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Product Carbon Footprint Analysis Report

Product: rnlgskpqpl

Protocol Data (Accounting Standard): GHG Protocol

Name of the Company: nmrzgtrzie

Senior Sustainability Consultant: mgmkjijlwr

Disclaimer: This report is generated based on available data and industry standards. While efforts have been made to ensure accuracy, certain assumptions are inherent due to data limitations. This analysis serves as a high-level assessment for strategic decision-making.

Product Carbon Footprint Analysis Report

Generated Date: May 28, 2026

Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for **rnlgskpqpl**, conducted by **mgmkjijlwr**, Senior Sustainability Consultant at **nmrzgtrzie**. The analysis adheres to the GHG Protocol and incorporates specific data for materials, logistics, production energy, use phase, and end-of-life scenarios. The total PCF for the functional unit of 1.0 unit of rnlgskpqpl is calculated across its lifecycle, highlighting key emission hotspots and offering insights for sustainability improvements. This report aims to provide nmrzgtrzie with a comprehensive understanding of rnlgskpqpl\'s environmental impact, in line with 2026 reporting requirements including the Land Sector and Removals (LSR) Standard and 95% Scope 3 coverage.

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1. Define Scope

The scope definition sets the boundaries and parameters for this Product Carbon Footprint (PCF) analysis, ensuring consistency and comparability.

- **Functional Unit:** 1.0 unit of rnlgskpqpl. This unit serves as the reference basis for all calculations, ensuring that

the environmental impacts are quantified per defined product output.

- **System Boundary:** factory_gate. This boundary typically includes raw material acquisition, manufacturing, and transport to the factory gate. However, for a comprehensive assessment, the scope has been extended to include selected downstream activities: transportation, use phase, and end-of-life treatment, effectively aligning with a "cradle-to-grave" approach for relevant Scope 3 categories as requested.
- **Geographic Scope:** Final Production Country: China, Supply Chain Focus: Europe Focused. This dual focus acknowledges the primary manufacturing location while recognizing the significant influence of European supply chain activities, including sourcing and distribution channels.
- **Accounting Standard:** GHG Protocol. All emissions are categorized and calculated in accordance with the Greenhouse Gas Protocol\'s Product Standard, ensuring robust and internationally recognized methodology for carbon accounting.
- **Allocation:** Mass allocation is the primary method applied where co-products or by-products are present, distributing environmental burdens proportionally based on the mass of the output. For energy consumption, specific allocation to the product unit is based on provided energy intensity data.

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2. Map Lifecycle (LCI Inventory Stages)

The lifecycle mapping identifies all relevant stages of rnlgskpqpl\'s existence, from raw material extraction to end-of-life. This section details the material and energy inputs at each stage.

Detailed Bill of Materials (BOM)

The following table presents the detailed Bill of Materials (BOM) for rnlgskpqpl, incorporating specific data points for high-accuracy material impact calculation as provided by **ohkqtrwi**. The \'Total Carbon\' for each item is directly used in calculations for Scope 3 emissions (Category 1: Purchased goods and services).

ID	Description	Category	Process	Quantity	Unit	Emission Factor (kg CO2e/ unit)	Total Carbon (kg CO2e)

Energy Inputs for Production

The production phase for rnlgskpqpl, located in China, relies on specific energy inputs:

- **Energy Intensity (kWh/unit):** fkfsoptrzm kWh/unit. This represents the total electrical energy required to produce one functional unit of rnlgskpqpl.
- **Renewable Energy Usage:** xxtgkngnxx. This percentage indicates the proportion of purchased electricity that originates from renewable sources, significantly impacting the Scope 2 emissions.

Logistics Data

Transportation plays a crucial role in the supply chain. The following parameters are considered for both upstream and downstream logistics:

- **Primary Transport Mode (Upstream/Distribution):** Select Mode.
- **Transport Distance (Upstream/Distribution):** pytmrvprjo km.

- **Last-Mile Delivery Channel:** Delivery Type.

Use Phase Data

The impact during the product\'s operational life is calculated using:

- **Product Lifespan:** dgupdljpvi. This defines the duration over which the product is expected to be used.
- **Energy Consumption in Use:** pdtiqquxkv. This quantifies the energy consumed by the product during its lifespan.

End-of-Life (EoL) Scenarios

The end-of-life treatment for rnlgskpqpl includes:

- **Recyclability Percentage:** tfsdywpivp. This indicates the proportion of the product\'s materials that are technically recyclable.
- **Circular/Take-back Programs:** onfjptteoj. The presence and effectiveness of such programs influence the actual recycling rates and circularity benefits.

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3. Collect Data (Primary/Secondary Data Points)

Data collection for this PCF analysis integrates both primary data (specific to nmrzgtrzie\'s operations and product) and secondary data (industry averages and databases).

- **Primary Data:**
  - Detailed Bill of Materials (BOM): ohkqtrwi (containing material IDs, quantities, and pre-calculated total carbon values).

- Production Energy Intensity: fkfsoptrzm kWh/unit.
- Renewable Energy Usage: xxtgkngnxx.
- Product Lifespan: dgupdljpvi.
- Energy Consumption in Use: pdtiqquxkv.
- Recyclability Percentage: tfsdywpivp.
- Circular/Take-back Programs: onfjptteoj.
- Transport Distance: pytmrvprjo km.

- **Secondary Data:**
  - **Emission Factors:** Industry-standard emission factors are sourced from reputable databases such as Ecoinvent and DEFRA for processes where primary data on emissions is not available (e.g., general electricity grid mixes, specific transport modes, and generic waste treatment processes).
  - **Assumed Emission Factors:**
    - **China Electricity Grid Mix:** 0.556 kg CO2e/kWh (approximation for typical Chinese grid mix, as of 2020). Some sources indicate ranges from 0.8 to 1.2 kg CO2e/kWh depending on province and year. For this report, 0.556 kg CO2e/kWh is used.
    - **European Electricity Grid Mix (Average for Supply Chain):** 0.181 kg CO2e/kWh (approximation for average European grid mix in 2024, showing a decreasing trend).
    - **Road Freight (Select Mode - assumed Heavy Goods Vehicle):** 0.09 kg CO2e/tonne-km (a commonly cited value for heavy goods vehicles, based on sources like McKinnon or DEFRA). For general road freight, values can be around 0.062 kg CO2/tonne-km.
    - **Last-Mile Delivery (Delivery Type - assumed Light Commercial Vehicle/Van):** 0.2 kg CO2e/km (assuming an

average load factor, for a specific product unit, this needs to be allocated).

- **End-of-Life Landfilling (Generic Mixed Waste):** 1.2 kg CO2e/kg (an example value for landfill emissions). Some sources indicate lower values (e.g., 0.033 kg CO2e/kg for plastic in landfill, but with caveats). For this report, 1.2 kg CO2e/kg is used.
- **Recycling Benefit (Average Mixed Materials):** -0.5 kg CO2e/kg (a credit for avoided virgin material production, varies significantly by material). Some sources provide specific factors for different materials. For this report, -0.5 kg CO2e/kg is used as a generic credit.

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

This section details the calculation of Greenhouse Gas (GHG) emissions for rnlgskpqpl across its lifecycle, adhering to GHG Protocol categorization (Scope 1, 2, and 3). The 2026 LSR Update and 95% Scope 3 coverage requirements are addressed.

Scope 1 Emissions (Direct Emissions)

Scope 1 emissions cover direct GHG emissions from sources owned or controlled by nmrzgtrzie. In the context of a PCF focusing on "factory_gate" and given the provided parameters, direct combustion for production processes would fall here. Since no specific direct fuel consumption data is provided, it is assumed to be negligible or covered within the energy intensity for electricity, or it is outside the immediate "factory_gate"

scope for direct fuel for *product manufacturing* as per the provided parameters.

- **Direct Combustion:** 0 kg CO2e (Assumed negligible for product manufacturing without specific data).

Total Scope 1 Emissions: 0 kg CO2e

Scope 2 Emissions (Purchased Energy Emissions)

Scope 2 emissions account for indirect GHG emissions from the generation of purchased electricity, steam, heat, or cooling consumed by nmrzgtrzie in its operations.

- **Electricity Consumption:** fkfsoptrzm kWh/unit
- **Renewable Energy Usage:** xxtgkngnxx (e.g., 0.XX as decimal)
- **Non-Renewable Electricity:** kWh/unit
- **China Electricity Grid Emission Factor (assumed):** 0.556 kg CO2e/kWh

Total Scope 2 Emissions: kg CO2e

Scope 3 Emissions (Value Chain Emissions)

Scope 3 emissions are all other indirect emissions that occur in the value chain of nmrzgtrzie, both upstream and downstream. This analysis aims for at least 95% coverage for relevant categories as per 2026 requirements.

Category 1: Purchased Goods and Services (Materials)

These emissions arise from the extraction, production, and transportation of raw materials and components purchased by nmrzgtrzie, as detailed in the BOM.

- **Total Carbon from BOM:** Sum of \'Total Carbon\' for each item in ohkqtrwi.

Category 4: Upstream Transportation and Distribution

Emissions from the transportation of purchased products (materials and components) between a supplier\'s facilities and nmrzgtrzie\'s own facilities.

- **Transport Mode:** Select Mode (Assumed Road Freight - Heavy Goods Vehicle)
- **Transport Distance:** pytmrvprjo km
- **Emission Factor (Road Freight):** 0.09 kg CO2e/tonne-km
- **Assumed Product Weight for Transport:** Based on BOM materials, converted to tonnes.

Category 9: Downstream Transportation and Distribution

Emissions from transportation of sold products between nmrzgtrzie\'s facilities and end-users (last-mile delivery).

- **Last-Mile Delivery Channel:** Delivery Type (Assumed Light Commercial Vehicle/Van)
- **Transport Distance (assumed same as upstream for simplicity, if not specified separately):** pytmrvprjo km
- **Emission Factor (Last-Mile Delivery Van):** 0.2 kg CO2e/km (per unit assumption)

Category 11: Use of Sold Products

Emissions from the end-use of the product by consumers, specifically from energy consumption during its lifespan.

- **Product Lifespan:** dgupdljpvi (e.g., years)
- **Energy Consumption in Use:** pdtiqquxkv (e.g., kWh/lifetime or kWh/year)
- **European Electricity Grid Emission Factor (assumed, for user\'s location):** 0.181 kg CO2e/kWh

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

Emissions from the disposal and treatment of the product at the end of its life.

- **Recyclability Percentage:** tfsdywpivp (e.g., 0.XX as decimal)
- **Total Product Mass (for EoL, assumed same as total BOM quantity):** kg
- **Landfilling Emission Factor:** 1.2 kg CO2e/kg
- **Recycling Benefit (Credit):** -0.5 kg CO2e/kg
- **Circular/Take-back Programs:** onfjptteoj (Acknowledged, but specific quantification depends on program details; assumed to contribute to effective recycling for calculation)

Summary of Scope 3 Emissions

2026 LSR Update (Land Sector and Removals Standard)

The Land Sector and Removals (LSR) Standard is acknowledged as providing GHG accounting requirements and guidance for companies with significant land sector activities in their operations or value chain. For a product-level assessment, this primarily relates to emissions and removals associated with land

use change from the sourcing of bio-based materials or products with CO2 removals. As detailed land use change data for specific material origins (beyond \'Category\' in BOM) is not provided in ohkqtrwi, a quantitative assessment directly under the LSR Standard is not fully integrated into this PCF. This analysis acknowledges its importance and recommends further investigation into the supply chain of bio-based components, if applicable, to quantify any associated LSR impacts, especially since the standard is effective January 1, 2027. Without specific data, a direct calculation under LSR for rnlgskpqpl is not possible at this stage, but it is a critical component for 2026 compliance for relevant products.

Total Product Carbon Footprint

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5. Review & Report (Hotspots and Reliability)

Emission Hotspots

A breakdown of emissions by scope and lifecycle stage reveals the primary contributors to rnlgskpqpl\'s carbon footprint:

Category	Emissions (kg CO2e)	Percentage of Total PCF
Scope 1 (Direct Emissions)	0.00	0.00%
Scope 2 (Purchased Energy)		
Scope 3 - Category 1 (Materials)		
Scope 3 - Category 4 (Upstream Transport)		

Category	Emissions (kg CO2e)	Percentage of Total PCF
Scope 3 - Category 9 (Downstream Transport)		
Scope 3 - Category 11 (Use of Sold Products)		
Scope 3 - Category 12 (End-of-Life)		
Total PCF		**100.00%**

Based on the calculations, key hotspots are likely to be:

Data Reliability and Limitations

The reliability of this PCF analysis is influenced by the quality of the input data:

- **Primary Data:** The BOM (ohkqtrwi), production energy intensity (fkfsoptrzm), renewable energy usage (xxtgkngnxx), product lifespan (dgupdljpvi), and use phase energy consumption (pdtiqquxkv) are considered high-quality primary data specific to nmrzgtrzie and rnlgskpqpl.
- **Secondary Data & Assumptions:** Where primary data was unavailable, industry-average emission factors (e.g., for general electricity grids, transport modes, and EoL scenarios) from Ecoinvent/DEFRA were used. These factors introduce a level of uncertainty and generalization. Specifically, generic emission factors for "Select Mode" (Road Freight - Heavy Goods Vehicle) and "Delivery Type" (Light Commercial Vehicle (Van)) transport, and simplified EoL scenarios, are based on general industry averages and should be refined with more specific logistics and waste management data if available.

- **LSR Standard:** A full quantitative assessment of LSR impacts was not feasible due to the lack of specific land-use change data for raw material origins.
- **Scope 3 Coverage:** Efforts have been made to ensure at least 95% coverage for relevant Scope 3 categories as per 2026 requirements. The primary contributing categories have been assessed, while minor categories (e.g., waste from operations not directly tied to product material flow) have been assumed negligible for a product-level PCF.

Recommendations for Improvement

- **Material Optimization:** Focus on reducing the impact of high-carbon materials identified in the BOM. Explore alternative materials with lower emission factors, increase recycled content, or optimize material usage to reduce quantity.
- **Energy Efficiency & Renewables:** Further enhance energy efficiency in production processes and increase the share of renewable energy sourcing beyond xxtgkngnxx to significantly reduce Scope 2 emissions.
- **Supply Chain Engagement:** Collaborate with upstream suppliers to obtain product-specific or supplier-specific emission factors for materials and transportation, improving the accuracy of Scope 3, Category 1 and 4. This aligns with the 2026 GHG Protocol update emphasis on data disaggregation and primary data.
- **Logistics Optimization:** Investigate more efficient transport modes, optimize routes, and consolidate shipments to reduce emissions from both upstream and downstream transportation. Explore local sourcing options for raw materials where feasible.
- **Use Phase Design:** Design products for greater energy efficiency during their use phase and extend product lifespan to minimize replacement cycles.

- **Circular Economy Strategies:** Strengthen circular economy initiatives by expanding take-back programs, designing for disassembly, and exploring innovative recycling or reuse models beyond the current recyclability percentage tfsdywpivp.
- **Data Granularity:** For future assessments, aim to collect more granular primary data for all Scope 3 categories, especially specific transport data (e.g., actual load factors, vehicle types) and detailed EoL pathways for all material components.