CARBON TRUST

# MKS PAMP SA – Carbon Footprints of RJC CoC Recycled Silver Grains (25kg and 6509g)

# Product Emissions Report

April 2025

# Contents

# 1. Summary

## 1.1. Introduction

This report presents the results from the carbon footprint study of MKS PAMP SA's RJC CoC Recycled Silver Grains products.

This report conforms to the requirements for public disclosure of the life cycle GHG emissions of products laid out in the "Code of Good Practice for product GHG emissions and reductions". It aims to provide the basis to allow consistent information for product GHG emissions and reduction, assessed in conformity with the ISO 14067 Standard. The Product Emissions Report should be made available in the public domain

## 1.2. Background Information

**Table 1: MKS PAMP SA Product Carbon Footprint - Background Information**

| Category | Description |
|---|---|
| **Company name** | MKS PAMP SA |
| **Company contact information** | Prom. de Saint-Antoine 10, 1204 Geneva, Switzerland |
| **Product name** | RJC CoC Recycled Silver Grains |
| **Boundary** | Cradle to customer gate (includes outbound distribution) |
| **Standards, specifications and/or other documents used for footprinting methodology against which the company has been assessed for conformity** | ISO 14067 Standard<br>Carbon Trust Product Carbon Footprint - Requirements for Certification v3.0 |
| **Name of the independent, third-party verifier** | Carbon Trust Assurance Ltd |
| **Level of assurance achieved** | Reasonable |
| **Date of certification** | 01/04/2025 |

| | |
|---|---|
| **Final reference flow** | $kgCO_2e$ per kg of silver grain |
| **Data period** | 01/07/2023 – 30/06/2024 |
| **Product consistency criteria (PCC)** | Product Category Criteria Form for Precious Metals (unapproved) |

## 1.3. Results

The overall emissions are reported in Table 3 and 4 below. Please refer to the complementary Excel file, Final - MKS PAMP Footprint Expert – Silver bar and grain , for a full breakdown of all product carbon footprints.

**Table 2: List of footprinted products**

| Product Name | Product Name | SKU |
|---|---|---|
| RJC CoC Recycled Silver Grains | Silver 999.9 - 6509 g Bottled Grains CoC recycled - P (source 100% recycled) | ZAGGR00023 |
| RJC CoC Recycled Silver Grains | Silver 999.9 - Bottled Grains in g CoC recycled - P (source 100% recycled) | ZAGGR00025 |
| RJC CoC Recycled Silver Grains | Silver 999.9 - 25 Kg Grain in bag CoC recycled - DRW (source 100% recycled) | ZAGGR00062 |

**Table 3: 25kg RJC CoC Recycled Silver Grains Results (Cradle-to-gate) – Global Market**

| **Net Total Emissions (kgCO2e per kg of product)** | **110.71** |
|---|---|
| Fossil Emissions (kgCO2e per kg of product) | 73.92 |
| Biogenic Emissions (kgCO2e per kg of product) | 0.004 |
| Land Use Change Emissions (kgCO2e per kg of product) | 36.79 |

**Table 4: 6509g Bottled RJC CoC Recycled Silver Grains Results (Cradle-to-gate) – Global Market**

| **Net Total Emissions (kgCO2e per kg of product)** | **117.74** |
|---|---|
| Fossil Emissions (kgCO2e per kg of product) | 80.94 |
| Biogenic Emissions (kgCO2e per kg of product) | 0.004 |
| Land Use Change Emissions (kgCO2e per kg of product) | 36.79 |

## 1.4. Data

The data quality assessments were carried out based on a key developed internally at Carbon Trust. The overall data quality for the project was good, because of the granularity of the data received and its completeness.

## 1.5. Interpretation of results

An overall breakdown of the emissions associated with the various products and process steps for each product are reported in **Table 8: 25kg RJC CoC Recycled Silver Grains Results (Cradle-to-Gate) – Global Market,** and **Table 9: 6509g Bottled RJC CoC Recycled Silver Grains Results (Cradle-to-Gate) – Global Market.** This table demonstrates that the highest emission process is that of the raw material (raw silver) which account for 72% of the total footprint and land use change which accounts for of the total footprint.

LUC is being estimated due to some input metal which is classified as “Industrial By-Product”, which is assumed to be contain some percentage of virgin silver in the absence of more specific data.

The LUC methodology follows the 2019 IPCC Guidelines for National Greenhouse Gas Inventories. The equations and default constants used in the methodology are revised for specific land and biomes. To calculate LUC emissions, direct LUC equations and methodology were used. Indirect LUC has not been accounted for due to the lack of internationally agreed procedure.

Further details are recorded in section 2.4.1 Methodological Choices

## 1.6. Disclaimer on uncertainty

The emissions figures provided in this report have been calculated in accordance with the requirements of ISO 14067 standard, using the primary and secondary sources of data specified above. Based on ISO 14067 standard method of assessment, we believe that our assessment has identified 95% of the likely GHG emissions associated with the full life cycle of the product(s) covered in this report. However, readers should be aware that even primary sources of data are subject to variation over time, and the figures given in this report should be considered as our best estimates, based on reasonable cost of evaluation.

# 2. Main Report

## 2.1. Goal of the study

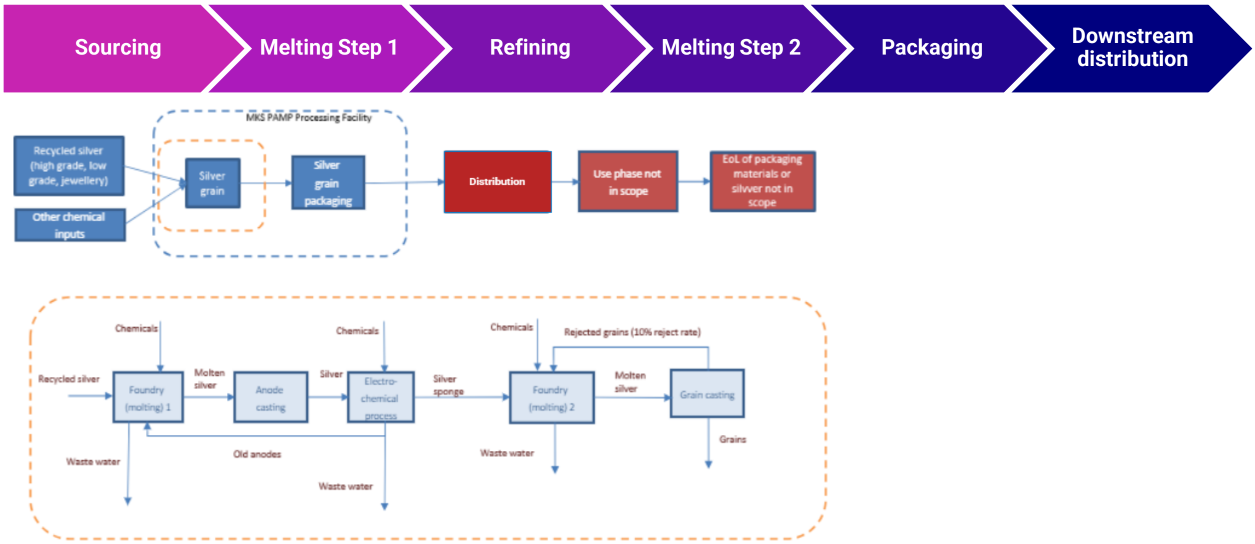
**Table 4: Goal of the Study**

| Category | Description |
|---|---|
| **Intended application of study** | Business to Business |
| **Environmental footprint impact category** | Climate change |
| **Reasons for carrying out the study** | To calculate the carbon footprints of the RJC CoC Recycled Silver Grains products |
| **Target audience** | Customers of the reporting company, MKS PAMP SA |
| **Reference PEFCRs** | N/A |
| **Commissioner of the study** | Tamara Jomaa-Shakarchi |

## 2.2. Scope

The project scope involves calculating the carbon footprint of the RJC CoC Recycled Silver Grains. These product(s) will be footprinted cradle-to-gate using kgCO2e/kg of product as the final reference flow. Cradle-to-gate is the appropriate boundary for products which are not finished goods and which are sold business-to-business.

## 2.3. Boundary




### 2.3.1. Raw materials

Silver inputs come from sources classified as either “Recycled” or “Industrial By-Product”. The activity data provided by MKS PAMP SA was the total mass of the raw material inputs for each footprinted product over the reporting year.

The largest emission source within the raw materials was the silver input. The emission factors used for the silver were calculated using the EU Product Environmental Footprint Circular Footprint Formula (PEF CFF).

The Product Environmental Footprint (PEF) is a life cycle assessment (LCA) based method to quantify the environmental impacts of products established by the EU. The overarching purpose of PEF is to enable the reduction of the environmental impacts of goods, accounting for supply chain activities (from extraction of raw materials, through production and use and to final waste management). This purpose is achieved through the provision of detailed requirements for modelling the environmental impacts of the flows of material/energy and the emissions and waste streams associated with a product throughout its life cycle.

The Circular Footprint Formula (PEF CFF) provides the approach that shall be used to estimate the overall emissions associated to a certain process involving recycling and/or energy recovery. These moreover also relate to waste flows generated within the system boundary.

The emission factor applied to the input silver material was calculated using the following two formulae which have been derived from PEF CFF below. An adaptation has been made in multiplying it with EvLUC to account for land use change from mining,

**Pr = R2 x (1−A)MQL+R1A**

**EF = Pr x Er + (1-Pr) x Ev + Pr x Er + (1-Pr) x EvLUC**

**Table 5: Explanation of PEFCFF formula**

| Parameter | Definition |
|---|---|
| Pr | The portion of the emission factor which can use Er (the recycled content) |
| Ev | Specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material, 3-year rolling average applied to this figure. |
| Ev LUC | Specific emissions and resources consumed (per functional unit) arising from land use change emissions caused by extraction of the virgin material. |
| Er | Specific emissions and resources consumed (per functional unit) arising from the recycling process of the recycled (reused) material, including collection, sorting and transportation process. |
| Er LUC | Specific emissions and resources consumed (per functional unit) arising from land use change emissions caused by the recycled material |
| R1 | Proportion of material in the input to the production that has been recycled from a previous system. A three year rolling average has also been applied to R1. |
| R2 | Proportion of the material in the product that will be recycled (or reused) in a subsequent system. $R_2$ shall therefore take into account the inefficiencies in the collection and recycling (or reuse) processes. $R_2$ shall be measured at the output of the recycling plant. |
| A | Allocation factor of burdens and benefits (jointly: “credits”) between supplier and user of recycled materials.<br><br>*For metals, this value is 0.2.* |
| MQL | The recycling process shall account for material quality loss during recycling, which is pre-defined for most materials.<br><br>*For metals, this value is 1.* |

Definitions from: Publications Office

For other chemical inputs, emission factors were taken from BEIS 2023 and EcoInvent 3.10. In the cases when the emission factors were not available in either database, an emission factor of a similar chemical was applied from EcoInvent 3.10.

### 2.3.2. Manufacturing

The raw materials were transported to MKS PAMP SA’s manufacturing facility in Switzerland.

The activity data provided by MKS PAMP SA included the distance and mode of transport for each of the raw materials, as well as supplier location. Using these distances, the Carbon Trust road freight v4.5

calculator was used to find the emission factors for each raw material's upstream transport, along with tonne.km calculations for air freight.

For manufacturing, electricity was the main energy source and 100% of the electricity was derived from hydroelectric power. Other energy sources used at the plant were natural gas and propane. This activity data was provided by MKS PAMP SA in MWh / year (for electricity) and $m^3$ / year (for natural gas and propane) for each process step. IEA 2023 emission factor was used for electricity as they use renewable energy. Emission factors from BEIS 2023 were used for natural gas and propane. For each process step a specific amount of $kgCO_2e$ emissions were associated with them, namely for example the first melting or the anode casting.

There were the following waste streams: black water, white water, non-precious metal waste, used crucibles, and copper sulphate (name given to all chemical waste in the model). Waste activity data was derived from input data provided by MKS PAMP SA and BEIS 2023 was used for waste treatment emission factors.

### 2.3.3. Packaging

Packaging was carried out at MKS PAMP SA's facility in Ticino, Switzerland.

25kg RJC CoC Recycled Silver Grains are individually packaged in protective plastic bags, 25kg of grain to a bag, with a paper certificate each. These bags are packaged in wooden pallets, 20 to a pallet. Each pallet contains 500kg of silver (20 bags of 25kgs each).

6509g bottled grains are individually packaged in protective plastic bags, 6.5kg to a bag, with a paper certificate and silica gel pouch each. These bags are packaged in wooden pallets, 80 to a pallet. Each pallet contains 520.72kg of silver (80 bags of 6.509kgs each).

In terms of activity data, the mass of materials for one box or pallet was provided. These masses were then scaled up to account for the total production output for each product. Emission factors applied to these packaging materials came from the PEF CFF calculator and Ecoinvent 3.10.

### 2.3.4. Transport

Finished products are transported by road from MKS PAMP SA in Switzerland to Zurich airport or to the final customers in Switzerland. For the 25kg RJC CoC Recycled Silver Grains, the products are flown to Thailand and India. From here, the products are transported to the end customer, by air and/or road. For the Bottled grains they are then flown to Thailand and Hong Kong.

For each country, the activity data was calculated using the specific mode and distance of the type of transport used. Emission factors were applied to these activity data which derive from the Carbon Trust Road Freight Calculator v4.5 and BEIS 2023.

### 2.3.5. Use Phase

For recycled grains the footprinting boundary is cradle-to-gate, ending at the customer's gate. Therefore, the use phase is not included in the boundary

### 2.3.6. End of life

For recycled grains the boundary ends at downstream distribution, so End of Life was excluded from the model.

## 2.4. Methodology

### 2.4.1. Methodological choices

Significant methodological choices for calculating the product footprint of MKS PAMP SA's SKUs are listed below:

- Calculation models were based on templates available in Footprint Expert Multi SKU and Footprint Expert 5.1 (FPX). These were set out in the different life cycle stages of RJC CoC Recycled Silver Grains, from the raw materials entering the facility and going through the first round of the foundry, to the packaging, and distribution to retailers.
- Global warming potential (GWP) factors were taken from the PEF CFF calculator, Road Freight v4.5 calculator, Ecoinvent 3.10, and BEIS 2023.
- Based on low materiality, emissions from upstream packaging of the raw material inputs, namely the chemicals and silver, and land use change for procured silver where the mine source could not be verified and accurately calculated, are being excluded
- Land use change calculation tool follows the 2019 IPCC Guidelines for National Greenhouse Gas Inventories. Equations and default constants used in the methodology are revised for specific land and biomes.

### 2.4.2. Key Assumptions

The below table outlines the assumptions that have been made for this metal type.

**Table 6: List of Assumptions**

| Process Step | Key Assumption |
|---|---|
| Raw Material | All silver is recycled or industrial byproduct |
| Co-product allocation in input materials (silver) | For the provenance ("recycled") grains the input silver is either from recycled or industrial by-product sources.<br>For the industrial by-product we must make an assumption on the original source of that metal (tier 1 supplier's co-product silver).<br>In this instance, the assumption comes from MKS PAMP SA's own recyclate/virgin metal data from the previous year, such that we have assumed that the industrial by-product is 64% recyclate and 36% virgin |
| Water | No water input data was provided; therefore, it was assumed that the sum of black and white water was that of input water. |
| Emission factors | For the raw materials where emission factors were not found, a generic Ecoinvent organic chemical emission factor was applied. |
| Inbound transportation | To calculate exactly how much silver was transported per different supplier, looked at total amount transported, and then calculated the percentage per supplier and |

| | |
|---|---|
| | applied that to the total amount of silver used in the grains production. This percentage split is included in the model. |
| Allocation of inputs | The data received was for the family group of the product and not per different SKU, hence an allocation key was created which was then used to determine the amount of RJC CoC Recycled Silver Grains produced and consequently the amount of materials/utilities is used. |
| Weight | 400oz is 12.5kg |
| Helicopter Transport | Have assumed that helicopter flies at 250km/h as EF used is kgco2(e)/hour - https://www.helicentre.eu/en/faq/#:~:text=How%20fast%20do%20helicopters%20fly,on%20one%20tank%20of%20fuel |
| Transport distance US | As per conversation with Paul, have manually added the kms for the journey |
| Downstream transport | Zurich downstream transport for silver large bars - the pivot says 244km road, sea and air. Assumption is that this is a mistake as 244km is the road distance from PAMP to Zurich, so treat the distance as just 244km road. |
| Transport distance Bangkok | Bangkok downstream the pivot tables say 0km travelled, using other data available in the PAMP MIDAS delivery data, can see road and air freight from PAMP to Bangkok, which is what we've used |
| Mass balance in material inputs | MKS PAMP SA inputs include raw metals and chemicals. To balance the inputs and output materials, it is assumed all chemicals are wasted as copper sulphates. |
| LUC calculation methodology | The LUC methodology follows the 2019 IPCC Guidelines for National Greenhouse Gas Inventories. Equations and default constants used in the methodology are revised for specific land and biomes. To calculate land use change, direct LUC equations and methodology were used. iLUC has not been accounted for due to the lack of internationally agreed procedure. |
| Exclusion | Assume no land use change where land type is rocky or desert or where there has been no visible expansions or change to the landscape in the last 20 years. |
| Helicopter Transport | Assuming a standard utility helicopter such as: https://www.airbus.com/en/products-services/helicopters/civilhelicopters/h145/h145-technical-information with a carrying load of 1905kg.<br>Assumed standard capacity at 70% of this which is 1333.5kg. Helicopter model found here: https://www.ias-aviation.net/en/notre-entreprise/ |

### 2.4.3. Allocation of inputs

MKS PAMP SA produce several products at their facility. Raw materials, outputs and utilities were provided for each process step for all products within project scope. When modelling the individual product footprints, a calculation was made to identify the production inputs and utilities required for 1kg of each product and the associated outputs for 1kg of product. This was then multiplied by the total output of the product to determine the total input emissions associated with each SKU.

The inbound transportation file included the transportation information for all inbound silver. In order to allocate only the emissions related to the 25kg and 6509g RJC CoC Recycled Silver Grains, an allocation factor was required. Using the percentage of silver procured from each provenance source of the total silver procured, an allocation was calculated to determine the input silver transported from each source for the 25 kg grains and the 6509g grains. An additional adjustment was made to the inbound silver to remove the inbound silver related solely to the general feed.

The LUC emissions were also calculated using an allocation factor. The change in land use was calculated by drawing polygons on google earth of the developed land areas. The land use change in hectares was apportioned based on the percentage of gold procured by MKS PAMP SA for this product over the total metals production of the mine.

### 2.4.4. Allocation due to recycling

Recycling allocation allows products to use the generally lower, recycled material emissions factor, rather than exclusively using virgin material emissions factors, for a portion of some input materials — thereby reflecting the benefits of recycling in reducing GHG emissions. The methodology (PEF CFF) used, balances how much benefit is attributed to products that use recycled input materials and how much is attributed to products that are recycled and provided these materials.

Please refer to section 2.3.1 where further information is provided on the PEF CFF.

### 2.4.5. Grouping

This footprint includes the grouping of three SKUs into two final products: 25kg RJC CoC Recycled Silver Grains and 6509g bottled grains. The reasoning behind the grouping is due to the similarity of the products. The silver 999.9 bottled grains in g CoC recycled is grouped with the 6509g grains due to its similar manufacturing process, packaging, and immaterial downstream distribution compared to 6509g.

### 2.4.6. Methodological changes since previous report

**Input metal data granularity - Co-Product and Ex-Investment**
Data granularity for input metals has improved so that supply can be defined as ex-investment or industrial by-product rather than only recyclate or virgin (dore).
To use the PEF CFF approach, inputs must be defined as virgin or recyclate so that credit can be allocated for recycling/use of recyclate.
Ex-investment metals are deemed to be recyclate. Industrial by-product metals are offcuts/scrap which the supplier cannot process, e.g. the remnants of a blank after some shape has been stamped from it. In GHG accounting terminology, this is a co-product, an output which is not the primary product but which is not a waste (i.e. it has value). Without knowing the supplier's own inputs, an assumption must be made on the content of that co-product metal with respect to virgin and recyclate percentage.
For this assumption, MKS PAMP SA has taken their own virgin:recyclate split from the previous year (before the improvement of data granularity) and used this as a proxy for the virgin:recyclate split of their suppliers of industrial by-product. With this assumption, there is an assumed 36:64 split of virgin:recyclate for these inputs.

**Harmonisation of Emission Factor Databases**

In the previous set of footprints, End of Life emission factors for treatment of waste came from both the BEIS and EcoInvent databases. In order to harmonise the approach and to update to the latest best practice guidance from our Data Team, in this year's footprints, all end of life and waste emission factors have been taken from the BEIS database.

**Biogenic Emissions**
In the previous footprint, Carbon Trust used a biogenic calculator, separate to the CFF calculator, to calculate the biogenic emissions factors for the packaging material. This year, the biogenic emissions calculation has been incorporated into an improved tool.

## 2.5. Data

### 2.5.1. Data Collection and Validation

MKS PAMP SA provided all activity data used for the analysis. All the input data drivers are summarised in the footprint model under their relevant process sheet. The main point of contacts for the data was MKS PAMP SA ESG team members. The Carbon Trust provided MKS PAMP SA with a data collection template to be used.

### 2.5.2. Data Quality

The data quality assessments were carried out based on a key developed internally at Carbon Trust. The overall data quality for the project was good. This is because the activity data was consistent with the boundary year, provided with an acceptable level of granularity, such as chemicals and waste broken down per product group, which enabled selection of best available emission factors. Where assumptions were made (see **Table 6**) they were appropriate and reasonable. More primary data could have been supplied for transport, and more granularity to a SKU level for material inputs, would result in a higher data quality score. **Table 7** summarises the data quality assessment of the most material data points.

**Table 8: Data quality assessment for material data points**

| Data point | Emission Factor Data Quality Indicator | Activity Data Quality Indicator | Application Data Quality Indicator |
|---|---|---|---|
| Raw materials | Good | Good | Good |
| Transport | Good | Good | Good |
| Utilities | Good | Good | Good |
| Packaging | Good | Good | Good |

| | | | |
|---|---|---|---|
| Waste | Good | Good | Good |
| Downstream Distribution | Good | Good | Good |

## 2.6. Results

An overall breakdown of the emissions associated with the various products and process steps is reported in Table 6 below.

**Table 9: 25kg RJC CoC Recycled Silver Grains Results (Cradle-to-Gate) – Global Market**

| Data Category | Emissions | Emissions | % |
|---|---|---|---|
| *Process/ Material* | *kg$CO_2$e/kg* | *Total t$CO_2$e* | |
| Input Materials (Silver) | 1,394,383 | 101.08 | 91.42% |
| Input Material | 13,307 | 0.96 | 0.87% |
| Transport | 9,449 | 0.68 | 0.62% |
| Utility | 50,489 | 3.66 | 3.31% |
| Packaging | 281 | 0.02 | 0.02% |
| Output (Waste) | 152 | 0.01 | 0.01% |
| Downstream Distribution | 57,270 | 4.30 | 3.75% |
| **PRODUCT CARBON FOOTPRINT** | 1,525,330.88 | 110.71 | **100%** |

**Table 10: 6509g Bottled RJC CoC Recycled Silver Grains Results (Cradle-to-Gate) – Global Market**

| Data Category | Emissions | Emissions | % |
|---|---|---|---|
| *Process/ Material* | *kg$CO_2$e/kg* | *Total t$CO_2$e* | |
| Input Materials (Silver) | 14,678,877 | 101.08 | 86.38% |
| Input Material | 140,083 | 0.96 | 0.82% |
| Transport | 99,421 | 0.68 | 0.59% |
| Utility | 531,506 | 3.66 | 3.13% |
| Packaging | 3,687 | 0.03 | 0.02% |
| Output (Waste) | 1,600 | 0.01 | 0.01% |
| Downstream Distribution | 1,537,267 | 11.32 | 9.05% |
| **PRODUCT CARBON FOOTPRINT** | 16,992,441 | 117.74 | **100%** |

## 2.7. Conclusions

The hotspot within the carbon footprint of the RJC CoC Recycled Silver Grains is that of the raw materials, namely the recycled silver, and the upstream and downstream transportation. This is due to the high carbon intensity (emission factor) of the input silver material relative to other inputs and lifecycle stages.

## 2.8. Recommendations

### 2.8.1. Emissions reductions

The main emissions hotspot of the SKUs is the silver raw material input and transport. Sourcing raw materials with a higher percentage of recycled content than industrial by-product (which is assumed to be partially virgin material where there is no more specific data) would be the most impactful way of reducing the product footprint. Additionally, switching to low-carbon transport methods in both inbound and outbound transport would decrease the footprint further. This could include alternative fuels, switching to electric vehicles, or taking more efficient delivery routes.

### 2.8.2. Data quality improvements

There are some recommendations to improve future recertification and results:

**Raw Materials (silver):** Supplier-specific factors would increase the accuracy of the footprint over generic emission factors.

**Inbound and outbound transportation**: More clarity over transportation stages would further improve accuracy, for example more information about the types of delivery vehicles, fuel type used etc.

## 2.9. Disclaimer on potential uses of this report

The results presented in this report are unique to the assumptions and practices of . The results are not meant as a platform for comparability to other companies and/or products. Even for similar products, differences in unit of analysis, use and end-of-life stage profiles, and data quality may produce incomparable results. The reader may refer to the ISO 14067 standard for additional insight into the GHG inventory process.

# Annex 2: Certification Details (Third Party Sign-Off)

This product footprinting study has been subject to an independent critical review to verify whether the methodology used for this LCA is compliant with ISO 14067 standard

| Category | Description |
| --- | --- |
| Name of the certifier | Rajul Shah |
| Date of certification | 01/04/2025 |
| Data valid until | 31/03/2027 |

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