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Product Carbon Footprint (PCF) Analysis Report

For Product: **eelgnvwsni**

Company Name: **eowmfqdyjm**

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

Senior Sustainability Consultant: **ovfmpklmog**

Disclaimer: This report is generated based on available data and industry standards. While every effort has been made to ensure accuracy, the results are indicative and should be used for informational and strategic planning purposes.

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Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product "eelgnvwsni", manufactured by eowmfqdyjm. The analysis adheres to the Greenhouse Gas (GHG) Protocol, including the latest 2026 Land Sector and Removals (LSR) Standard updates and a commitment to achieve at least 95% coverage for Scope 3 emissions. The aim is to quantify the greenhouse gas emissions across the product\'s lifecycle, identify key hotspots, and provide a foundation for strategic decarbonization efforts.

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1. Define Scope

The scope of this Product Carbon Footprint (PCF) analysis for "eelgnvwsni" is defined as follows:

- **Functional Unit:** 1.0 unit of "eelgnvwsni". This unit serves as the reference basis for all quantified environmental impacts.
- **System Boundary:** factory_gate. This "cradle-to-gate with End-of-Life" approach includes raw material acquisition, manufacturing of components,

product assembly at the factory gate, product use phase, and end-of-life treatment.

- **Geographic Scope:** Final Production Country: China, Supply Chain Focus: Europe Focused. This dual focus acknowledges the primary manufacturing location while capturing upstream impacts from key European supply chains.
- **Accounting Standard:** GHG Protocol. All emissions are categorized into Scope 1 (direct emissions from owned or controlled sources), Scope 2 (indirect emissions from the generation of purchased energy), and Scope 3 (all other indirect emissions that occur in a company\'s value chain). The analysis also incorporates the 2026 Land Sector and Removals (LSR) Standard where applicable and aims for at least 95% coverage for Scope 3 reporting, in line with 2026 requirements.
- **Allocation:** Where co-products or by-products are identified, economic allocation is primarily used to distribute environmental burdens, reflecting the relative economic value of the outputs. However, for a single product PCF, the majority of emissions are directly attributable.

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2. Map Lifecycle (LCI inventory stages) & 3. Collect Data (Primary/Secondary data points)

The lifecycle of "eelgnvwsni" encompasses raw material extraction, component manufacturing, product assembly, transportation, use, and end-of-life. Data collection involved leveraging both provided primary data and industry-standard secondary data from reputable databases like Ecoinvent and DEFRA.

Detailed Bill of Materials (BOM) - hesvtsdx

The following Bill of Materials (BOM) for "eelgnvwsni" was used to calculate the material-related emissions. The \'Total Carbon\' values provided for each item are directly incorporated into the emissions calculation.

ID	Description	Category	Process	Qty	Unit	Emission Factor (kgCO2e/unit)	Total Carbon (kgCO2e)
1	Steel Chassis	Metal	Forming	2	kg	1.5	3.0
2	Plastic Casing	Plastic	Injection Molding	1.5	kg	2.2	3.3
3	Electronic Board	Electronics	Assembly	1	unit	5.0	5.0
4	Packaging (Cardboard)	Paper/ Cardboard	Manufacturing	0.5	kg	1.0	0.5

Total Product Weight (estimated for transport): 5 kg

Production Phase Energy Inputs

The energy consumed during the production phase in China significantly contributes to the product\'s footprint.

- **Renewable Energy Usage (tumwynotqu):** 75%
- **Energy Intensity (kWh/unit - gfeyiwdwtp):** 50 kWh/unit
- **China Electricity Grid Emission Factor (non-renewable portion):** ~0.7 kg CO2e/kWh (based on Ecoinvent data for China updated to 2021/2022)

- **Renewable Energy Upstream Emission Factor:** ~0.02 kg CO2e/kWh (representative value for upstream impacts of renewable energy infrastructure)

Transport Logistics Data

Transportation emissions are calculated based on the specified modes and distances, primarily focusing on a European supply chain and final delivery.

- **Primary Transport Mode (Supply Chain - Select Mode):** Road freight (Heavy Goods Vehicle > 7.5t)
- **Primary Transport Distance (knmffnkdpk):** 1500 km (Europe Focused)
- **Last-Mile Delivery Channel (Delivery Type):** Road freight (Light Commercial Vehicle < 3.5t)
- **Last-Mile Delivery Distance (Assumed):** 200 km
- **Road Freight (HGV > 7.5t) Emission Factor:** ~0.025 kg CO2e/tkm (from DEFRA/Ecoinvent data)
- **Road Freight (LCV < 3.5t) Emission Factor:** ~0.15 kg CO2e/tkm (from DEFRA/Ecoinvent data, higher due to lower load factors and stop-start operation)

Use Phase Durability and Consumption

The product\'s lifespan and energy consumption during its use contribute to its lifecycle emissions.

- **Product Lifespan (ulusyiprup):** 5 years
- **Energy Consumption in Use (qokzqiejyl):** 10 kWh/year
- **Electricity Emission Factor (End-user):** ~0.7 kg CO2e/kWh (assuming average grid mix for end-

user location if not specified, aligning with production country\'s general grid if applicable)

End-of-Life (EoL) Scenarios

End-of-Life considerations are crucial for assessing the overall environmental impact and circularity.

- **Recyclability Percentage (zdjntwzywq):** 80%
- **Circular/Take-back Programs (juzvqkixku):** Yes, established program for end-of-life collection.
- **Disposal Emission Factor (Non-recycled portion):** ~0.1 kg CO2e/kg (representative value for landfill/incineration burden)

The existence of a high recyclability percentage and established take-back programs significantly reduces the overall environmental burden by promoting material reuse and avoiding virgin material production, aligning with circular economy principles.

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

Emissions are calculated and categorized according to the GHG Protocol, distinguishing between Scope 1, Scope 2, and Scope 3 emissions. The 2026 LSR Standard is considered for land use and removals. All Scope 3 emissions are aimed for at least 95% coverage.

Calculations:

1. Material Acquisition & Processing (Scope 3 - Upstream)

Sum of \'Total Carbon\' from the Detailed Bill of Materials (BOM): 3.0 kgCO2e (Steel) + 3.3 kgCO2e (Plastic) + 5.0 kgCO2e (Electronics) + 0.5 kgCO2e

(Packaging) =
11.8 kgCO2e

2. Production Phase Emissions (Scope 1, 2, 3)

Assuming direct Scope 1 emissions at the factory are negligible or covered by energy consumption.

- **Purchased Electricity (Scope 2):**
  - Non-renewable electricity: 50 kWh/unit * (1 - 75/100) = 12.5 kWh/unit
  - Renewable electricity: 50 kWh/unit * (75/100) = 37.5 kWh/unit
  - Emissions from non-renewable electricity: 12.5 kWh/unit * 0.7 kg CO2e/kWh = 8.75 kgCO2e
  - Emissions from renewable electricity (upstream): 37.5 kWh/unit * 0.02 kg CO2e/kWh = 0.75 kgCO2e
  - **Total Production Energy Emissions:** 8.75 + 0.75 = **9.5 kgCO2e**

3. Transportation Emissions (Scope 3 - Upstream & Downstream)

Product weight for transport = 5 kg = 0.005 tonnes

- **Primary Transport (Supply Chain - Europe Focused, HGV):**
  - Distance: 1500 km
  - Emission Factor: 0.025 kg CO2e/tkm
  - Emissions: 0.005 tonnes * 1500 km * 0.025 kg CO2e/tkm = **0.1875 kgCO2e**
- **Last-Mile Delivery (LCV):**
  - Distance: 200 km
  - Emission Factor: 0.15 kg CO2e/tkm

    - Emissions: 0.005 tonnes * 200 km * 0.15 kg CO2e/tkm = **0.15 kgCO2e**
- **Total Transportation Emissions:** 0.1875 + 0.15 = **0.3375 kgCO2e**

4. Use Phase Emissions (Scope 3 - Downstream)

- Energy Consumption in Use: 10 kWh/year * 5 years = 50 kWh
- Emissions: 50 kWh * 0.7 kg CO2e/kWh = **35.0 kgCO2e**

5. End-of-Life Emissions (Scope 3 - Downstream)

- Non-recycled portion: Product Total Weight * (1 - Recyclability Percentage) = 5 kg * (1 - 0.80) = 1 kg
- Disposal Emissions: 1 kg * 0.1 kg CO2e/kg = **0.1 kgCO2e**
- The established circular/take-back programs and high recyclability significantly reduce the overall EoL impact by promoting material recovery and reuse, thus avoiding virgin material production.

Total Product Carbon Footprint (eelgnvwsni)

Summing up all calculated emissions:

- Material Acquisition & Processing: 11.8 kgCO2e
- Production Phase Energy: 9.5 kgCO2e
- Transportation: 0.3375 kgCO2e
- Use Phase: 35.0 kgCO2e
- End-of-Life: 0.1 kgCO2e
- **TOTAL PCF: 11.8 + 9.5 + 0.3375 + 35.0 + 0.1 = 56.7375 kgCO2e per functional unit.**

GHG Protocol Categorization:

- **Scope 1 Emissions:** Assumed negligible direct operational emissions not covered by purchased energy. If there were on-site fuel combustion or process emissions, they would be reported here. For this analysis, direct process emissions related to manufacturing are largely captured within the material and energy inputs (Scope 3 and 2 respectively).
- **Scope 2 Emissions:** 9.5 kgCO2e (from purchased electricity for production).
- **Scope 3 Emissions:**
  - Category 1: Purchased Goods and Services (Materials): 11.8 kgCO2e
  - Category 4: Upstream Transportation and Distribution: 0.1875 kgCO2e
  - Category 9: Downstream Transportation and Distribution (Last-Mile): 0.15 kgCO2e
  - Category 11: Use of Sold Products: 35.0 kgCO2e
  - Category 12: End-of-Life Treatment of Sold Products: 0.1 kgCO2e
  - **Total Scope 3 Emissions:** 11.8 + 0.1875 + 0.15 + 35.0 + 0.1 = 47.2375 kgCO2e

2026 LSR Update: The Land Sector and Removals (LSR) Standard, effective January 1, 2027, provides guidelines for accounting for land-based emissions and removals. For this product, direct land use change or land management emissions within our defined system boundary are not explicitly identified as significant impact drivers from the provided parameters. Should agricultural or forestry inputs be a larger part of the supply chain in more detailed assessments, the LSR Standard would be applied to quantify and report those

impacts, acknowledging that forest carbon accounting is not yet included in the current LSR Standard.

Scope 3 Compliance (2026 Requirements): With the inclusion of material, transport, use-phase, and end-of-life impacts, this analysis aims for at least 95% coverage of relevant Scope 3 emissions. The detailed breakdown by category supports this compliance goal, ensuring transparency and accountability. Any exclusions would be quantified and justified as per the standard\'s requirements.

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5. Review & Report

Hotspots Identification:

The primary hotspots for the "eelgnvwsni" product are identified as:

- **Use Phase (35.0 kgCO2e):** This is the most significant contributor to the PCF, primarily due to the energy consumption over the product\'s 5-year lifespan. This suggests that improving energy efficiency during use or extending product longevity with low-impact repair options would yield the largest reductions.
- **Material Acquisition & Processing (11.8 kgCO2e):** The embodied emissions in raw materials, particularly the Electronic Board and Plastic Casing, represent the second largest impact. Sourcing lower-carbon materials, optimizing design for less material use, or increasing the use of recycled content are key areas for improvement.
- **Production Phase Energy (9.5 kgCO2e):** While 75% renewable energy is used, the remaining 25% powered by the China grid still contributes significantly. Increasing renewable energy

procurement to 100% and improving energy efficiency in manufacturing operations are crucial steps.

Reliability:

The reliability of this PCF analysis is considered moderate to high, given the use of:

- Specific primary data for BOM, renewable energy usage, energy intensity, product lifespan, energy in use, and recyclability.
- Industry-standard emission factors from recognized databases (Ecoinvent, DEFRA), ensuring consistency and comparability.
- Adherence to the GHG Protocol\'s comprehensive methodology.

However, certain assumptions were made for generic parameters (e.g., specific transport mode for "Select Mode," default last-mile distance, and disposal emission factors) where detailed primary data was not provided. Further improvements in accuracy could be achieved with more granular, supplier-specific data for all Scope 3 categories and precise regional electricity grid mixes for the product\'s use phase.

Recommendations:

1. **Enhance Use Phase Efficiency:** Focus on R&D for more energy-efficient product designs. Explore options for low-power modes, smart energy management, and user education to reduce energy consumption during the product\'s lifespan.
2. **Decarbonize Material Sourcing:** Collaborate with suppliers to identify and procure lower-carbon materials, increase the percentage of recycled content, or explore innovative bio-based

alternatives, especially for steel, plastics, and electronics.

3. **Increase Renewable Energy Adoption:** Strive for 100% renewable energy usage in manufacturing operations through direct procurement, Power Purchase Agreements (PPAs), or high-quality renewable energy certificates.
4. **Optimize Logistics:** Continuously evaluate and optimize transport routes, modes, and load factors to reduce emissions from both upstream and downstream transportation. Explore local sourcing where feasible to reduce transport distances.
5. **Strengthen Circular Economy Initiatives:** Expand and promote the existing circular/take-back programs. Investigate opportunities for product refurbishment, repair, and component reuse to further extend product lifespan and minimize waste.