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# **Product Carbon Footprint Analysis**

## **for sikuxoturz**

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**Accounting Standard:** GHG Protocol

Disclaimer: This report is generated based on available data and industry standards. The accuracy of the results is dependent on the completeness and precision of the provided input parameters and the emission factors used.



# Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product **sikuxoturz**, manufactured by **jrzkzenomh**. The analysis was conducted by **tlgvwydslg**, Senior Sustainability Consultant, adhering strictly to the Greenhouse Gas (GHG) Protocol. The objective is to quantify the greenhouse gas emissions (expressed in CO<sub>2</sub>e) associated with the product's lifecycle, from material extraction to end-of-life, to identify emission hotspots and inform strategic decarbonization efforts.

The total Product Carbon Footprint for one functional unit of sikuxoturz is calculated to be **14.05 kg CO<sub>2</sub>e**. Key emission contributors include the Use Phase, followed by the Production Phase and material impacts. Significant benefits are identified from end-of-life recycling programs.

## 1. Methodology and Scope Definition

This Product Carbon Footprint (PCF) analysis for **sikuxoturz** follows the five-step methodology recommended by the GHG Protocol Product Life Cycle Accounting and Reporting Standard.

### 1.1. Define Scope

- **Functional Unit:** 1.0 unit of sikuxoturz. This represents the quantified performance of the product system for use as a reference unit.
- **System Boundary:** Cradle-to-grave, specifically "factory\_gate" for initial production, extending through transport, use, and end-of-life.

Supply chain focus on Europe. The use phase is assumed to primarily occur in Europe.

- **Accounting Standard:** The analysis strictly adheres to the [GHG Protocol Product Life Cycle Accounting and Reporting Standard](#). Emissions are categorized into Scope 1 (direct emissions), Scope 2 (purchased energy emissions), and Scope 3 (value chain emissions).
- **Allocation:** Emissions are allocated directly to the functional unit based on mass, energy consumption, and distance traveled, where applicable. For shared transport, a mass-based allocation approach is applied.

## 1.2. Map Lifecycle (LCI inventory stages)

The lifecycle of sikuxoturz is mapped across the following stages, each contributing to the overall carbon footprint:

1. **Material Acquisition & Pre-processing (Upstream - Scope 3):** Includes extraction of raw materials, manufacturing of components, and their transport to the production facility.
2. **Production (Core - Scope 1 & 2):** Manufacturing processes at jrkzkenomh's facility in China, including direct emissions (Scope 1, assumed negligible for this product given parameters) and purchased electricity (Scope 2).
3. **Transport & Distribution (Downstream - Scope 3):** Transportation of the finished product from the factory gate to the customer.
4. **Use Phase (Downstream - Scope 3):** Energy consumption during the product's operational lifespan.
5. **End-of-Life (Downstream - Scope 3):** Disposal or recycling of the product after its useful life.

## data points)

Both primary and secondary data sources were utilized. Primary data was provided by **jrzkzenomh** for the Bill of Materials (BOM), production energy usage, transport logistics, product lifespan, energy consumption in use, recyclability, and circular programs. Secondary data, including industry-average emission factors, were sourced from reputable databases (e.g., Ecoinvent/DEFRA equivalents, IEA, GLEC) where specific primary data was unavailable.

### Detailed Bill of Materials (BOM): kepdmiws

The following detailed Bill of Materials (BOM) was used for high-accuracy material impact calculation:

ID	Description	Category	Process	Quantity	Unit	Emission Factor (kgCO2e/unit)	Total Carbon (kgCO2e)
1	Aluminum Casing	Metals	Extrusion	0.5	kg	2.5	1.25
2	Plastic Enclosure	Plastics	Injection Molding	0.3	kg	3.0	0.90
3	Circuit Board	Electronics	Assembly	0.1	kg	15.0	1.50
4	Copper Wiring	Metals	Drawing	0.05	kg	5.0	0.25

Total product mass for one functional unit: 0.95 kg.

### Energy and Logistics Inputs:

- **Renewable Energy Usage:** frmirqshpo (60%)
- **Energy Intensity (kWh/unit):** sgergltsdx (15 kWh/unit)
- **Transport Mode (Primary):** Select Mode (Road Freight (HGV

- **Product Lifespan:** tqgrnewsn (5 years)
- **Energy Consumption in Use:** hjooxzmdmf (10 kWh/year)
- **Recyclability Percentage:** whwmjdirjv (80%)
- **Circular/Take-back Programs:** zrttslptkj (Yes, Product Take-back Initiative)

## 1.4. Calculate Emissions (Activity \* Emission Factor = CO2e)

Emissions for each lifecycle stage are calculated by multiplying activity data (e.g., kg of material, kWh of energy, km traveled) by relevant emission factors (EFs). EFs represent the greenhouse gas emissions per unit of activity. Industry-standard emission factors from recognized sources are applied.

### Key Emission Factors Used:

- China Grid Electricity Emission Factor (2023/2024): 0.581 kg CO2e/kWh
- Europe Average Grid Electricity Emission Factor (2024): 0.181 kg CO2e/kWh
- Road Freight (HGV > 32t) Emission Factor: 0.027 kg CO2e/tonne-km (Well-to-Tank, Europe/South America)
- Parcel Delivery Van Emission Factor (allocated via mass-distance for consistency): 0.027 kg CO2e/tonne-km (simplified from HGV factor for consistency, actual van km factor is 0.25 kgCO2e/km which would yield a very high per-unit emission without load factor allocation)
- Recycling Credit (Metals/Plastics average): -2.0 kg CO2e/kg (simplified for mixed materials, actual values vary significantly)
- General Waste Disposal Emission Factor (Landfill/Incineration, placeholder): 0.5 kg CO2e/kg

The results are reviewed to identify emission hotspots and assess data reliability. The report aims to provide transparent insights into the product's environmental performance.

## **GHG Protocol Adherence:**

Emissions are meticulously categorized into Scope 1, Scope 2, and Scope 3 as per GHG Protocol requirements. This ensures comprehensive reporting across direct operations and the entire value chain.

**2026 LSR UPDATE:** In line with the forthcoming Land Sector and Removals (LSR) Standard, this analysis conceptually considers land-use impacts and potential carbon removals. While specific data for LSR application is not provided for sikuxoturz, future iterations of this analysis will incorporate detailed land-use change emissions and removals associated with raw material sourcing and bio-based materials as per the 2026 requirements.

**SCOPE 3 COMPLIANCE:** The analysis aims for at least 95% coverage for Scope 3 reporting, as per the stringent 2026 requirements, by incorporating detailed material, transport, use, and end-of-life data. Any minor omissions are due to data limitations in placeholder parameters.

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## **2. Product Carbon Footprint Calculation and Analysis**

The PCF for one functional unit of sikuxoturz is calculated across its lifecycle stages:

## processing (Scope 3 - Upstream)

This stage accounts for the emissions embedded in the raw materials and components used to manufacture sikuxoturz.

- Total Material Carbon from BOM (kepdmiws): 1.25 (Aluminum) + 0.90 (Plastic) + 1.50 (Circuit Board) + 0.25 (Copper) = 3.90 kg CO<sub>2</sub>e.

**Material Impact: 3.90 kg CO<sub>2</sub>e**

## 2.2. Production Phase (Scope 2)

This covers the electricity consumption during the manufacturing process at **jrzkzenomh**'s facility in China.

- Energy Intensity: 15 kWh/unit [cite: sgergltsdx (parameter)]
- Renewable Energy Usage: 60% [cite: frmirqshpo (parameter)]
- Non-renewable electricity consumption: 15 kWh/unit \* (1 - 0.60) = 6 kWh/unit
- China Grid Electricity Emission Factor: 0.581 kg CO<sub>2</sub>e/kWh
- Production Emissions (Scope 2): 6 kWh/unit \* 0.581 kg CO<sub>2</sub>e/kWh = 3.486 kg CO<sub>2</sub>e/unit

**Production Emissions: 3.49 kg CO<sub>2</sub>e**

## 2.3. Transport & Distribution (Scope 3 - Upstream/Downstream)

This includes emissions from transporting materials to the factory and the finished product to the customer.

- Total Product Mass: 0.95 kg
- Primary Transport (Factory to Distribution Hub, e.g., in Europe):
  - Mode: Road Freight (HGV > 32t) [cite: Select Mode (parameter)]

- Primary Transport Emissions: (0.95 kg / 1000 kg/tonne) \* 1500 km \* 0.027 kg CO2e/tonne-km = 0.038 kg CO2e/unit
- Last-Mile Delivery (Distribution Hub to Customer):
  - Channel: Parcel Delivery Van [cite: Delivery Type (parameter)]
  - Assumed Distance: 50 km
  - Emission Factor (allocated via mass-distance for consistency with primary transport): (0.95 kg / 1000 kg/tonne) \* 50 km \* 0.027 kg CO2e/tonne-km = 0.001 kg CO2e/unit
  - Note: Using a direct van emission factor of 0.25 kg CO2e/km for 50 km would result in 12.5 kg CO2e/unit, which is typically allocated over multiple parcels. For this PCF, a mass-distance factor is applied for better per-unit attribution.

**Total Transport & Distribution Emissions: 0.04 kg CO2e**

## 2.4. Use Phase (Scope 3 - Downstream)

This stage accounts for the electricity consumed by the product during its operational lifespan.

- Product Lifespan: 5 years [cite: tqgrnewsn (parameter)]
- Energy Consumption in Use: 10 kWh/year [cite: hjooxzmdmf (parameter)]
- Total Energy in Use: 10 kWh/year \* 5 years = 50 kWh/unit
- Geographic Scope (Use Phase): Europe Focused (assuming product is used in Europe)
- Europe Average Grid Electricity Emission Factor: 0.181 kg CO2e/kWh
- Use Phase Emissions: 50 kWh/unit \* 0.181 kg CO2e/kWh = 9.05 kg CO2e/unit

**Use Phase Emissions: 9.05 kg CO2e**

## Downstream)

This stage considers the emissions or credits associated with the product's disposal or recycling.

- Total Product Mass: 0.95 kg
- Recyclability Percentage: 80% [cite: whwmjdirjv (parameter)]
- Circular/Take-back Programs: Yes, Product Take-back Initiative [cite: zrttslptkj (parameter)]
- Mass Recycled:  $0.95 \text{ kg} * 0.80 = 0.76 \text{ kg}$
- Mass Disposed:  $0.95 \text{ kg} * 0.20 = 0.19 \text{ kg}$
- Recycling Credit (for 0.76 kg of mixed materials):  $0.76 \text{ kg} * -2.0 \text{ kg CO}_2\text{e/kg} = -1.52 \text{ kg CO}_2\text{e}$  (negative indicates avoided emissions)
- Disposal Emissions (for 0.19 kg disposed):  $0.19 \text{ kg} * 0.5 \text{ kg CO}_2\text{e/kg} = 0.095 \text{ kg CO}_2\text{e}$
- Net EoL Emissions:  $0.095 \text{ kg CO}_2\text{e} - 1.52 \text{ kg CO}_2\text{e} = -1.425 \text{ kg CO}_2\text{e/unit}$

**Net End-of-Life Emissions: -1.43 kg CO<sub>2</sub>e** (net carbon benefit)

## 3. Overall Product Carbon Footprint Summary

The total Product Carbon Footprint for one functional unit of **sikuxoturz** is summarized below:

Lifecycle Stage	GHG Scope	CO <sub>2</sub> e (kg per functional unit)	Percentage of Total
Material Acquisition & Pre-processing	Scope 3 (Upstream)	3.90	27.76%

		functional unit)	of total
Transport & Distribution	Scope 3 (Upstream/ Downstream)	0.04	0.28%
Use Phase	Scope 3 (Downstream)	9.05	64.41%
End-of-Life Phase (Net)	Scope 3 (Downstream)	-1.43	-10.18%
<b>TOTAL PRODUCT CARBON FOOTPRINT</b>		<b>15.05</b>	<b>100.00%</b>

The total Product Carbon Footprint for one functional unit of sikuxoturz is **15.05 kg CO<sub>2</sub>e**.

### 3.1. Identified Hotspots and Reliability

- **Use Phase:** This phase is identified as the most significant hotspot, contributing 64.41% of the total PCF. This is primarily due to the product's energy consumption over its 5-year lifespan and the assumed grid electricity mix in Europe.
- **Material Acquisition & Pre-processing:** The materials, particularly the Circuit Board and Aluminum Casing, contribute substantially (27.76%) to the upfront emissions.
- **Production Phase:** While located in China with a relatively carbon-intensive grid, the 60% renewable energy usage significantly mitigates emissions in this phase (24.84%).
- **Transport & Distribution:** Represents a minor portion (0.28%) of the total footprint, indicating relatively efficient logistics or low-mass product.
- **End-of-Life:** The high recyclability (80%) and the presence of take-back programs result in a net carbon benefit, highlighting the positive impact of circular economy

parameters directly provided. Emission factors are sourced from recognized databases or calculated based on industry-standard methodologies. Assumptions for placeholder values (e.g., specific last-mile distance, general recycling credit) are clearly stated and represent reasonable estimates where specific primary data was not available. For enhanced accuracy, further primary data collection for specific supply chain emission factors would be beneficial.

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## 4. Recommendations for Decarbonization

Based on this PCF analysis, **jrzkzenomh** can focus on the following areas to reduce the carbon footprint of **sikuxoturz**:

- **Optimize Use Phase Efficiency:** Invest in R&D to significantly reduce the product's energy consumption during its use phase. Explore lower power components, introduce energy-saving modes, or improve overall energy efficiency.
- **Promote Renewable Energy Adoption in Use:** Encourage end-users to power the product with renewable electricity where possible, perhaps through partnerships or education campaigns.
- **Sustainable Material Sourcing:** Investigate alternative, lower-carbon materials for the Circuit Board and Aluminum Casing. Explore options with higher recycled content (beyond current inputs) or bio-based alternatives, considering their full lifecycle impacts and the 2026 LSR Standard.
- **Enhance Circularity:** Continue to strengthen existing take-back programs and explore innovative circular business models to increase actual recycling rates beyond 80% and investigate opportunities for product refurbishment or reuse.
- **Supply Chain Engagement:** Collaborate with suppliers to identify and implement further emission reduction

especially for high impact components.

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## Conclusion

This high-detail Product Carbon Footprint analysis provides **jrzkzenomh** with a comprehensive understanding of the environmental impact of **sikuxoturz**. By adhering to the GHG Protocol, including considerations for the 2026 LSR Update and ensuring robust Scope 3 coverage, this report serves as a critical tool for strategic sustainability planning. The identified hotspots offer clear pathways for targeted emission reduction initiatives, enabling **jrzkzenomh** to drive meaningful decarbonization throughout the product's lifecycle.