (EFs) were utilized in this analysis. These values are illustrative and derived from a combination of recognized databases (such as Ecoinvent, DEFRA, and EPA) and general industry estimates, providing a representative basis for calculation.

Activity/ Material	Emission Factor (kgCO2e/unit)	Source (Illustrative)
Electricity (China Grid Mix)	0.6	Industry Average
Electricity (Renewable)	0.02	Embedded Emissions Estimate
Electricity (European Grid Mix)	0.25	Industry Average
Ocean Freight (Container Ship)	0.000016 kgCO2e/kg-km	DEFRA 2021/2019
Road Freight (HGV)	0.0001 kgCO2e/kg-km	DEFRA/EPA Estimate
Road Freight (LCV - Last Mile)	0.0002 kgCO2e/kg-km	Industry Estimate
Plastic Landfill	0.033 kgCO2e/kg	EPA WARM
Plastic Recycling (Net Credit)	-0.5 kgCO2e/kg	Simplified Average (reflecting avoided virgin production)

Activity/ Material	Emission Factor (kgCO2e/unit)	Source (Illustrative)
Metal Recycling (Net Credit)	-4.0 kgCO2e/kg	Simplified Average (reflecting avoided virgin production for copper/aluminum)

Product Carbon Footprint Summary by Lifecycle Stage and Scope

Lifecycle Stage	GHG Scope	Emissions (kgCO2e/ functional unit)
1. Materials Acquisition & Processing	Scope 3, Category 1 (Purchased Goods and Services)	6.81
2. Manufacturing (Production Energy)	Scope 2 (Purchased Electricity)	4.42
3. Transportation	Scope 3, Category 4 (Upstream Transport) & Category 9 (Downstream Transport)	1.274
4. Use Phase	Scope 3, Category 11 (Use of Sold Products)	14.0
5. End-of-Life	Scope 3, Category 12 (End-of-Life Treatment of Sold Products)	-4.217
Total Product Carbon Footprint		22.287

Detailed Emissions Breakdown

Materials Acquisition & Processing (Scope 3)

Emissions from the extraction and processing of raw materials, including Aluminum Alloy, ABS Plastic, Copper Wire, PCB Assembly, and Packaging Cardboard, collectively contribute ****6.81 kgCO2e****. These emissions fall under Scope 3, Category 1 (Purchased Goods

Confidential - Internal Use Only

and Services). The calculation is a direct summation of the '\Total Carbon\' values provided in the Detailed Bill of Materials (BOM) for each component.

Manufacturing (Production Energy - Scope 2)

The energy consumed during the manufacturing process, with an intensity of 12 kWh/unit and 40% renewable energy usage, results in ****4.42 kgCO₂e****. This is categorized as Scope 2 emissions, primarily from purchased electricity. The non-renewable portion of electricity from the China grid (EF: 0.6 kgCO₂e/kWh) accounts for the majority of these emissions, while renewable electricity (EF: 0.02 kgCO₂e/kWh) contributes a smaller fraction.

Transportation (Scope 3)

Transportation emissions, encompassing both upstream (raw materials) and downstream (finished product) logistics, total ****1.274 kgCO₂e****. These are classified under Scope 3, Categories 4 and 9.

- ****Inbound Raw Materials (Ocean Freight):**** Shipping 2.1 kg of materials over 15,000 km (e.g., from Europe to China) using ocean freight (EF: 0.000016 kgCO₂e/kg-km) generates 0.504 kgCO₂e.
- ****Outbound Finished Product (Ocean Freight):**** Transporting a 2.5 kg product over 18,000 km (e.g., China to European distribution hub) via ocean freight (EF: 0.000016 kgCO₂e/kg-km) accounts for 0.72 kgCO₂e.
- ****Last-Mile Delivery (Road Freight LCV):**** The final 100 km delivery of the 2.5 kg product using a Light Commercial Vehicle (EF: 0.0002 kgCO₂e/kg-km) adds 0.05 kgCO₂e.

Use Phase (Scope 3)

Over its 7-year lifespan, the product gkfvngxsyzf consumes 8 kWh of energy annually, totaling 56 kWh. Assuming an average European grid mix (EF: 0.25 kgCO₂e/kWh) for electricity consumption during use, this phase accounts for the largest share of the PCF at ****14.0 kgCO₂e****. These are categorized as Scope 3, Category 11 (Use of Sold Products).

Confidential - Internal Use Only

End-of-Life (Scope 3)

The End-of-Life (EoL) scenario, with a 60% recyclability percentage and the presence of circular/take-back programs, results in a net avoided emission of **-4.217 kgCO₂e**. This is classified under Scope 3, Category 12 (End-of-Life Treatment of Sold Products).

- The 60% recycled portion (1.5 kg, assumed mix of metal and plastic) benefits from significant avoided emissions. A simplified net credit of -4.0 kgCO₂e/kg for recycled metal (1 kg) and -0.5 kgCO₂e/kg for recycled plastic (0.5 kg) results in a total recycling credit of -4.25 kgCO₂e.
- The remaining 40% (1.0 kg, mainly plastic/other non-recycled) is assumed to be landfilled, incurring a burden of 0.033 kgCO₂e/kg, leading to 0.033 kgCO₂e.
- The strong negative value indicates the substantial environmental benefit derived from effective recycling and circular economy initiatives, particularly for metals.

5. Review & Report

Hotspots: The primary emissions hotspots for gkfvngxsyf are identified in the **Use Phase** (62.8%), followed by **Materials Acquisition & Manufacturing** (30.6%) and **Production Energy** (19.8%). These areas offer the greatest opportunities for emission reduction strategies.

Data Reliability: The calculations are based on the specific parameters provided and illustrative industry-average emission factors. While these factors are from recognized sources, actual values can vary depending on supplier-specific data, geographic location, and technological specifics. The provided BOM data was explicitly utilized for material impact calculations.

Recommendations: Focus on improving energy efficiency during the product's use phase and exploring opportunities for deeper decarbonization of the energy supply for manufacturing in China. Furthermore, continue to optimize material selection for lower embodied emissions and enhance circularity programs to maximize end-of-life value.

GHG Protocol Compliance

This Product Carbon Footprint (PCF) analysis adheres to the Greenhouse Gas (GHG) Protocol, the world's most widely used greenhouse gas accounting standards. Emissions have been meticulously categorized into Scope 1, Scope 2, and Scope 3 to provide a comprehensive view of zrtwltvrlw's carbon impact for gkfvngxsyzf.

- **Scope 1 Emissions:** Direct GHG emissions from sources owned or controlled by zrtwltvrlw. No direct Scope 1 emissions were identified in the manufacturing process for gkfvngxsyzf based on the provided parameters, assuming production energy is purchased electricity.
- **Scope 2 Emissions:** Indirect GHG emissions from the generation of purchased or acquired electricity, steam, heat, or cooling consumed by zrtwltvrlw. The electricity consumed during the manufacturing of gkfvngxsyzf (4.42 kgCO₂e) is accounted for under Scope 2.
- **Scope 3 Emissions:** All other indirect GHG emissions that occur in the value chain of the reporting company, both upstream and downstream. This report covers several critical Scope 3 categories, including:
 - Category 1: Purchased Goods and Services (Materials Acquisition & Processing: 6.81 kgCO₂e).
 - Category 4: Upstream Transportation and Distribution (Inbound Transport: 0.504 kgCO₂e).
 - Category 9: Downstream Transportation and Distribution (Outbound and Last-Mile Transport: 0.77 kgCO₂e).
 - Category 11: Use of Sold Products (Use Phase: 14.0 kgCO₂e).
 - Category 12: End-of-Life Treatment of Sold Products (EoL: -4.217 kgCO₂e).
- **2026 LSR Update:** As of January 30, 2026, the GHG Protocol released its Land Sector and Removals (LSR) Standard, effective January 1, 2027. This standard provides accounting

Confidential - Internal Use Only

requirements for entities with significant land sector activities and those choosing to report CO2 removals. While direct land use change or biogenic carbon removals are not explicitly detailed in the provided parameters for gkfvngxsyzf, the principles of accounting for removals are implicitly applied in the End-of-Life phase through recycling credits. Future analyses should explicitly consider land-related impacts if zrtwltvrlw's operations or supply chain involve significant land use, such as in agriculture or forestry, following the forthcoming LSR Guidance expected in Q2 2026.

- ****Scope 3 Compliance (95% Coverage):**** The 2026 revisions to the GHG Protocol Scope 3 Standard propose a prescriptive completeness requirement, mandating that companies account for at least 95% of total required Scope 3 emissions. This report aims for comprehensive coverage of relevant Scope 3 categories, addressing key upstream and downstream activities that are expected to constitute the vast majority of the product's value chain emissions. The detailed breakdown demonstrates a commitment to identifying and quantifying all material Scope 3 sources.