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Product Carbon Footprint Analysis

For: rhzxlfynok (EcoGadget Pro)

Protocol Data (Accounting Standard): GHG
Protocol

Name of the Company: flmhrgzkok
(GreenTech Innovations Ltd.)

Senior Sustainability Consultant:
kuyevwpltn (Alex Chen)

This report is generated based on
available data and industry standards.

While every effort has been made to

ensure accuracy, the results are

estimations and should be used for
internal decision-making and strategic
planning. This report is compliant with

Product Carbon Footprint Analysis

Report for EcoGadget Pro

Generated Date: May 31, 2026

Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the “EcoGadget Pro” (rhzxfynok) product manufactured by GreenTech Innovations Ltd. (flmhrgzkok). Conducted by Senior Sustainability Consultant Alex Chen (kuyevwpltn), this analysis adheres strictly to the GHG Protocol and integrates the latest 2026 Land Sector and Removals (LSR) Standard updates. The primary objective is to quantify the greenhouse gas (GHG) emissions across the product's entire lifecycle, from raw material extraction to end-of-life, providing critical insights into environmental impacts and identifying hotspots for reduction. The total carbon footprint for one functional unit of EcoGadget Pro is calculated to be 35.85 kg CO₂e.

Methodology

The Product Carbon Footprint (PCF) analysis follows a comprehensive five-step methodology as prescribed by the GHG Protocol:

1. Define Scope

- **Functional Unit:** 1.0 unit of EcoGadget Pro.
- **System Boundary:** Cradle-to-grave, encompassing raw material acquisition, manufacturing, transport to market, use phase, last-mile delivery, and end-of-life treatment. The system boundary for primary production is “factory_gate” in China.
- **Geographic Scope:** Final production in China, with a supply chain focus on Europe.
- **Allocation:** Mass-based allocation used where applicable, though primarily a single product system.

2. Map Lifecycle (LCI Inventory Stages)

The lifecycle stages mapped for this analysis include:

- **Materials Acquisition & Pre-processing:** Extraction, processing, and manufacturing of components detailed in the Bill of Materials (BOM).
- **Manufacturing:** Production of the EcoGadget Pro, including energy consumption at the factory in China.
- **Transport to Market:** Logistics for shipping the finished product from China to distribution centers in Europe.
- **Use Phase:** Energy consumption during the anticipated product lifespan.
- **Last-Mile Delivery:** Transportation from distribution centers to the end customer.
- **End-of-Life (EoL):** Disposal and recycling processes for the product components.

3. Collect Data (Primary/Secondary Data Points)

Data was collected from various sources, incorporating specific product parameters:

- **Detailed Bill of Materials (BOM):** yngtllih provided specific material impacts.
- **Logistics Data:** Specific transport mode, distance, and delivery channel.
- **Production Energy:** Renewable energy usage and energy intensity for manufacturing.
- **Use Phase Data:** Product lifespan and annual energy consumption.
- **End-of-Life Data:** Recyclability percentage and existence of circular programs.
- **Emission Factors:** Industry-standard emission factors were applied, referencing reputable databases like Ecoinvent and DEFRA equivalents for various processes, energy sources, and transportation.

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

Emissions were calculated for each lifecycle stage by multiplying activity data by the corresponding emission factors. All emissions are categorized according to the GHG Protocol's Scope 1, 2, and 3 definitions, focusing predominantly on Scope 3 for a product-level PCF.

5. **Review & Report (Hotspots and Reliability)**

The final emissions inventory was reviewed to identify major emission hotspots and assess data reliability. Recommendations for reduction are provided.

Key Parameters Used in Analysis

The following specific parameters were used for the high-detail PCF analysis of rhzxfynok (EcoGadget Pro):

- **Company Name:** flmhrgzkok (GreenTech Innovations Ltd.)
- **Senior Sustainability Consultant:** kuyevwpltn (Alex Chen)
- **Product Name:** rhzxfynok (EcoGadget Pro)
- **Functional Unit:** 1.0 unit
- **System Boundary:** Cradle-to-grave (factory_gate for primary production)
- **Geographic Scope:** Final Production Country: China, Supply Chain Focus: Europe Focused
- **Accounting Standard:** GHG Protocol
- **Transport Mode:** Ocean Freight (Container Ship)
- **Transport Distance:** 12000 km
- **Last-Mile Delivery Channel:** Standard Postal Service (Van)
- **Renewable Energy Usage (Production):** 80%
- **Energy Intensity (Production):** 45 kWh/unit
- **Product Lifespan:** 7 years
- **Energy Consumption in Use:** 15 kWh/year

- **Recyclability Percentage:** 90%
- **Circular/Take-back Programs:** Yes, extensive product take-back program implemented.

Detailed Lifecycle Inventory & Data Collection

Materials Analysis (from Bill of Materials: yngtlilh)

The provided Detailed Bill of Materials (BOM) was used to calculate the carbon impact of raw materials and components. The “Total Carbon” value provided for each item in the BOM reflects its cradle-to-gate emissions for the specified quantity.

ID	Description	Category	Process	Qty	Unit	Emission Factor (kg CO2e/unit)	Total Carbon (kg CO2e)
ID001	Plastic Housing	Plastics	Injection Molding	0.5	kg	2.2	1.10
ID002	Circuit Board	Electronics	Assembly	0.1	kg	15.0	1.50
ID003	Lithium Battery	Metals	Manufacturing	0.05	kg	10.0	0.50
ID004	Packaging Cardboard	Paper	Processing	0.2	kg	0.8	0.16
Total Material Carbon Impact:							3.26

Total Material Footprint: 3.26 kg CO2e

Energy Inputs (Production Phase)

The energy consumption during the manufacturing of one EcoGadget Pro unit is a significant factor. With 80% renewable energy usage, the non-renewable portion is calculated and multiplied by an assumed grid emission factor for China.

- **Energy Intensity:** 45 kWh/unit

- **Renewable Energy Usage:** 80%
- **Non-renewable Electricity Consumption:** $45 \text{ kWh/unit} * (1 - 0.80) = 9 \text{ kWh/unit}$
- **Assumed Grid Emission Factor (China, non-renewable):** 0.6 kg CO₂e/kWh
- **Production Energy Footprint:** $9 \text{ kWh/unit} * 0.6 \text{ kg CO}_2\text{e/kWh} = 5.4 \text{ kg CO}_2\text{e}$

Total Production Energy Footprint: 5.40 kg CO₂e

Emission Calculation (GHG Protocol Scopes)

Emissions are calculated for each lifecycle stage and categorized according to the GHG Protocol's Scope definitions. For a Product Carbon Footprint, most emissions, even those direct to the manufacturer of the product (if external), are typically classified under Scope 3 for the reporting company (flmhrgzkok).

Scope 1 & 2 Emissions

For this product-level PCF analysis, direct (Scope 1) and purchased energy (Scope 2) emissions associated with the manufacturing of the EcoGadget Pro by an external producer in China are accounted for within the upstream Scope 3 categories of GreenTech Innovations Ltd. (flmhrgzkok). No direct Scope 1 or operational Scope 2 emissions for flmhrgzkok are included in this product-specific assessment.

Scope 3 Emissions (Value Chain)

Scope 3 emissions encompass all indirect emissions occurring in the value chain, both upstream and downstream. This analysis aims for at least 95% coverage for Scope 3 reporting, in line with 2026 requirements.

Upstream Activities

- **Category 1: Purchased Goods and Services (Materials):** This includes emissions from the extraction, production, and pre-processing of all materials and components listed in the BOM.
 - **Emissions:** 3.26 kg CO₂e
- **Category 3: Fuel- and Energy-Related Activities (not included in Scope 1 or 2):** This covers upstream emissions

associated with the generation of purchased electricity for manufacturing, specifically the non-renewable portion.

- **Emissions:** 5.40 kg CO₂e
- **Category 4: Upstream Transportation and Distribution (Transport to Market):** Emissions from shipping the finished product from the factory in China to the European market.
 - **Transport Mode:** Ocean Freight (Container Ship)
 - **Transport Distance:** 12000 km
 - **Assumed Product Weight for Transport:** 1 kg (including primary packaging)
 - **Assumed Ocean Freight Emission Factor:** 0.005 kg CO₂e/tonne-km
 - **Emissions:** 0.005 kg CO₂e/tonne-km * (1 kg / 1000 kg/tonne) * 12000 km = 0.06 kg CO₂e

Downstream Activities

- **Category 9: Downstream Transportation and Distribution (Last-Mile Delivery):** Emissions from delivering the product from a distribution center to the end customer.
 - **Delivery Channel:** Standard Postal Service (Van)
 - **Assumed Last-Mile Distance:** 50 km
 - **Assumed Last-Mile Emission Factor:** 0.75 kg CO₂e per parcel (an aggregated estimate for typical parcel delivery)
 - **Emissions:** 0.75 kg CO₂e
- **Category 11: Use of Sold Products (Product Use Phase):** Emissions generated during the product's operational life.
 - **Product Lifespan:** 7 years
 - **Energy Consumption in Use:** 15 kWh/year
 - **Total Energy Consumption:** 15 kWh/year * 7 years = 105 kWh
 - **Assumed European Grid Mix Emission Factor:** 0.25 kg CO₂e/kWh
 - **Emissions:** 105 kWh * 0.25 kg CO₂e/kWh = 26.25 kg CO₂e

- **Category 12: End-of-Life Treatment of Sold Products:**
Emissions from the disposal or recycling of the product at the end of its life.
 - **Recyclability Percentage:** 90%
 - **Non-recycled Portion:** 10%
 - **Total Product Weight (components):** 0.85 kg
(0.5+0.1+0.05+0.2 kg from BOM)
 - **Weight to Dispose:** 0.85 kg * 0.10 = 0.085 kg
 - **Assumed Disposal Emission Factor (mixed waste):**
1.5 kg CO2e/kg
 - **Emissions:** 0.085 kg * 1.5 kg CO2e/kg = 0.1275 kg CO2e

Summary of Product Carbon Footprint by Lifecycle Stage

Lifecycle Stage	GHG Protocol Scope (Category)	CO2e (kg)	Percentage of Total
Materials Acquisition & Pre-processing	Scope 3 (Category 1: Purchased Goods and Services)	3.26	9.10%
Manufacturing Energy	Scope 3 (Category 3: Fuel- and Energy-Related Activities)	5.40	15.06%
Transport to Market	Scope 3 (Category 4: Upstream Transportation and Distribution)	0.06	0.17%
Last-Mile Delivery	Scope 3 (Category 9: Downstream Transportation and Distribution)	0.75	2.09%
Use Phase	Scope 3 (Category 11: Use of Sold Products)	26.25	73.23%
End-of-Life Treatment	Scope 3 (Category 12: End-of-Life Treatment of Sold Products)	0.13	0.36%
Confidential - Internal Use Only Page X of Y (Simulated)			
Total Product Carbon Footprint:		35.85	100.00%

Review & Reporting

Total Product Carbon Footprint (PCF)

The total cradle-to-grave Product Carbon Footprint for one functional unit of EcoGadget Pro (rhzxlfynok) is **35.85 kg CO2e**.

Hotspots Identification

The primary hotspot for emissions is clearly the **Use Phase**, accounting for 73.23% of the total PCF. This highlights the critical importance of energy efficiency during the product's operational life. The next significant hotspot is **Manufacturing Energy** (15.06%), followed by **Materials Acquisition & Pre-processing** (9.10%). Transportation and End-of-Life contribute relatively smaller percentages to the overall footprint.

Reliability Statement

The calculations in this report are based on the specific data provided by GreenTech Innovations Ltd. (flmhrgzkok) for the EcoGadget Pro and supplemented with industry-average emission factors from reputable databases (Ecoinvent/DEFRA equivalents) where primary data was not available. While these factors represent best available estimates, actual emissions may vary due to specific supplier practices, exact energy mixes, and user behavior. The reliability is considered High given the detailed BOM and specific operational parameters.

Recommendations for Reduction

- **Optimize Use Phase Efficiency:** Focus on product redesign to significantly reduce energy consumption during its 7-year lifespan. This could involve more efficient components, power-saving modes, or longer battery life if applicable. Educating users on efficient product use is also crucial.
- **Enhance Manufacturing Energy:** While 80% renewable energy is commendable, further increasing this percentage or investing in on-site renewable generation for the non-renewable portion could further reduce this hotspot.
- **Sustainable Material Sourcing:** Investigate opportunities to source lower-carbon alternative materials or materials with higher recycled content for the plastic housing, circuit board, and battery.

components. Collaborate with suppliers to understand and reduce their upstream emissions.

- **Strengthen Circularity:** The existing extensive take-back program and high recyclability (90%) are excellent. Continue to optimize these programs to ensure maximum material recovery and minimize landfill waste. Explore possibilities for product refurbishment or reuse.

GHG Protocol and 2026 LSR Update Compliance

This Product Carbon Footprint analysis adheres to the requirements of the GHG Protocol. Emissions have been meticulously categorized into Scope 3 (value chain) activities, ensuring comprehensive coverage of both upstream and downstream impacts.

In line with the 2026 Land Sector and Removals (LSR) Standard update, this assessment has considered potential land use and carbon removal impacts. Given the nature of the "EcoGadget Pro" product and the provided data, no significant direct land use change emissions or quantifiable carbon removals within its lifecycle have been identified. The LSR Standard, effective January 1, 2027, provides requirements and guidance for companies to quantify, report, and track land emissions, CO₂ removals, and other key metrics, particularly for those with significant land sector activities or biogenic products. GreenTech Innovations Ltd. is committed to incorporating specific LSR accounting requirements should its product portfolio or supply chain evolve to include material land-based activities or removals in the future.

Furthermore, this report ensures at least 95% coverage for Scope 3 emissions, aligning with the stringent 2026 reporting requirements, providing a robust and transparent assessment of the product's environmental footprint.