Greenhouse Gas Analysis of MOTH Drinks

MOTH:

zevero

Analysis of the greenhouse gas
emissions associated with MOTH Drinks by Zevero LTD 03/2023

Contents

Abstract

An environmental assessment was undertaken for the greenhouse gas (GHG) emissions of the core range sold by MOTH Drinks. The analysis is from cradle-to-grave and analyses three. The results are split into stages of Ingredients, Packaging, Processing, Transportation, Use, and End-of-Life. The highest GHG emission product was Old Fashioned due to the packaging size of the product at 1.99kgCO_2e/L whereas French 75 has the least GHG emissions attributed to the life cycle at 1.30kgCO_2e/L. For all products, packaging and ingredients made up the majority of GHG emissions.

1 Introduction

1.1 Overview

MOTH Drinks is a London-based canned cocktail drinks company founded in 2018. The drinks industry produces significant greenhouse gas emissions within the United Kingdom. The production of drinks involves several stages that contribute to GHG emissions, including the cultivation and processing of raw materials, the production and transportation of packaging materials, processing of drinks, distribution, use, and end-of-life of the final product.

There is growing interest in the environmental impact of companies, products and services throughout the industry. In this study, an environmental analysis was conducted to assess the greenhouse gas (GHG) emissions associated with the production of specific products produced by MOTH Drinks.

Conducting environmental studies to quantify the GHG emissions associated with the production of products sold by MOTH Drinks and other drinks companies can be provided with data that can help them make low-carbon business decisions and reduce their overall environmental impact.

1.2 Aims and Objectives

The overall aim is to calculate the life cycle GHG emissions associated with MOTH Drinks' core range of canned cocktails. This report will subdivide the GHG emission into life cycle stages for MOTH Drinks to understand where they can make further GHG emission reductions in the future across operations and their supply chain. Moreover, further implementation of techniques to reduce the GHG emissions within their products will be highlighted within the main body of this report.

1.3 Standard Compliance

This report is based on compliance conditions with GHG Protocol Product Standard [1, 2], introduced by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). A Product Footprint is a greenhouse gas emission analysis of a product that is sold by a given company. The analysis relates solely to the products analysed. The results are used to understand the full life cycle GHG emissions of a product and focus efforts on the greatest GHG reduction opportunities.

2 Scope of Study

2.1 Product Systems and Functional Unit

Eight products sold by MOTH Drinks have been analysed within this study, Espresso Martini, Negroni, Margarita, Old Fashioned, Mojito, Piña Colada, Aperitivo Spritz and French 75. Table 1 shows the breakdown of items, their packaging volumes and the respective masses that make up the different packaging types.

2.2 Functional Unit

The functional unit for this study is 'One Litre of canned drink'. The functional unit allows MOTH Drinks and other stakeholders to compare the studied products' GHG emissions.

Table 1: The breakdown of items and their respective masses that make up the three packaging types

Packaging of MOTH Drinks' Cocktail	Quantity of item	Unit of measurement
Espresso Martini	**125ml**	**ml**
Board Packaging	0.066	kg
Can Ends	0.0026	kg
Can-150ml	0.011	kg
Label	0.0008	kg
Margarita	**125ml**	**ml**
Board Packaging	0.066	kg
Can Ends	0.0026	kg
Can-150ml	0.011	kg
Label	0.0008	kg
Mojito	**200ml**	**ml**
Board Packaging	0.076	kg
Can Ends	0.0026	kg
Can-200ml	0.013	kg
Label	0.001	kg
Negroni	**125ml**	**ml**
Board Packaging	0.066	kg
Can Ends	0.0026	kg
Can-150ml	0.011	kg
Label	0.0008	kg
Old Fashioned	**100ml**	**ml**
Board Packaging	0.066	kg
Can Ends	0.0026	kg
Can-150ml	0.011	kg
Label	0.0008	kg
Piña Colada	**200ml**	**ml**
Board Packaging	0.076	kg
Can Ends	0.0026	kg
Can-200ml	0.013	kg
Label	0.001	kg
Aperitivo Spritz	**200ml**	**ml**
Board Packaging	0.076	kg
Can Ends	0.0026	kg
Can-200ml	0.013	kg
Label	0.001	kg
French 75	**200ml**	**ml**
Board Packaging	0.076	kg
Can Ends	0.0026	kg
Can-200ml	0.013	kg
Label	0.001	kg

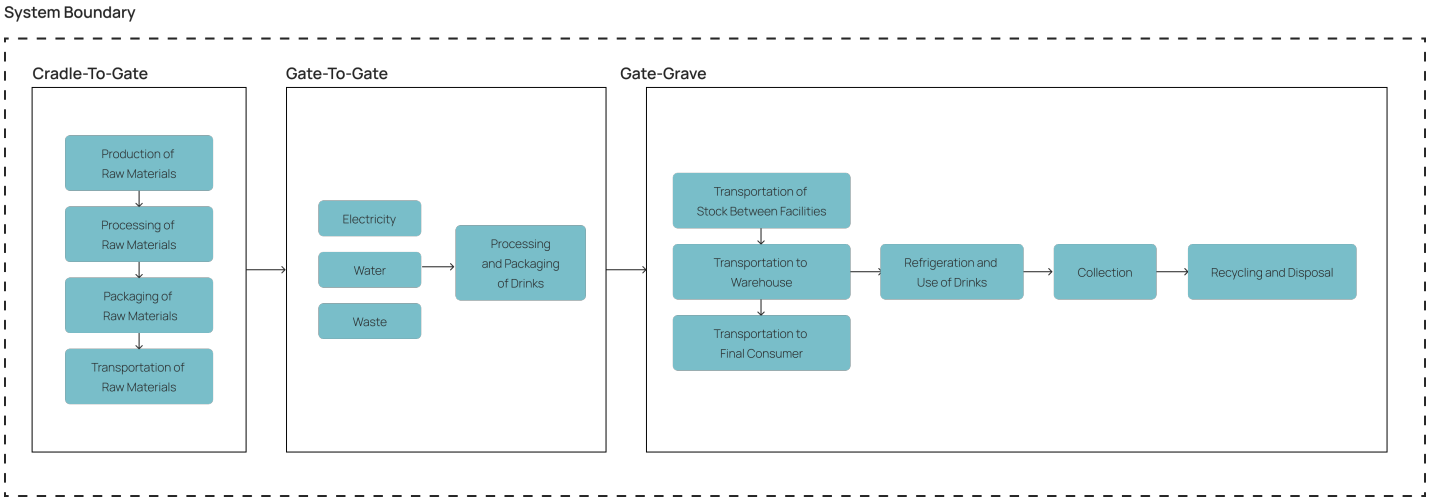

Figure 1: The system boundaries for MOTH Drinks' products life cycle.

2.3 System boundary

The system boundary for this cradle-to-grave life cycle assessment (LCA) of the products analysed encompasses all stages of the product's lifecycle, from the extraction of raw materials to the end of the life of the product. The study includes all direct and indirect GHG emissions associated with the production, packaging, transportation, distribution, consumption, and disposal of the products. Figure 1 shows the system boundary grouped by categories for results.

2.4 Impact Factors

The scope of this assessment is limited to global warming potential (GWP) which is measured as a function of carbon dioxide equivalent (CO_2e). This impact category uses the global warming potential of CO_2 as a reference value and analyses gases' environmental impact over a 100-year period (GWP1000). The GHG gases considered included: CO_2, CH_4, N_2O, HFCs, PFCs, NF_3 and SF_6.

3 Inventory Analysis

3.1 Data Collection and Uncertainty

MOTH Drinks provided records of all data necessary for the completion of the analysis. Where data had not already been collected or needed further detail, suppliers were contacted directly for activity data or industry averages were used and have been referenced. All data collected in this study from MOTH Drinks refers to the period of Feb 22 to Jan 23, aligned with MOTH Drinks' financial reporting period.

Emission factors are the GHG emissions per unit of activity data, and they are multiplied by activity data to calculate GHG emissions. Due to the available data of published reports in the industry, emission factor data in this study were collected from various published sources, including life cycle databases, published product inventory reports, government agencies, industry associations, company-developed factors, and peer-reviewed literature.

It should be noted that within the cocktail industry, there is a lack of data on specific studies on spirits and flavourings used in the ingredient section of this report. Due to this, proxy data has had to be used for a number of ingredients purchased by MOTH Drinks. Working with the supply chain to get supplier-specific GHG emission product data should be a focus and will allow MOTH Drinks in to further increase the accuracy of the analysis. A full breakdown of sources is detailed in the supplementary data. To ensure accuracy in emission results all emission factors used are checked with consideration of the Location, Time Frame, Supply Chain, and Completeness.

- **Location** Different locations can create disparities in GHG emissions. Therefore, a hierarchical approach was used in order to obtain the most accurate emission factor (country region, country, continent or global), depending on the availability of data.

- **Time Frame** The latest available and appropriate emission factors are used within the analysis. The creation and updating of emission factors can differ between each study, as a result, the emission factors used within a study can be across a range of different years. Where appropriate, the most recent emission factor was used.

- **Supply Chain** Where available, this study looked to use supplier-specific data for supply chain GHG emissions. Supplier-specific emission factors are reviewed against the Product Life Cycle Accounting and Reporting Standard to ensure accuracy. Supplier-specific emission factors are prioritised over location-specific emission factors.

- **Completeness** Due to the variation in sources of

GHG emissions factors, each source is reviewed internally by Zevero to ensure that all appropriate emission contributors are accounted for within the scope of the source as well as checks for the exclusion of delayed and offset emissions.

3.2 Allocation Approach

Companies often generate multiple products through processes therefore emissions must be subdivided (allocated) to respective products based on either the physical characteristics of the co-products such as mass/energy content or based on their market values (economic allocation). Within this study, multi-output allocation was performed where operational activity data was collected on the facility level. Further information can be found in section 3.5, where for example. electricity consumption was collected site-wide at the outsourced beverage facility and allocated to the volume of drinks produced within the same time period.

The end-of-life allocation of inventory data (i.e. raw materials used in the making of the products) relates to the sources used for life cycle datasets. Multiple sources were used however all sources were reviewed and adapted (if necessary) to relate to the cut-off approach. The cut-off system model is based on recycled content. In this system model, wastes are the producer's responsibility and there is an incentivisation to use recyclable products, that are available burden free. This approach was chosen to highlight the benefit of sourcing low-carbon ingredients within the drinks industry [3].

3.3 Category Model description

The below describes the inventory data used within the analysis for each category within the studied product's life cycle.

3.3.1 Ingredients

Within the creation process of MOTH Drinks, raw ingredients are purchased from suppliers and delivered to MOTH Drinks' contracted beverage facility to be made into the final product. Recipes for each product were collected from MOTH Drinks. For each product used, information was collected on the supplier, supplier location, and origin location via Unleashed software to ensure the appropriate emission factor was used. The category of 'Ingredients' is made up of separate GHG emission stages up to MOTH Drinks' contracted beverage facility. Farming or manufacturing of the raw materials that are purchased, the processing to turn raw materials into the finished products purchased as well as the packaging and transport of products. Regarding transportation, there is variation in whether GHG emission factor sources include or exclude transportation from the origin to the final destination. Therefore, if transportation is excluded, Zevero calculates this within purchases with the same methodology as in section 3.6.

3.4 Packaging

For packaging materials, the process of analysis is similar to that outlined in section 3.3.1. The GHG emission arising from aluminium cans have been analysed with respect to the study conducted by [4]. Due to the exact volumes of all cans not being analysed within the study, results have been linearly interpolated from the Can-330ml and Can-500ml analysed within the report.

Also considered for can packaging were can labels and cardboard boxes used in shipment. It is assumed that cans are sold in packs of 12 where data was gathered from MOTH Drinks on cardboard boxes and suppliers.

3.5 Processing of Products

Once raw ingredients arrive at MOTH Drinks' outsourced beverage facility they are processed into cocktails. MOTH Drinks are processed via mixing with industrial mixes powered by electricity. Furthermore, water is used as an ingredient as well as in cleaning the machinery. For the below GHG emission category, figures were obtained via meter readings and utility bills via MOTH Drinks' outsourced beverage facility. Total GHG emissions per functional unit were then calculated by volume allocation to the number of litres of product within the respective timeframe.

- **Electricity**

  Electricity is a key resource in drink processing, powering a wide range of equipment and systems throughout the industry. The majority of electricity consumption in MOTH Drinks' outsourced beverage facility can be attributed to pumping, motors, refrigeration, packaging, and lighting.

- **Water Demand**

  Both water supply and water treatment quantities were assumed to be equal as even if water is not treated onsite, the water will be treated downstream of manufacturing. The quantity of water used as an ingredient in the cocktails was gathered from recipe sheets. Water used within the cleaning and other processing aspects in MOTH Drinks was calculated by subtracting the total of all water metre readings from the total volume of water used as ingredients within the year.

- **Waste**

  GHG emissions arising from waste treatment include the transportation, sorting, reprocessing and disposal of any given material. For this study, dry waste was included in the processing phase due to it being upstream of delivery. The dry mass of food waste produced in the creation of MOTH Drinks' canned cocktails was estimated based on industry averages at 0.29kg/L, as

described within the 2016 report conducted by B. Weidema et al [5].

3.6 Transportation

The transportation category within this study includes all transportation involved in products after they leave MOTH Drinks' facility. This includes all warehouse movements, trade sales, and e-commerce sales. MOTH Drinks uses third-party logistic (3PL) providers to deliver their products. Distances were calculated from MOTH Drinks storage and production facilities to the end destination. Every delivery for the reporting year was analysed via Radar's point-to-point API, with the method of transportation and the weight of each delivery included in the calculations.

3.7 Use Phase

GHG emissions relating to the use of sold products occur from the end use of products sold by MOTH Drinks and are related to the electricity consumption used in refrigeration from end users. Refrigeration electricity consumption has been estimated to be 0.28kWh per functional unit [6].

3.8 End of Life

The end of life of sold products is the GHG emissions occurring from the waste disposal and treatment of products sold. All primary and secondary packaging were included in the analysis, as seen in Table 1. For MOTH Drinks, the GHG emissions relating to the disposal, transportation and treatment of packaging were considered. For more information on the end-of-life allocation of waste data, see section 3.2.

4 Results

All results within this report are shown in terms of the functional unit. This section further subdivides results into the life cycle categories, as well as a summary results section.

The overall results are shown for each product in Figure 2, which highlights the lowest GHG emissions per functional unit being the French 75 cocktail and the highest GHG emissions per functional unit being Old Fashioned.

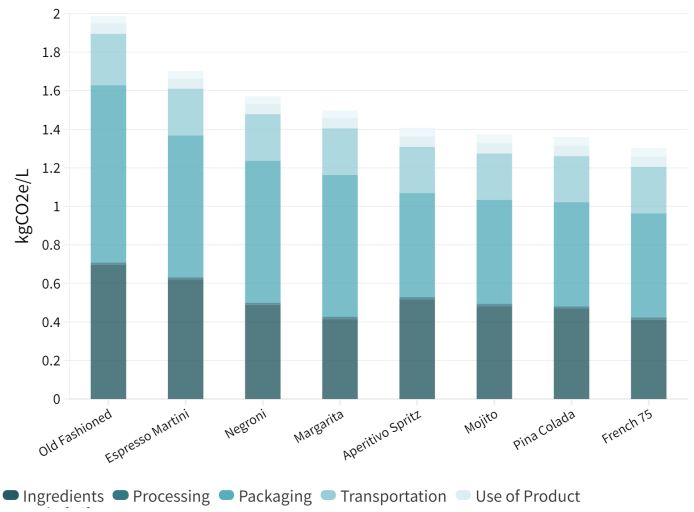

Figure 2: Figure showing the breakdown of GHG emissions relating to each core range product sold by MOTH Drinks.

4.1 Ingredients

Figure 4 gives a full breakdown of the GHG emission for ingredients used per functional unit. Where the same ingredient has been used for both products, a mean average has been displayed. The results show that the spirits used within each cocktail make up a significant proportion of GHG emissions. Furthermore, liquid sugar which is used in most products sold by MOTH Drinks has a high GHG emission contribution (0.170kgCO_2e/L on average).

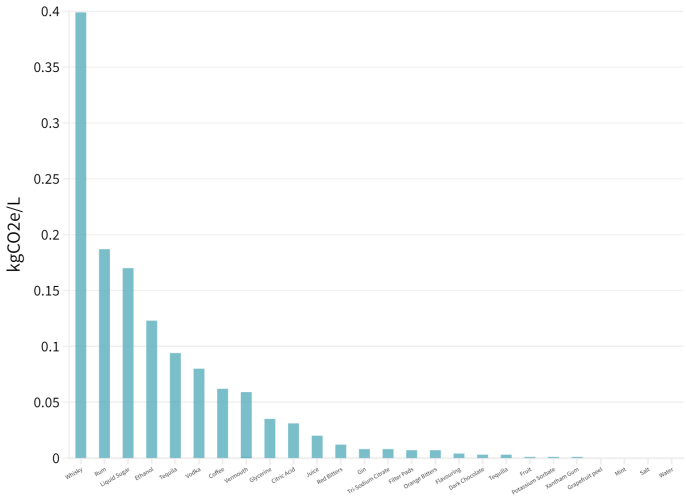

Figure 3: The breakdown of GHG emissions relating to the ingredients included within the study

4.2 Packaging

The breakdown of GHG emissions associated with packaging material is highlighted in Figure 5. 150ml Cans make up a 37% increase in can GHG emissions per functional unit compared to 200ml. This disparity is because as the size of the can decreases, the surface area to volume ratio increases, leading to a higher proportion of material needed to produce the same amount of beverage. This increased material usage results in a higher carbon footprint during the manufacturing

process for the same volume.

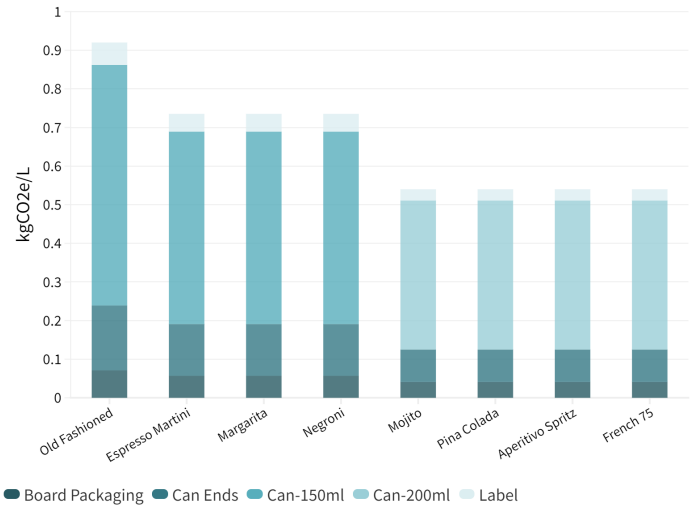

Figure 4: The breakdown of GHG emissions relating to the packaging included within the study

4.3 Processing

Electricity contributes to 42.67% of the GHG emissions associated with the processing of MOTH Drinks. Water only makes up 0.22% whereas food waste is 57.10%.

4.4 Transportation

The GHG emissions from transportation are constant for each product but differ for each packaging type, due to the difference in packaging weights per functional unit.

Per functional unit, Old Fashioned ,packaged in 100ml cans, have the highest emissions at 0.267kgCO_2e/L, 125ml packaging volumes are 0.242kgCO_2e/L and 200ml packaging volumes at 0.267kgCO_2e/L.

4.5 Use Phase

All Products have the same use phase GHG emissions 0.054kgCO_2e/L with the assumption of 0.28kWh per functional unit.

4.6 End-of-life

Figure 6 shows the GHG emissions arising from the end of life of the products sold, broken down by packaging item for each packaging type.

5 Discussion

The results show the GHG emission significance in each stage of MOTH Drinks products' life cycle. variance in GHG emission between packaging and ingredient choices.
The results highlight that packaging (44%) and ingredients (33%) are the biggest contributors to GHG emissions for products sold by MOTH Drinks. Therefore it should be of high priority for MOTH Drinks to be working with their supply chain to choose low-carbon alternatives within packaging and ingredients.

Transportation makes up 17% of products' GHG emissions on average. Due to the structure of MOTH Drinks, there are many movements of drinks around the united kingdom due to the location of outsourced facilities and warehousing. To minimise transportation, MOTH Drinks should understand where their operation can be placed to decrease the kilometres and weight of products moved.

Although processing is a less significant part of the GHG emissions of MOTH Drinks' products making sure outsourced facilities are employing good practices will be important as MOTH Drinks continue to grow.

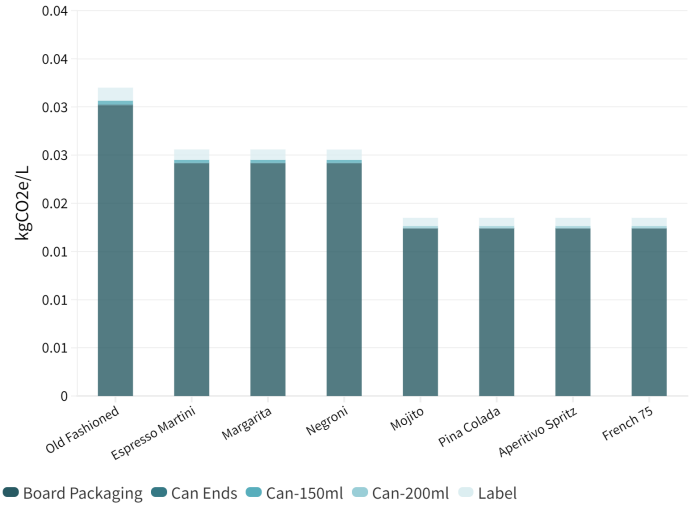

Figure 5: The breakdown of GHG emissions relating to the end of life of packaging included within the study

6 Conclusion

An environmental assessment was undertaken for the greenhouse gas (GHG) emissions of the core range sold by MOTH Drinks. The analysis is from cradle-to-grave and analyses three. The results are split into stages of Ingredients, Packaging, Processing, Transportation, Use, and End-of-Life. The highest GHG emission product was Old Fashioned due to the packaging size of the product at 1.99kgCO_2e/L whereas the French 75 has the least GHG emissions attributed to the life cycle at 1.30kgCO_2e/L. For all products, packaging and ingredients made up the majority of GHG emissions.

7 Supplementary Data

To be made available on request

8 Assurance

Zevero Ltd has undertaken a first-party limited assurance review of the Greenhouse Gas Analysis of MOTH Drinks, with the conducting participants not responsible for the

GHG inventory process. Conflict of interest was avoided by best academic integrity practices and mutually exclusive reviewed data by participants with necessary academic GHG inventory competencies.

Procedures of assurance were performed by counter calculation and were dictated by inspection of documents, assessment of the appropriateness of methods and cross-referenced verification of obtained data.

Based on the review performed and the data gathered, nothing has come to our attention that the inventory process and subsequent GHG emission findings are not in accordance with the GHG Protocol Product Standard.

Zevero Ltd, London, UK.

9 References

[1] P. Bhatia, C. Cummis, D. Rich, L. Draucker, H. Lahd, and A. Brown, "Greenhouse gas protocol corporate value chain (scope 3) accounting and reporting standard," 2011.

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[4] R. E. SA, "Life cycle assessment of metal packaging in europe - update," 2022.

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