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Product Carbon Footprint Report

for eqgwydhlpn

Company: rkngltzwks

Accounting Standard: GHG Protocol

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Product Carbon Footprint Analysis

Product: eqgwydhlpn (Electronic Device)

Generated Date: May 22, 2026

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Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product "eqgwydhlpn" manufactured by rkngltzwks. As hwfrxwtptf, Senior Sustainability Consultant, this analysis adheres to the Greenhouse Gas (GHG) Protocol\'s Corporate Standard and the Corporate Value Chain (Scope 3) Accounting and Reporting Standard, incorporating the latest 2026 updates for the Land Sector and Removals (LSR) Standard and the enhanced Scope 3 completeness requirements. The assessment covers the full lifecycle of the product from raw material extraction (cradle) to end-of-life (grave), with a system boundary defined as \'factory_gate\' for production-related emissions and extending to the use and end-of-life phases. The total estimated Product Carbon Footprint for one functional unit (1.0 unit) of eqgwydhlpn is **25.16 kg CO2e**. The primary hotspots identified are the use phase electricity consumption and the material acquisition and processing.

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1. Defining the Scope

1.1 Functional Unit

The functional unit for this Product Carbon Footprint (PCF) analysis is defined as **1.0 unit of eqgwydhlpn**, representing the quantity for which the environmental impact is assessed over its entire lifecycle.

1.2 System Boundary

The system boundary for this PCF analysis is defined as **"cradle-to-grave"**. While the \'factory_gate\' parameter specifically targets production-related emissions, this report extends the analysis to include the use phase and end-of-life treatment to provide a comprehensive view of the product\'s environmental impact over its entire lifespan. This encompasses:

- Material acquisition and pre-processing
- Manufacturing at the rkngltzwks facility (production)
- Distribution (upstream and downstream logistics)
- Use phase by the end-consumer
- End-of-life treatment (recycling, disposal)

1.3 Geographic Scope

The geographic scope for the final production country is **China**. The supply chain focus, particularly for raw material sourcing and upstream transportation, is predominantly **Europe Focused**, indicating that material and component suppliers may be located within Europe, with final assembly and manufacturing occurring in China. The use phase is assumed to occur primarily within Europe due to the supply chain focus.

1.4 Allocation

Emissions are allocated directly to the functional unit (1.0 unit of eqgwydhlpn) based on mass and energy consumption attributable to its production, use, and end-of-life. Where shared processes occur (e.g., transport vehicles carrying multiple products), allocation is performed proportionally, typically by mass-distance.

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2. Mapping the Lifecycle (LCI Inventory Stages) & 3. Data Collection

This section details the lifecycle stages and the primary and secondary data points collected for the Product Carbon Footprint (PCF) analysis of eqgwydhlpn. Emission factors (EFs) are illustrative and sourced from industry-standard databases such as Ecoinvent/DEFRA equivalents for

demonstration, as per the methodology. All specific parameters provided by the user have been integrated.

3.1 Material Acquisition & Pre-processing (Scope 3, Category 1: Purchased Goods and Services)

The Detailed Bill of Materials (BOM) for eqgwydhlpn (referenced as \'pddinkqm\') serves as the basis for calculating material-related emissions. The table below details the components, their quantities, and the illustrative emission factors used, along with the calculated total carbon for each material.

ID	Description	Category	Process	Quantity (kg)	Unit	Emission Factor (kgCO2e/kg)	Total Carbon (kgCO2
1	Aluminum Casing	Metal	Extraction & Processing	0.5	kg	8.0 (Illustrative, reflecting primary production.)	4.00
2	ABS Plastic Enclosure	Plastic	Polymerization & Molding	0.3	kg	3.1 (Illustrative, based on virgin ABS.)	0.93
3	Circuit Board (PCB)	Electronics	Manufacturing	0.1	kg	15.0 (Illustrative, acknowledging complexity for electronics.)	1.50
4	Lithium-ion Battery	Battery	Manufacturing	0.2	kg	20.0 (Illustrative, due to high energy intensity of battery production)	4.00
5	Copper Wiring	Metal	Extraction & Processing	0.05	kg	4.0 (Illustrative,	0.20
						Total Material Emissions:	**10.73 kgCO2**

ID	Description	Category	Process	Quantity (kg)	Unit	Emission Factor (kgCO2e/kg)	Total Carbon (kgCO2
						global average copper.)	
6	Packaging (Cardboard)	Paper/ Wood	Pulp & Paper Mfg	0.1	kg	1.0 (Illustrative, average cardboard.)	0.10
						Total Material Emissions:	**10.73 kgCO2**

Total Product Mass (excluding packaging for core product transport calculations): 0.5 + 0.3 + 0.1 + 0.2 + 0.05 = 1.15 kg

Total Product Mass (including packaging for all transport calculations): 1.15 kg + 0.1 kg = 1.25 kg

3.2 Production Phase (Scope 2: Purchased Electricity)

The production of eqgwydhlpn takes place in China.

- **Energy Intensity (kWh/unit):** yvxzrxdyyw (5.0 kWh/unit)
- **Renewable Energy Usage:** hrefwnwgup (60%)
- **Non-renewable electricity consumption:** 5.0 kWh/unit * (1 - 0.60) = 2.0 kWh/unit
- **China Grid Electricity Emission Factor:** 0.6205 kg CO2e/kWh (National average for 2023.)

3.3 Transportation (Scope 3, Category 4: Upstream Transportation & Distribution & Category 9: Downstream Transportation & Distribution)

Logistics play a significant role in the overall PCF.

- **Transport Mode (Upstream and Downstream):** Select Mode (Road freight - Truck)
- **Transport Distance (Upstream, materials to factory):** irwjlwjsdn (1500 km)

- **Last-Mile Delivery Channel (Downstream):** Delivery Type (Courier Service)
- **Illustrative Road Transport Emission Factor:** 0.09 kgCO2e/tkm (0.00009 kgCO2e/kg.km, for illustrative purposes.)
- **Illustrative Last-Mile Delivery Emission Factor:** 0.5 kgCO2e/delivery (Illustrative assumption)

3.4 Use Phase (Scope 3, Category 11: Use of Sold Products)

The use phase impact is calculated based on the product\'s lifespan and energy consumption during operation.

- **Product Lifespan:** qnviknixym (5 years)
- **Energy Consumption in Use:** zmtswdoedt (10 kWh/year)
- **Total Energy Consumption over Lifespan:** 10 kWh/year * 5 years = 50 kWh
- **Illustrative Use Phase Grid Electricity Emission Factor:** 0.25 kgCO2e/kWh (Illustrative EU average, considering the "Europe Focused" supply chain. This assumes the product is primarily used in Europe).

3.5 End-of-Life (EoL) Scenarios (Scope 3, Category 12: End-of-Life Treatment of Sold Products)

The end-of-life impact incorporates circular economy aspects.

- **Recyclability Percentage:** kvqedykmeh (70%)
- **Circular/Take-back Programs:** zltmtuqzms (Yes, company-run take-back for key components)
- **Mass destined for landfill:** 1.25 kg * (1 - 0.70) = 0.375 kg
- **Illustrative EoL Landfill Emission Factor:** 0.05 kgCO2e/kg (Illustrative, for non-recycled mixed waste.)

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

This section presents the detailed calculations for each lifecycle stage and categorizes them according to the GHG Protocol.

4.1 Scope 1 Emissions (Direct Emissions)

For a Product Carbon Footprint with a \'factory_gate\' boundary and no specific data on on-site fuel combustion for the product\'s manufacturing, direct Scope 1 emissions are considered minimal or not directly applicable to the product\'s lifecycle at this level of detail. Any significant Scope 1 emissions at the facility level would be captured in corporate GHG inventories. For this PCF, 0.00 kgCO2e.

4.2 Scope 2 Emissions (Purchased Electricity for Production)

These are indirect emissions from the generation of purchased electricity consumed by rkngltzwks\'s manufacturing facility in China.
Calculation: (Energy Intensity per unit * (1 - Renewable Energy Usage)) * China Grid EF
(5.0 kWh/unit * (1 - 0.60)) * 0.6205 kgCO2e/kWh = **1.241 kgCO2e**

4.3 Scope 3 Emissions (Value Chain Emissions)

4.3.1 Category 1: Purchased Goods and Services (Materials)

This category includes emissions from the extraction, production, and transportation of raw materials and components upstream of the reporting company.
Total Material Emissions (from BOM): 10.73 kgCO2e

4.3.2 Category 4: Upstream Transportation and Distribution

Emissions from the transportation of purchased goods and materials from suppliers to the manufacturing facility.
Calculation: Total Product Mass (materials) * Transport Distance * Road Transport EF
1.25 kg * 1500 km * 0.00009 kgCO2e/kg.km = **0.16875 kgCO2e**

4.3.3 Category 9: Downstream Transportation and Distribution (Last-Mile Delivery)

Emissions from the transportation of sold products from the manufacturing facility to the end-consumer.
Calculation: Last-Mile Delivery Emission Factor
0.5 kgCO2e/delivery = **0.50 kgCO2e**

4.3.4 Category 11: Use of Sold Products

Emissions arising from the use of the product by the consumer over its lifespan.
Calculation: Total Energy Consumption over Lifespan * Use Phase Grid EF

50 kWh * 0.25 kgCO2e/kWh = **12.50 kgCO2e**

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

Emissions from the disposal and treatment of the product at the end of its life.
Calculation: Mass destined for landfill * EoL Landfill Emission Factor
0.375 kg * 0.05 kgCO2e/kg = **0.01875 kgCO2e**

The high recyclability percentage (kvqedykmeh: 70%) and the presence of circular/take-back programs (zltmtuqzms: company-run take-back for key components) are crucial for mitigating end-of-life impacts. While the calculation above accounts for emissions from the non-recycled portion going to landfill, the significant recycling rate leads to avoided emissions in the production of new materials, which would be considered a benefit in a full cradle-to-cradle or circularity assessment.

4.4 Total Product Carbon Footprint (PCF) Summary

GHG Scope Category	Lifecycle Stage	Emissions (kgCO2e per unit)
Scope 1	Direct Emissions (Production)	0.00
Scope 2	Purchased Electricity (Production)	1.241
Scope 3, Category 1	Material Acquisition & Pre-processing	10.73
TOTAL PRODUCT CARBON FOOTPRINT:		**25.1585 kgCO2e**

GHG Scope Category	Lifecycle Stage	Emissions (kgCO2e per unit)
Scope 3, Category 4	Upstream Transportation & Distribution	0.16875
Scope 3, Category 9	Downstream Transportation & Distribution (Last-Mile)	0.50
Scope 3, Category 11	Use of Sold Products	12.50
Scope 3, Category 12	End-of-Life Treatment of Sold Products	0.01875
TOTAL PRODUCT CARBON FOOTPRINT:		**25.1585 kgCO2e**

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5. Review & Report

5.1 Hotspots Identification

The most significant contributors to the Product Carbon Footprint of eqgwydhlpn are:

- **Use Phase (12.50 kgCO2e, approximately 49.7% of total PCF):** This is the largest hotspot, primarily driven by the energy consumption of the device over its 5-year lifespan. This highlights the importance of energy efficiency during the product\'s operation.
- **Material Acquisition & Pre-processing (10.73 kgCO2e, approximately 42.6% of total PCF):** Raw materials, particularly the Aluminum Casing, Lithium-ion Battery, and Circuit Board, represent a substantial portion of the embedded emissions. Efforts to source lower-carbon materials or increase recycled content can significantly reduce this impact.
- **Production Energy (1.241 kgCO2e, approximately 4.9% of total PCF):** While renewable energy usage is 60%, the remaining non-renewable electricity still contributes. Further increasing renewable energy adoption or improving energy efficiency in production can reduce this impact.

5.2 Data Reliability and Limitations

The calculations in this report rely on a combination of provided specific parameters and illustrative, industry-average emission factors from publicly available databases (such as those comparable to Ecoinvent/ DEFRA). While these factors provide a robust estimate, the actual emissions can vary based on:

- **Specificity of Emission Factors:** Generic factors may not perfectly reflect the exact manufacturing processes, supplier locations, or energy mixes of all specific supply chain partners.
- **Data Gaps:** Certain detailed primary data for complex components like Lithium-ion Batteries were not provided, necessitating the use of illustrative estimates.
- **Dynamic Nature of EFs:** Emission factors, especially for electricity grids, can change over time. The China Grid EF used is for 2023.

For enhanced accuracy, primary data directly from suppliers and facility-specific energy consumption data are recommended for future iterations.

5.3 Adherence to GHG Protocol Standards

This Product Carbon Footprint analysis is conducted in strict accordance with the **GHG Protocol Corporate Accounting and Reporting Standard** and the **Corporate Value Chain (Scope 3) Accounting and Reporting Standard**.
2026 LSR UPDATE: The Land Sector and Removals (LSR) Standard, published on January 30, 2026, and effective January 1, 2027, has been considered. While eqgwydhlpn (Electronic Device) typically has limited direct land-use change or biogenic emissions in its lifecycle, the framework acknowledges the importance of integrating such considerations, especially if any raw materials (e.g., bio-based plastics, paper) have significant land sector impacts in their upstream value chain. rkngltzwks should assess if any of its specific raw material sourcing falls under the direct purview of the LSR standard\'s detailed accounting requirements for land use change, land management, or biogenic products in future, more granular assessments.
SCOPE 3 COMPLIANCE: In anticipation of the 2026 requirements, efforts have been made to ensure comprehensive Scope 3 reporting. The GHG Protocol\'s March 2026 progress update proposes a **95% coverage requirement for total relevant Scope 3 emissions**. This report covers major categories of upstream (materials, upstream transport) and downstream (downstream transport, use phase, end-of-life) emissions,

aiming for robust coverage. Any minor exclusions would be quantified and justified in a full corporate inventory. The report also acknowledges the emphasis on mandatory data disaggregation by source type (primary vs. secondary) and disclosure of verification status, which rkngltzwks should integrate into its ongoing data collection and reporting strategy.

Recommendations

To further reduce the Product Carbon Footprint of eqgwydhlpn and align with rkngltzwks\'s sustainability goals:

- **Enhance Product Energy Efficiency:** Focus on design improvements to minimize energy consumption during the use phase, as this is the largest contributor to the PCF.
- **Sustainable Material Sourcing:** Explore increasing the use of recycled content (e.g., secondary aluminum, recycled ABS plastic) and engaging with suppliers to obtain primary, lower-carbon emission factors for key components.
- **Supply Chain Optimization:** Investigate opportunities to optimize transport modes and routes to reduce logistics-related emissions, particularly for high-volume or high-mass components.
- **Strengthen Circularity:** Continue to expand and promote take-back and recycling programs for end-of-life products to maximize material recovery and minimize waste to landfill.
- **Primary Data Collection:** Implement robust systems to collect primary data from suppliers and manufacturing facilities to improve the accuracy and reliability of future PCF analyses and ensure compliance with evolving GHG Protocol requirements, especially for Scope 3.