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Product Carbon Footprint Analysis Report

Product: mtmghlzngu

Company Name: ljgxzdsyji

Accounting Standard: GHG Protocol

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Disclaimer: This report is generated based on available data and industry standards. While every effort has been made to ensure accuracy, the actual environmental impacts may vary depending on real-world conditions and data availability. This analysis provides an estimate to identify emission hotspots and inform sustainability strategies.

Product Carbon Footprint Analysis for mtmghlzngu

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Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for the product "mtmghlzngu," manufactured by ljpgxzdsyji. The analysis was conducted by gttndnhfzg, Senior Sustainability Consultant, adhering strictly to the GHG Protocol Product Life Cycle Accounting and Reporting Standard. The system boundary for this analysis is "cradle-to-gate" with an expanded scope to include downstream transportation, use phase, and end-of-life scenarios as per specific requirements, providing a holistic view of the product's environmental impact. The primary goal is to quantify greenhouse gas (GHG) emissions across the product's lifecycle, categorize them into Scope 1, 2, and 3, and identify key emission hotspots to guide reduction strategies. The report also incorporates considerations from the 2026 GHG Protocol Land Sector and Removals (LSR) Standard update and aims for at least 95% Scope 3 coverage.

1. Define Scope

1.1 Functional Unit

The functional unit for this Product Carbon Footprint analysis is **1.0 unit of mtmghlzngru**.

1.2 System Boundary

The primary system boundary for this PCF is defined as "factory_gate" (cradle-to-gate). However, as per the detailed requirements, the analysis has been expanded to include significant downstream activities, specifically:

- **Cradle-to-gate:** Includes all processes from raw material acquisition and pre-processing, through manufacturing, up to the point the product exits the factory gate in China.
- **Downstream Transportation:** Emissions associated with the last-mile delivery of the product.
- **Use Phase:** Emissions generated during the product's active usage by the consumer.
- **End-of-Life (EoL):** Emissions and potential credits associated with the disposal and recycling of the product.

This comprehensive approach allows for a more complete understanding of the product's lifetime emissions, aligning with the intent of a cradle-to-grave assessment while maintaining the core "factory_gate" focus for upstream reporting.

1.3 Geographic Scope

- **Final Production Country:** China
- **Supply Chain Focus:** Europe Focused (for upstream materials and potential transport routes)
- **Use Phase & End-of-Life:** Assumed to occur predominantly within Europe, consistent with the supply chain focus.

1.4 Accounting Standard

This analysis strictly adheres to the **GHG Protocol Product Life Cycle Accounting and Reporting Standard**. Emissions are categorized into Scope 1 (direct emissions from owned or controlled sources), Scope 2 (indirect emissions from purchased electricity, steam, heat, or cooling), and Scope 3 (all other indirect emissions in the value chain, both upstream and downstream).

1.5 Allocation

Standard allocation methods as per GHG Protocol guidance have been applied. Where co-products or by-products exist, economic or physical allocation methods would be used. For this analysis, where specific co-product data is not provided, impacts are assumed to be fully allocated to the functional unit.

2. Map Lifecycle & 3. Collect Data

The product lifecycle for "mtmghlzngu" encompasses several stages, from raw material extraction to end-of-life. Data collection involved primary data (Detailed Bill of Materials, energy usage) and secondary data (industry-average emission factors for transportation, electricity grids, and generic EoL scenarios).

3.1 Material Acquisition and Pre-processing (Scope 3 - Category 1: Purchased goods and services)

The Detailed Bill of Materials (BOM) for mtmghlzngu (dwmgnlyj) provides specific data points for a high-accuracy material impact calculation. The total carbon values for each material component are directly utilized.

```

IDDescriptionCategoryProcessQtyUnitEmission Factor (kgCO2e/
Unit)Total Carbon (kgCO2e)\'; $total_material_carbon = 0;
$total_product_weight_kg = 0; // For transport calculations
foreach ($materials_data as $index => $item_str) { if ($index
== 0) continue; // Skip header row from the string if present,
assuming \'ID\' is just a label for the first row. $item_details =
explode(\'\', $item_str); if (count($item_details) == 8) { //
Ensure all 8 fields are present $id = trim($item_details);
$description = trim($item_details); $category =
trim($item_details); $process = trim($item_details); $qty =
(float)trim($item_details); $unit = trim($item_details);
$emission_factor_per_unit = (float)trim($item_details);
$total_carbon_per_item = (float)trim($item_details);
$materials_table .= "{$id}{$description}{$category}
{$process}{$qty}{$unit}{$emission_factor_per_unit}
{$total_carbon_per_item}"; $total_material_carbon +=
$total_carbon_per_item; // Sum up quantity for weight-based
calculations if unit is kg. Assuming units are consistent for
transport calc. if (strtolower($unit) == \'kg\')
{ $total_product_weight_kg += $qty; } elseif (strtolower($unit)
== \'unit\' && $category == \'Electronics\') { // For circuit board,
assume a default weight if not specified, e.g., 0.1 kg
$total_product_weight_kg += ($qty * 0.1); } } }
$materials_table .= \'; echo $materials_table; ?>

```

Total Emissions from Material Acquisition: kg CO2e.

3.2 Production Energy (Scope 2 - Purchased electricity)

- Energy Intensity (kWh/unit): kWh/unit
- Renewable Energy Usage: %
- Geographic Scope: China
- China Grid Emission Factor: 0.6205 kg CO2e/kWh (2023 average for electricity carbon footprint, including life cycle)

3.3 Transport (Scope 3 - Category 4: Upstream transportation and distribution & Category 9: Downstream transportation and distribution)

- Main Transport Distance (Upstream): km
- Main Transport Mode: Select Mode (Assumed: Road freight, HGV >20 tonnes, Europe to China)
- Last-Mile Delivery Channel: Delivery Type (Assumed: Light Commercial Vehicle)
- Assumed Product Weight for Transport: kg (based on BOM quantifiable mass).

3.4 Use Phase (Scope 3 - Category 11: Use of sold products)

- Product Lifespan: years
- Energy Consumption in Use: kWh/year (assumed annual consumption)
- Geographic Scope: Europe Focused (for use phase electricity mix)
- Europe Grid Emission Factor: $0.181 \text{ kg CO}_2/\text{MWh} = 0.181 \text{ kg CO}_2\text{e}/1000 \text{ kWh} = 0.000181 \text{ kg CO}_2\text{e}/\text{kWh}$ (2024 for leading European electricity producers, for electricity generation)

3.5 End-of-Life (EoL) Scenarios (Scope 3 - Category 12: End-of-life treatment of sold products)

- Recyclability Percentage: %
 - Circular/Take-back Programs:
 - Assumed Product Weight for EoL: kg
-

4. Calculate Emissions

Emissions are calculated using the formula: Activity Data × Emission Factor = CO₂e. Industry-standard emission factors are applied where primary data is not available. The analysis ensures categorization into GHG Protocol Scopes.

4.1 Scope 1 Emissions (Direct Emissions)

For this product-level PCF with a "factory_gate" system boundary (expanded to include downstream), direct Scope 1 emissions from Ijgzdsyji's owned or controlled sources (e.g., on-site fuel combustion) are assumed to be negligible for the functional unit or covered within the Scope 2 and 3 categories related to purchased energy and materials. A detailed corporate GHG inventory would capture these at an organizational level.

4.2 Scope 2 Emissions (Purchased Electricity for Production)

The production facility in China utilizes electricity, with a portion sourced from renewable energy.

- Total Energy for Production: kWh/unit
- Effective Emission Factor for Production Electricity: kgCO₂e/kWh (China grid average) × (1 - % renewable) = kgCO₂e/kWh.
- **Total Scope 2 Emissions:** kWh/unit × kgCO₂e/kWh = **kg CO₂e.**

4.3 Scope 3 Emissions (Value Chain Emissions)

Scope 3 emissions represent the most significant portion of the product's carbon footprint, covering both upstream and downstream activities. This analysis aims for at least 95% coverage as per 2026 requirements, utilizing the detailed BOM and specific logistics data.

4.3.1 Category 1: Purchased Goods and Services (Material Acquisition)

As calculated from the detailed Bill of Materials (dwmgnlyj).

- **Total Scope 3 (Category 1) Emissions: kg CO₂e.**

4.3.2 Category 4 & 9: Transportation and Distribution

```
20t, Europe) $upstream_transport_emissions =  
$transport_distance_km * $product_weight_tonnes *  
$hgv_ef_tonne_km; // Downstream Transport (Last-Mile Delivery)  
$last_mile_distance_km = 50; // Assumed generic last-mile  
distance $light_commercial_vehicle_ef_km = 0.15; // kgCO2e/km  
(Light Commercial Vehicle, up to 3.5t payload)  
$downstream_transport_emissions = $last_mile_distance_km *  
$light_commercial_vehicle_ef_km; $total_transport_emissions =  
$upstream_transport_emissions +  
$downstream_transport_emissions; ?>
```

- **Upstream Transportation (Europe to China - Main Transport):**
 - Mode: Assumed Road freight (HGV >20 tonnes)
 - Distance: km
 - Product Weight: tonnes
 - Emission Factor: kgCO₂e/tonne-km
 - Emissions: km × tonnes × kgCO₂e/tonne-km = **kg CO₂e.**
- **Downstream Transportation (Last-Mile Delivery):**
 - Mode: Assumed Light Commercial Vehicle
 - Distance: km (assumed)
 - Emission Factor: kgCO₂e/km
 - Emissions: km × kgCO₂e/km = **kg CO₂e.**
- **Total Scope 3 (Category 4 & 9) Emissions: kg CO₂e.**

4.3.3 Category 11: Use of Sold Products

- Product Lifespan: years
- Annual Energy Consumption: kWh/year
- Total Energy Consumption over Lifespan: kWh
- Europe Grid Emission Factor (Use Phase): kgCO₂e/kWh
- **Total Scope 3 (Category 11) Emissions:** kWh × kgCO₂e/kWh = **kg CO₂e.**

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

- Recyclability Percentage: %
- Circular/Take-back Programs: (Qualitative benefit, not quantified in this calculation without specific data)
- Total Product Weight for EoL: kg
- Non-Recycled Mass: kg (% of total weight)
- Assumed Disposal Emission Factor: kgCO₂e/kg (for non-recycled portion)
- **Total Scope 3 (Category 12) Emissions:** kg × kgCO₂e/kg = **kg CO₂e.**

The active take-back program for key components () suggests further reduction potential or material recovery benefits not fully captured in a simplified EoL calculation, but it represents a commitment to circularity.

Total Product Carbon Footprint (PCF) Summary

Lifecycle Stage	GHG Protocol Scope	Emissions (kg CO ₂ e)
Material Acquisition & Pre-processing	Scope 3 (Category 1)	
Production Energy	Scope 2	

Lifecycle Stage	GHG Protocol Scope	Emissions (kg CO2e)
Transportation (Upstream & Downstream)	Scope 3 (Category 4 & 9)	
Use Phase	Scope 3 (Category 11)	
End-of-Life Treatment	Scope 3 (Category 12)	
Total Product Carbon Footprint:		

5. Review & Report

5.1 Emission Hotspots

Based on this analysis, the primary emission hotspots for mtmghlzngu are:

- **Material Acquisition:** This stage, primarily driven by the aluminum alloy, contributes the largest share of emissions, highlighting the importance of sustainable material sourcing and design for circularity.
- **Use Phase:** The energy consumption during the product's lifespan, even with Europe's increasingly decarbonized grid, represents a significant proportion, indicating opportunities for energy efficiency improvements.
- **End-of-Life:** While recyclability is high, the emissions associated with the non-recycled portion still represent a considerable impact, emphasizing the need for maximizing recycling rates and exploring further circular economy initiatives.

5.2 Data Reliability and Limitations

The reliability of this PCF analysis is bolstered by the use of detailed primary data for the Bill of Materials. However, certain limitations exist:

- **Generic Emission Factors:** For certain lifecycle stages (e.g., specific transport modes, EoL disposal), industry-average emission factors were used due to the absence of company-specific or product-specific data. More precise primary data for these activities would enhance accuracy.
- **Transport Assumptions:** Specific transport modes ("Select Mode", "Delivery Type") and distances for last-mile delivery were assumed for demonstration. Actual logistics data would yield a more precise footprint.
- **Geographic Specificity:** While production is in China and the supply chain/use phase is Europe-focused, precise geographical emission factors for all sub-components and their manufacturing locations were not available and rely on broader regional averages.

5.3 GHG Protocol 2026 LSR Update Considerations

The GHG Protocol's Land Sector and Removals (LSR) Standard (effective January 1, 2027) provides requirements and guidance for quantifying, reporting, and tracking land emissions and CO₂ removals. For Ijgxdzsyji, applying the LSR Standard would involve:

- Assessing land use change and land management emissions associated with the raw materials in the Bill of Materials, particularly for any bio-based or agricultural components.
- Quantifying any CO₂ removals with storage in land or geologic carbon pools linked to the product's value chain.
- Reporting emissions from biogenic products across the value chain.

While specific land-use data was not provided for the materials in `dwmgnlyj`, future iterations of this PCF should integrate detailed land-use impacts of relevant materials as required by the LSR Standard to achieve a more complete picture of biogenic emissions and removals.

5.4 Scope 3 Compliance (95% Coverage)

This report has strived to meet the 2026 GHG Protocol requirement for at least 95% coverage for Scope 3 reporting. By leveraging a high-detail Bill of Materials, incorporating specific logistical and energy data, and systematically addressing key upstream and downstream categories (purchased goods & services, transportation, use of sold products, end-of-life treatment), a substantial portion of the product's value chain emissions has been accounted for. Continuous engagement with suppliers and primary data collection efforts will further enhance the completeness and accuracy of Scope 3 reporting.