MKS PAMP – CARBON FOOTPRINTS of Large Gold Bars and 1kg Gold Bars

Specific Sources
1, 2, 3, 4

Product Emissions Report

April 2024

Contents

1. Summary

1.1. Introduction

This report presents the footprinting study results calculated for MKS PAMP to measure the carbon footprints of their gold bars, namely 1kg and large bars from four specific mine sources: Ahafo, Akyem, Cripple Creek and Victor and Minera Florida. FPX Multi SKU v1.1 (Footprint Expert) is a Carbon Trust developed and owned footprinting tool that was used to calculate the results.

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.

1.2. Background Information

Table 1: MKS PAMP Products Carbon Footprint - Background Information

Category	Description
Company name	MKS PAMP SA
Company contact information	Prom. de Saint-Antoine 10, 1204 Geneva, Switzerland
Product name(s)	Large Gold Bars - Source 1 Large Gold Bars - Source 2 Large Gold Bars - Source 3 Large Gold Bars - Source 4 1kg Gold Bar - Source 1 1kg Gold Bar - Source 2 1kg Gold Bar - Source 3 1kg Gold Bar - Source 4
Boundary	Cradle-to- grave
Standards, specifications and/or other documents used for footprinting methodology against which the company has been assessed for conformity	ISO 14067 Standard Carbon Trust Product Carbon Footprint - Requirements for Certification

Name of the independent, third-party verifier	Carbon Trust Assurance Ltd
Level of assurance achieved	Reasonable
Date of certification	01/01/2024– 31/12/2024
Functional unit	kgCO_2e per kg
Data period	01/07/2022 – 30/06/2023
Product consistency criteria (PCC)	Product Category Criteria Form for Precious Metals

1.3. Results

Table 2: List of footprinted products

Product Name	Source	SKU
Large Gold Bar	Source 1	ZAULB00128
Large Gold Bar	Source 2	ZAULB00129
Large Gold Bar	Source 3	ZAULB00126
Large Gold Bar	Source 4	ZAULB00127
1kg Gold Bar	Source 1	ZAUCB00219
1kg Gold Bar	Source 2	ZAUCB00220
1kg Gold Bar	Source 3	ZAUCB00217
1kg Gold Bar	Source 4	ZAUCB00218

The overall emissions are reported in Table 3 and Table 4 below.

Table 3: Footprinting results Large Gold Bar Carbon Footprint Results (Cradle-to-Grave) – Global Market

	Source 1 Large Gold Bar	Source 2 Large Gold Bar	Source 3 Large Gold Bar	Source 4 Large Gold Bar
Weight per SKU (kg)	12.50	12.50	12.50	12.50
Fossil emissions	899,843	397,406	2,831,732	320,762
Biogenic Emissions	4	2	8	2
Biogenic Removals	-1	-1	-3	-1
Land Use Change	109,590	82,742	1	12,210
Total annual production (kg)	240	139	549	121
Total fossil footprint (kgCO2e)	**899,843**	**397,406**	**2,831,732**	**320,762**
Total Biogenic & LUC Emissions (kgCO2e)	**109,593**	**82,744**	**6**	**12,211**
Total Emissions (kgCO2e)	**1,009,436**	**480,150**	**2,831,738**	**332,973**
Total Emissions/kg (kgCO2e/kg)	**4,212**	**3,446**	**5,162**	**2,741**

Table 4: Footprinting results 1kg Gold Bar Carbon Footprint Results (Cradle-to-Grave) – Global Market

	Source 1 1kg Gold Bar	Source 2 1kg Gold Bar	Source 3 1kg Gold Bar	Source 4 1kg Gold Bar
Weight per SKU (kg)	1	1	1	1
Fossil emissions per SKU	5,510,945	2,434,293	17,348,047	1,964,793
Biogenic emissions per SKU	14	8	32	7
Biogenic removals per SKU	- 1	- 1	- 2	- 1
Land Use Change per SKU	671,489	506,984	4	74,814
Total production (kg)	1,468	854	3,361	744
Total fossil footprint (kgCO2e)	**5,510,945**	**2,434,293**	**17,348,047**	**1,964,793**
Total Biogenic & LUC Emissions (kgCO2e)	**671,502**	**506,991**	**34**	**74,821**
Total Emissions (kgCO2e)	**6,182,447**	**2,941,284**	**17,348,081**	**2,039,614**
Total Emissions per kg (kgCO2e)	**4,211**	**3,445**	**5,161**	**2,740**

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. Key Assumptions

Table 4 in Section 1.10 Methodology outlines the key assumptions that have been made.

1.6. Interpretation of results

An overall breakdown of the emissions associated with the various products and process steps for each product are reported in **Tables 8 – Table 15**

These tables demonstrate that the highest emission process is that of the raw material (raw gold) which account for between 83% and 100% of total footprints. Land use change is the next largest contributor to the footprints of Source 1, 2, 4 being driven by land use change from mining.

Land Use Change (LUC) emissions were not calculated in the previous product footprints but have been included for this product footprint in order to keep up with current standards and best practices, such as Land Sector and Removals Guidance from the Greenhouse Gas Protocol (GHGP) and World Resource Institute (WRI).

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 1.9.1 Methodological Choices.

1.7. 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 products 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.

1.8. Boundary

The process map for the specific source gold bars (1kg and large bars) are as follows:

Figure 1: Life Cycle Stages

1.8.1. Raw materials

Gold inputs come from specific mining sources as named above. The activity data provided by MKS PAMP 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 gold input. MKS PAMP have provided supplier specific emissions factors for each of the mine sources. The emissions have been pulled from a mine data base called SKARN. The activity data provided by MKS PAMP was the total mass of the raw material inputs for each footprinted product over the reporting year.

The emission factors used for the gold were calculated using the EU Product Environmental Footprint Circular Footprint Formula (PEF CFF). The virgin emission factor for gold was calculated for specific suppliers provided by MKS PAMP.

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 to reduce 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 gold 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,

$$\mathbf{Pr = R2 \times (1-A)MQL+R1A}$$

$$\mathbf{EF = Pr \times Er + (1-Pr) \times Ev + Pr \times Er + (1-Pr) \times EvLUC}$$

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.
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.
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. *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. *For metals, this value is 1.*

Definitions from: PowerPoint-Präsentation (europa.eu)

For other chemical inputs, emission factors were taken from the FPX v4.7 database, BEIS 2022 and EcoInvent 3.9.1. In the cases when the emission factors were not available in either database, an emission factor of a similar chemical was applied from EcoInvent.

1.8.2. Manufacturing

The raw materials were transported to MKS PAMP's manufacturing facility in Switzerland.
The activity data provided by MKS PAMP included the distance and mode of transport for each of the raw materials, as well as supplier location. Using these distances, the air freight, road freight and sea freight FPX v4.7 calculators were used to find the emission factors for each ingredient's upstream transport.

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 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 2022 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. Waste activity data was derived from input data provided by MKS PAMP and BEIS 2022 was used for waste treatment emission factors.

1.8.3. Packaging

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

1kg gold bars are individually packaged in protective plastic rolls with a paper certificate each. 25 bars are packaged in one plastic box for shipping.

Large Bars are packaged in wooden pallets, separated by a cardboard sheer. Each pallet contains 500kg of gold (40 large bars at 12.5kgs 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 Carbon Trust's FPX v4.7 database.

1.8.4. Downstream Distribution

Finished products are transported by road from MKS PAMP in Switzerland to Zurich airport or to the final customers in Switzerland. Ahafo final large gold bars are transported by air to London.

For the 1kg Gold Bars, there is no outbound data for Source 3 or 4 products. We used an assumption of the average outbound transportation distance of Source 1 and 2 products, as directed by MKS PAMP. Therefore, all provenance 1kg Gold Bars were distributed within Switzerland.

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 Carbon Trust FPX v4.7 transportation calculator.

1.8.5. End of life

For the gold bars it is assumed 100% of the metal is recycled. The End-of-Life profile for packaging was calculated using BEIS 2022 disposal emission factors and the disposal method percentages of the different countries of the sold products.

1.9. Methodology

1.9.1. Methodological choices

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

- Calculation models were based on templates available in Footprint Expert Multi SKU and Footprint Expert 4.7 (FPX). These were set out in the different life cycle stages of gold bar, from the raw materials entering the facility and going through the first round of the foundry, to the grain entering the bullion department, packaging, and sent to retailers.

- Global warming potential (GWP) factors were taken from the FPX Reference Database and EcoInvent 3.9.1.
- Materiality methodology and cut-off criteria: any process that constituted less than 1% of total emissions was excluded from the assessment. This includes; upstream packaging of the raw material inputs, namely the chemicals and gold, and land use change for 2% of procured gold where the mine source could not be verified and accurately calculated.
- 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.

Table 6: List of Assumptions

Process Step	Key assumption
Entire process	400oz = large bars
Grouping	Grouping has been done for the different finesses, ie 995+ and 999.9 gold large bars have been grouped as large bars. This is because the differences lie in downstream distribution and end of life, the rest of the processes remain exactly the same. The two are less than 1% of the total footprint and hence have been aggregated
Water	To balance out the waste black and white water, an additional water input has been added.
End of Life	Where specific packaging disposal data could not be provided, assumptions were made based on the percentage of gold sold in each geographical region and applied to each SKU to calculate end of life emissions per country.
Input gold	MKS PAMP provided a % split for the input gold in the provenance gold bars based on the total gold from the inbound. Source 1 – 10% allocated to provenance feed. Source 2 – 10% allocated to provenance feed. Source 3 – 100% allocated to provenance feed. Source 4 – 50% allocated to provenance feed.
SKUs	For the large bars, the LBMA and Swiss products are the same finesse and hence product, the only difference is the engraving on the product, for it to be sold in specific areas.
Emission factors	For the raw materials where emission factors were not found, a generic EcoInvent organic chemical emission factor was applied.
Allocation of inputs	The data received was for the family group of the product and not per different SKU, essentially it was for all the gold large bars produced, hence an allocation key was created which was then used to determine the amount of gold produced and consequently the amount of materials/utilities is used.

Raw Materials	Given the start date of the project, MKS PAMP Provided 10 months of production data, so an appropriate calculation was made to made calculation to uplift to data for 12 months.
Raw materials	The virgin emission factor for gold was provided by MKS PAMP for each supplier
Raw materials	Potassium fluoroborate EF was not reported in Ecoinvent 3.9.1 so the EF for sodium fluoroborate was used instead
Raw materials	For trimercaptotriazine and many chemicals in the minting department, a specific chemical could not be found in EcoInvent 3.9.1 so the 'chemical, organic//[GLO] chemical production, organic' was used instead
End of life	In terms of the PEF CFF, a 100% recycling rate of finished gold is assumed for finished gold products.
Land Use Change	Land Use change methodology follows the IPCC 2019 refinement and 2006 IPCC Guidelines for National Greenhouse Gas Inventories with its default values. 20 years was used for the land use change assessment period.
Land Use Change	Using the gold procured by MKS PAMP, a calculation for the % of procured by MKS PAMP was made to apportion the hectares of the mine attributable to MKS purchases.
Land Use Change	If exact start date for the mine is unknown, assume mid period start date of 2013
Land Use Change	Assume no land use change where land type is rocky/ desert or where there has been no visible expansions or change to the land scape in the last 20 years.
Outbound Distribution	No outbound distribution data is available for Source 3 & 4 1kg Gold Bars. An average of distance travelled by the Ahafo and Akyem 1kg Gold Bars has been used as a proxy with the same final destinations in Switzerland.

1.9.2. Allocation

MKS PAMP produces many more products at their facility than the products in scope. Therefore, MKS PAMP calculated raw material inputs, outputs, and energy usage for each process step for all products in scope. We used the production data to calculate the utilities and inputs for 1kg of produced product. This was then multiplied by the production to calculate the inputs for each process step.

For the specific source inbound gold – MKS PAMP provided a percentage allocation for these sources from the general feed as follows;

- Source 1 Inbound - 10% allocated to provenance.
- Source 2 Inbound - 10% allocated to provenance.
- Source 3 Inbound – 100% allocated to provenance.
- Source 4 Inbound – 50% allocated to provenance.

There was an additional allocation made to the Source 3 and 4 provenance gold to account for the gold which was used to produce the source 3 and 4 Gold Grains. The amount of produced gold grains was taken from Outbound Transportation and the 7.5% of waste was added back to this gold to calculate the inbound gold weight for grains. This was deducted from the Gold which was allocated to the Large and Kilo bars.

The gold used to produce the provenance bars was split between large gold bars and 1kg Gold Bars based on the percentage of large bars and 1kg Gold Bars or total gold bars produced. These percentages were worked out from the production data file provided by MKS PAMP.

1.9.3. 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.

It was assumed that gold had a recycling rate of 100% due to the value of the end product. The end-of-life fates for packaging materials were found at a country level.

1.10. Data

1.10.1. Data Collection and Validation

MKS PAMP 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 contact for the data was MKS PAMP ESG team. The Carbon Trust provided MKS PAMP with a data collection template for usage.

1.10.2. Data Quality

The data quality assessments were carried out based on a key developed internally at Carbon Trust.

Scores range from “Excellent” to “Lowest” with an excellent score representing data at the most granular level, in units which relate directly to the best available emission factors. An example of lower quality data would be data derived from proxies or uncalibrated assumptions. The table below provides some guidance and example data for the Carbon Trust scoring system. Note that the final data quality results, presented in Table 5, shows scores ranging between very good and excellent with an overarching score of Good, scores rated good and acceptable have an overarching score of Medium and the lower scores all fall under a Low score.

Data Quality Score	Scoring Guidance	Example Data
Excellent	Data at granular level in units that directly relate to the best available emission factor	Tonnes of “Steel grade XY”
Very Good	Data with some granularity (eg by country) in units that directly relate to the best available emissions factors	Tonnes of “Steel BOF production” or aluminium extruded
Good	Data in units that are a good proxy for emissions	Tonnes of “Gold” or “Silver”
Acceptable	Data in units that are a reasonable proxy for emissions	Tonnes of “Metals”
Low Quality	Data in units that are a low-quality proxy for emissions	Spend on “parts” or “components”
Lower Quality	Data in units that are a lower quality proxy for emissions	Spend on “goods”
Lowest Quality	Data from uncalibrated assumptions	Unknown

Generally, data quality for the project ranged between good and excellent with some acceptable scoring. Overall, the activity data was consistent with the boundary year, provided in some granularity and could be matched with the best available emission factors. In some cases, such as the land use change, assumptions were made around the mine data (see **Table 4** for full assumption list), which were appropriate and reasonable, such as the allocation of hectares based on the procured raw materials of total mine production and some proxies where mine data was unavailable. More primary data for the land use change emissions calculation would result in a higher data quality score. For example, outbound distribution of 1kg Gold Bars was an assumption of the average of Source 1 and 2 for the Source 3 and 4 products. **Table 5** summarises the data quality assessment of the most material data points.

Table 7: Data quality assessment for material data points (Scale; Low, Medium, Good)

Data point	Activity Data Quality Indicator	Emission Factor Data Quality Indicator	Application Data Quality Indicator
Raw Materials	Good	Medium	Medium
Packaging	Good	Good	Good
Manufacturing	Good	Good	Good
Downstream distribution	Good	Good	Good
End-of-Life	Medium	Medium	Medium
Land use change	Medium	Medium	Medium

1.11. Results

An overall breakdown of the emissions associated with the various products and process steps is reported in Table 6 below. Please refer to the complementary Excel files, [Phase 2 MKS PAMP FPX Multi SKU Provenance Large Bars] and [Phase 2 MKS PAMP FPX Multi SKU Provenance 1kg Gold Bars], for a full breakdown of all product carbon footprints.

Table 8: Source 1 Large Gold Bar Carbon Footprint Results (Fossil, Biogenic & Land Use Change)

Life Cycle Stage	kgCO2e	kgCO2e/kg	Contribution per lifecycle stage
Upstream transport of input materials	1,880.83	7.85	0.19%
Raw materials (Gold)	1,006,721.12	4,201.13	99.73%
Raw materials (Chemicals)	256.55	1.07	0.03%
Utilities	90.50	0.38	0.01%
Waste	228.20	0.95	0.02%
Packaging	6.25	0.03	0.001%
Downstream distribution	252.52	1.05	0.03%
End of Life	0.11	0.0005	0.00001%
Total footprint (kg CO2e)	**1,009,436.08**	**4,212.46**	**100%**

Figure 2: Source 1 Large Gold Bar LCA Carbon Footprint

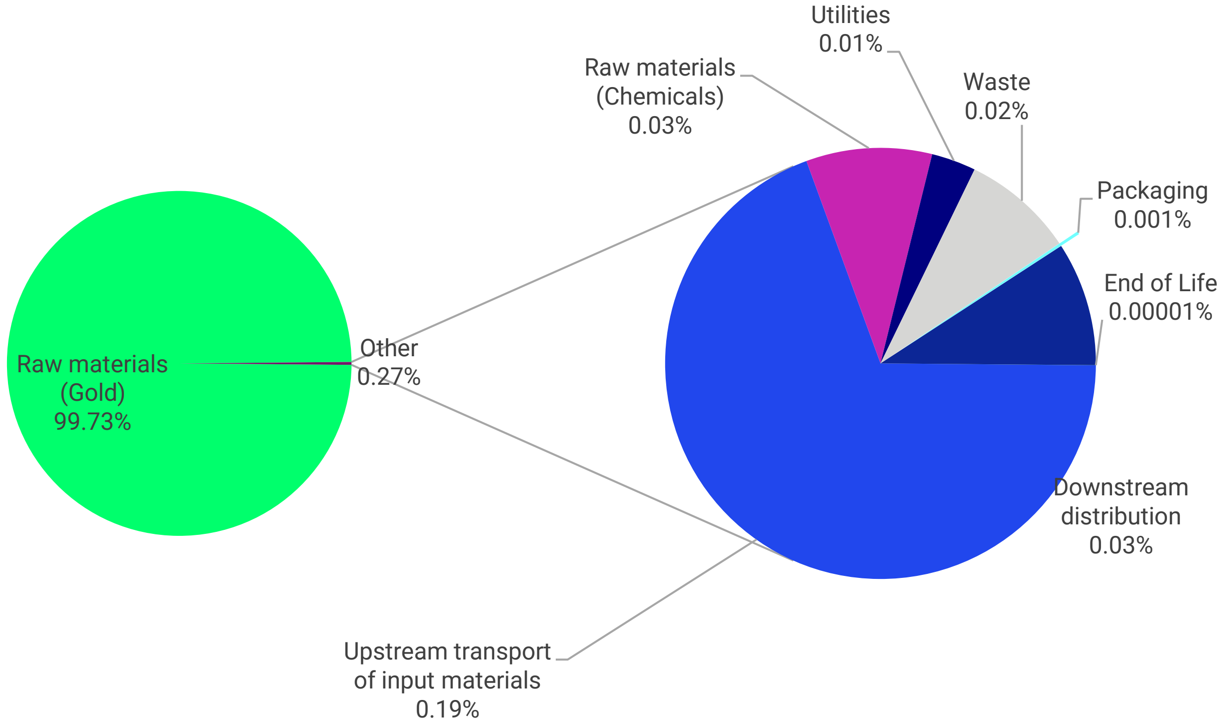


Table 9: Source 1 1kg Gold Bar Carbon Footprint Results (Fossil, Biogenic & Land Use Change)

Life Cycle Stage	kgCO2e	kgCO2e/kg	Contribution per lifecycle stage
Upstream transport of input materials	11,524.39	7.85	0.19%
Raw materials (Gold)	6,168,437.44	4,201	99.77%
Raw Materials (Chemicals)	1,582.35	1.08	0.03%
Utilities	648.50	0.44	0.01%
Waste	19.03	0.01	0.0003%
Packaging	71.60	0.05	0.001%
Downstream distribution	157.40	0.11	0.003%
End of Life	5.98	0.004	0.0001%
Total footprint (kgCO2e)	**6,182,447**	**4,211**	**100%**

Figure 3: Source 1 1kg Gold Bar LCA Carbon Footprint

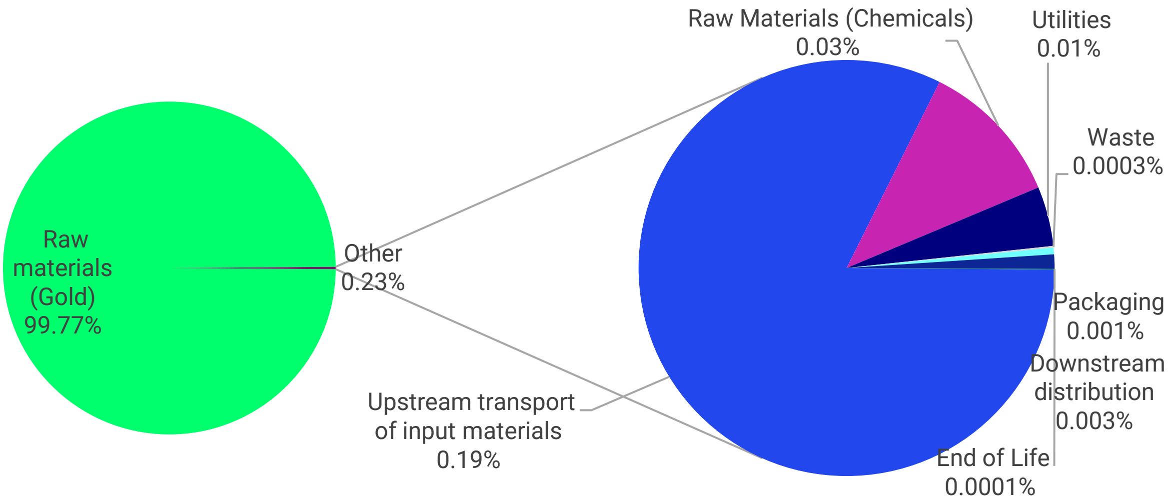


Table 10: Source 2 Large Gold Bar Carbon Footprint Results (Fossil, Biogenic & Land Use Change)

Life Cycle Stage	kgCO2e	kgCO2e/kg	Contribution per lifecycle stage
Upstream transport of input materials	1,093.65	7.85	0.23%
Raw materials (Gold)	478,703.40	3,435.54	99.70%
Raw materials (Chemicals)	149.18	1.07	0.03%
Utilities	52.62	0.38	0.01%
Waste	132.69	0.95	0.03%
Packaging	3.63	0.03	0.001%
Downstream distribution	14.60	0.10	0.003%
End of Life	0.03	0.0002	0.00001%
Total Footprint (kgCO2e)	**480,150**	**3,446**	**100%**

Figure 4: Source 2 Large Gold Bar LCA Carbon Footprint

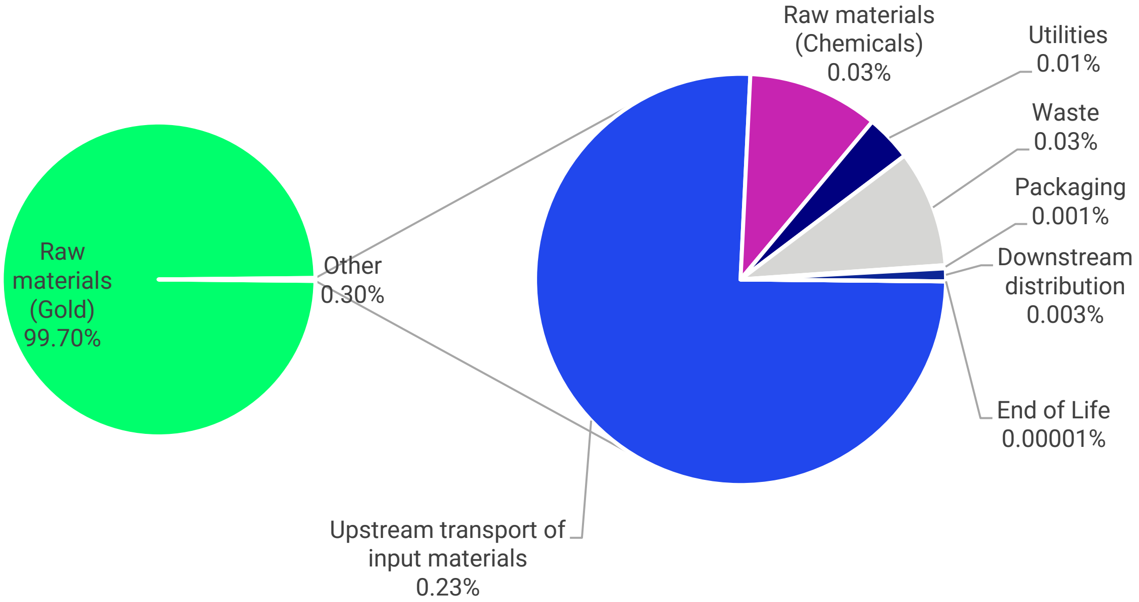


Table 11: Source 2 1kg Gold Bar Carbon Footprint Results (Fossil, Biogenic & Land Use Change)

Life Cycle Stage	kgCO2e	kgCO2e/kg	Contribution per lifecycle stage
Upstream transport of input materials	6,701.10	7.85	0.23%
Raw materials (Gold)	2,933,138.01	3,436	99.72%
Raw Materials (Chemicals)	920.09	1.08	0.03%
Utilities	377.08	0.44	0.01%
Waste	11.07	0.01	0.0004%
Packaging	41.64	0.05	0.001%
Downstream distribution	91.52	0.11	0.003%
End of Life	3.48	0.004	0.0001%
Total Footprint (kgCO2e)	**2,941,284**	**3,445**	**100%**

Figure 5: Source 2 1kg Gold Bar LCA Carbon Footprint

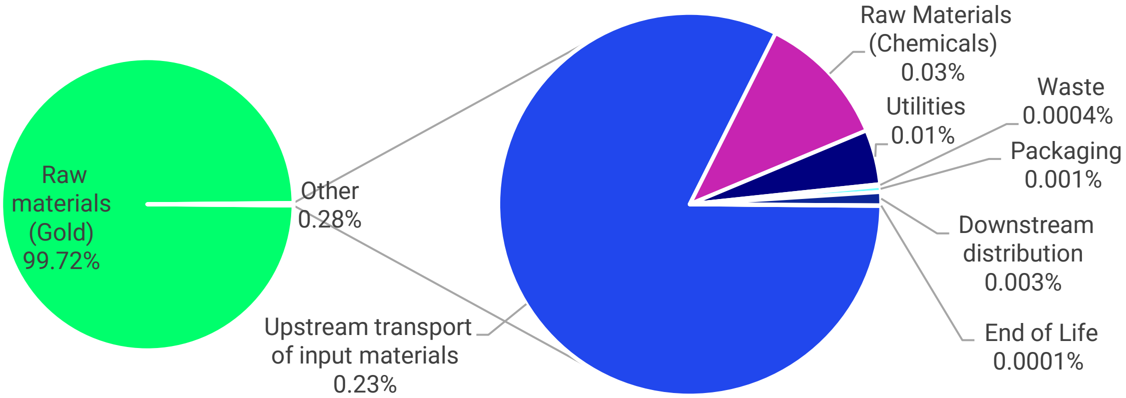


Table 12: Source 3 Large Gold Bar Carbon Footprint Results (Fossil, Biogenic & Land Use Change)

Life Cycle Stage	kgCO2e	kgCO2e/kg	Contribution per lifecycle stage
Upstream transport of input materials	4,661.41	8.50	0.16%
Raw materials (Gold)	2,825,707.40	5,151	99.79%
Raw materials (Chemicals)	587.29	1.07	0.02%
Utilities	207.17	0.38	0.01%
Waste	522.39	0.95	0.02%
Packaging	14.31	0.03	0.001%
Downstream distribution	37.67	0.07	0.001%
End of Life	0.10	0.0002	0.000004%
Total Footprint (kgCO2e)	**2,831,738**	**5,162**	**100%**

Figure 6: Source 3 Large Gold Bar LCA Carbon Footprint

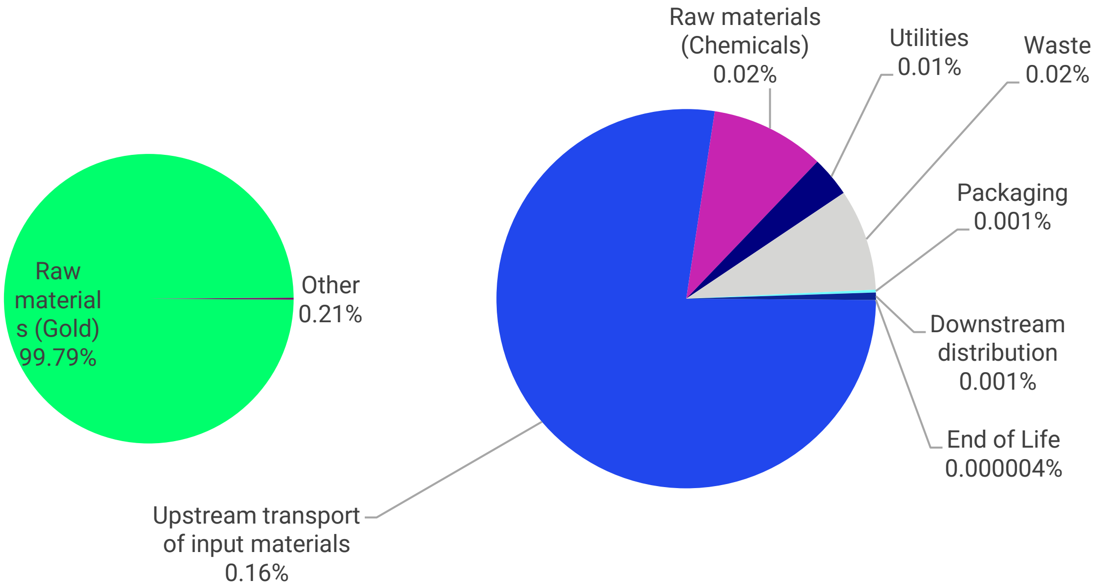


Table 13: Source 3 1kg Gold Bar Carbon Footprint Results (Fossil, Biogenic & Land Use Change)

Life Cycle Stage	kgCO2e	kgCO2e/kg	Contribution per lifecycle stage
Upstream transport of input materials	28,561.81	8.50	0.16%
Raw materials (Gold)	17,313,831.05	5,151	99.80%
Raw materials (Chemicals)	3,622.27	1.08	0.02%
Utilities	1,484.52	0.44	0.01%
Waste	43.57	0.01	0.0003%
Packaging	163.91	0.05	0.001%
Downstream distribution	360.31	0.11	0.002%
End of Life	13.69	0.004	0.00001%
Total Footprint (kgCO2e)	**17,348,081**	**5,161**	**100%**

Figure 7: Source 3 1kg Gold Bar LCA Carbon Footprint

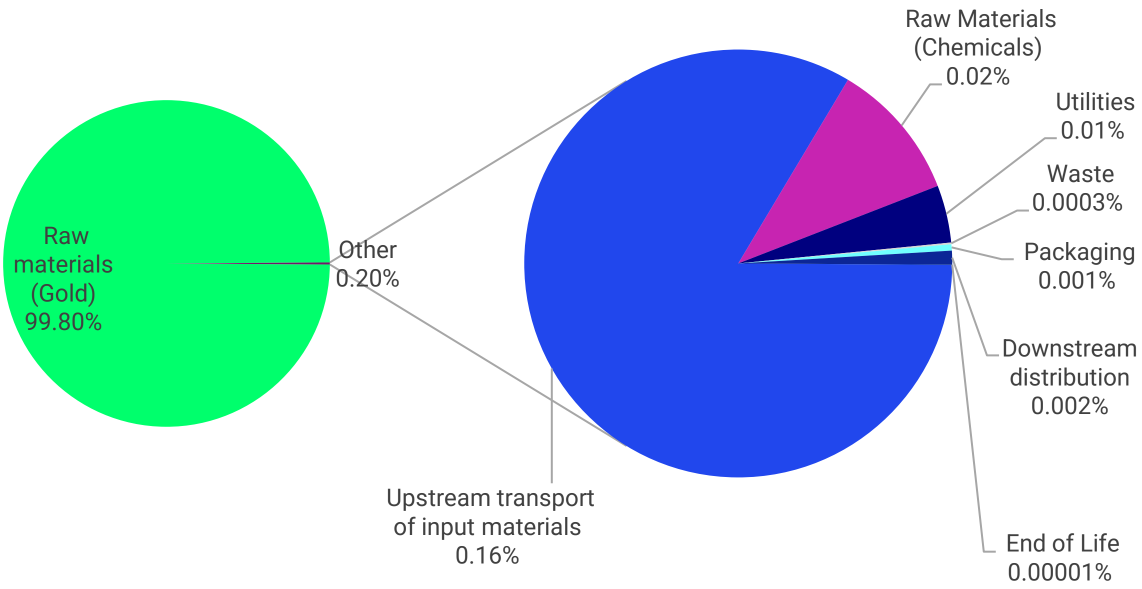


Table 14: Source 4 Large Gold Bar Carbon Footprint Results (Fossil, Biogenic & Land Use Change)

Life Cycle Stage	kgCO2e	kgCO2e/kg	Contribution per lifecycle stage
Upstream transport of input materials	2,051.46	16.88	0.62%
Raw materials (Gold)	330,618.49	2,721	99.29%
Raw materials (Chemicals)	130.08	1.07	0.04%
Utilities	45.89	0.38	0.01%
Waste	115.70	0.95	0.03%
Packaging	3.17	0.03	0.001%
Downstream distribution	8.34	0.07	0.003%
End of Life	0.02	0.0002	0.000007%
Total Footprint (kgCO2e)	**332,973**	**2,741**	**100%**

Figure 8: Source 4 Large Gold LCA Carbon Footprint

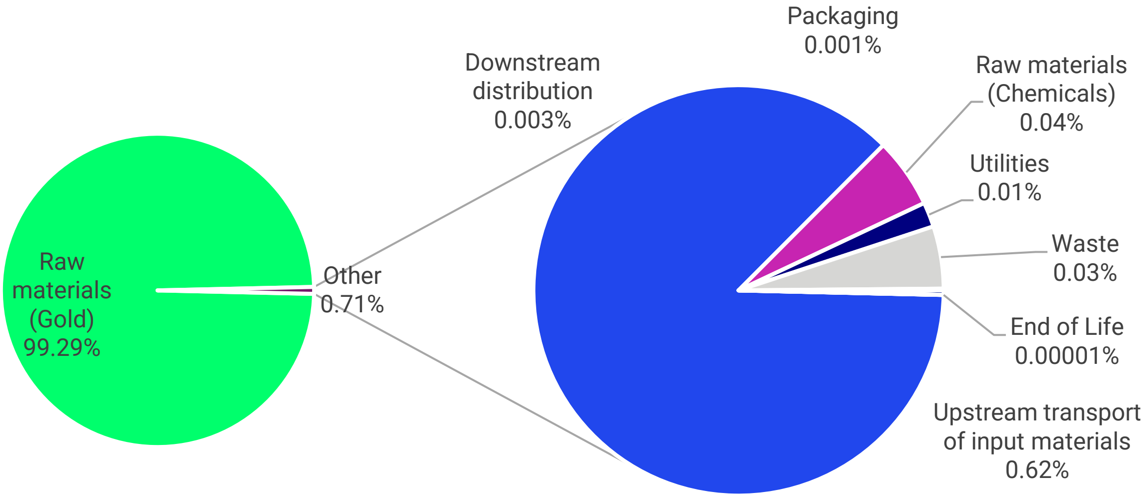
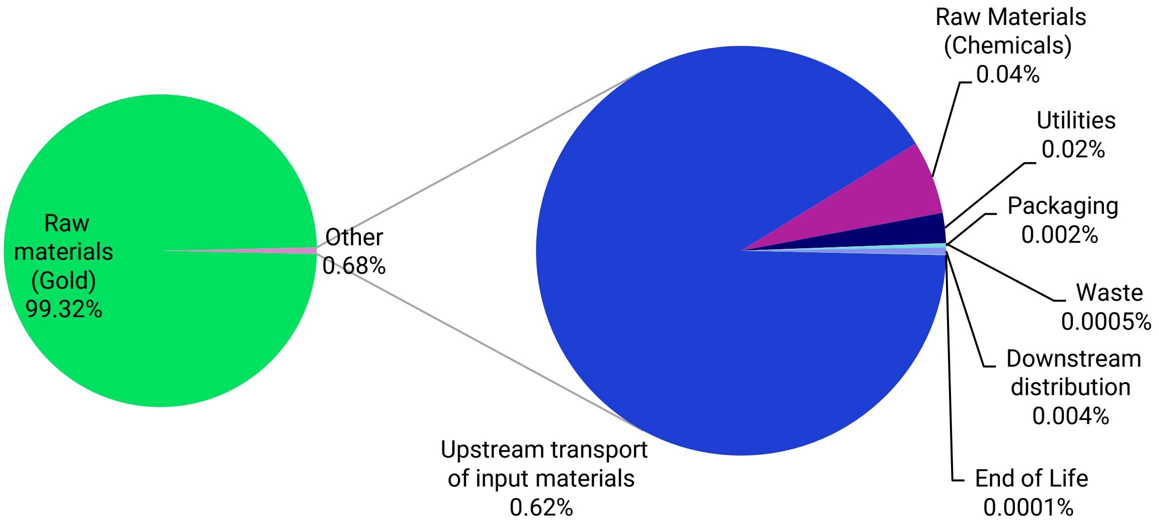


Table 15: Source 4 1kg Gold Bar Carbon Footprint Results (Fossil, Biogenic & Land Use Change)

Life Cycle Stage	kgCO2e	kgCO2e/kg	Contribution per lifecycle stage
Upstream transport of input materials	12,569.84	16.88	0.62%
Raw materials (Gold)	2,025,783.94	2,721	99.32%
Raw materials (Chemicals)	802.29	1.08	0.04%
Utilities	328.80	0.44	0.02%
Waste	9.65	0.01	0.0005%
Packaging	36.30	0.05	0.002%
Downstream distribution	79.81	0.11	0.004%
End of Life	3.03	0.004	0.0001%
Total Footprint (kgCO2e)	**2,039,614**	**2,740**	**100%**

Figure 9: Source 4 1kg Gold Bar LCA Carbon Footprint



1.12. Conclusions

The two main hotspots within the carbon footprint of both the gold large bars and of the 1kg Gold Bars is the raw materials, namely raw gold. Land use change contributes a smaller proportion of the total footprint. These are both driven by the carbon intensity surrounding the emission factors.

1.13. Recommendations

1.13.1. Emissions reductions

The main emissions hotspot of the SKUs is the gold raw material input. Sourcing raw materials with a higher percentage of recycled content would be the most impactful way of reducing the product footprint. Moreover, switching to the use of low-carbon methods of transport, both upstream and downstream, will decrease this further. This might include alternative fuels, electric vehicles or even more efficient delivery routes.

In addition to the procurement of recycled gold, MKS PAMP could work more with mines to understand what land rehabilitation projects they are involved and see where they could lower LUC emissions by sourcing from mines that are in not in expansion or increasing emissions through land use change.

1.13.2. Data quality improvements

There are several recommendations to improve future recertification and results:

Raw materials (Gold): MKS PAMP provided the gold sourcing data of the used mines and the emission factors from these mines. What would be of interest is to receive those that are not only Dore but of also recycled content.

Inbound transportation and downstream distribution: Attaining more clarity over the transportation stages could improve footprint accuracy. For example, it may be that the suppliers use electric vehicles, or particularly efficient logistical practices.

Mine Data: For the calculation of land use change, a large amount of primary data research was required by the delivery team as the client did not hold specific data on the mines. Gaining visibility on the expansion of mines and land use change due to gold exploration will help with the calculation of the land use change emissions.

1.14. Disclaimer on potential uses of this report

The results presented in this report are unique to the assumptions and practices of MKS PAMP. 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.

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