LCA of Beverage Packaging

in Australia and New Zealand

Created by thinkstep-anz on behalf of Tetra Pak

ZP104200
January 2026
Public Report

Document approval and revision

Client:	Tetra Pak Oceania
Project name:	Life Cycle Assessment for Tetra Pak Oceania
Project number:	ZP104200
Report title:	LCA of Beverage Packaging in Australia and New Zealand
Report version:	2.0
Report date:	January 2026
Report copyright:	thinkstep pty ltd
Cover photo:	Tetra Pak
Author(s):	Gayathri Gamage | Head of Quality Assurance Chia Wu Tan | Sustainability Specialist
Quality assurance:	Emily Townsend | Services Director Jeff Vickers | Technical Director
Approved:	Gayathri Gamage | Head of Quality Assurance
Endorsed:	Emily Townsend | Services Director
Sensitivity:	Not confidential
Audience:	Public
Contact:	thinkstep pty ltd 25 Jubilee Street South Perth Western Australia 6151 Australia www.thinkstep-anz.com anz@thinkstep-anz.com +61 2 8007 5201

Suggested citation format:
thinkstep-anz. (2026). LCA of Beverage Packaging in Australia and New Zealand, Perth: thinkstep-anz.

Version	Date	Changes	Author	Reviewer	Approved
1.0	07/10/2025	Report issued to client	GG, CT	ET, JV	GG
2.0	27/01/2026	Update to packaging scope	CT, GG	ET	GG

Executive summary

Why Tetra Pak Oceania commissioned this report

Tetra Pak engaged thinkstep-anz to carry out an updated Life Cycle Assessment (LCA) study comparing the environmental performance of beverage cartons to other packaging choices available in the Australia and New Zealand markets in 2024. This study is intended for staff, customers, and other stakeholders.

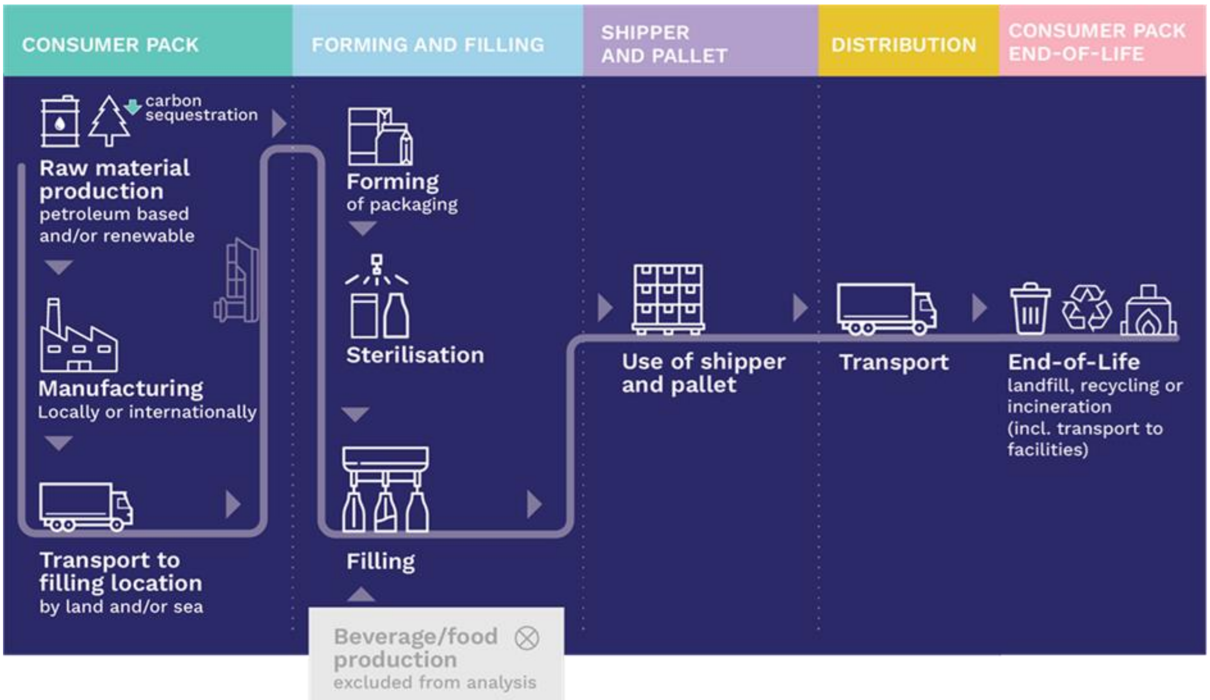
What we did

We used Life Cycle Assessment (LCA) to help Tetra Pak understand the environmental performance of different packages available across Australia and New Zealand.

The goals of our LCA were to:

1. **Quantify the environmental performance of different options** within each beverage category, size class and use (fresh or aseptic).
2. **Compare the environmental footprint of packages** to identify environmentally preferable options, with a focus on the carbon footprint.

This study covers the full life cycle of beverage packaging as shown in Executive Summary Figure 1.



Executive Summary Figure 1: Beverage packaging life cycle

Environmental impacts of beverage production and transport are not included in the study. Refrigeration impact for chilled products at retail outlets and after leaving the outlets are also excluded.

To make fair comparisons, different types of packaging are grouped by how they're used (fresh or aseptic) and by size. The beverage packaging choices we investigated:

- **packaging sizes** (from 250mL to 2L)
- **products** (white milk, ready-to-drink (RTD) coffee and Food Supplement & Nutrition (FSN), and juice
- **ways these products are filled** (including fresh products that need refrigeration, shelf-stable aseptic packaging, and chilled aseptic packaging)
- **primary packaging materials** (cartons, PET bottles, recycled PET (rPET) bottles, HDPE bottles, pouches, aluminium bottle cans, and glass bottles).

We included details from 26 carton designs based on Tetra Pak's specifications and collected data. For the packaging types which Tetra Pak does not produce, we purchased 78 packages from retailers in Australia and New Zealand in 2024. These were cleaned, weighed, and then compared. Where the required size class was unavailable, we scaled existing packs to match the required size class.

We used forming and filling data from the previous version of the study (thinkstep-anz, 2021). We excluded the impacts of printing inks for all packaging types. We also excluded shrink wrap used for wrapping products on pallets (tertiary packaging) and impact from the retail stage (e.g., chilling).

The study looks at three levels of packaging:

- **Primary packaging:** the packaging used by consumers.
- **Secondary packaging:** plastic wrapping, one-way cardboard shipping cartons or reusable crates.
- **Tertiary packaging:** wooden pallets used for transport.

The standards we followed

This study complies with international standards ISO 14044:2006 for LCA and ISO 14067:2018 for product carbon footprint. The other environmental impact indicators we used align with the guidelines of the Product Category Rules (PCR) for packaging (PCR 2019:13) **(EPD International, 2024)**. Our headline indicator is the carbon footprint (also known as Global Warming Potential (GWP) which measures greenhouse gas emissions over the full life cycle). We also used guidance from PCR EN 16485 **(CEN, 2014)** for timber products in construction to model biogenic material and treatment of biogenic carbon.

As a comparative study, it has undergone a critical review by a panel of three independent experts.

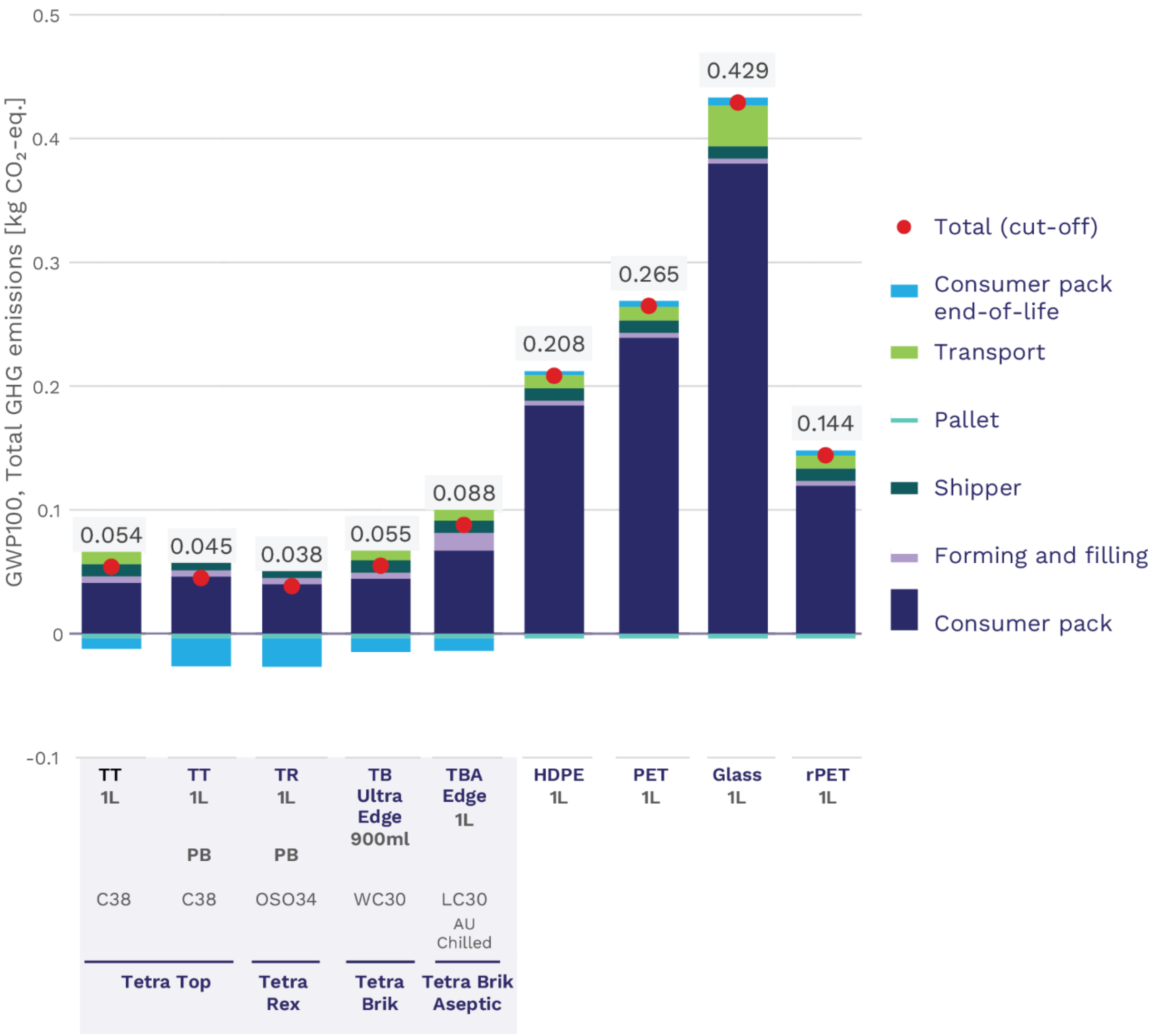
The environmental indicators we assessed

The study focused on key environmental indicators to evaluate the impact of different packaging options. Carbon Footprint (Global Warming Potential - GWP) is the primary measure used to quantify the greenhouse gas emissions associated with the life cycle of packaging. A range of other environmental indicators are included but only discussed in the main report if they significantly alter conclusions based on the carbon footprint. Some indicators, including those related to human toxicity, were out of scope for this study.

Results in these environmental indicators are relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks.

What we found

- Among the packaging compared in this study, **cartons maintain their position as a lower-carbon option** under all scenarios in Australia. Meanwhile, cartons result in one of the lowest carbon footprint options in New Zealand.
- **The production stage has the most significant impact** on the carbon footprint of consumer/primary packaging (see example comparison in Executive Summary Figure 2).



Abbreviations used in the figure: Tetra Top (TT), Tetra Rex (TR), Tetra Brik (TB), Tetra Brik Aseptic (TBA). C38, OSO34, LC30, WC30, LW30 are closure types. Plant Based (PB), recycled polyethylene terephthalate (rPET), high density polyethylene (HDPE)

Executive Summary Figure 2: Carbon footprint comparison of 1L chilled milk packaging - AU

- The **mass of packaging and component materials** significantly influence its carbon footprint.
- For most packaging types, **forming and filling have an insignificant carbon footprint**. Impact is driven by electricity at the location where packaging is filled.
- **Distribution has a low relative impact on carbon footprint results**, mainly due to the lightweight nature of most consumer packaging and the exclusion of beverage mass in transport impact calculations for both chilled and ambient conditions.

- Based on end-of-life rates (landfill and recycling), the degradable organic carbon fraction (DOC_f) value for paperboard (0.21), the landfill gas capture rate (68%), and the overall methodology used for biogenic carbon treatment in this study, the consumer end-of-life of cartons is assessed using a conservative approach. In this approach, biogenic carbon sequestration and release lead to a small net sequestration, mainly due to high landfill rates (71% for Australia and 99% for New Zealand) and low degradation rates (21%). **End-of-life carbon footprint remains minor for the overall life cycle, hence not significant.**
- Since the **New Zealand electricity grid has a lower carbon emission factor than Australia's**, packaging manufactured and filled in New Zealand has a lower carbon footprint than that produced and filled in Australia. **The difference in carbon footprint between Australia and New Zealand is significant.**

Packaging types compared

In the Australian market:

- **cartons have one of the lowest whole life cycle carbon footprints** of all beverage packaging options considered in this study.

In the New Zealand market:

- for beverage packaging **below 750mL, cartons have the lowest carbon footprint** of all options considered in this study
- for **1.5L beverage packaging, locally recycled PET (rPET) bottles have comparable carbon footprint to cartons** due to New Zealand's highly renewable electricity mix.

Impact of recycled materials

Glass packaging has the highest carbon footprint when included in the comparison, while aluminium cans also show a high footprint. Using recycled glass and aluminium significantly lowers their environmental impacts compared to virgin materials. However, even with recycled content, the carbon footprint of glass and aluminium packaging always remains significantly higher than that of cartons.

Contributions from secondary packaging

Secondary packaging, such as corrugated cardboard boxes, can contribute significantly to the carbon footprint due to its higher mass per unit compared to alternatives like reusable crates. This choice is typically made by the packaging consumer.

Sensitivity analysis

To account for areas of uncertainty and methodological choices, sensitivity analysis was carried out. This includes investigating: carton end-of-life alternative scenarios, recycled content of glass, recycling content and carbon emission factors for aluminium cans, methodological approach to release biogenic carbon when recycling at end-of-life, and impact of distribution distance.

Analysis shows that:

- **End-of-life parameters** such as degradable organic carbon fraction (DOC_f), landfill gas capture rate and recycling/landfilling rates **are significant for cartons.**
- **Cartons have the lowest or one of the lowest carbon footprints of all packaging systems** considered by this study, irrespective of which end-of-life allocation method is applied.
- When the recycled content of glass and aluminium are increased, carbon footprint of glass and aluminium packaging decreased. However, **cartons still outperform both glass and aluminium packaging.**
- The modelling approach used in this study releases biogenic carbon when materials containing biogenic carbon are recycled at end-of-life. **The amount of biogenic carbon released depends on the recycling rate.** Under this approach, the carbon footprint of cartons increases with increasing recycling rates. Meanwhile, only a portion of the biogenic carbon is released (according to the DOC_f) when cartons are sent to landfill. In this study, the baseline recycling rates are low for both Australia (29%) and New Zealand (1%). However, the overall approach led to conservative results for cartons, making the results for cartons conservative.
- **Results are sensitive to distribution distance.**

Comparison to the previous study

Compared to the previous study, this study shows:

- Lower carbon footprint impacts for glass, PET and rPET packaging – significant change
- Similar carbon footprint for aluminium packaging – no significant change
- Higher carbon footprint for pouches – significant change
- Variable results for cartons depending on the average mass of cartons.

Reasons for differences in results include a combination of:

- Lightweighting of some packaging (rPET)
- Increased recycled contents for glass bottles (70% baseline for this study)
- Updated background data (carbon emission factors) for modelling (i.e. changes to emission factors for materials and processes).

The mass of the cartons determined the carbon footprint comparison with the previous study. Since different cartons were used in the two studies, average carton masses were used for comparison. When the average mass was higher than in the 2021 study, the carbon footprint in this study was also higher, and vice versa.

The paperboard has higher embodied carbon compared to the version used in the original LCA and is based on Tetra Pak's global three-year running average for paperboard. However, this has not impacted on carbon footprint of cartons in a significant way.

The increased recycled content in glass packaging led to significant reductions in carbon footprint in this study. Although the recycled content of aluminium also increased, the use of a global average carbon emission factor for aluminium resulted in no change in the overall carbon footprint of aluminium cans. The combined effects of lightweighting and a lower carbon emission factor for electricity significantly reduced the carbon footprint of rPET packaging in this study.

Our recommendations

Use low-carbon materials
For aseptic cartons, source aluminium with the lowest possible carbon emission factor.

Use recycled content in cartons
Source materials with the highest possible recycled content. Ensure suppliers provide independent verification of the recycled content to confirm sustainability claims.

Adopt bio-based materials
Replace fossil-fuel-based materials with bio-based alternatives to reduce environmental impacts.

Improve data quality for plastic materials
While Tetra Pak-sourced plastic appears to have a low carbon footprint, this study lacks official LCA data from suppliers. Obtain primary data for plastic (granulate) production from suppliers, or third-party-certified LCA data on plastic materials to improve accuracy and reliability in future studies.

Improve data quality for biodegradability of beverage cartons in landfills
Commission a desktop bioreactor study into the biodegradability of beverage cartons in landfills to reduce the uncertainty regarding the degradable organic carbon fraction (DOCf) of laminated and coated paperboard, improving accuracy and reliability in future studies.

Optimise packaging for chilled and ambient conditions
Conduct a market survey to understand retailer and customer behaviour when packaging products for chilled and ambient conditions. Since packaging chilled products in aseptic cartons has a higher carbon footprint, consider using non-aseptic packaging for beverages that require refrigeration.

Table of Contents

1. Goal of the Study

Tetra Pak is one of the world's leading suppliers of food and beverage packaging systems, with products to suit a wide variety of requirements. Several comparative Life Cycle Assessment (LCA) studies of Tetra Pak products have already been completed across the European, North American and Oceania markets. thinkstep-anz completed the original comparative LCA study for Tetra Pak Oceania in 2021 (thinkstep-anz, 2021). Tetra Pak Oceania has engaged thinkstep-anz to refresh this assessment to include updated data for existing products (white milk and juice) and to capture the impact of a new product range (Ready to Drink (RTD) coffee and Food Supplement & Nutrition (FSN)). The water category included in the 2021 study is not updated in this report.

This study aims to conduct a robust and transparent LCA of Tetra Pak packaging systems in comparison to a range of competitive packaging systems found in Australia and New Zealand. It is primarily based on data collected between October 2024 and November 2024. Some data from the previous study, for example forming and filling data, were also used in this study. The packaging systems included in the study are given in Table 1-1.

Table 1-1: Product categories included in the study

Product categories	Australia		New Zealand	
	2021	This study	2021	This study
White milk	✓Yes	✓Yes	✓Yes	✓Yes
RTD coffee and FSN	✗No	✓Yes	✗No	✓Yes
Juice	✓Yes	✓Yes	✓Yes	✓Yes
Water	✓Yes	✗No	✓Yes	✗No

To make fair comparisons, different types of packaging are grouped by how they're used (fresh or aseptic for beverages) and by size (ranging from 200mL to 2L). Tetra Pak packaging is compared with alternative packaging options within these groups in most cases. The full explanation of these comparison categories is provided in Section 2.

The main difference between fresh and aseptic carton packaging is the use of an aluminium foil barrier in aseptic packs. This layer blocks oxygen and light, helping preserve perishable drinks for months without refrigeration. While aseptic packaging does not require refrigeration, there are some exceptions to this approach. For example, some beverage types in both the chilled and ambient categories use aseptic packaging, but are still stored and transported chilled - reflecting how they are handled in certain markets.

The study complies with international standards ISO 14040:2006 (ISO, 2006a) and ISO 14044:2006 (ISO, 2006b). The carbon footprint also complies with ISO 14067:2018 (ISO, 2018) for product carbon footprinting. The impact indicators used in the study align with the guidelines of the Product Category Rules (PCR) for packaging (PCR 2019:13) (EPD International, 2024).

This study intends to provide Tetra Pak with a factual basis with which it can make statements to current and potential clients about the environmental performance of its packaging when compared to other systems. These statements will focus on:

- The carbon footprint of products; and
- Packaging metrics such as:
  - The mass of product that can be contained by a certain amount of packaging (product-to-packaging ratio)
  - How much plastic packaging is required to contain a fixed volume of product (plastic-per-litre ratio)

The packaging metrics are provided to align with the methodology of the previous study (thinkstep-anz, 2021) and to enable high-level comparison of packaging across the two studies (applicable for juice and white milk).

Other indicators as listed in PCR 2019:13 (acidification potential, eutrophication potential (aquatic freshwater, aquatic marine, terrestrial), photochemical ozone creation potential, abiotic depletion for non-fossil resources, abiotic depletion for fossil resources, and ozone depletion potential) are given in Annex F but are not commented upon in detail within this report unless they change the conclusions drawn from the carbon footprint alone.

Because the results from this study will be used to make public comparative assertions, this study has been critically reviewed by a panel of experts in both LCA and packaging, as required by ISO 14044:2006 (ISO, 2006b) and ISO 14067:2018 (ISO, 2018). A critical review statement can be found in Annex I.

2. Scope of the Study

The following sections describe the general scope of the project to achieve the stated goals. This includes, but is not limited to, the identification of specific product systems to be assessed, the product function(s), functional unit and reference flows, the system boundary, allocation procedures, and cut-off criteria of the study.

Product Information

The products analysed in this study include a range of packaging systems for a variety of beverages within markets in Australia and New Zealand. These systems cover:

- A range of packaging size classes (from 250mL to 2L), and
- A range of product categories (white milk, RTD coffee and FSN, and juice).

The primary packaging materials considered include:

- Cartons (aseptic cartons made of paper, plastic and aluminium laminate layers for long-life or shelf-stable beverages; and fresh or non-aseptic cartons made of paper and plastic laminate layers for chilled beverages),
- Polyethylene terephthalate (PET) bottles,
- Recycled polyethylene terephthalate (rPET) bottles,
- High-density polyethylene (HDPE) bottles,
- Pouches (laminate made of plastic and aluminium layers),
- Aluminium cans, and
- Glass bottles.

Table 2-1 and Table 2-2 summarise the packaging size classes and materials considered in this study for Australia and New Zealand respectively. Secondary packaging (a one-way shipper carton or reusable plastic crate) and tertiary packaging (a wooden pallet) are also included as part of the packaging system.

Data for the individual packages was obtained by weighing 78 packages available in Australia and New Zealand between October 2024 and November 2024. These packages were filled within Australia and New Zealand. 65 out of the 78 packages were purchased within Australia. The beverage brands are available across both markets with the same packaging. Chilled milk and juice were purchased across both countries while RTD coffee and FSN packages were purchased from Australia.

All packages were purchased from retailers, disassembled, cleaned, dried, and weighed. Where possible, three different packages (i.e., three different brands (not replicates of the same package) for a beverage category, function and size class) for each primary material (PET, glass, etc.) were weighed and an average mass was taken for each product category and size class per market. However, it was not always possible to purchase three brands for some material types as there was not a large enough range of brand options available in supermarkets. Where possible, the average mass of packages was calculated using a combination of packs from Australia and New Zealand. The averaged mass was then used for impact assessment across both Australia and New Zealand.

Carton details such as layer thicknesses were derived from 26 types of Tetra Pak carton design specifications. In the previous study, the difference between the measured Tetra Pak carton mass data and the mass calculated from specifications was found to be negligible. Therefore, this study uses specification data for Tetra Pak cartons rather than purchasing and measuring the cartons.

Packaging systems with the same beverage type, size class, and country of purchase have been presented together in the main body of this report. Results for aseptic packaging (packaging with aluminium foil layer used for long-life or shelf-stable products) are shown separately due to different carton compositions. The distribution conditions - either ambient or chilled - are also noted. Aseptic packaging is designed for shelf-stable or long-life products and can be distributed under ambient conditions. In contrast, non-aseptic cartons and their fresh or short-life beverages must be delivered and stored under chilled conditions. This report includes some scenarios (e.g. in the RTD Coffee and FSN category), where aseptic cartons are compared against non-aseptic cartons, reflecting market conditions where aseptic cartons are also chilled.

Table 2-1: Summary of packaging size classes and materials for Australia

Product category	Size (mL)	Ambient/ Chilled	Tetra Pak carton	PET	rPET	Al Can	Glass	Pouch	HDPE
Milk	750	Chilled	X	X	X				
	1,000	Ambient	X						
	1,000	Chilled	X	X	X		X		X
	1,500	Chilled	X	X	X				
	2,000	Chilled	X						X
RTD Coffee and FSN	250	Ambient	X			X			
	300	Ambient	X	X	X				
	330	Ambient	X	X	X				
	500	Ambient	X	X	X				X
	500	Chilled	X						
Juice	250	Ambient	X	X			X	X	
	300	Chilled	X	X	X		X		
	500	Ambient	X	X	X		X		
	500	Chilled	X	X	X				
	1,000	Ambient	X	X	X		X		
	1,000	Chilled	X	X	X				
	1,500	Ambient	X	X	X				
	2,000	Chilled	X	X	X				X

Table 2-2: Summary of packaging size classes and materials for New Zealand

Product category	Size (mL)	Ambient/ Chilled	Tetra Pak carton	PET	rPET	Al Can	Glass	Pouch	HDPE
Milk	750	Chilled	X	X	X				
	1,000	Ambient	X						
	1,000	Chilled	X	X	X		X		X
	1,500	Chilled	X	X	X				
	2,000	Chilled	X						X
RTD Coffee and FSN	250	Ambient	X			X			
	300	Ambient	X	X	X				
	330	Ambient	X	X	X				
	500	Ambient	X	X	X				X
	500	Chilled	X						
Juice	250	Ambient	X	X			X	X	
	300	Chilled	X	X	X		X		
	500	Ambient	X	X	X		X		
	500	Chilled	X	X	X				
	1,000	Ambient	X	X	X		X		
	1,000	Chilled	X	X	X				
	1,500	Ambient	X	X	X				
	2,000	Chilled	X	X	X				X

High-level details and assumptions per packaging material are described below:

- Cartons are manufactured from a multi-layer paperboard/plastic, and aluminium (where applicable) laminate that is produced in Europe and distributed either as a roll or as blanks to converting facilities.
  - While Tetra Pak cartons were converted primarily in Beijing (China), some packs were converted in Binh Duong (Vietnam), Budaors (Hungary), Chakan (India), Dijon (France), Izmir (Turkey), Kunshan (China), Limburg (Germany), Ponta Grossa (Brazil), Rubiera (Italy), Sunne (Sweden), Taoyuan (Taiwan).
  - Closures were manufactured in Thailand, France, Hungary, Spain and Italy.
  - Carton components are then transported to the markets (Australia and New Zealand) where they are formed and filled. More details of the manufacturing locations of cartons and closures can be found in Annex C.4.
- It is assumed that plastic packaging is manufactured in Australia and New Zealand using raw materials sourced from China.
  - Virgin PET bottles are assumed to be manufactured from plastic granulate manufactured in Asia and formed locally in Australia and New Zealand. Both the manufacturing of the pre-form and bottle blowing are assumed to occur in-market.
  - Virgin HDPE bottles are also assumed to be manufactured using granulate from China, and formed locally.
  - Recycled PET bottles are assumed to be manufactured from plastic granulate that is obtained from recycled PET bottles in-market (i.e., within Australia and New Zealand). The pre-form and bottle blowing are both assumed to occur in-market.
- Pouches are assumed to be manufactured in China and then transported to Australia or New Zealand for filling.
- Glass containers are assumed to be manufactured locally in either Australia or New Zealand using standard manufacturing techniques. The baseline scenario in the study contains 70% recycled content.
- Aluminium cans are assumed to be manufactured using 70% recycled aluminium (30% virgin aluminium). using standard manufacturing techniques. It is assumed that cans are manufactured from coils of rolled aluminium purchased on the global market. Aluminium ingot reflects global average production mix.

These assumptions do not necessarily reflect market-average performance for each packaging material (e.g., recycled plastic granulate may be imported and pre-forms can be manufactured offshore). Instead, a conservative approach has been used, which means that, where there is uncertainty, a choice has been made in a way that is designed to favour alternative packaging formats over cartons. Due to significant variability within the aluminium supply chain which has a significant influence on the results, scenario analysis is conducted using 70% recycled aluminium.

2.1. Product Function(s) and Functional Unit

The functional unit of this study is based on one unit of consumer packaging, as delivered to the retailer and disposed of by the consumer. This means that this report includes multiple functional units due to the variety of packaging sizes assessed. A distinction is made between short-life or fresh products packaged in non-aseptic packaging and long-life or shelf-stable products packaged in aseptic packaging. Within each of these categories, a key assumption was made that all packaging options fulfil the equivalent function of protecting the product and that there is no difference in shelf-life.

Comparisons are only made within the same size class – products of different size classes are not compared. The results are deliberately not normalised (e.g., to 1L of beverage) because packaging suppliers optimise their packs to meet each given size class and consumers typically purchase packs that suit their consumption patterns. So, for example, a consumer who purchases a 2L milk bottle is likely to purchase this instead of four 0.5L bottles because they are more likely to consume large amounts of milk or are more cost-driven than the average consumer.

This study looks at the impacts of specific Tetra Pak cartons compared to competitor packaging. The Tetra Pak packaging types in this study are shown in Figure 2-1. Details of Tetra Pak cartons for Australia and New Zealand are given in Table 2-3. Two versions of Tetra Pak cartons are included in this study:

1. Cartons with fossil-based plastics (HDPE closures and laminate coating)
2. 'Plant-based' versions of cartons where plastics used for closures and laminate coating are made of bio-based plastics: bio-HDPE and bio-LDPE respectively. Both bio-HDPE and bio-LDPE are made from sugarcane. They are non-biodegradable and have the same properties as fossil-fuel based HDPE and LDPE plastics (see sections 3.3.2.3 and 3.8.3).

The competitor packages represent an average package of a specific size class per beverage and material in Australia and New Zealand. For example, the average package for juice in a 1L PET bottle is calculated using three 1L PET bottles used to package juice of three different brands. In some cases, an average of three packs could not be formed as multiple packaging brands for the beverage in the specific size class were not available. Where this occurs, notes are provided to describe the specifics (i.e. whether it is a 2-pack average or a single pack). Some Tetra Pak cartons were not available in the Australia or New Zealand markets at the time when weighing was done (see Section 3.2). All packs (cartons, bottles, cans, pouches) included in the study are presented in Annex B.3 and B.4.

Tetra Brik Aseptic (TBA)

Tetra Stelo Aseptic (TSA)

Tetra Prisma Aseptic (TPA)

Tetra Top (TT)

Tetra Rex (TR)

Figure 2-1: Tetra Pak cartons analysed

Table 2-3: Tetra Pak cartons analysed for Australia and New Zealand

Category	Pack Description	Short Name	Size (mL)	Carton mass (g)	Straw	Closure	Closure details	Closure mass (g)	Package mass (g)
Milk	Tetra Brik Slim Aseptic 1L HC23 Ambient	TBA 1L Slim HC23	1,000	30.5	No	Yes	HC23	2.7	33.2
	Tetra Brik Edge Aseptic 1L LC30 Ambient - carton	TBA 1L Edge LC30	1,000	29.6	No	Yes	LC30	1.05	30.7
	Tetra Brik Edge Aseptic 1L LW30 Ambient - plant-based	TBA 1L Edge LW PB	1,000	29.6	No	Yes	BIO LW30	1.3	30.9
	Tetra Brik Square Aseptic 1L HC27 Ambient	TBA 1L Square HC27	1,000	31.3	No	Yes	HC27	3.88	35.2
	Tetra Top 1L C38 Chilled	TT 1L C38	1,000	22.5	No	Yes	C38	2.8	25.3
	Tetra Top 1L C38 Chilled - plant-based	TT 1L C38 PB	1,000	22.5	No	Yes	BIO C38	2.8	25.3
	Tetra Rex 1L OSO34 Chilled - plant-based	TR 1L OSO34 PB	1,000	20.2	No	Yes	BIO OSO34	4.1	24.3
	Tetra Brik Edge Aseptic 1.5L Ambient WC30 - carton	TBA 1.5L Edge WC30	1,500	30.8	No	Yes	WC30	1.31	32.1
	Tetra Brik Ultra Edge 900mL WC30 Chilled	TBA 900mL Ultra Edge WC30	900	28.6	No	Yes	WC30	1.31	29.9
	Tetra Rex 750mL OSO34 Chilled	TR 750mL OSO34	750	17.9	No	Yes	OSO34	4.1	22
	Tetra Brik Slim Aseptic 250mL Ambient	TBA 250mL Slim	250	9.22	Yes	No	-	-	9.86

Category	Pack Description	Short Name	Size (mL)	Carton mass (g)	Straw	Closure	Closure details	Closure mass (g)	Package mass (g)
RTD Coffee and FSN	Tetra Prisma Edge Aseptic 300mL DC26 - carton	TPA 300mL Edge DC26	300	11.5	No	Yes	DC26	3.71	15.2
	Tetra Prisma Edge Aseptic 300mL DC26 - plant-based	TPA 300mL Edge DC26 PB	300	11.5	No	Yes	DC26	3.71	15.2
	Tetra Prisma SQ Aseptic 330mL DC26 – carton	TPA 330mL Square DC26	330	12.8	No	Yes	DC26	3.71	16.5
	Tetra Top C38 330mL - carton	TT 330mL C38	330	10.9	No	Yes	C38	2.8	13.7
	Tetra Prisma Edge Aseptic 500mL DC26 – carton	TPA 500mL Edge DC26	500	18.5	No	Yes	DC26	3.71	22.2
	Tetra Top 500mL C38 - carton	TT 500mL C38	500	14.6	No	Yes	C38	2.8	17.4
	Tetra Top 500mL C38 - plant-based	TT 500mL C38 PB	500	14.6	No	Yes	BIO C38	2.8	17.4
	Tetra Brik Base Aseptic 250mL paper straw	TBA 250mL Base paper straw	250	6.29	Yes	No	-	-	6.93
Juice	Tetra Brik Base Crystal Aseptic 200mL paper straw - carton	TBA 200mL Base Crystal paper straw	200	8.48	Yes	No	-	-	8.56
	Tetra Prisma Edge Aseptic 250mL DC26 - carton	TPA 250mL Edge DC26	250	11	No	Yes	DC26	3.71	14.7
	Tetra Stelo Aseptic 1L WC - carton	TSA 1L WC30	1,000	30.2	No	Yes	WC30	1.31	31.5
	Tetra Rex 1L - carton	TR 1L EO	1,000	16.7	No	No	-	-	16.7
	Tetra Rex 2L	TR 2L EO	2,000	29.3	No	Yes	OSO34	4.1	33.4

Category	Pack Description	Short Name	Size (mL)	Carton mass (g)	Straw	Closure	Closure details	Closure mass (g)	Package mass (g)
	Tetra Rex 2L - plant-based	TR 2L PB	2,000	24.6	No	Yes	BIO OSO34	4.1	28.7
	Tetra Pak Square Aseptic 1L HC27	TPA 1L Square HC27	1,000	31.3	No	Yes	HC27	3.88	35.2

2.2. System Boundary

All packaging systems in this study are for beverages only. The packaging levels considered include the primary packaging (consumer packaging), secondary packaging (a one-way shipper carton or reusable crate) and tertiary packaging (a wooden pallet). The Australia and New Zealand markets are considered in this LCA, with the major differences between the two being the electricity mix for forming/filling, the transportation distances, and the end-of-life treatment rates. The focus of the study is the packaging; hence processes such as pasteurisation and ultra-heat treatment of beverages are not included in the study.

2.2.1. System boundary for pack comparisons

This is a cradle-to-grave analysis including material production, pack manufacture, filling, transport, and end-of-life (Figure 2-2). The forming and filling of cartons are included in the analysis. Sterilisation of the packaging material prior to filling is included where appropriate. The impact of producing the beverage is excluded from the assessment. Only the packaging portion is included for distribution and end-of-life.

Plastic bottles have been assumed to be blow moulded onsite, with offsite blow moulding not included due to previous LCA studies showing that it does not affect conclusions (Franklin Associates, 2015) (thinkstep-anz, 2021). Plastic and glass bottles are already formed when they reach the filling stage, so only need to be sterilised prior to being filled and sealed.

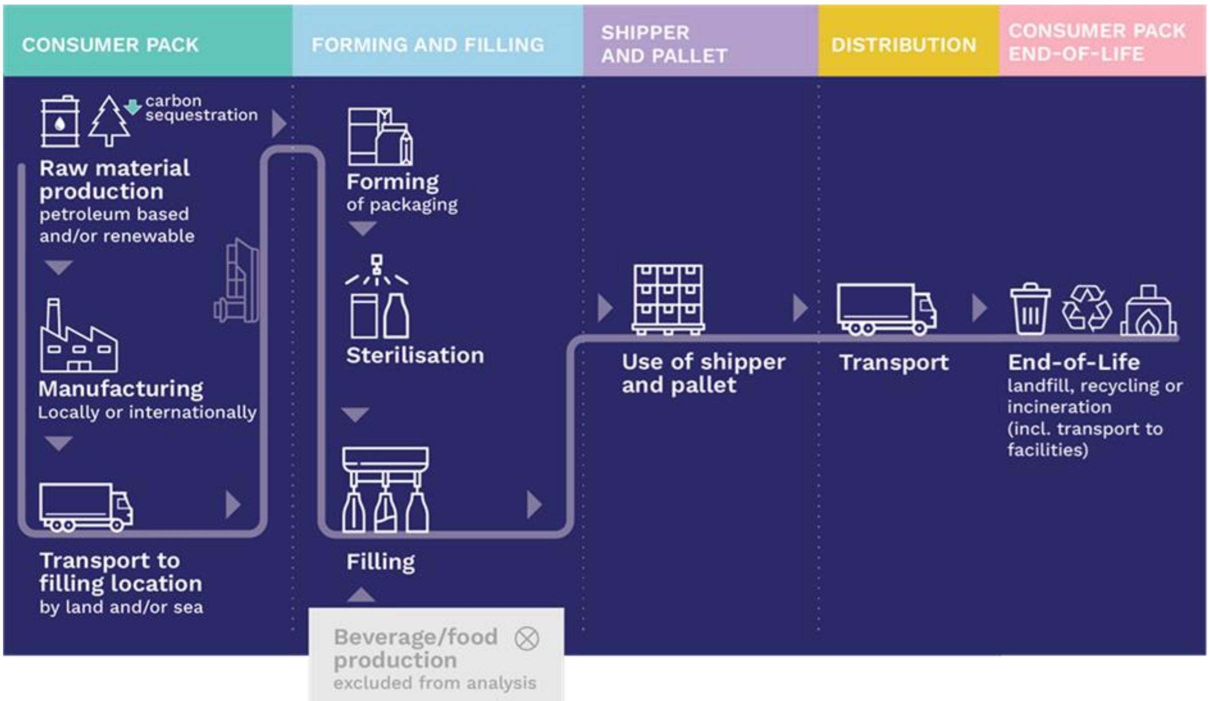


Figure 2-2: Flow diagram and system boundary – pack comparison scope

Refrigeration impacts during distribution have been included although they are minor. For chilled scenarios, a refrigerated truck is used to model distribution. Refrigeration impacts at retail are excluded as they are assumed to be part of the beverage/food life cycle and therefore not part of the packaging life cycle. This exclusion is expected to benefit heavier types of packaging, like glass, which have higher thermal mass. This methodological choice is supported by an LCA study done for Tetra Pak within the North American market, which shows that the inclusion of home refrigeration is largely irrelevant (Franklin Associates, 2015).

For biogenic materials which are recycled (paper, cardboard, bio-based plastics), the biogenic carbon that is sequestered when the material is produced is modelled as being released artificially as carbon dioxide to the atmosphere during the recycling process. This occurs due to the material leaving the system boundary to become part of another product system, in line with ISO 14067:2018 and supported by non-packaging standards such as EN 16485:2014 and ISO 21930:2017. From a carbon perspective, this makes recycling appear similar to incineration, with landfilling often appearing as preferential for biological materials, depending on the degradable organic carbon fraction (DOC_f) of the material and the landfill gas capture rate (see end-of-life sensitivity analysis in Section 5.4), However, as a generalisation, recycling of biogenic materials is likely to be environmentally preferable to landfilling because it keeps the biogenic carbon sequestered within a product.

In this study, none of the recycled raw material inputs contain biogenic carbon. In other words, the cartons labelled as plant-based in Table 2-3 are made from virgin bio-based plastics.

While included for Tetra Pak cartons, the impacts of coatings and printing inks were excluded from the study for competitor packaging. The impacts of those aspects were expected to be minimal compared to the impacts of the packaging materials and the data and impacts are in line with the Tetra Pak Oceania LCA study (thinkstep-anz, 2021). The impacts of production and distribution of the beverage or food contained within the consumer package are not within the system boundary for this study scope. A summary of key inclusions and exclusions is provided in Table 2-4.

Table 2-4: System boundaries – packaging scope

Included	Excluded
✓ Production and end-of-life of the components used in the consumer packaging ✓ Production and end-of-life of the components used in the display and shipment packaging ✓ Transportation of consumer, display, and shipment packaging from production facility to filling location ✓ Forming of cartons from laminated sheets and blowing/moulding of other packaging formats ✓ Filling of all packaging systems ✓ Transportation of consumer, display, and shipment packaging from filling to the retailer (including refrigerated transport)	× Coatings and printing inks for competitor packaging (except for Tetra Pak cartons) × Any product contained within the packaging × Intermediate packaging used in the transportation between the consumer packaging production facility and the filling location × Refrigeration of the filled packaging × Final transportation of packaging from the retailer to the consumer's home × Refrigeration at retail × Plastic shrink wrap pallet packaging (tertiary packaging)

2.2.2. Time Coverage

Data collection (measurement of packaging) for this assessment occurred between October 2024 and November 2024. Manufacturing data for Tetra Pak reflects the 2024 calendar year. The reference year for this analysis is 2024.

2.2.3. Technology Coverage

Data used is representative of the technologies available for beverage packaging companies operating in Australia and New Zealand in 2024.

Attempts were made to create an average pack composition using three packs per product category, material and size class (i.e. by using three brands to represent the respective markets). The aim of using three brands (or three single packages from different manufacturers) was to capture variation of packages within the market. However, not all product categories, materials and size classes have three brands available in the market. The number of packs used for averaging is detailed in Annex B.1.

Some packaging formats were unavailable in sizes and materials required. In the case of Tetra Pak packaging, data from specifications were used (see Section 3 for details). Where specific size classes were unavailable for non-Tetra Pak packaging, a close size was scaled to enable comparison (as detailed in Section 3.2.3).

2.2.4. Geographical Coverage

This LCA is intended to cover both the Australia and New Zealand markets and uses geographically appropriate data wherever possible. Results are presented separately for Australia and New Zealand in all cases.

2.2.5. Boundaries for manufacturing of equipment and for employees

Environmental impacts from infrastructure, construction, production equipment, and tools that are not directly consumed in the production process, ('capital goods') regardless of potential significance are excluded.

An important exception is the inclusion of capital goods for electricity generation, where the capital goods are very important for modelling changes towards more renewable generation. Capital goods related to electricity generation are included in all Managed LCA Content (MLC) electricity datasets and in all thinkstep-anz LCA studies and EPDs.

Personnel-related activities, such as transportation to and from work, are not accounted for in the LCI, while all process-related transport is included.

Note: The system boundaries on manufacturing of equipment and for employees are *not* regarded as limiting the scope of the inventory or as an incomplete inventory (i.e. a cut-off).

2.2.6. Biogenic Carbon in Packaging

All cartons (primary packaging), corrugated cardboard (secondary packaging) and wooden pallets (tertiary packaging) included in this study contain biogenic carbon. Biogenic carbon is defined as carbon derived from materials of biological origin, excluding material embedded in geological formations (ISO, 2018). The biogenic content of these materials per kg of material is shown in Annex Table D-1. The calculated biogenic carbon in packaging (per 1 primary package and per 1 secondary package) is given in Annex D.

With respect to the treatment of biogenic carbon, ISO 14067 states the following in Annex E.3:

In the case of products from biomass, carbon storage is calculated as carbon removal during plant growth and subsequent emission if the biogenic carbon is released in the use or end-of-life stages. If carbon removal from the atmosphere is included within the system boundary, the flows of biogenic carbon into and out of biomass-derived materials that are combusted as the end-of-life scenario will result in zero net contribution to the CFP, except for any portion of biogenic carbon converted to CH4. If the product is reused or recycled as the end-of-life scenario, this can also result in zero net contribution to the CFP, when biogenic carbon flows are transferred to subsequent product systems.

This report assumes that the biogenic carbon sequestered in the bio-based materials (renewable raw materials of plant origin such as paper, and cardboard) is released as carbon dioxide to the atmosphere when those materials are recycled. In other words, the biogenic carbon leaves the system boundary being assessed and becomes part of another product's (or material's) system boundary. This assumption is in line with ISO 14067:2018 (ISO, 2018) and supported by non-packaging standards such as EN 16485:2014 (CEN, 2014) for timber products, and EN15804+A2 for construction products (CEN, 2019).

When recycled at end-of-life, all sequestered carbon is emitted to air. When in landfill, the biogenic carbon sequestered in the bio-based materials are partly emitted to air as carbon dioxide and methane, and partly sequestered (depending on material degradability). See more details in Section 3.8.

2.3. Allocation

2.3.1. Multi-output Allocation

Multi-output allocation is important for processes that produce two or more co-products and must follow the requirements of ISO 14044, section 4.3.4.2. Within this study, there are no significant cases of multi-output allocation in the foreground system. Allocation of background data (energy and materials) taken from the Managed LCA Content (MLC) 2024 databases is documented online (Sphera, 2025).

2.3.2. Allocation of Background Data

Allocation of background data (energy and materials) taken from the MLC databases is documented online at https://lcadatabase.sphera.com/

2.3.3. End-of-Life Allocation

End-of-life allocation addresses the question of how to assign impacts from virgin production processes to material that is recycled and used in future product systems. This is important when a product system uses recycled content or is recycled at end-of-life. The approaches used follow the requirements of ISO 14044, section 4.3.4.3.

While there are many possible approaches to end-of-life allocation, there are two main approaches commonly used in LCA studies: the cut-off approach and the substitution approach (GHG Protocol, 2011) as shown in Figure 2-3. This study uses the cut-off approach as the primary method, as the authors consider it to be the most appropriate for packaging materials, given there is generally high supply but low demand for recycled packaging material. The substitution approach is tested through sensitivity analysis in Section 5.4.2.

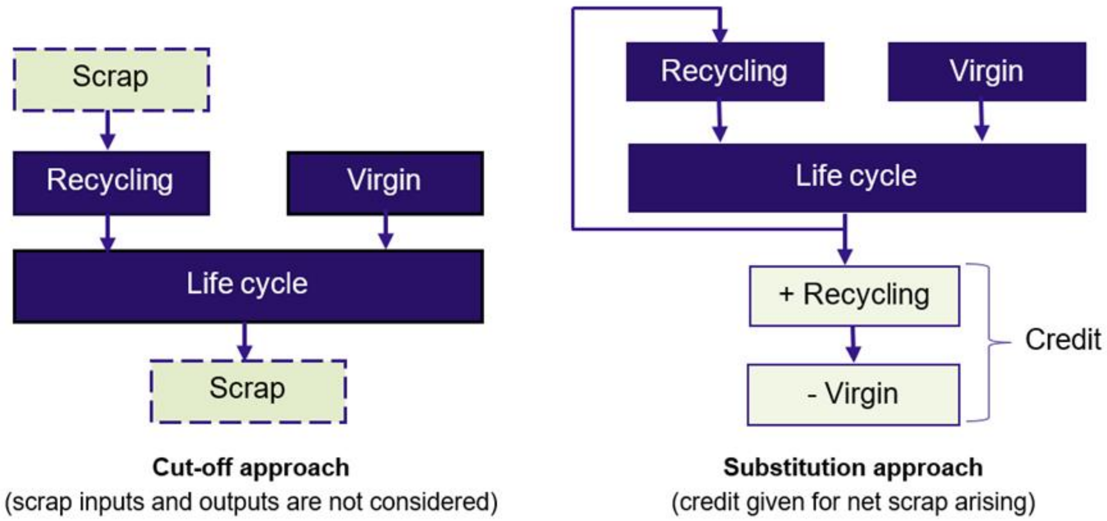


Figure 2-3: Flow diagrams for cut-off end-of-life allocation method (thinkstep-anz, 2021)

Cut-off approach (also known as 100:0 or recycled content approach)
Burdens or credits associated with material from previous or subsequent life cycles are not considered, i.e., they are "cut-off". Therefore, the recycled material input to the production process is considered to be burden-free and, equally, no credit is received for waste available for recycling at end-of-life. This approach rewards the use of recycled content but does not reward end-of-life recycling. This approach is generally preferred in cases where there is a high supply of recyclable materials and a low demand.

Material recycling: Any open scrap inputs into manufacturing remain unconnected. The system boundary at end-of-life is drawn after scrap collection and processing (end-of-waste-state) to account for the collection rate, which generates an open scrap output for the product system. The processing and recycling of the scrap is associated with the subsequent product system and is not considered in this study.

Energy recovery and landfilling: Any open scrap inputs into manufacturing remain unconnected. The system boundary includes the waste incineration and landfilling processes following the polluter-pays-principle. In cases where materials are sent to waste incineration, they are linked to an inventory that accounts for waste composition and heating value as well as for regional efficiencies and heat-to-power output ratios. In cases where materials are sent to landfills, they are linked to an inventory that accounts for waste composition, regional leakage rates, landfill gas capture as well as utilisation rates (flaring vs. electricity production). No credits for electricity or heat production are assigned.

Substitution approach (also known as 0:100, closed-loop approximation, recyclability substitution or end-of-life approach)
This approach is based on the idea that material that is recycled into secondary material at end-of-life will substitute for a functionally equivalent amount of virgin material. Hence, a credit is given to account for this material substitution. However, this also means that burdens equivalent to this credit should be assigned to recycled material used as an input to the production process, with the overall result that the impact of using recycled material is the same as using virgin material. This approach rewards end-of-life recycling but does not reward the use of recycled content. It is generally preferred in situations where there is limited supply of recycled materials and the demand for them is high.

Material recycling: The amount of recycled material inputs from the production stage are subtracted from waste to be recycled at end-of-life to give the net scrap output from the product life cycle. This remaining net scrap is sent to material recycling. Where there is a shortfall of input into the product life cycle, then material input is sourced from the open market, thus leading to a burden instead of a credit. The original burden of the primary material input is allocated between the current and subsequent life cycle using the mass of recovered secondary material to scale the substituted primary material, i.e., applying a credit for the substitution of primary material so as to distribute burdens appropriately among the different product life cycles. These subsequent process steps are modelled using industry average inventories.

Energy recovery: In cases where materials are sent to waste incineration, they are linked to an inventory that accounts for waste composition and heating value as well as for regional efficiencies and heat-to-power output ratios. A credit is assigned for electricity output using the regional grid mix. No credit is awarded for thermal energy.

Landfilling: In cases where materials are sent to landfills, they are linked to an inventory that accounts for waste composition, regional leakage rates, landfill gas capture as well as utilisation rates (flaring vs. electricity production). No credit are assigned for electricity outputs in this study.

2.4. Cut-off Criteria

Cut-off criteria refer to anything within the product system that is not included in the model. Inks and dyes of competitor packs have been excluded from this study due to their very low mass, and the fact that whole containers have been weighed, meaning that the ink/dye mass has already been captured with the base packaging materials.

Plastic shrink wrap used to wrap pallets is excluded. The retail stage, mainly electricity use (e.g., for chilling), is also excluded. No other cut-off criteria have been defined for this assessment and all reported data have been incorporated and modelled using the best available LCI data. Where specific datasets are not available for a given input or process, these have been modelled using proxy data.

The choice of proxy data is documented in Section 3.9. The influence of these proxy data on the results of the assessment has been carefully analysed and is discussed in Section 6.

2.5. Scenario Analyses

The baseline scenario for this study has been defined to best reflect the most realistic situation for the packaging systems. To account for areas of uncertainty, different methodological choices and future changes in technology and packaging design, several scenario analyses have been carried out. Scenario analysis was carried out on select packs rather than all packaging within scope.

- Carton end-of-life alternative scenarios (Section 5.4.1) include:
  - Varying the DOC_f of the laminated paper between 0% (no degradation, i.e., behaves as plastic), 21% (baseline) and 50% (high degradation, i.e. behaves as paper) (Section 5.4.1)
  - Varying the landfill gas collection at the landfill between 0% and 90%
  - Setting the carton recycling to a minimum of 0% (no recycling) and a maximum of 80% (world best practice)
- Three scenarios for the recycled content of glass bottles were considered: 0% recycled content (100% virgin glass), which was assumed to be the minimum recycled content available in the market; 30% which is the baseline for this study, and a potential 70% recycled content as a best case. The 2021 Oceania study estimated recycled content percentage for clear glass in Australia and New Zealand as 20% (figure supplied by O-I Australia) and 45% (figure supplied by O-I NZ) respectively (thinkstep-anz, 2021). Results of the scenario analysis is provided in Section 5.4.2).
- Two scenarios for the recycled content of aluminium cans are considered in this study: 70% as the base case, and 0% recycled content for scenario analysis. These were assumed to be the maximum and minimum values (The Aluminium Association, 2024) available in market and were included to demonstrate the possible range of results in the best and worst-case scenarios. Furthermore, packaging made from virgin aluminium sourced from global and European markets is assessed to show the possible range of carbon emission factors and their implications. Results of the scenario analysis and sensitivity analysis are presented in Section 5.4.4.
- Sensitivity analysis on the methodological approach to release biogenic carbon when recycling at end-of-life was examined via two scenarios in Section 5.4.5.
- The carbon footprint of distribution distance was examined in Section 5.4.6 to identify the extent to which it contributed to the carbon footprint.

2.6. Selection of LCIA Methodology and Impact Categories

The headline indicator for this report is carbon footprint, as measured using Global Warming Potential (GWP). Other environmental indicators have been considered to understand if there are environmental trade-offs, but are only discussed in the body of this report if they affect the conclusions.

As this study intends to support comparative assertions to be disclosed to third parties, no grouping or further quantitative cross-category weighting has been applied. Instead, each impact is discussed in isolation, without reference to other impact categories, before conclusions and recommendations are made.

It shall be noted that the below impact categories represent impact *potentials*, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) actually follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. In addition, the inventory only captures that fraction of the total environmental load that corresponds to the functional unit (relative approach). LCIA results are therefore relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks.

2.6.1. Carbon Footprint (GWP)

Carbon footprint, measured using Global Warming Potential (GWP), is presented in detail within this study to follow ISO 14067 (ISO, 2018) and as climate change is of high public and institutional interest and is often deemed to be the most pressing environmental issue of our time (Bjørn & Hauschild, 2015).

Carbon footprint is measured using the Global Warming Potential impact category, which is assessed based on the characterisation factors for GWP_{100} from the IPCC's Sixth Assessment Report (IPCC, 2021). Fossil carbon, biogenic carbon (emissions and removals), carbon from land use change and aviation are reported as a total in the body of this report to simplify the analysis but are reported separately in Annex A for compliance with ISO 14067. The sequestered biogenic carbon for the packaging is reported in Annex D in compliance with ISO 14067. The carbon indicators considered are shown in Table 2-5.

Table 2-5: Life cycle assessment carbon footprint indicators

Impact Category	Abb	Description	Unit	Reference
GWP100, Total, incl. biogenic, inc. land use	GWP-t	Total global warming potential, including biogenic carbon and including land use and change, over a 100-year time horizon	kg CO_2e	(IPCC, 2021)
GWP100, Aviation	GWP-avi	Global warming potential from aviation over a 100-year time horizon	kg CO_2e	(IPCC, 2021)
GWP100, Biotic emissions	GWP-bioE	Global warming potential due to biogenic emissions over a 100-year time horizon	kg CO_2e	(IPCC, 2021)
GWP100, Biotic uptake	GWP-bioR	Global warming potential due to biogenic removal over a 100-year time horizon	kg CO_2e	(IPCC, 2021)
GWP100, Fossil	GWP-f	Global warming potential due to fossil fuels over a 100-year time horizon	kg CO_2e	(IPCC, 2021)
GWP100, Land Use	GWP-dLULUC	Global warming potential impact of land use and transformation over a 100-year time horizon	kg CO_2e	(IPCC, 2021)

2.6.2. Other environmental impact indicators

Other impact categories considered are provided below. Together with carbon footprint, these indicators reflect the core environmental impact indicators required for producing Environmental Product Declarations (EPDs). These impact indicators follow the guidelines of the Product Category Rules (PCR) for packaging (PCR 2019:13) (EPD International, 2024).

- Acidification potential (AP)
- Eutrophication aquatic freshwater (EP-fw)
- Eutrophication aquatic marine (EP-fm)
- Eutrophication terrestrial (EP-tr)
- Photochemical ozone creation potential (POCP)
- Abiotic depletion for non-fossil resources (ADP-mm)
- Abiotic depletion for fossil resources (ADP-fossil)
- Depletion of the stratospheric ozone layer (ODP)

Eutrophication, acidification, and photochemical ozone creation potentials were chosen because they are closely connected to air, soil, and water quality and capture the environmental burdens associated with commonly regulated emissions such as NO_x, SO_2, VOCs, and others. The abiotic depletion indicators are included to highlight stress placed on mineral resources (ADP-mm) and fossil resources (ADP-fossil).

The indicators used in this study are summarised in Table 2-6 and results are given in Annex F. The Life Cycle for Experts (LCA FE) EN15804+A2 characterisation factors for Environmental Footprint (EF 3.1) are used. Long-term emissions (> 100 years) are not taken into consideration in the impact estimate.

For an overall sustainability assessment of different packaging options, factors such as the potential of littering or breakdown into microplastics should also be considered. However, these are not covered by robust methodologies for Life Cycle Impact Assessment and are therefore excluded from the scope of this study.

Table 2-6: Core environmental impact indicators (based on EF 3.1)

Indicator	Description	Abbrev.	Unit	Reference
Ozone Depletion	A measure of air emissions that contribute to the depletion of the stratospheric ozone layer. Depletion of the ozone leads to higher levels of UVB ultraviolet rays reaching the earth's surface with detrimental effects on humans and plants	ODP	kg CFC11-eq.	(WMO, 2014)
Acidification	A measure of emissions that cause acidifying effects to the environment. The acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H^+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline and the deterioration of building materials.	AP	Mole of H^+ eq.	(Seppälä, 2006; Posch, 2008)
Eutrophication aquatic freshwater	Eutrophication covers all potential impacts of excessively high levels of macronutrients, the most important of which nitrogen (N) and phosphorus (P). Nutrient enrichment may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. In aquatic ecosystems increased biomass production may lead to depressed oxygen levels, because of the additional consumption of oxygen in biomass decomposition.	EP-fw	kg P eq.	(Struijs, 2009)
Eutrophication aquatic marine		EP-fm	kg N eq.	(Struijs, 2009)
Eutrophication terrestrial		EP-tr	Mole of N eq.	(Seppälä, 2006; Posch, 2008)

Indicator	Description	Abbrev.	Unit	Reference
Photochemical ozone formation	A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O_3), produced by the reaction of VOC and carbon monoxide in the presence of nitrogen oxides under the influence of UV light. Ground level ozone may be injurious to human health and ecosystems and may also damage crops.	POCP	kg NMVOC eq.	(van Zelm, 2008)
Depletion of abiotic resources - minerals and metals*	The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources. Depletion of mineral resources is assessed based on ultimate reserves.	ADP-mm	kg Sb-eq.	(van Oers, et al., 2002; Guinée, et al., 2002)
Depletion of abiotic resources - fossil fuels*	The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources.	ADP-fossil	MJ	(van Oers, et al., 2002)

*The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

Water use (WDP), one of the EF3.1 environmental indicators, is excluded from this study. While the raw material sources for the Tetra Pak packaging system were identified, those for the alternative packaging are based on assumptions. As a result, any WDP results would rely on global average water scarcity data, which closely aligns with the unweighted blue water consumption metric. Therefore, blue water consumption is used in this study instead of the WDP indicator.

Table 2-7: Other environmental indicators

Indicator	Description	Abbrev.	Unit	Reference
Blue Water Consumption	A measure of the net intake and release of fresh water across the life of the product system. This is not an indicator of environmental impact without the addition of information about regional water availability.	BWC	Litres of water	(Sphera, 2025)

2.7. Interpretation to be used

The results of the LCI and LCIA are interpreted according to the Goal and Scope. Other environmental indicators are only discussed insofar as they alter the conclusions reached from the GWP results alone. The interpretation (Section 7) addresses the following topics:

- Identification of findings, such as the main process step(s), material(s), and/or emission(s) contributing to the overall results
- Evaluation of completeness, sensitivity, and consistency to justify the exclusion of data from the system boundaries as well as the use of proxy data
- Conclusions, limitations and recommendations

Note that in situations where no product outperforms all of its alternatives in each of the impact categories, some form of cross-category evaluation is necessary to draw conclusions regarding the environmental superiority of one product over the other. Since ISO 14044 rules out the use of quantitative weighting factors in comparative assertions to be disclosed to the public, this evaluation will take place qualitatively and the defensibility of the results therefore depend on the authors' expertise and ability to convey the underlying line of reasoning that led to the conclusion.

2.8. Data Quality Requirements

The data used to create the inventory model shall be as precise, complete, consistent, and representative as possible with regards to the goal and scope of the study under given time and budget constraints.

- Measured primary data are considered to be of the highest precision, followed by calculated data, literature data, and estimated data. The goal is to model all relevant foreground processes using measured or calculated primary data.
- Completeness is judged based on the completeness of the inputs and outputs per unit process and the completeness of the unit processes themselves. The goal is to capture all relevant data in this regard.
- Consistency refers to modelling choices and data sources. The goal is to ensure that differences in results reflect actual differences between product systems and are not due to inconsistencies in modelling choices, data sources, emission factors, or other artefacts.
- Reproducibility expresses the degree to which third parties would be able to reproduce the results of the study based on the information contained in this report. The goal is to provide enough transparency with this report so that third parties are able to approximate the reported results. This ability may be limited by the exclusion of confidential primary data, methodology for creating the average packaging per material type, size class and beverage, and access to the same background data sources.
- Representativeness expresses the degree to which the data matches the geographical, temporal, and technological requirements defined in the study's goal and scope. The goal is to use the most representative primary data for all foreground processes and the most representative industry-average data for all background processes. Whenever such data were not available (e.g., no industry-average data available for a certain country), best-available proxy data were employed. An evaluation of the data quality with regard to these requirements is provided in Section 6 of this report.

2.9. Type and format of the report

In accordance with the ISO requirements (ISO, 2006b) this document aims to report the results and conclusions of the LCA completely, accurately and without bias to the intended audience. The results, data, methods, assumptions and limitations are presented in a transparent manner and in sufficient detail to convey the complexities, limitations, and trade-offs inherent in the LCA to the reader. This allows the results to be interpreted and used in a manner consistent with the goals of the study.

2.10. Software and Database

The LCA model was created using the Life Cycle for Experts (LCA FE) version 10.9.0.31, formerly known as GaBi Software system for life cycle engineering, developed by Sphera Solutions, Inc. Sphera's Packaging Calculator (version 3.3), a model developed specifically for modelling packaging, was updated and modified to suit Australia and New Zealand packaging systems.

The Managed LCA Content (MLC) database (Sphera, 2025), formerly known as GaBi LCI database, provides the life cycle inventory data for several of the raw and process materials obtained from the background system. MLC CUP 2025.1 version was used.

2.11. Critical Review

As this study is intended to provide comparative assertions that may be made available to the public, ISO 14040/44 requires that it undergo a critical review. This critical review has been conducted by a panel of three experts:

- Rob Rouwette, Life Cycle Expert, start2see (Chair)
- Dr Gordon Robertson, former Adjunct Professor, University of Queensland
- Dr Elspeth MacRae, former Chief Innovation & Science Officer, Scion, currently co-chair IACGB

The panel has not viewed or reviewed the LCA models created in the LCA FE software for this project. The scope of their review is focused on this report and the confidential data which supports it. The Critical Review Statement can be found in Annex I. The Critical Review comments by the independent experts as well as the practitioner's responses are available in Annex J.

3. Life Cycle Inventory Analysis

3.1. Data Collection Procedure

In this project, data specific to Tetra Pak products (including pack specifications, manufacturing/converting data and forming and filling data) were provided by Tetra Pak and modelled by thinkstep-anz in a modified version of Sphera's Packaging Calculator in LCA FE version 10.9.0.31. This data can be found in Annex C.

Competitor products were physically weighed in both Australia and New Zealand (Annex B.1) and averages were calculated for each packaging format and volume class (Annex B.2). Secondary packaging (shipper) was also physically collected and weighed where possible. This information can be found in Section 5.3.5 and Annex B.5. Tertiary packaging (pallets) data, including primary units within secondary packaging and units of secondary packaging on pallets, were provided by Tetra Pak based on observations and internal palletisation data (Section 5.3.6 and Annex B.6).

3.2. Packaging Teardowns

3.2.1. Selection of Packs

Packs were purchased from major supermarkets (e.g. Woolworths, Coles, Foodland and IGA in Australia, New World and Woolworths in New Zealand) between October 2024 and November 2024. Most of the packs (85.9%) were purchased from Australia.

Packs were selected to represent a given beverage category, function, size class and material type (e.g., Australian 250mL chilled juice packed in a PET bottle). The aim was to purchase three different packs (i.e., three different brands) per category (juice), function (chilled or aseptic), size class (e.g. 250mL) and material (e.g. PET). For example, for the 250mL juice in a PET bottle, we purchased a package each from Berri, V8 and Pop Tops branded packages. In many cases, there were not enough brands available to meet this aim. In cases where there were many different options, the packs that occupied the greatest shelf-frontage were selected, as these were assumed to be the highest-selling products in that category.

3.2.2. Weighing Procedure

Consumer packaging was purchased, and its contents were removed. Packages were thoroughly washed with warm soapy water, rinsed, and then left upside down to dry for 24 hours in a well-ventilated room. The cartons went through the same washing procedure, but these were taken apart after washing to separate components like closures. Cartons were not broken down to their specific laminate layers as this was not physically possible. When weighing, the inside of the packaging was checked to ensure that it was completely clean and dry.

Purchasing and weighing were carried out by thinkstep-anz in Australia and New Zealand. Balances were used with 0.1 g readability and 0.1 g reproducibility. During internal quality assurance, thinkstep-anz checked for outliers across both markets and a few packs were reweighed because of this process.

3.2.3. Scaling

Some of the competitor products weighed did not have the internal volumes that matched the rest of their category. In these cases, scaling was used to estimate the mass of the pack if it was to be one of the standard sizes. Scaling was performed using one of three methods:

- If there were two pack sizes of the same branded product (e.g. 750mL and 1.5L Farmhouse Gold PET milk bottles), it was assumed that the packs scaled in mass linearly between the two sizes.
- If there was only one pack size of a branded product, then it was assumed that the pack would scale in mass based on the scaling in size of a similar branded product of the same material class (e.g. the scaling of all PET milk bottles was based on the scaling ratio of Farmhouse Gold-branded PET milk bottles).
- For foil pouches and scaling where the volume changed by less than 10%, the component masses were all scaled linearly.

Only the main container (i.e., the bottle, pouch, or can) was scaled as above. The pack closure was assumed to remain at a constant mass unless there were two samples of the same brand in different pack sizes that had different closure masses. Tetra Pak cartons were not scaled.

3.2.4. Product Composition Data

The average product teardown values used for the results in Section 5.1 are presented in Annex B.1. An average of the consumer packs of the same size, beverage and primary material type was calculated for each market using up to three brands available in the market. Cartons are split into aseptic and refrigerated as aseptic cartons include an aluminium barrier layer within the carton laminate. This same distinction is not made for other materials (PET, rPET, and glass) because there is no additional material present in the packaging for aseptic filling.

Raw data for all individual consumer packs weighed can be found in Annex B.1. Many consumer packs come with a closure with tamper-evident band (see Figure 3-1) that is ruptured during opening. Due to modelling constraints, if there are more than three plastic materials (not including cartons or other laminates) then the masses of each plastic component of the closure are summed together. As these components are injection-moulded from the same material, this would not influence the results.

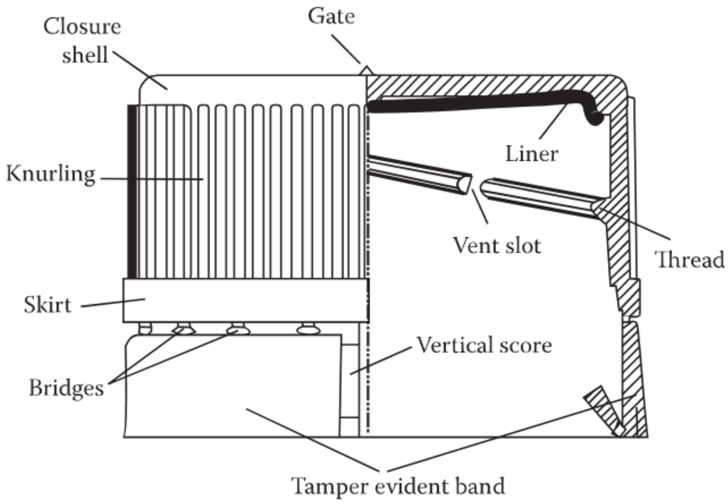


Figure 3-1: Cross-section of a plastic closure with tamper-evident band, found on consumer packs (Source: (Robertson, 2013))

All data for Tetra Pak packaging are based on specifications. The original study shows minor variation between weighed mass and packaging specifications (thinkstep-anz, 2021). Some competitor product packs were found to be rare in both markets (i.e., three brands for a material type, size class and beverage could not be found), hence a few comparisons are based on single or two-brand averages, rather than a three-brand average.

3.3. Manufacturing

3.3.1. Cartons

The body of a Tetra Pak carton is made from laminated paperboard (liquid packaging board). For aseptic beverages, this laminate comprises paperboard, polyethylene, and aluminium (see Figure 3-2). Refrigerated non-aseptic (for beverages that are short shelf life or fresh) cartons have a similar structure but have only one internal and one external plastic (LDPE) layer. There is no aluminium barrier layer.

Liquid packaging board (marked "paper" in Figure 3-2) is a multi-layer paperboard with between one and five plies manufactured from virgin pulp using two different production routes: chemical pulp (kraft pulp) and CTMP (Chemi-Thermomechanical Pulping). Kraft pulp is the most common and is used in the inner and outer layers of the board. Kraft pulp can come from softwood or hardwood trees, with hardwood kraft pulp typically reserved for the top (outer) ply as the shorter hardwood fibres provide a better printing surface. CTMP can be used in the middle layers, providing bulk and stiffness. The outer print surface of the board is always bleached for printing, though the inner layers are typically unbleached. The board can also consist of fillers, pigments, and binders.

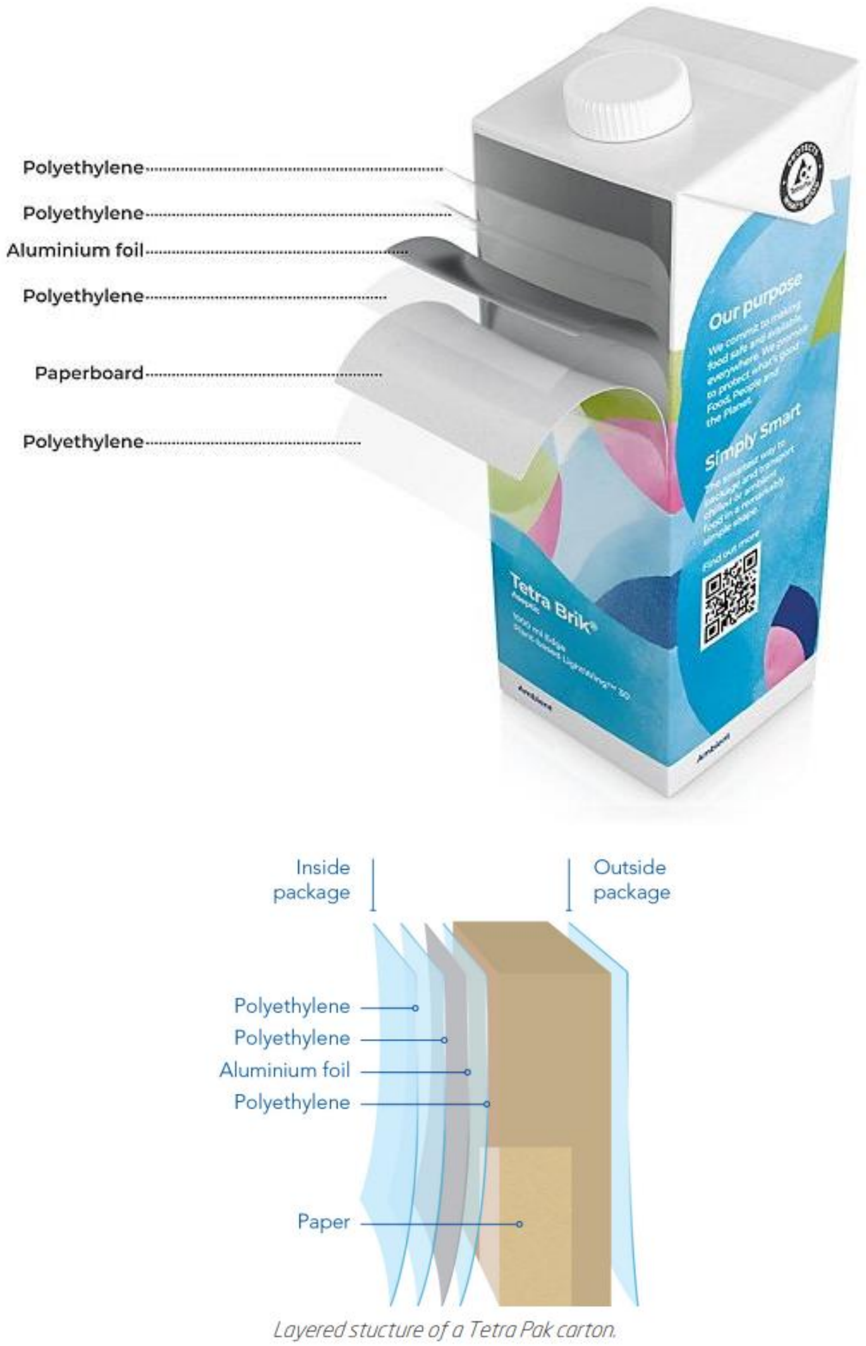


Figure 3-2: Layers of a Tetra Pak aseptic carton (source: Tetra Pak)

Globally, Tetra Pak sources its liquid packaging board from Scandinavia, Brazil, and the USA. All pulp and paper are FSC-certified. Tetra Pak Australia and New Zealand source the liquid packaging board from Scandinavia. In this analysis, we assume transport from Norrköping, Sweden to the lamination plants.

The liquid packaging board is then bonded with plastic film and (optionally) aluminium foil to create a multi-layer laminate that is used to manufacture the finished carton. The aluminium layer is used in aseptic products to protect the contents from oxygen and light. The stages of carton manufacturing used for modelling are shown in Figure 3-3. Printing follows lamination, after which the laminate is transported in rolls for forming.

Lamination for Tetra Pak Oceania products occurs in facilities located globally (Brazil, China, France, Hungary, India, Italy, Germany, Sweden, Taiwan, Türkiye, Vietnam). Each Tetra Pak product was modelled using pack-specific layer data and site-specific lamination/converting data from its respective manufacturing location (see Annex C.1 and C.2 for further information). The closures, made of HDPE or bio-HDPE, were manufactured in France, Hungary, Italy, Spain, and Thailand. Region-specific electricity grid mixes and natural gas mixes were used for manufacturing countries in the EU. Country-specific electricity grid mixes and natural gas mixes were used for Thailand.

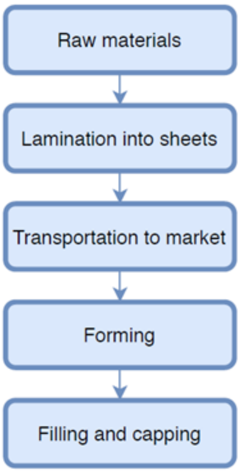


Figure 3-3 Carton manufacturing stages (thinkstep-anz, 2021)

It is important to note that the carton and other component masses used are collected from the packaging teardowns in Section 3.2 and Annex B.1, and that Tetra Pak's layer specifications are only used to determine the relative layer thickness of the paperboard, plastic and aluminium layers.

The primary life cycle inventory dataset used for this project was created using the "European Database for Corrugated Board Life Cycle Studies" (FEFCO and CCB, 2018) (as implemented in MLC Databases 2024 (Sphera, 2025). This choice was made because they are the most recent life cycle inventory datasets available, and their implementation directly within the software means that a full suite of environmental indicators could be applied. The paperboard has higher embodied carbon compared to the version used in the original LCA study and is based on Tetra Pak's global three-year running average for paperboard. As a conservative measure, the dataset has higher carbon footprint. Given the significance of this choice to the overall results, carbon footprint comparisons have been made between this and other data sources in Annex E.

The conclusion that can be drawn from this comparison is that the dataset created using FEFCO/CCB/Sphera data adequately represents the GWP of Tetra Pak Oceania's liquid packaging board.

The aluminium input used for modelling the aluminium barrier layer for Tetra Pak cartons used a European average aluminium dataset from the MLC Database (Sphera, 2025). This choice was made as Tetra Pak's global three-year running average for aluminium carbon emission factor was much lower than the global aluminium emission factor and closer to the European aluminium dataset.

The European dataset is conservative compared to Tetra Pak's global average emission factor, as Tetra Pak's global average is lower than the European value. For Tetra Pak cartons, the European dataset was used because its carbon emission factor is similar to the available primary data. According to ISO 14067, primary data should be used where available. However, since Tetra Pak's emission factor is proprietary, a conservative approach was applied by using the European dataset. None of the cartons in this study contain recycled aluminium content in their barrier layers.

3.3.2. Plastics Manufacturing

The manufacturing process used for the manufacture of plastic components was defined based on the component type. To alter material characteristics (colour, strength, flexibility) some plastic components require an extra manufacturing step (compounding), where the granulate is re-melted and additives are added. A list of plastic components and manufacturing and compounding assumptions is presented in Table 3-1.

All plastic granulate (competitor products) is assumed to have been produced in China. While granulate could be imported from other countries, China exports more plastics than any other country to both Australia and New Zealand (World Integrated Trade Solution, 2025). Additionally, the LCA databases used for this project do not have Australia- or New Zealand-specific plastic granulate datasets. Datasets reflective of European granulate production are used as a proxy if Chinese datasets were not available in LCA FE.

Table 3-1: Plastic manufacturing assumptions

Component	Manufacturing	Compounding
PET Bottle	Preform injection moulding and bottle blow moulding	No
HDPE Bottle	Blow moulding	No
Closure	Injection moulding	Yes
Induction seal	Film metalized	No
Tamper evident band	Injection moulding	Yes
Label	Film thermoformed	No
Straw	Extrusion	No

PET and HDPE bottles follow different manufacturing processes, as shown in Figure 3-4. For this study, PET bottles are manufactured by stretch blow moulding, which is then transported 50km to the filling site (or nearby site) and blown into a bottle. This transport distance aligns with the conservative approach, benefitting competitor products. HDPE bottles are made from granulate in one step by extrusion blow moulding. All steps for both PET and HDPE bottle manufacturing up until and including the filling process are assumed to occur within Australia or New Zealand.

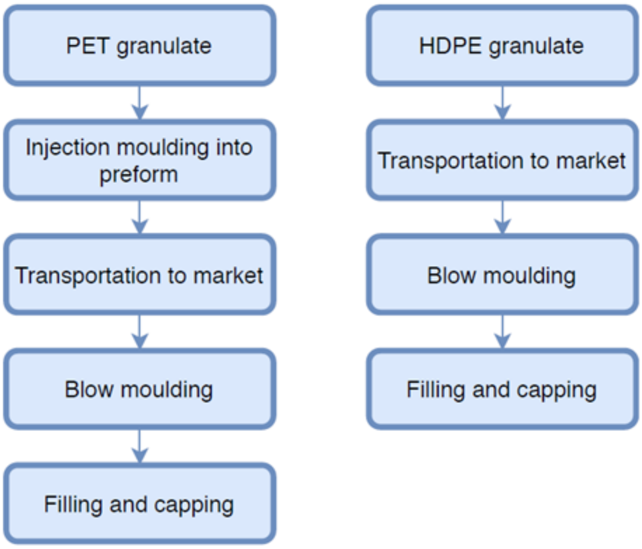


Figure 3-4: Manufacturing stage of PET and HDPE bottles (thinkstep-anz, 2021)

3.3.2.1 Recycled PET

Recycled PET (rPET) bottles were assumed to be mechanically recycled in the country of filling. For plastics such as PET, the end-of-waste state is reached after the waste is sorted and washed (Section 3.8.3). After this stage, rPET production involves baling, flaking, granulation, and pelletisation. A combination of literature data (electricity input of 0.379 kWh/kg of material from bale to flake (Franklin Associates, 2018)) and MLC database processes (granulation to pelletisation) was used to model the input rPET granulate. rPET bottles are then produced using the same PET-related process shown in Figure 3-4.

3.3.2.2 Closures

All but glass and aluminium packaging in this study have plastic closures. A cross-section of a typical plastic closure is shown in Figure 3-1. Closures are modelled as HDPE or PP. Tetra Pak also uses bio-HDPE closures. Non-Tetra Pak closures were modelled without recycled content or bio-based content.

Data for HDPE and PP closures are from the MLC Database (Sphera, 2025) while results from an LCA is used to model the bio-HDPE closures (Braskem, 2023).

3.3.2.3 Bio-based plastics

Bio-based plastics are plastics made from materials that come from biomass. *Biodegradable* means that a material can be broken down by microorganisms (European Commission, 2022). These two categories do not always overlap: some biodegradable plastics are made from fossil resources, while not all bio-based plastics are biodegradable (European Commission, 2022). Figure 3-5 shows the different classifications for bio-based and biodegradable plastics.

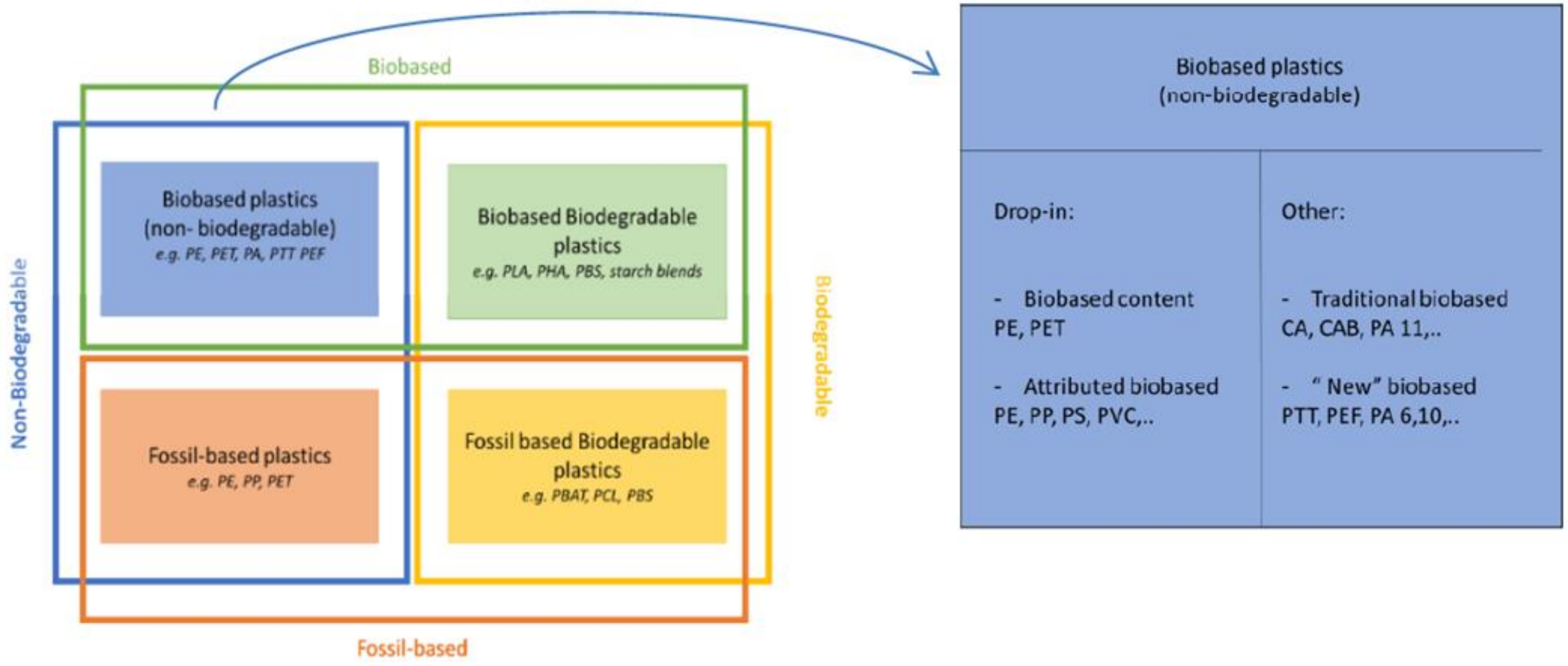


Figure 3-5: Biobased and biodegradable plastics (European Commission, 2022).

Examples of bio-based biodegradable plastics include polylactic acid (PLA) (Ülger-Vatansever, et al., 2024) and starch-based plastics (Cucina, et al., 2021). For instance, 48.1 % of the analysed starch-based plastic and 15 % of PLA plastic degraded. Ülger-Vatansever et al. (2024) simulated the degradability of PLA plastics in landfills and found no significant biodegradation during aerobic or semi-aerobic phases. Only PLA cups showed potential signs of biodegradation, with a weight decrease of 12.8% (Ülger-Vatansever, et al., 2024).

This LCA study focuses on bio-based HDPE (bio-HDPE) and bio-based LDPE (bio-LDPE) plastics, both of which are produced from sugarcane. These plastics are made from the bio-based material; however, they are not degradable. Bio-based PE plastics are chemically identical to fossil-based PE plastics and are classified as not biodegradable (European Commission, 2022). The degradation of polyethylene in landfill conditions is minimal (estimated at up to 1% in 100 years) (Ritzen, et al., 2024). They are chemical stable materials, and no degradation is assumed from landfilled bio-HDPE and bio-LDPE in this study.

3.3.3. Aluminium Cans

The manufacturing process for aluminium cans (for beverages) is shown below in Figure 3-6. Manufacturing of cans involves can body and end manufacturing processes. Aluminium input coils are uncoiled, cut and moulded to create the can base. The cupping, drawing and ironing processes form the cylinder shape, after which it is cleaned, printed and an internal coating is applied. Can end (or the lid) is manufactured via cutting, pressing and moulding processes after which the pull tab is rivetted onto the end and the lid scored to allow it to detach to open the can. (World of Cans Inc., 2025). The two parts are transported to the beverage filling facility where the cans are filled and the ends seamed on.

Aluminium cans were assumed to be manufactured from either primary aluminium sourced on the global market or a combination of both primary and recycled aluminium (for scenarios analysis in section 5.4.4). The rolled aluminium production process in this study is based on a European dataset, and the can-making process is based on a US dataset. While these datasets could not be regionalised, global average aluminium ingot was selected as the aluminium raw material input. All aluminium datasets were sourced from MLC Databases (Sphera, 2025). This is based on the information that Tetra Pak specifically sources low carbon aluminium from Aluminium Stewardship Initiative (ASI) certified suppliers, to support their branded products (as opposed to cans that carry the branding of the beverage company).

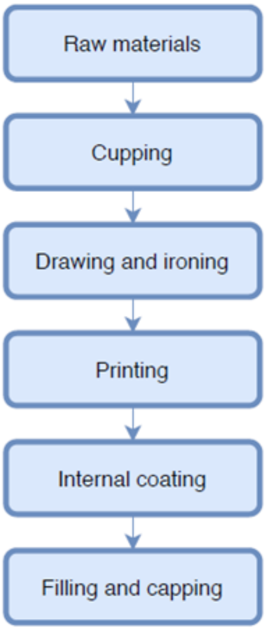


Figure 3-6: Aluminium can manufacture stages

According to annual trends published by International Aluminium, GHG emissions intensity for aluminium for 2022 was 15.1 tonnes of CO2e per tonne of primary aluminium (International Aluminium, 2024). This aluminium emission factor was modelled in LCA FE by using existing International Aluminium Institute datasets for primary aluminium ingot (2019).

The recycled content of aluminium cans varies between suppliers, and companies can request cans with up to 70% recycled content. Because of this variance, both 0% and 70% recycled content cans have been considered to provide worst- and best-case scenarios. Can-making was modelled using North American can-making data found in the MLC Databases.

3.3.4. Glass Containers

Glass containers are manufactured in the country of purchase using standard manufacturing techniques. The glass manufacturing process is shown in Figure 3-5. In the original study, the recycled content percentage for clear glass was estimated as 45% for New Zealand (figure supplied by O-I NZ) and 20% for Australia (from O-I Australia) (thinkstep-anz, 2021). This study applies a 70% recycled content as the baseline, based on previous work by thinkstep-anz All glass bottles in this study are colourless. Scenarios with 0% and 30% cullet are also included for analysis (see section 5.4.2).

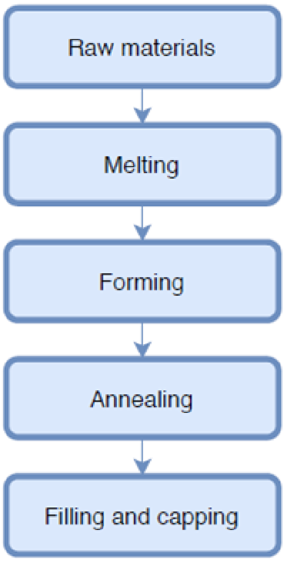


Figure 3-7: Glass container manufacturing

3.3.5. Aluminium Pouches

Aluminium pouches are assumed to be manufactured in China and then transported to Australia and New Zealand. An overview of the pouch manufacturing process can be seen in Figure 3-8. Acrylate was assumed to be the adhesive used and ethanol was the solvent, based on Tetra Pak Oceania study (thinkstep-anz, 2021). The solvent and adhesive used are not expected to have a significant impact on the GWP.

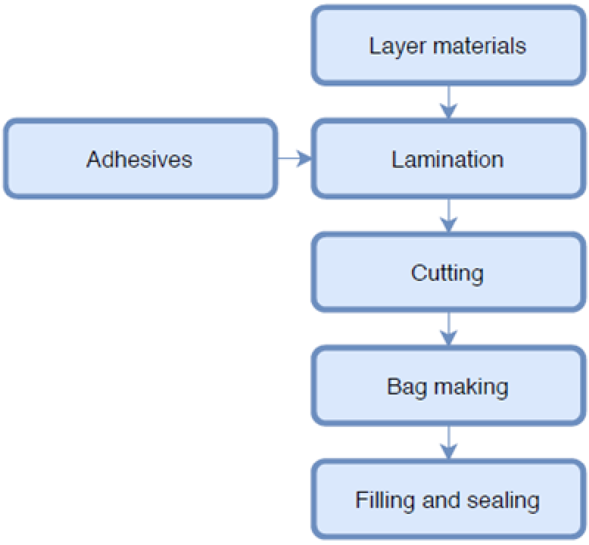


Figure 3-8: Aluminium pouch manufacturing

The pouches considered within this study are for aseptic beverages. This pouch has a polyethylene base layer as well as an aluminium and PET barrier layers. The thickness of each layer (Table 3-2) was calculated based on literature, the previous study (Lamberti & Escher, 2007; thinkstep-anz, 2021) and calculated surface area of packs (via dimensions taken during data collection).

Table 3-2 shows the thickness and calculated weight for the 2021 and this study (2025), with aluminium layer thickness and weight reduction. The aluminium layer reflects the lowest aluminium layer thickness used for Tetra Pak cartons in this study as a conservative approach. Aluminium input used for pouches has the same emission factor as that used for manufacturing the aluminium cans (15.1 tonnes of CO_2e per tonne of primary aluminium). This is based on the information that Tetra Pak specifically sources low carbon aluminium, to support their branded products (as opposed to pouches purchased in bulk without specific branding).

Table 3-2: Aseptic beverage pouch layer thickness

Layer Material	Thickness (μm)	Calculated weight (gsm)	Thickness (μm)	Calculated weight (gsm)
Year	2021	2021	2025	2025
PET	12.0	16.6	12.0	16.6
Aluminium foil	8.0	21.6	6.3	17.0
Polyethylene	75.0	69.4	75.0	69.4

3.3.6. Secondary and tertiary packaging

Secondary and tertiary packaging are used to store units of packages during shipping.

- Chilled milk containers are typically shipped and sold at retail in reusable HDPE crates. This study assumes that all chilled milk containers, including Tetra Pak cartons, are sold with reusable HDPE crates as secondary packaging.
- Besides chilled milk, all other packages are sold with corrugated board box secondary packaging.
- In one case, Juice 250mL PET bottle, the packages also come with LDPE plastic wrap.

Tertiary packaging used in Australia and New Zealand are wooden reusable pallets. This pallet is assumed for all packaging in this study. Pallet packaging such as plastic shrink wrap are excluded from the study. Plastic shrink wrap on packaging is expected to be identical across all packaging options.

To allow for a full assessment of the impacts of different packaging types, secondary and tertiary packaging was modelled. As this study is done on a consumer pack basis, the masses of each packaging type were divided by the number of consumer packs transported to obtain the impact per consumer pack. Masses for packaging types which are reused multiple times (e.g. pallets and crates) were divided by the number of use cycles to evenly allocate the burden of production. The number of consumer packs per secondary pack was identified during data collection (via purchase of whole cases of product) or through web search. The number of secondary packs per pallet was estimated based on palletising data from Tetra Pak, observations made during packaging purchases, and teardowns of secondary packaging.

3.3.6.1 Secondary packaging

All consumer packs, excluding fresh milk, are packaged in corrugated cardboard boxes. In a few instances, both a cardboard box and an outer plastic covering are used for small pack sizes. These include, for example, several packages contained within a corrugated cardboard base and an outer plastic wrap, and several packages fully wrapped in plastic covering included within corrugated cardboard boxes.

Consumer packs containing fresh milk are shipped in HDPE crates, which are reused multiple times. The reusable HDPE crate mass was based on mass measurements using crates purchased by Tetra Pak. This report assumes that each crate lasts 50 cycles before needing to be replaced. In practice, the number of use cycles typically assumed in LCA studies varies between 5 and 300 (for plastic crates), with 50 being a common assumption (Deviatkin, et al., 2019). To ensure proper hygiene, HDPE crates are washed between every cycle. A dataset from MLC Database was used for washing.

While primary data was available for Tetra Pak's secondary packaging, it was not possible to obtain measured secondary packaging data for all alternative packaging. Where measured data was unavailable, assumptions were made to fill in gaps using available measured data. Proxy data was selected based on primary packaging material and size class within the beverage category. For example, if secondary packaging was available for 250mL PET for coffee, its data was used as proxy for 250mL coffee in HDPE package. Data on secondary packaging for packages included in the study can be found in Annex B.5

Cardboard is assumed to be manufactured in Australia and New Zealand.

3.3.6.2 Tertiary packaging

Wooden pallet mass and reuse cycle data was selected based on measurement, conversations with Tetra Pak, suppliers and evidence in the market. The wooden pallet used for this study weighs 38.5 kg. The number of reuse cycles is uncertain, though it does affect all packaging systems equally as wooden pallets are assumed in all cases. This study assumes 5 reuse cycles, while other studies assume anywhere between 5 and 90 cycles (with 5, 10 and 30 cycles being the most common) (Deviatkin, et al., 2019).

Data and assumptions for tertiary packaging for packages included in the study can be found in Annex B.6.

3.3.6.3 Distribution

Secondary and tertiary packaging have the same distribution to market distance and methods as consumer packaging.

3.3.6.4 Use

No life cycle impacts have been associated with the use of the packaging.

3.3.6.5 End-Of-Life

End-of-life assumptions made for secondary and tertiary packaging are given in Section 3.8. The HDPE plastic recycling rate is the same as that of HDPE primary packaging. The cardboard recycling rate for Australia was available via Australian packaging material flow analysis (APCO, 2023). This rate was also used for New Zealand.

3.4. Transportation of materials and packages to filling

Transportation of raw materials from their sources to package manufacturing sites was included in the study.

For Tetra Pak packages, the distance for transporting raw materials to sites of manufacture was calculated based on the source of materials and Tetra Pak converting locations. Raw material locations for some Tetra Pak materials, such as the paperboard (from Scandinavia), were known, while sources of other materials (e.g. aluminium) were assumed. Sea (container ship) and road (truck-trailer) transport distances from the source to respective converting sites per material per package were calculated.

Laminated paperboard and closures for Tetra Pak cartons are manufactured overseas and transported to Australia and New Zealand for filling. For plastic, pouch, aluminium and glass packages, it was assumed that manufacture occurred within Australia or New Zealand. Glass, aluminium and non-laminate based raw materials were assumed to be sourced within the two countries. The raw materials for plastic and pouch packaging were assumed to be sourced from China. Thus, distances were calculated based on transport from Shanghai. In most cases, these assumptions result in a transport impact (e.g. carbon footprint) lower than Tetra Pak materials and are considered conservative for the goal of this study.

Filling occurs in the country of sale. Transport of packages to filling sites within Australia and New Zealand was also included for all packages. The impact of transporting the package from manufacturing site to filling site is included in the manufacturing stage. This was done due to some packaging solutions not being fully formed during the transportation to the filling site (e.g., PET bottles which are in preform moulds and cartons which can be in rolls).

Transport of packages from manufacture to filling was calculated based on the distance between the location of manufacture to filling city. For example, if a carton is manufactured at Tetra Pak's Beijing factory and filled in Melbourne, road transport of packaging over a 450 km distance and sea transport over a 10,900 km distance was applied (based on first/last mile distance between manufacturing/filling factory and their closest sea ports and the shipping distance between the two ports).

The weight of the different packaging types was considered for the transport modelling.

3.5. Filling and Forming

Filling and forming occur in the state and country of sale. Filling and forming data were reused from the previous Tetra Pak Oceania study (Annex B.7). In the previous study, filling and forming data for Tetra Pak products were provided in the form of technical datasheets of various Tetra Pak forming and filling machines. From these datasheets, process inputs per 1,000 filled packages were calculated, based on the median number of packages filled per hour (thinkstep-anz, 2021).

Other products' filling inputs were estimated using carton filling data and anecdotal information that were found to line up with previous work by thinkstep-anz. There is a degree of uncertainty with the filling impacts due to primary data not being available. However, the filling impact is minor relative to other life cycle stages.

For simplicity, compressed air input is assumed to be at 7-bar at medium efficiency and is converted to electricity using a process conversion within LCA FE software. Other inputs such as hydrogen peroxide are included based on filling requirements for the beverage. For white milk, hydrogen peroxide is included even though it is typically used for non-aseptic systems. Steam is assumed to be produced by the combustion of natural gas.

3.6. Distribution

After filling, the packaging is transported to the retailer. The truck transport is either in chilled or ambient conditions depending on the beverage. Two truck processes are used to model transport, both of which use a 'tonne-km' reference flow:

- Ambient transport: The truck process is based on a Euro 6 A-C, 28-32 t gross weight (22 t payload) truck, with a utilisation rate of 61% (the MLC database default), i.e. most return trips are empty. This is a diesel-fuelled truck.
- Chilled transport: The truck process is based on an insulated refrigerated / 13,000 lb payload truck - with a utilisation rate of 61%. This is a diesel-fuelled refrigerated truck (21 tonne).

Note that chilled transport was not included in the 2021 study (thinkstep-anz, 2021).

The weight of the different packaging types was considered for the transport modelling. The weight of the product contained within the packaging was excluded as this is assumed to be part of the product's life cycle, not the life cycle of the packaging.

The following assumptions were applied for transport distances:

- Transport of filled packages to retail: 330 km in Australia and 130 km in New Zealand. These distances were assumed as they reflect the distance between a significant filling customer to retailer via areas where major warehouses are located.

3.7. Use

No use phase (where the user stores and consumes the beverage in the packaging after purchase) is modelled for packaging comparisons. Here, refrigeration of the packaging systems is not included, as a previous Tetra Pak LCA study has shown it to have effectively no impact on the results (Franklin Associates, 2015). If refrigeration were included, this would favour lighter-weight products such as cartons and pouches due to the lower mass of packaging to be chilled.

3.8. End-of-Life

Once the beverage has been consumed, the packaging waste is expected to be sent for recycling or to a landfill. End-of-life treatment rates for Australia and New Zealand are given in the following sections. All packaging waste is assumed to be transported 50km.

3.8.1. Waste processing in Australia

Table 3-3 provides end-of-life rates used for Australia in this study. Recycling rates for most consumer packaging materials were based on data from the Australian Packaging Covenant Organisation's (APCO's) Packaging Material Flow Analysis 2020-2021 (APCO, 2023), which is the most recent published version of this study. It is assumed that the recycling rate is equal to the reported recovery rate (i.e., all recovered materials are recycled), with the remainder sent to landfill, since less than 0.5% of packaging in Australia goes to energy recovery (APCO, 2023).

The APCO study does not provide data for laminated products such as cartons and pouches. Therefore, the assumption from the previous Tetra Pak LCA study for Oceania, that 100% of pouches are sent to landfill, has been carried forward in this study (thinkstep-anz, 2021). This rate is applied due to their low value at end-of-life and complex layer structure. For cartons, Tetra Pak's own analysis suggests a recycling rate of 29% for Australia in 2024, and this number is used as a baseline. The effects of this assumption are tested using sensitivity analysis in Section 5.4.

Table 3-3: End-of-life treatment rates in Australia

Material	Recycled (%)	Landfill (%)	Reference
Glass	63%	37%	(APCO, 2023)
Paper/cardboard	70%	30%	(APCO, 2023)
Aluminium	74%	26%	(APCO, 2023)
Steel	47%	53%	(APCO, 2023)
PET	43%	57%	(APCO, 2023))
HDPE	30%	70%	(APCO, 2023)
Carton	29%	71%	Provided by Tetra Pak
Pouch	0%	100%	Assumption carried forward from previous study

3.8.2. Waste processing in New Zealand

A similar material flow analysis to the one commissioned by APCO does not exist for the New Zealand market. As a result, this study references the same report as the previous study from WasteMINZ (Yates, 2020), which is still the most current study on recycling for the New Zealand market. This is based on a waste audit of 875 households across New Zealand in 2019. Household waste was collected from bins at the kerbside with permission of the waste companies contracted to collect that waste (permission was not needed from the householders owing to the waste already being at the kerbside). Households included in the sample were deliberately chosen to represent both the diversity of waste collection systems across New Zealand (glass in co-mingled recycling, separate glass crate, etc.) and different socioeconomic demographics (using household income data for Statistics New Zealand meshblocks – the smallest geographic unit for which Statistics New Zealand collects data).

Table 3-4 includes the data applied within this study. The “Collected” column is based on data from the WasteMINZ study. The “Sorted” and “Recycled” columns are calculations applying the same losses as found in the APCO study for Australia (APCO, 2023). The only exceptions are for:

- Paper/cardboard, where APCO data has been used directly for all stages as this was not in scope of the WasteMINZ study.
- Glass, where recycling rates are calculated from the ratio of mass of glass in bottle-to-bottle recycling and total mass of glass consumption, which are published by the New Zealand Glass Packaging Forum in their annual Accreditation Report.
- Cartons, where the final recycling rate has been calculated based on data from the Food & Beverage Carton Recycling Scheme (FBCRS).
- Pouches, which is an estimate from the authors, due to existing soft plastics recycling programme in New Zealand. This was cross-checked with Tetra Pak.

Table 3-4: End-of-life treatment rates for New Zealand

Material	Collected (%)	Sorted (%)	Recycled (%)	Landfill (%)	Reference
Glass	75	n/a	47	53	(Glass Packaging Forum, 2021)
Paper/cardboard	71	71	70	30	Collection figures from (Yates, 2020). Ratios between collected sorted and recycled material obtained from (APCO, 2023)
Aluminium	74	69	64	36	
Steel	66	61	57	43	
PET	65	64	62	38	
HDPE	71	70	68	32	
Carton*	n/a	n/a	1.0	99	Recycling figure based on the portion of waste collected
Pouch	n/a	n/a	5.0	95	Authors' estimate

*Cartons are designed for recycling, however, recycling at end-of-life is hindered by lack of collection. In New Zealand, recycling food and beverage cartons is managed by the FBCRS. This scheme relies on people dropping off their cartons voluntarily, which is why the recycling rate is so low. Local council kerbside recycling doesn't accept these cartons. Between 1 August 2024 and 31 July 2025, the scheme collected 38 tonnes of cartons. Approximately 4,000 tonnes of food and beverage cartons are placed on the New Zealand market each year, which means the recycling rate is only about 1%. The remaining 99% goes to landfill. Cartons collected by the FBCRS are used to make building products while a small proportion is exported to pulp mills. For this study, it is assumed that cartons reach their end-of-waste state once they are washed and delivered to the collection point.

3.8.3. Calculation of biogenic carbon at end-of-life

Biogenic carbon sequestered in packaging (i.e., within bio-based materials) is released at end-of-life as follows:

- Where the material is sent for recycling, the sequestered biogenic carbon is calculated as a release of carbon dioxide to the atmosphere
- When the material is sent to landfill, the biogenic carbon sequestered in the bio-based materials is partly emitted into air as carbon dioxide and methane and partly sequestered.

Several landfilling datasets were used to calculate the environmental impacts associated with landfilling of materials (see Section 3.9.5). The resulting carbon emissions from landfilling organic material (i.e., paperboard and cardboard) and the breakdown of this have been calculated manually and used to adapt the dataset. It is assumed that plastics do not break down in landfills and that the fossil carbon content is not released into the air as greenhouse gases. Therefore, biogenic carbon in bio-based plastics that do not degrade in landfill (bio-HDPE and bio-LDPE) remains sequestered.

The following are used to calculate the emissions for materials that are expected to break down in landfills:

- Biogenic carbon content in product = Biogenic carbon content of material x material content in product
- Carbon degrading = Biogenic carbon content in product × DOC_f
- Emissions (CO_2) = Proportion CO2 from landfill × carbon degrading
- Emissions (CH_4) = Proportion CH4 from landfill × carbon degrading
- Sequestered Biogenic carbon = Biogenic carbon content in product × (1-DOC_f)
- Elemental composition of materials

The biogenic carbon sequestered in the material during growth is assumed to be released back into the atmosphere at end-of-life. These biogenic carbon emissions were modelled consistent with ISO 14067 (ISO, 2018).

The time horizon considered within this study for landfills is 100 years. However, it should be noted that the DOC_f values below have been calculated/extrapolated from short-term studies (e.g. desktop bioreactors which are designed to simulate an environment that degrades the material as completely as possible in anaerobic conditions). As such, applying a longer-term time horizon should not affect the results for biodegradable materials such as wool and paper, as all biogenic carbon emissions will have already been accounted for.

3.8.3.1 Degradable Organic Carbon Fraction (DOC_f)

The degradable organic carbon fraction (DOC_f) is a fraction of the biogenic carbon in a material that will break down and be emitted to the atmosphere as gaseous compounds over time (very long-term time horizons of 3 to 5 half-lives) (Pipatti et al., 2006), in this case in a landfill. For this study, the degradation of a product's biogenic carbon content in a solid waste disposal site is assumed to be without time limit.

DOC_f values vary by material, as seen in Table 3-5. Of the landfill gases produced from decomposition, 50% forms methane and 50% forms carbon dioxide (Australian Department of Industry, Science, Energy and Resources, 2021). Analysis is conducted on different coated paper DOC_f values in Section 5.4.1.

While there are bio-based plastics in packaging (bio-LDPE in bio coat laminate and bio-HDPE in bio closures), it is assumed that bio-based plastics, do not degrade in landfill. While bio-based plastics generally have lower carbon footprint than traditional plastics (owing to feedstock), some bio-based plastics such as bio-PET and bio-PE, which are chemically identical to their fossil fuel counterparts, do not readily biodegrade (Costa, et al., 2023) (Islam, et al., 2024) (see section 3.3.2.3).

There is a significant level of uncertainty regarding the DOC_f of laminated paperboard and it could vary anywhere from 0% (assuming that the plastic and aluminium barrier layers on either side of the paperboard stop it from breaking down at all) to 50% (assuming the barrier layers fail over time and the paperboard behaves like uncoated paper in landfill). A value of 21% for coated paper (Eleazer, et al., 1997). was used as the base case in this study because it is one of the few experimental values available for coated paper. It aligns well with another value of 17.5% for coated paper (Micales & Skog, 1997). Later studies including Australian National Greenhouse Accounts use DOCf of 21% for coated paper (DCCEEW, 2025).

Table 3-5: DOC_f values of materials

Material Type	DOC_f	Source/Description
Paper/cardboard	0.49	National Greenhouse Accounts. (Australian Department of Industry, Science, Energy and Resources, 2021)
Wood	0.1	
Coated paper (in cartons)	0.21	(Eleazer, et al., 1997)

3.8.3.2 Methane Capture Rate

Methane capture rates from landfill gas vary widely depending on the type of landfill. They can range from 0% in uncovered sites without gas collection to nearly 100% in covered landfills with highly effective systems. Large, modern landfills in Australasia generally achieve high gas collection rates, while older or smaller sites may have limited or no collection.

For landfills that do capture gas, instantaneous collection efficiencies range from about 50% to nearly 100% (Barlaz, et al., 2009). When averaged over the landfill's lifetime, efficiencies range between 55% and 91% (Barlaz, et al., 2009). The methane that is captured is either flared or used by operators to generate electricity; however, electricity generation credits are not included in this study.

For New Zealand, the national greenhouse gas inventory references a Eunomia study of similar landfills in the United Kingdom to estimate methane capture rates. The report recommends using recovery rates for open sites, as most landfills today are modern facilities with efficient systems. In the latest reporting year, open sites are assigned a 68% gas recovery rate (Ministry for the Environment, 2024).

This study applies a landfill gas recovery rate of 68% for both Australia and New Zealand, specific to open landfills that are still accepting waste (Ministry for the Environment, 2021). While Australia's reported national average landfill gas recovery rate is 42% (DCCEEW, 2024), this figure also includes closed landfills that are no longer accepting waste. This 42% rate is comparable to the 40% rate historically reported in New Zealand for all landfills (Ministry for the Environment, 2015). Large municipal landfills in both countries, however, have similar gas capture systems and achieve similar recovery rates. Sensitivity analysis with lower and higher gas collection rates is presented in Section 5.4.1.

3.8.4. Material Recovery Facilities

Recycling initiatives are supported by material recovery facilities (MRF) (also called material reclamation facilities), where waste materials are sorted, separated and prepared for recycling. Portions of plastics, metals, glass and paper/cardboard materials in this study are recycled at end-of-life. Impacts from MRF are included in the model using data from literature (Table 3-6). Energy (electricity, natural gas, LPG), water, and treatment of waste residue are included according to data available.

- It is assumed that metals are sorted before they can be recycled, and this impact is added to end-of-life (as opposed to this impact being included together with input scrap). i.e. for metals, the end-of-waste state occurs after sorting.
- Plastics are assumed to be sorted and then washed, ready for recycling. Here it is assumed that the end-of-waste state for plastics is reached after washing, hence it is included at end-of-life rather than start-of-life.
- Glass waste is assumed to be sorted, crushed and washed as part of end-of-life processing, with the end-of-waste state occurring once cleaned crushed glass is available.
- For cartons, it is assumed that recycling of materials will require similar processing as metals and plastics. Therefore, the plastic and metal processes are included at the carton end-of-life where recycling occurs.

Table 3-6: Material recovery facility processes modelled per material (See Annex H)

	Process	Reference
Metals	Sorting of waste tinplate and aluminium	(Haupt, et al., 2018a) (Haupt et al., 2018b)
Cartons and Plastics	Sorting and separating	(Tonini, et al., 2021)
	Washing	(Sphera, 2025)
Glass	Sorting and separating*	(Tonini, et al., 2021)
	Crushing, screening, contaminant removal	(Zulkarnain, et al., 2021)
	Washing to remove small particles, dirt, oil and fat residues	(Germani, et al., 2019)

*Same as the sorting process used for mixed plastics

3.9. Background Data

The most relevant LCI datasets used in modelling the product systems are detailed below. All background datasets were obtained from the MLC Database and documentation can be found at: https://lcadatabase.sphera.com/

Note that all MLC datasets have as a minimum their energy upstreams (and any energy upstreams present in their material upstreams) updated on an annual basis. In addition, all MLC datasets are updated whenever the technology or geographical mix of the producers of a product changes significantly.

The proxy column is used to indicate whether a dataset accurately represents the desired material or process; a No* indicates the use of a geographical proxy for a correct dataset where the region of manufacture is expected to have little influence on its environmental profile; and a Yes* indicates the use of a geographical proxy for a correct dataset where the region of manufacture is expected to materially influence its environmental profile.

3.9.1. Fuels and Energy

National averages for fuel inputs and electricity grid mixes were obtained from the MLC databases to match the location of manufacture. Table 3-7 shows the most relevant electricity and other energy datasets used in modelling the product systems. The locations relevant to the data source include:

- AU: Australia
- BR: Brazil
- CN: China
- DE: Germany
- FR: France
- GLO: Global
- HU: Hungary
- IN: India
- IT: Italy
- NZ: New Zealand
- RER: Europe
- TH: Thailand
- TR: Türkiye
- VN: Vietnam

Table 3-7: Key electricity and energy datasets used in inventory analysis

Material	Process Location	Dataset Geography	Dataset	Data Provider	Reference Year	Proxy?
Electricity	AU	AU	AU: Electricity grid mix	Sphera	2021	No
	NZ	NZ	NZ: Electricity grid mix	Sphera	2021	No
	FR	FR	FR: Electricity grid mix	Sphera	2021	No*
	DE	DE	DE: Electricity grid mix	Sphera	2021	No*
	HU	HU	HU: Electricity grid mix	Sphera	2021	No*
	IT	IT	IT: Electricity grid mix	Sphera	2021	No*
	TR	TR	TR: Electricity grid mix	Sphera	2021	No*
	TH	TH	TH: Electricity grid mix	Sphera	2021	No*
	VN	TH	TH: Electricity grid mix	Sphera	2021	Yes
	CN	CN	CN: Electricity grid mix	Sphera	2021	No
	BR	BR	BR: Electricity Grid Mix	Sphera	2021	No
	IN	IN	IN: Electricity Grid Mix	Sphera	2021	No
Natural gas	AU	AU	AU: Thermal energy from natural gas	Sphera	2021	No
	NZ	NZ	NZ: Thermal energy from natural gas	Sphera	2021	No
	FR, HU, IT, NL, TR	RER	RER: Thermal energy from natural gas	Sphera	2021	No*
	TH, VN	TH	TH: Thermal energy from natural gas	Sphera	2021	No
	VN	TH	TH: Thermal energy from natural gas	Sphera	2021	Yes
	CN	CN	CN: Thermal energy from natural gas	Sphera	2021	No
	BR	BR	BR: Thermal energy from natural gas	Sphera	2021	No
	IN	IN	IN: Thermal energy from natural gas	Sphera	2021	No

Material	Process Location	Dataset Geography	Dataset	Data Provider	Reference Year	Proxy?
Natural gas (Glass)	AU	AU	AU: Natural gas mix	Sphera	2021	No
	NZ	NZ	NZ: Natural gas mix	Sphera	2021	No
Diesel	AU/NZ	AUAU	AU: Diesel mix at filling station	Sphera	2021	No
	GLO	CN	CN: Diesel mix at filling station	Sphera	2021	No*
Light Fuel Oil	AU/NZ	CN	CN: Thermal energy from light fuel oil (LFO)	Sphera	2021	No*
LPG	CN	CN	CN: Thermal energy from LPG	Sphera	2021	No
Heavy fuel oil	GLO	CN	CN: Heavy fuel oil at refinery (1.0 wt.% S)	Sphera	2021	No*

3.9.2. Raw Materials and Processes

Data for upstream and downstream raw materials and unit processes were obtained from the MLC database. Table 3-8 shows the most relevant LCI datasets used in modelling the product systems.

Datasets for raw materials include upstream processes involving mining and extraction, followed by refinement and required level of processing towards the raw materials for the packaging. For example,

- Paperboard – upstream starts with the trees being harvested, followed by processing (e.g. pulping). Planting of trees is excluded, however, biogenic carbon sequestration during tree growth is included.
- Aluminium - upstream data includes bauxite mining, refining, and smelting via electrolysis. This is followed by processes such as aluminium sheet making and can making
- Plastics – upstream data includes extraction and refinement of crude oil to produce refinery products and precursors required for chemical reactions needed to produce plastics.
- Glass – includes upstream mining of sand and other inputs, refinement and heating of inputs to create glass.

Documentation for all MLC datasets can be found at: https://lcadatabase.sphera.com

Table 3-8: Key material datasets used in inventory analysis (primary packaging material)

Material / process	Process Location	Dataset Geography	Dataset	Data Provider	Reference Year	Proxy?
Aluminium	GLO	GLO	GLO: Aluminium ingot mix IAI 2015*	IAI	2015	No
Aluminium recycling	AU/NZ	EU28+EFTA	EU28+EFTA: Aluminium refining: casting alloy ingot from scrap (2010)	European Aluminium	2011	Yes
Bio-HDPE	BR	BR	BR: Polyethylene high density granulate (HDPE/PE-HD) (biobased from sugar cane)	Braskem	2024	No
HDPE**	Europe	RER	RER: Polyethylene high density granulate (HDPE/PE-HD)	Sphera	2024	No*
	Asia	CN	CN: Polyethylene high density granulate (HDPE/PE-HD)	Sphera	2024	No*
Bio-LDPE	BR	BR	BR: Polyethylene low density granulate (LDPE/PE-LD) (biobased from sugar cane)	Sphera	2024	No*
LDPE**	Europe	RER	RER: Polyethylene low density granulate (LDPE/PE-LD) (approximation)	Sphera	2024	No*
	Asia	CN	CN: Polyethylene high density granulate (HDPE/PE-HD)	Sphera	2024	No*
Glass***	AU/NZ	EU-28/US	EU-28: Container glass	Sphera/ts	2024	No*
PET	AU/NZ	CN	CN: Polyethylene terephthalate granulate (PET) via PTA	Sphera	2024	No*
PP	AU/NZ	CN	CN: Polypropylene granulate (PP) (approximation)	Sphera	2024	No*
Paperboard*****	SE	RER	RER: Kraftliner 2022; by-products: tall oil, turpentine; cut-off EoL; [mass allocation]	Sphera/ FEFCO	2024	No
Steel	AU/NZ	Asia	Asia: Steel tinplated	worldsteel	2022	No

* The aluminium dataset from 2015 was scaled to produce the expected GWP for 2022.
** HDPE and LDPE datasets match regional sourcing for plastic granulates– the European dataset is used for Tetra Pak cartons manufactured in Europe while those manufactured in Asia use the CN dataset.
*** The underlying material dataset for glass in this process was modified to “US: Batch materials for container glass” with 2023 reference year from MLC database.
**** The paperboard dataset used to model the paper layers for all cartons is based on “European Database for Corrugated Board Life Cycle Studies” report published in 2018 as implemented and updated in MLC Database.

Table 3-9: Manufacturing processes and inputs

Material / process	Process Location	Dataset Geography	Dataset	Data Provider	Reference Year	Proxy?
Compounding	AU/NZ	GLO	GLO: Compounding (plastics)	Sphera	2024	No
Injection moulding	AU/NZ	GLO	GLO: Plastic injection moulding (parameterized)	Sphera	2024	No
Compressed air	AU/NZ	GLO	GLO: Compressed air 7 bar (medium power consumption)	Sphera	2024	No
Plastic extrusion	AU/NZ	GLO	GLO: Plastic extrusion profile (unspecific)	Sphera	2024	No
Plastic film	AU/NZ	GLO	GLO: Plastic Film (PE, PP, PVC)	Sphera	2024	No
Blow moulding	AU/NZ	DE	DE: Polyethylene (HDPE/PE-HD) blow moulding	Sphera	2024	No
Laminating	CN	GLO	GLO: Lamination & Extrusion Sphera <u-so>	Sphera	2024	No
Can making	AU/NZ	US	RNA: Aluminium can manufacturing	AA	2016	Yes
Stamp and bend	AU/NZ	GLO	GLO: Steel sheet stamping and bending (5% loss)	Sphera	2024	No
Granulator	AU/NZ	DE	DE: Granulator	Sphera	2024	No*
Plastic washing	AU/NZ	DE	DE: Washing (plastic recycling)	Sphera	2024	No*
Pelletizing and compounding	AU/NZ	DE	DE: Pelletizing and compounding	Sphera	2024	No*
Packaging and filling	CN	GLO	GLO: Packaging & Filling Sphera <u-so>	Sphera	2020	No
Water (Plastics Manufacturing)	AU/NZ	RER	RER: Process water from groundwater	Sphera	2024	Yes
Water (Injection Moulding)	AU/NZ	RER	RER: Tap water from surface water	Sphera	2024	Yes
Lubricating Oil	AU/NZ	US	US: Lubricants at refinery	Sphera	2021	Yes

3.9.3. Transportation

Average transportation distances and modes of transport are included for the transport of raw materials, operating materials, and auxiliary materials to production and assembly facilities.

The MLC database was used to model transportation. Transportation was modelled using the MLC global transportation datasets. Fuels were modelled using the geographically appropriate datasets as per Section 3.9.1.

Table 3-10: Transportation and road fuel datasets

Mode / fuels	Location	Dataset	Data Provider	Reference Year	Proxy?
Euro 6 truck, 28-32 t gwt	GLO	GLO: Truck, Euro 6 A-C, 28 - 32t gross weight / 22t payload capacity	Sphera	2024	No
Refrigerated truck	GLO	US: Truck - Insulated Refrigerated / 13,000 lb payload - 7	Sphera	2024	No
Ship	GLO	GLO: Container ship, 5,000 to 200,000 dwt payload capacity, deep sea	Sphera	2024	No

3.9.4. Secondary and Tertiary Packaging

The datasets used for modelling product packaging materials are provided in Table 3-11.

Table 3-11: Key material and process datasets used in secondary and tertiary packaging

Material/ process	Packaging level	Packaging Location	Dataset Geography	Dataset	Data Provider	Reference Year	Proxy?
Cardboard	Secondary	AU/NZ	RER	RER: Corrugated board 2022; 84,5% recycled fiber; cut-off EoL	Sphera/FEFCO	2024	No*
LDPE plastic wrap	Secondary	AU/NZ	RER	RER: Polyethylene low density granulate (LDPE/PE-LD) (approximation)	Sphera	2024	No*
HDPE crate	Tertiary	AU/NZ	CN	CN: Polyethylene high density granulate (HDPE/PE-HD)	Sphera	2024	No*

3.9.5. Waste and wastewater treatment processes

The datasets used for modelling wastewater treatment are provided in Table 3-12.

Table 3-12: Waste treatment processes

Treatment/ Process	Location	Dataset Geography	Dataset	Data Provider	Reference Year	Proxy?
Aluminium - landfill	AU/NZ	US	US: Inert matter (Aluminium) on landfill	Sphera	2024	No*
Glass - landfill	AU/NZ	US	US: Inert matter (Glass) on landfill	Sphera	2024	No*
Steel landfill	AU/NZ	US	US: Ferro metals on landfill, post-consumer	Sphera	2024	No*
Paper/wood landfill	AU/NZ	AU	GLO: Landfill for wood products*	Sphera	2024	No*
Plastic landfill	AU/NZ	US	US: Plastic waste on landfill, post-consumer	Sphera	2024	No*
Washing	AU/NZ	GLO	Washing (glass recycling)	Sphera	2024	No*
Washing crates	AU/NZ	GLO	Washing for reuse (generic machine)	Sphera	2024	No*
Wastewater	AU/NZ	GLO	GLO: Municipal wastewater treatment (sludge treatment mix, for water regionalization) - open energy	Sphera	2024	No*
Wastewater (plastic manufacturing)	AU/NZ	RER	RER: Municipal wastewater treatment (mix)	Sphera	2024	No*

*Underlying energy and process inputs have been regionalised to Australia and New Zealand where possible

4. Life Cycle Inventory (LCI) Analysis

4.1. Packaging Metrics

Tetra Pak packaging metrics for each size class per beverage are given in Annex B.3 and B.4, respectively. The packaging metrics outline:

- Product-to-packaging ratio: The ratio represents the volume of product per gram of packaging. A higher ratio means that more volume is contained per gram of packaging.
- Plastic per litre of beverage (g/L): This indicates the plastic intensity per beverage size class. A higher value means that more plastic packaging is present per litre of beverage.

Glass has the lowest product-to-packaging ratio while lightweight rPET bottles have the highest product-to-packaging ratio. Cartons, PET and rPET bottles have similar product-to-packaging ratios.

Larger cartons have a lower plastic ratio per litre, and this ratio increases as the volume decreases, or when the product contains a closure or straw. Glass bottles, and aluminium cans have lower plastic-per-litre ratios than cartons, while pouches, HDPE, rPET and PET packages have higher plastic ratios.

5. Life Cycle Impact Assessment

This section contains the results for the impact categories and additional metrics defined in Section 2.6. It shall be reiterated at this point that the reported impact categories represent impact potentials, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. In addition, the inventory only captures that fraction of the total environmental load that corresponds to the chosen functional unit (relative approach).

LCIA results are therefore relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks.

5.1. Assessment Results

Results are presented graphically for total GWP within the report. Annex A.1 presents results for GWP-fossil, GWP-biogenic, GWP-land use and GWP-aviation; and Annex F presents results for other indicators included in this study. The Results section summarises the comparison outcomes, and the interpretation and discussion of the results are provided in Section 7.

Total GWP results in the following sections are broken down into six categories:

- **Consumer packs (primary packaging):** This category includes the production of raw materials used in the consumer packs (except biogenic carbon sequestered, which is included in 'consumer end-of-life'), the manufacture of these materials into the consumer packs and the transportation of the packaging to the filling location. Transportation of the beverage to filling location is excluded.
- **End-of-life:** This category includes the end-of-life disposal of the consumer packs, including transportation of the package to landfill or recycling. Biogenic carbon sequestered by paper and cardboard is included in this category to show the net carbon sequestered or released and to avoid having negative numbers within the Consumer Pack category above.
- **Forming and Filling:** This category includes the process inputs required for the filling of consumer packages, including the sterilisation of aseptic packaging. For cartons, this category also includes process inputs required for their forming from a laminated roll (as forming and filling are done on the same line). For all non-carton materials, forming impacts (e.g. bottle blowing) are included in the Consumer Pack category.
- **Transport:** This category includes transportation of raw materials to manufacturing locations, as well as transport of the package after it has been filled from the filling location to retailer. Distribution of the beverage is excluded. Distribution assumptions are given in section 3.6.
- **Secondary packaging:** This category is the sum of manufacture and end-of-life for all secondary packaging included in the packaging system. This includes both the uptake and release of biogenic carbon.
- **Tertiary packaging:** This category is the sum of manufacture and end-of-life for all tertiary packaging included in the packaging system.

Note that packaging results differing by less than ±10% are considered similar (lowest-equal, for example), as they fall within the margin of error for this study and can therefore be treated as equal.

5.1.1. White Milk Packaging

1L Milk Ambient

Figure 5-1 compares 1L milk Tetra Pak packaging in Australia and New Zealand, distributed in ambient conditions. These packages all have aluminium barrier layers and are shipped in corrugated cardboard secondary packaging and wooden pallet tertiary packaging.

Key packaging characteristics:

- TBA Slim: 30.5g carton and 2.7g closure
- TBA 1L Edge: 29.6g carton and 1.05g closure
- Plant-based TBA 1L Edge LW30: 29.6g carton with plant-based (PB) content in its LDPE layer and a 1.3g bio-HDPE closure
- TBA Square: 31.3g carton and 3.88g closure
- Corrugated cardboard box (300g) secondary packaging and wooden pallets (38.5 kg) are used for all packages, but the number of consumer packages in a box and the number of secondary packages on a pallet vary.

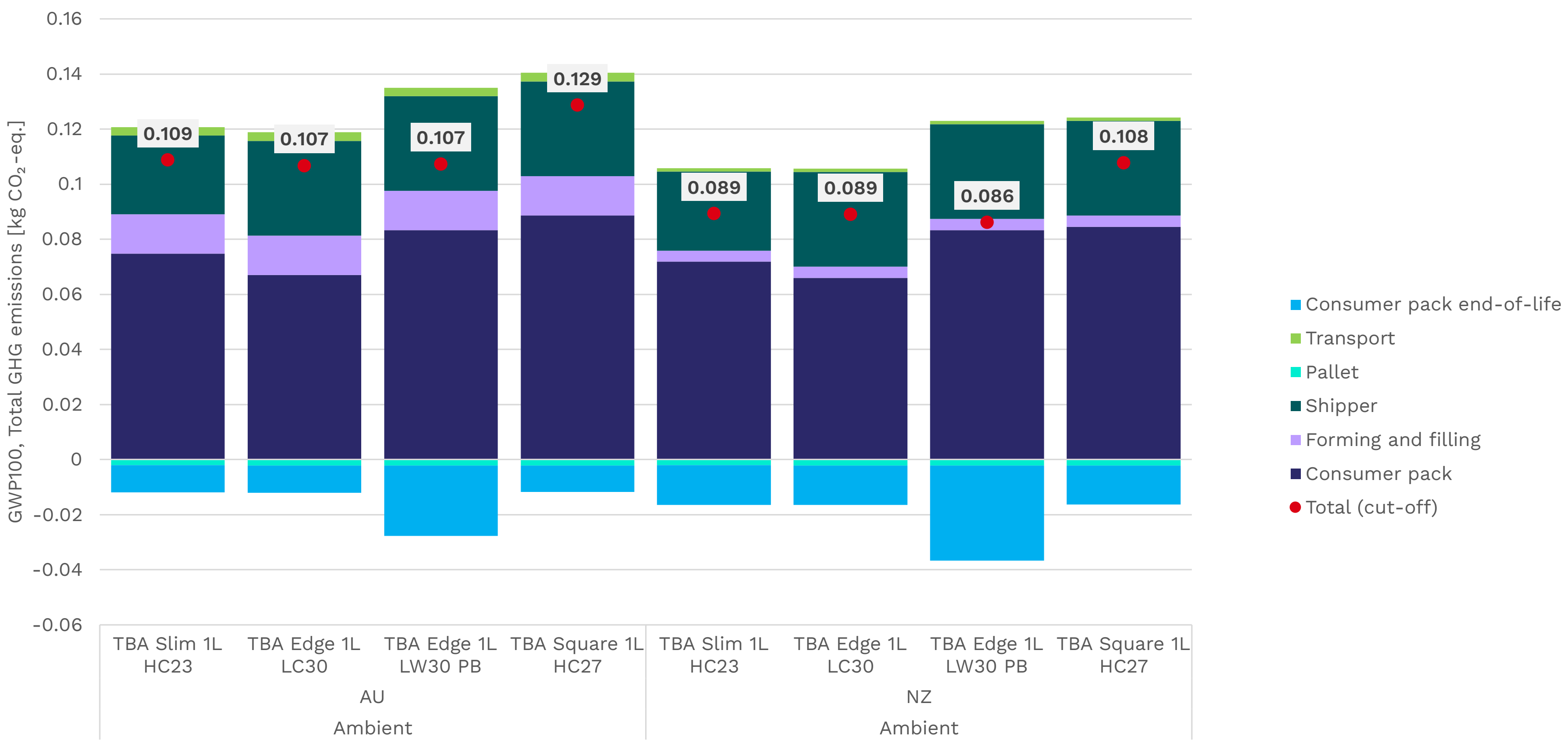


Figure 5-1: 1L Milk Ambient comparison carbon footprint results

- Heavier packages such as TBA Square have higher carbon footprints. The difference in carbon footprint is significant (17% greater than the next highest result)
- Forming and filling carbon footprint for New Zealand is smaller compared to Australia (due to electricity emission factors)
  The carbon footprint of cartons in Australia is greater than that of New Zealand, and the differences are significant

750mL Milk Chilled

Figure 5-2 compares the Tetra Rex (TR) carton against PET and rPET packages used for chilled white milk. These packages are transported chilled (using refrigerated trucks) in reusable plastic (HDPE) crates and wooden pallets.

Key packaging characteristics:

- TR (no aluminium): 17.9g carton and a 4.1g closure
- PET package: 34.3g bottle with a 3.7g closure
- rPET package: 33.3g bottle with a 3.0g closure

Figure 5-2: 750mL Milk Chilled comparison carbon footprint results

- The carton has the lowest carbon footprint for Australia, due to the lower mass of carton when compared against bottles, as well as the lower emissions intensity of carton compared against PET/rPET
- Producing rPET packaging in New Zealand leads to lower carbon footprint compared to Australia. This is due to New Zealand's lower electricity carbon emission factor
- PET package has the highest carbon footprint
- Carbon footprints of packaging in Australia are higher than in New Zealand, which is mainly a reflection of the difference in electricity emissions intensity between these countries and the amount of electricity required for manufacturing each packaging type

1L Milk Chilled

Figure 5-3 compares Tetra Top (TT), Tetra Rex (TR), Tetra Brik Aseptic (TBA), Tetra Brik (TB) cartons with HDPE, PET, rPET, and glass packaging. The chilled milk packages are distributed in reusable plastic crates and wooden pallets (using refrigerated trucks).

Key packaging characteristics:

- TT: cartons all have mass of 22.5g with 2.1g closures
- TR: 20.2g carton and 4.1g closure
- TB Ultra Edge: 28.6g carton and 1.31g closure
- TBA Edge: 29.6g carton and 1.05g closures
- HDPE package: 34g bottle and 3.4g closure.
- PET package: 39g bottle and 3g closure
- Glass package (70% recycled content): 460g bottle and 4.9g closure
- rPET package: 34g bottle and 3.4g closure

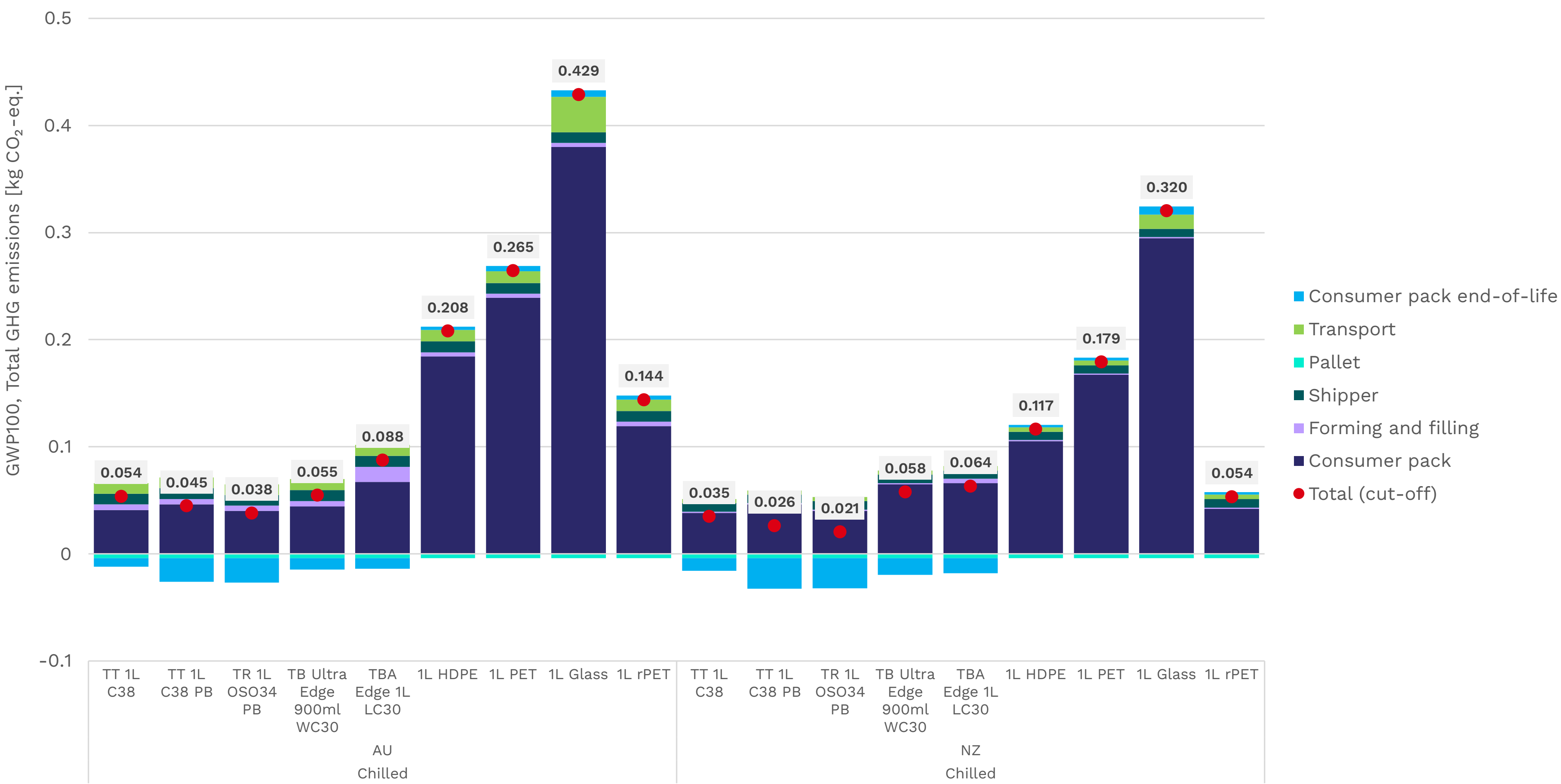


Figure 5-3: 1L Milk Chilled comparison carbon footprint results

- Glass package has the highest carbon footprint, followed by PET and HDPE
- Plant-based (PB) Tetra Rex (TR) carton has the lowest carbon footprint for Australia and New Zealand
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand

1.5L Milk Chilled

Figure 5-4 compares the Tetra Brick Aseptic (TBA) carton, PET and rPET packaging used for 1.5L chilled milk. The chilled milk packages are distributed in reusable plastic crates and wooden pallets via refrigerated trucks.

Key packaging characteristics:

- TBA Edge: 30.8g carton and 1.3g closure
- PET package: 50g bottle and 3.7g closure
- rPET package: 48.7g bottle and 3.1g closure

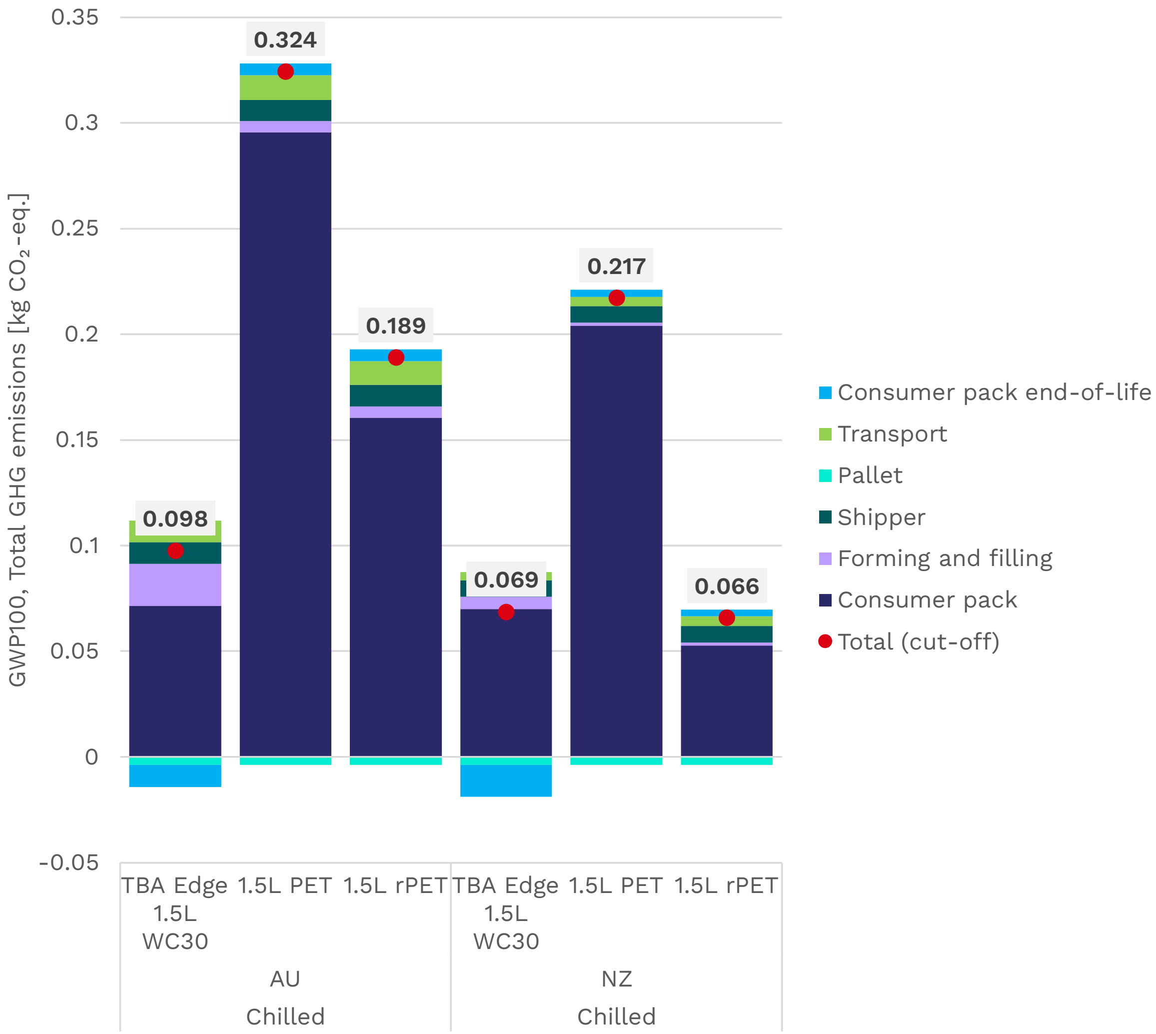


Figure 5-4: 1.5L Milk Chilled comparison carbon footprint results

- TBA Edge carton has the lowest carbon footprint for Australia
- PET package has the highest carbon footprint. The carbon footprint of PET packaging is significantly higher than that of the TBA Edge carton and rPET package
- rPET and TBA Edge carton have low total carbon footprint for New Zealand
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand

2L Milk Chilled

Figure 5-5 compares the Tetra Rex (TR) carton and the HDPE packaging used for 2L chilled milk. The chilled milk packages are distributed in reusable plastic crates and wooden pallets. Refrigerated trucks are used for distribution from filling to retail.

Key packaging characteristics:

- TR: 29.3g carton and a 4.1g closure
- HDPE package: 38.5g bottle and 2.7g closure

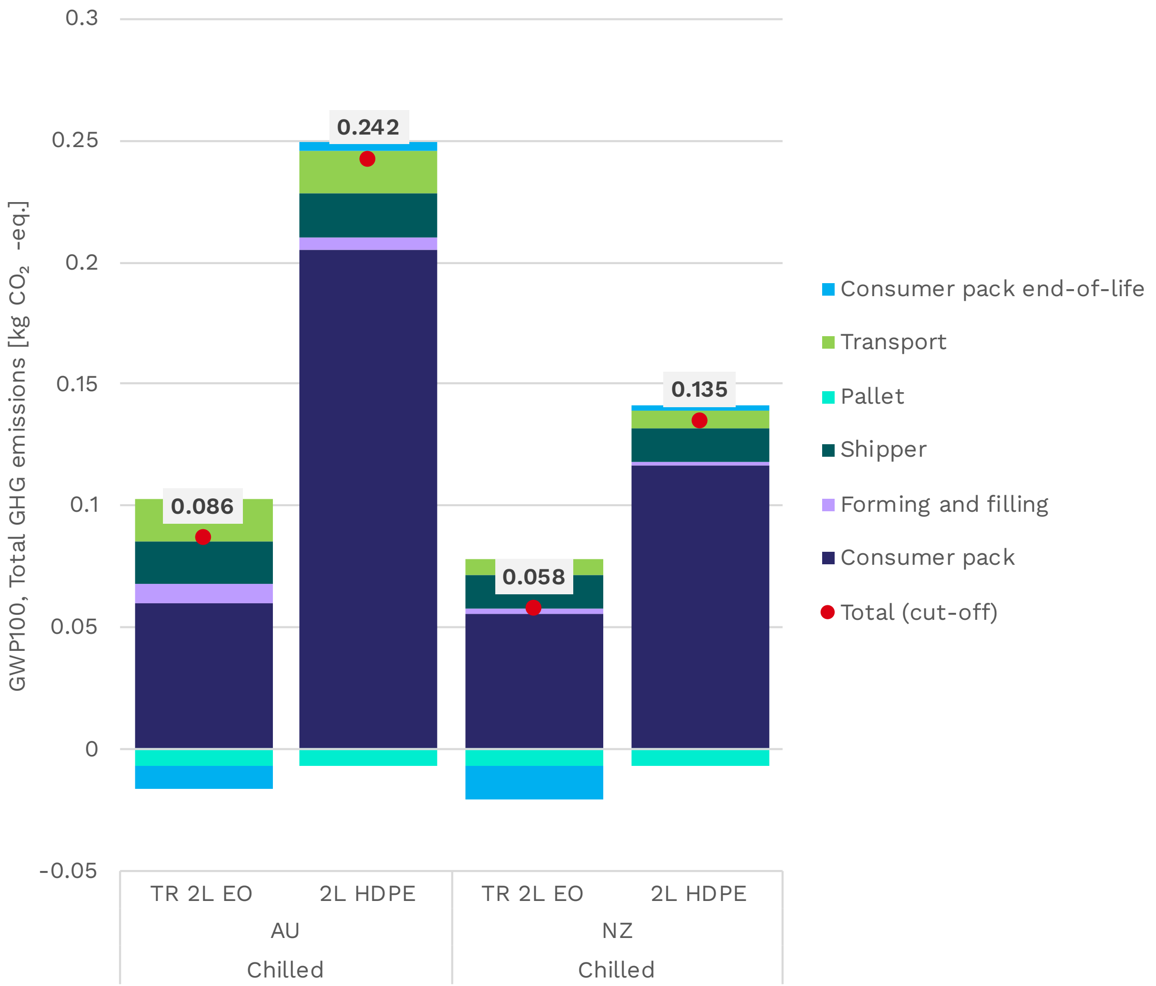


Figure 5-5: 2L Milk Chilled comparison carbon footprint results

- HDPE package has the higher carbon footprint compared to the TR carton
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand

5.1.2. RTD Coffee and FSN Packaging

250mL RTD Coffee and FSN Ambient

Figure 5-6 compares Tetra Prisma Aseptic (TPA), Tetra Brik Aseptic (TBA) and aluminium can package used for 250mL of RTD coffee and FSN. These packs are distributed in corrugated cardboard secondary packaging and wooden pallets. The aluminium cans distributed in chilled and ambient conditions are also illustrated in the same graph (with the same secondary packaging across the scenarios). The only difference between the ambient and chilled aluminium scenarios is the use of refrigerated truck during distribution.

Key packaging characteristics:

- TPA Edge: 14.7g carton with a closure mass of 3.7g
- TBA Base: carton mass of 6.3g, a paper straw instead of a closure,
- Aluminium can: mass of 12.4g (70% recycled content)

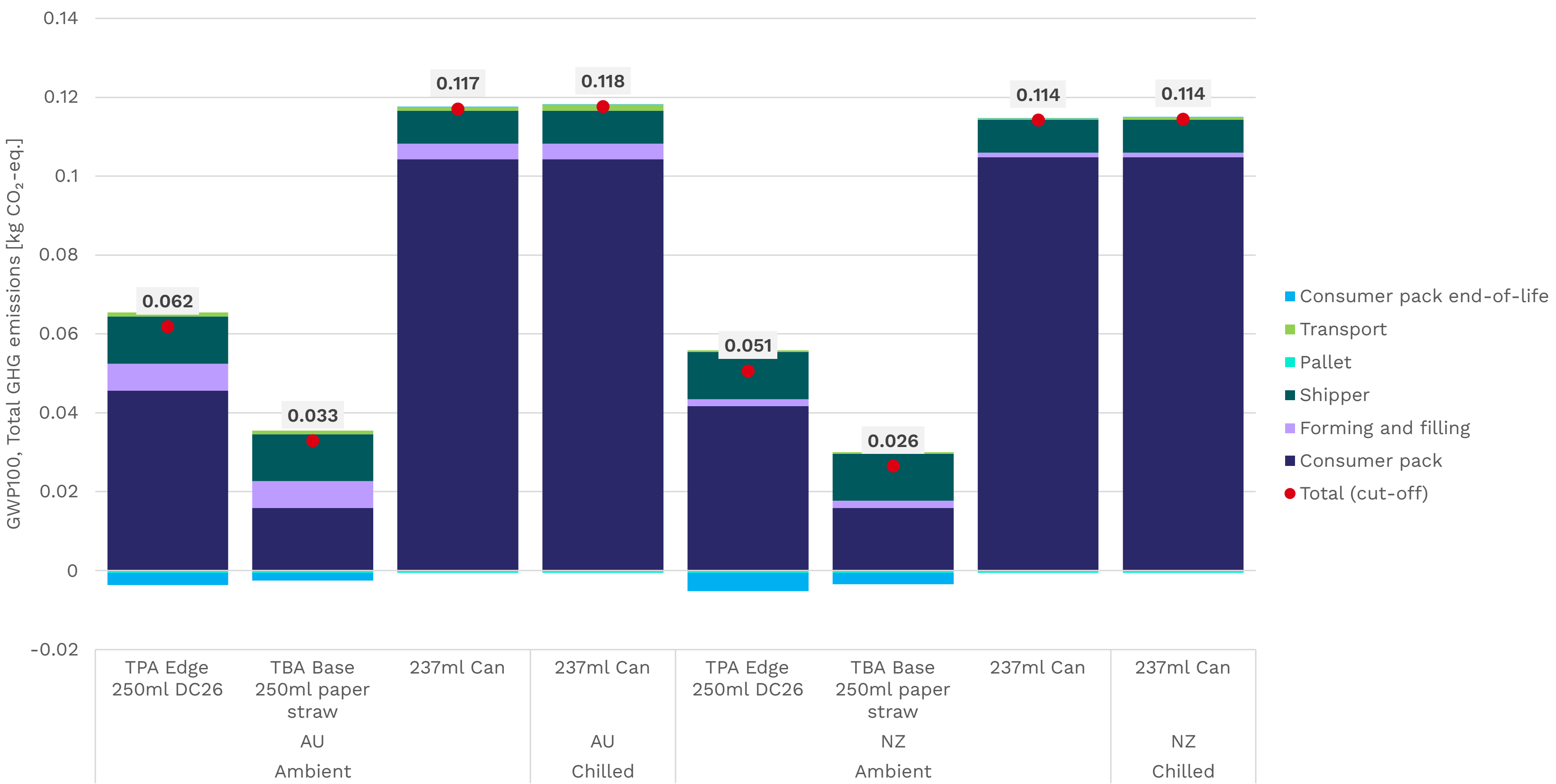


Figure 5-6: 250mL RTD Ambient and Chilled comparison carbon footprint results

- TBA Base has low carbon footprints
- TPA Edge has higher carbon footprint due to higher mass compared to the TBA Base carton (14.7g vs 7-8g)
- Aluminium cans have highest carbon footprint. There is no difference in carbon footprint between chilled and ambient distributed aluminium cans
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand except for aluminium cans

300mL RTD Coffee and FSN Ambient

Figure 5-7 compares three versions of Tetra Prisma Aseptic (TPA) and PET packaging used for 300mL of RTD coffee and FSN. These packs are distributed in corrugated cardboard secondary packaging and wooden pallets.

Key packaging characteristics:

- TPA Edge: 11.5g cartons and 3.7g closures
- TPA cartons also have a format with plant-based plastics (bio-LDPE in laminate layer and bio-HDPE in closure)
- PET packaging: 22.5g bottle and 3.7g closure

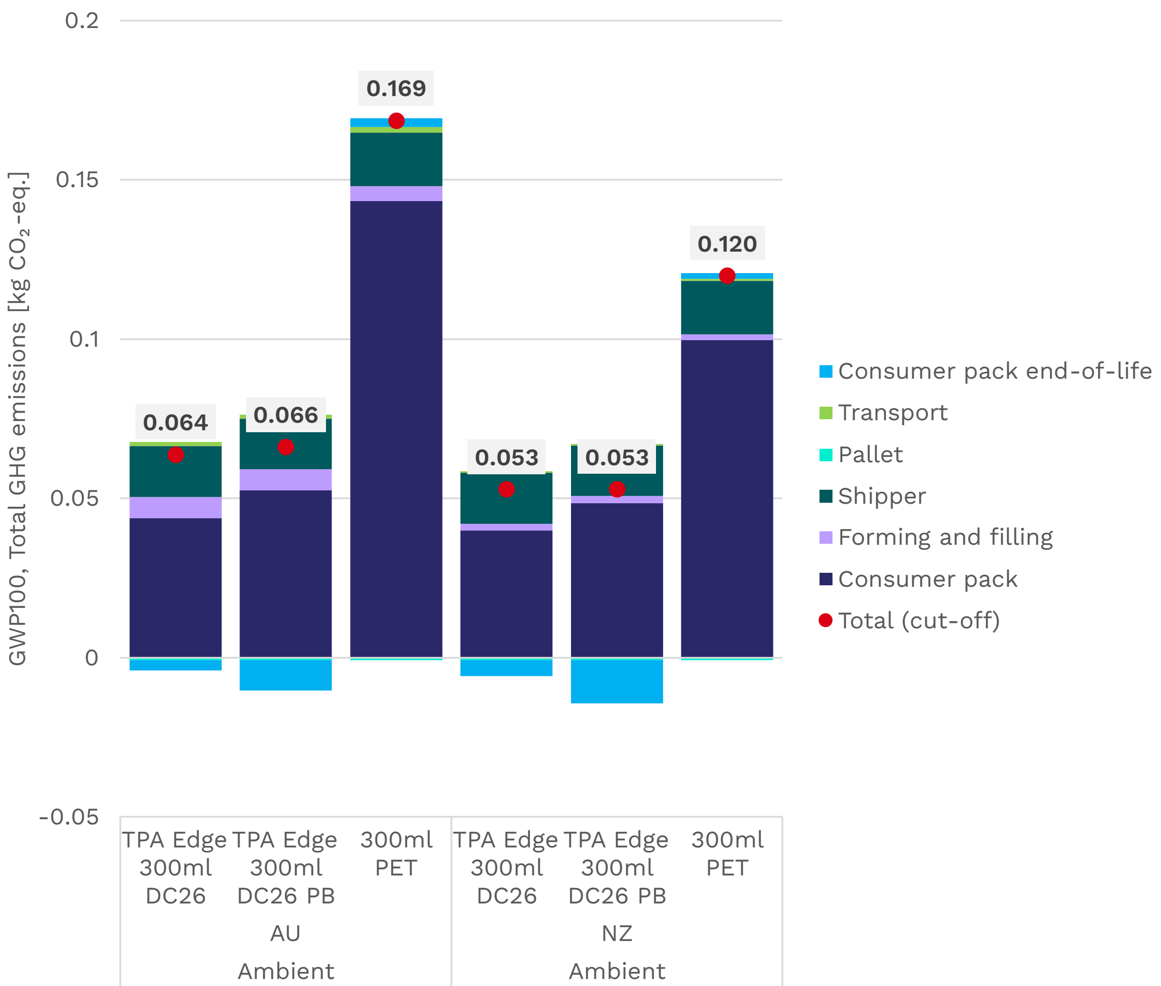


Figure 5-7: 300mL RTD Ambient comparison carbon footprint results

- Tetra Pak cartons have low carbon footprints compared to the PET package
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand

330mL RTD Coffee and FSN

Figure 5-8 compares Tetra Top (TT), Tetra Prisma Aseptic (TPA) and PET packaging used to package 330mL of RTD coffee and FSN. These packs are distributed in corrugated cardboard secondary packaging and wooden pallets. The TT carton is distributed chilled via a refrigerated truck.

Key packaging characteristics:

- TT: 10.9g carton (no aluminium layer) and 2.8g closure
- TPA Square: 12.8g carton and 3.1g closure
- PET packages:
  - 330mL: 27.8g bottle and 3g closure
  - 375mL bottle scaled linearly to 330mL: 21.3g bottle and 2g closure

Figure 5-8: 330mL RTD Ambient comparison carbon footprint results*

*TT is distributed chilled while all others are distributed in ambient conditions.

- PET package has the highest carbon footprint. The difference between cartons and PET packaging is significant
- Tetra Top (TT) cartons (no aluminium layer) have low carbon footprints
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand

500mL RTD Coffee and FSN Ambient and Chilled

Figure 5-9 compares Tetra Prisma Aseptic (TPA), Tetra Top (TT), HDPE, PET and rPET packaging used to package 500mL of RTD coffee and FSN. The TPA cartons are shown with both chilled (using refrigerated trucks) and ambient distribution. All packages are distributed in corrugated cardboard secondary packaging and wooden pallets.

Key packaging characteristics:

- TPA Edge: 18.5g cartons with 3.7g closures
- TT: 14.6g carton (no aluminium laminate layer) and 2.8g closure
- rPET package: 20.9g bottle and 2.7g closure
- HDPE package: 24g bottle and 3.5g closure
- PET package: 31.5g bottle and 3.9g closure

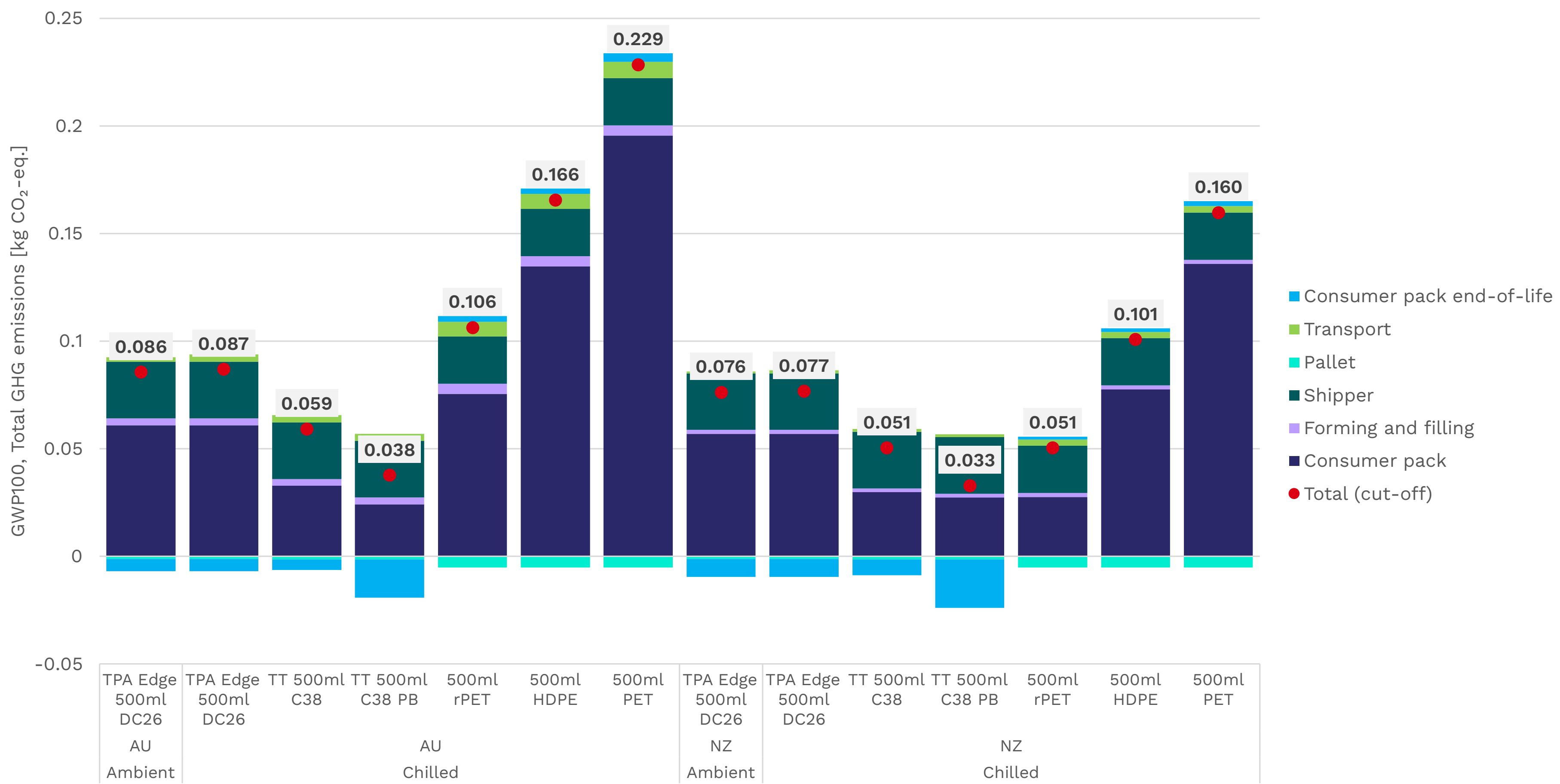


Figure 5-9: 500mL RTD Ambient and Chilled comparison carbon footprint results

- Plant-based TT carton has the lowest carbon footprint. The TT cartons have lower carbon footprints compared to TPA cartons. The difference in carbon footprints is significant
- PET packaging has the highest carbon footprint, significantly higher than other packaging types
- The carbon footprint of packaging in Australia is greater than that of New Zealand, and the differences are significant

5.1.3. Juice Packaging

250mL Juice Ambient

Figure 5-10 compares Tetra Prisma Aseptic (TPA), two versions of Tetra Brik Aseptic (TBA), glass, PET and pouch packaging used for 250mL ambient juice. These packs are distributed in corrugated cardboard secondary packaging and wooden pallets. The PET package had plastic wrapping secondary package only

Key packaging characteristics:

- TBA Base Crystal: 200 mL carton scaled up to 250 mL resulting in a 10.6g carton (no closure)
- TPA Edge: 11.0g carton and 3.71 g closure
- TBA Slim: 9.2g carton and no closure (has a thinner aluminium layer compared to TPA Edge)
- PET package: 17.4g bottle and 5.1g closure
- Glass package: 159g bottle with a 4.1g steel closure
- Pouch: 6.2 g pouch (aluminium, LDPE and PET film layers) with 3.7g polypropylene closure. The 200 mL pouch has not been scaled

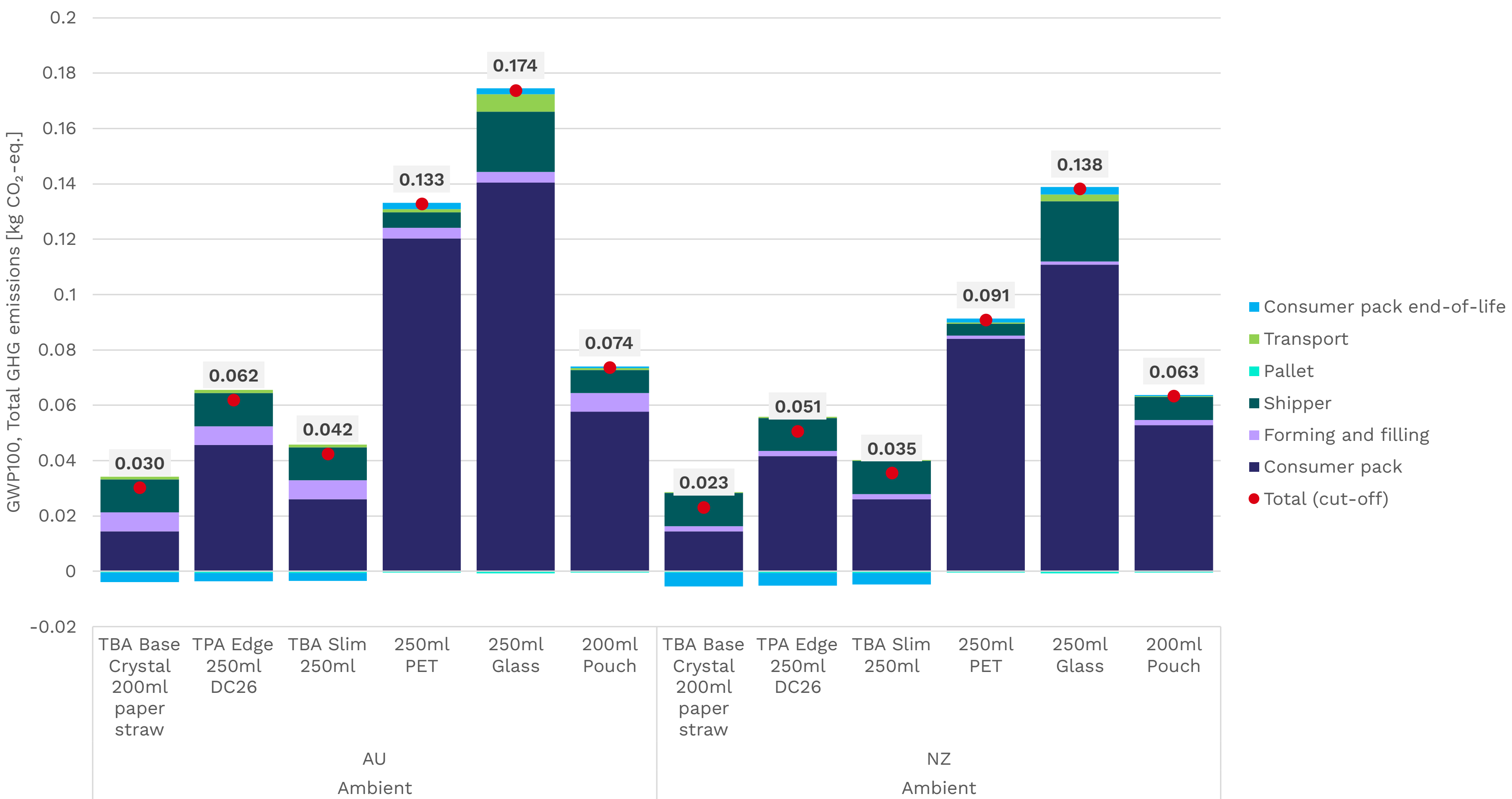


Figure 5-10: 250mL Juice Ambient comparison carbon footprint results

- Cartons have lower carbon footprints compared to other packages
- Glass package has the highest carbon footprint, followed by the PET package
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand

300mL Juice Chilled

Figure 5-11 compares three versions of Tetra Prisma Aseptic (TPA) cartons, glass and PET packaging used for 300mL chilled juice. These packs are distributed in refrigerated trucks and use corrugated cardboard secondary packaging and wooden pallets.

Key packaging characteristics:

- TPA Edge: 11.5g cartons and 3.7g closure, with a version with plant-based (PB) content in its LDPE layer
- Glass package: 168g bottle and 4.1g closure. This package has been scaled linearly from 250 mL to 300 mL
- PET package: 20g bottle and 3.5g closure. This package has been scaled linearly from 250 mL to 300 mL

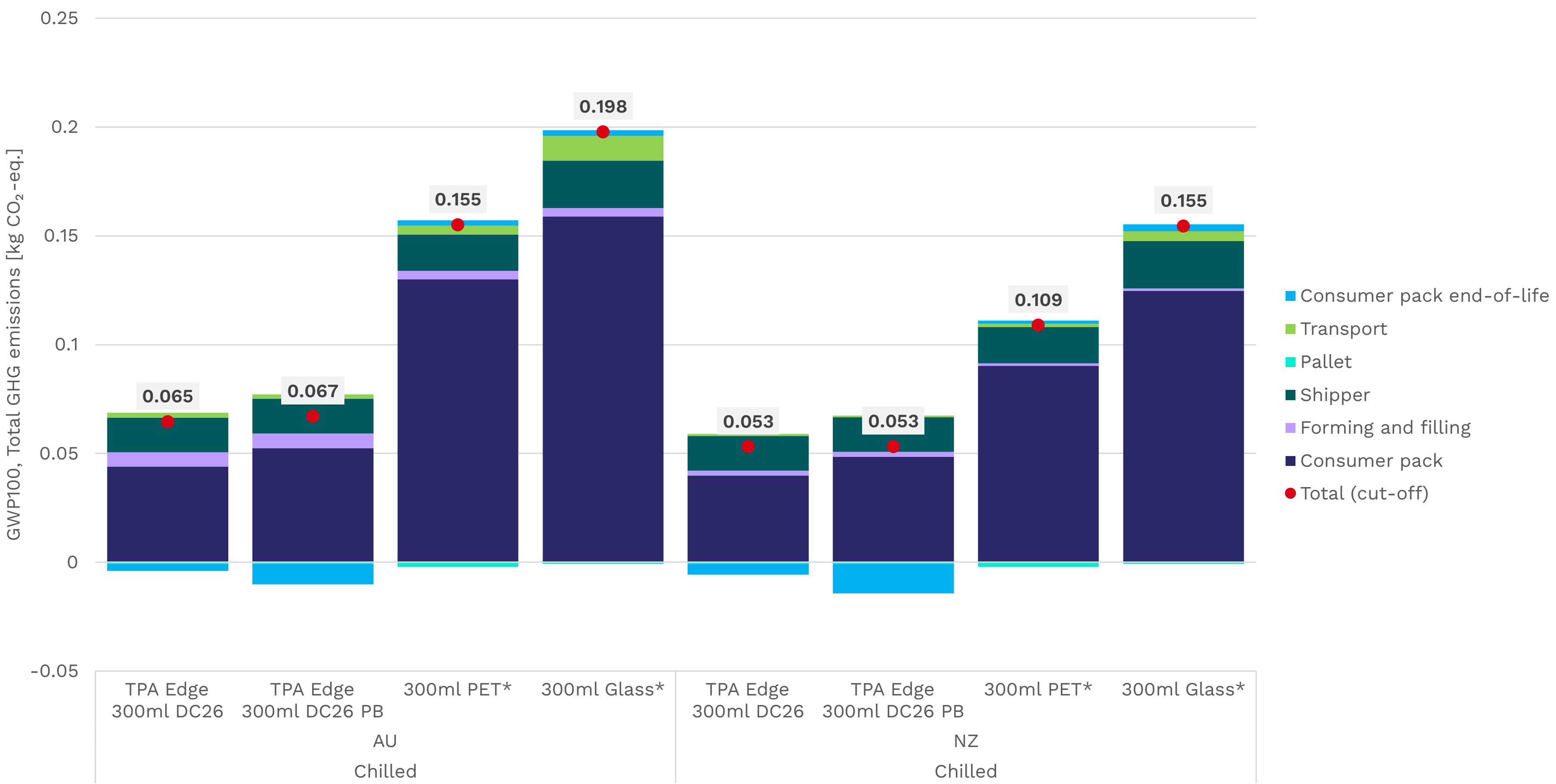


Figure 5-11: 300mL Juice Chilled comparison carbon footprint results

- Glass package has the highest carbon footprint
- PET package has the second highest carbon footprint
- Cartons have the lowest carbon footprint

500mL Juice Ambient

Figure 5-12 compares two versions of Tetra Prisma Aseptic (TPA) carton and PET packaging used for 500mL ambient juice. These packs are distributed in corrugated cardboard secondary packaging and wooden pallets via a conventional diesel truck.

Key packaging characteristics:

- TPA Edge: 18.5g carton and 3.7g closure
- PET package: 25.2g bottle and 3.1g closure

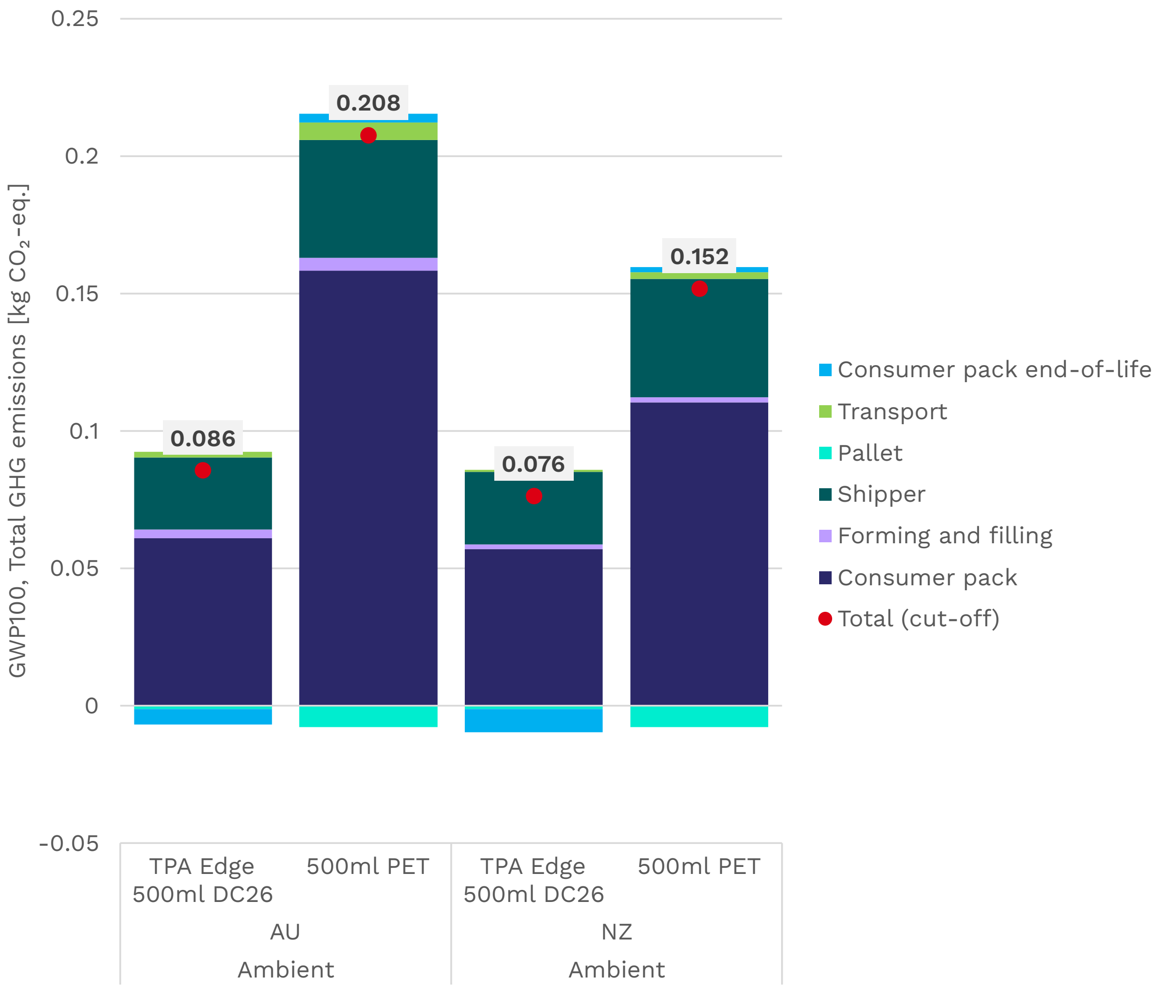


Figure 5-12: 500mL Juice Ambient comparison carbon footprint results

- PET package has a higher carbon footprint compared to the carton
- Carbon footprints of PET packaging in Australia are higher than in New Zealand

500mL Juice Chilled

Figure 5-13 compares the same two versions of Tetra Prisma Aseptic (TPA) carton and PET packaging as the previous section, but in chilled conditions. These packs are distributed in refrigerated trucks and use corrugated cardboard secondary packaging and wooden pallets.

Key packaging characteristics:

- TPA Edge: 18.5g carton and 3.7g closure
- PET package: 25g bottle and 3g closure

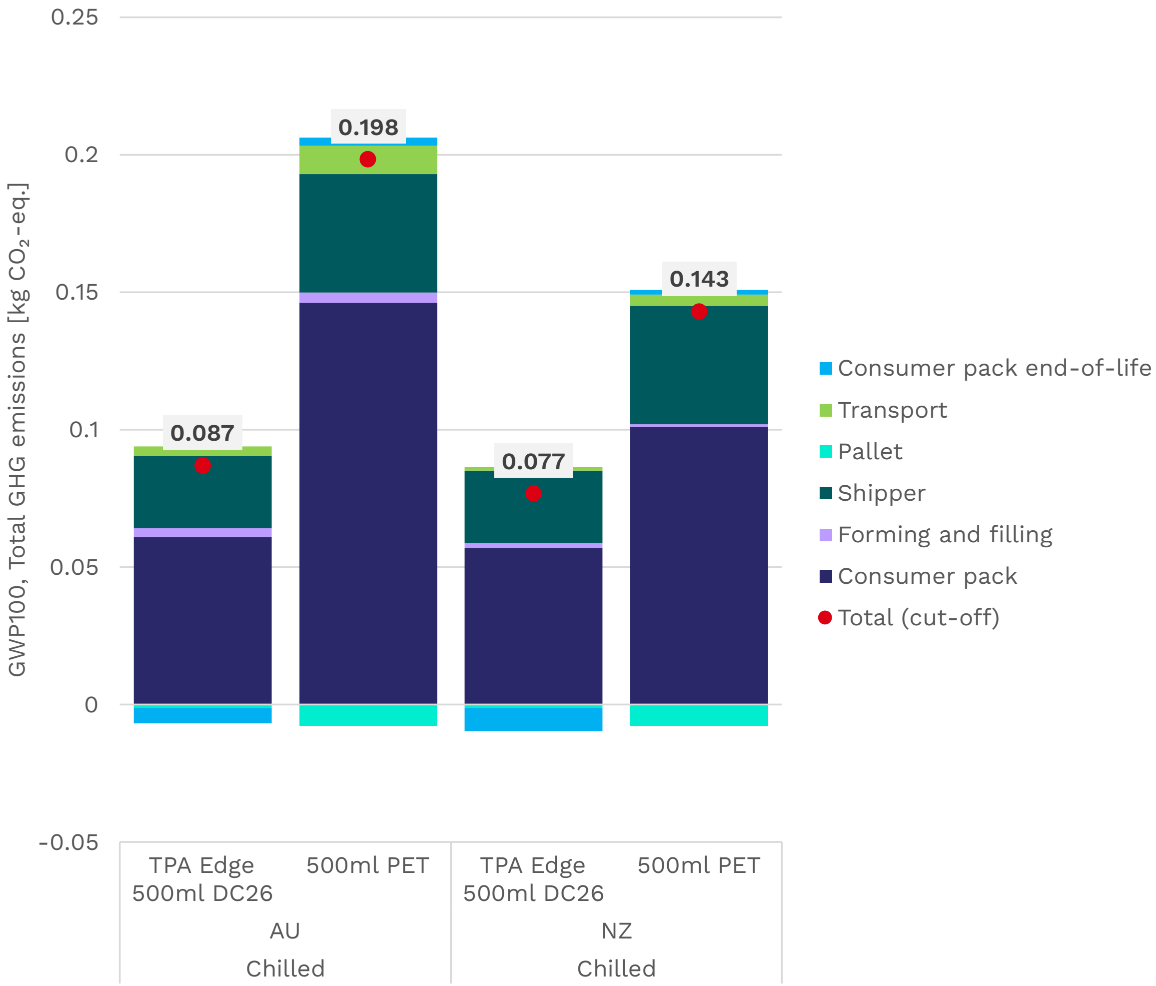


Figure 5-13: 500mL Juice Chilled comparison carbon footprint results

- PET package has a higher carbon footprint compared to cartons
- The carbon footprint of PET packaging in Australia is significantly higher than in New Zealand

1L Juice Ambient

Figure 5-14 compares Tetra Stelo Aseptic (TSA), Tetra Prisma Aseptic (TPA), glass and PET packaging used for 1L ambient juice. These packs are distributed in corrugated cardboard secondary packaging and wooden pallets.

Key packaging characteristics:

- TSA carton: 30.2g carton and 1.3g closure
- TPA Square: 31.3g carton and 3.9g closure
- Glass package: 510g bottle and 4.1g steel closure
- PET package: 37.5g bottle and 3.8g closure

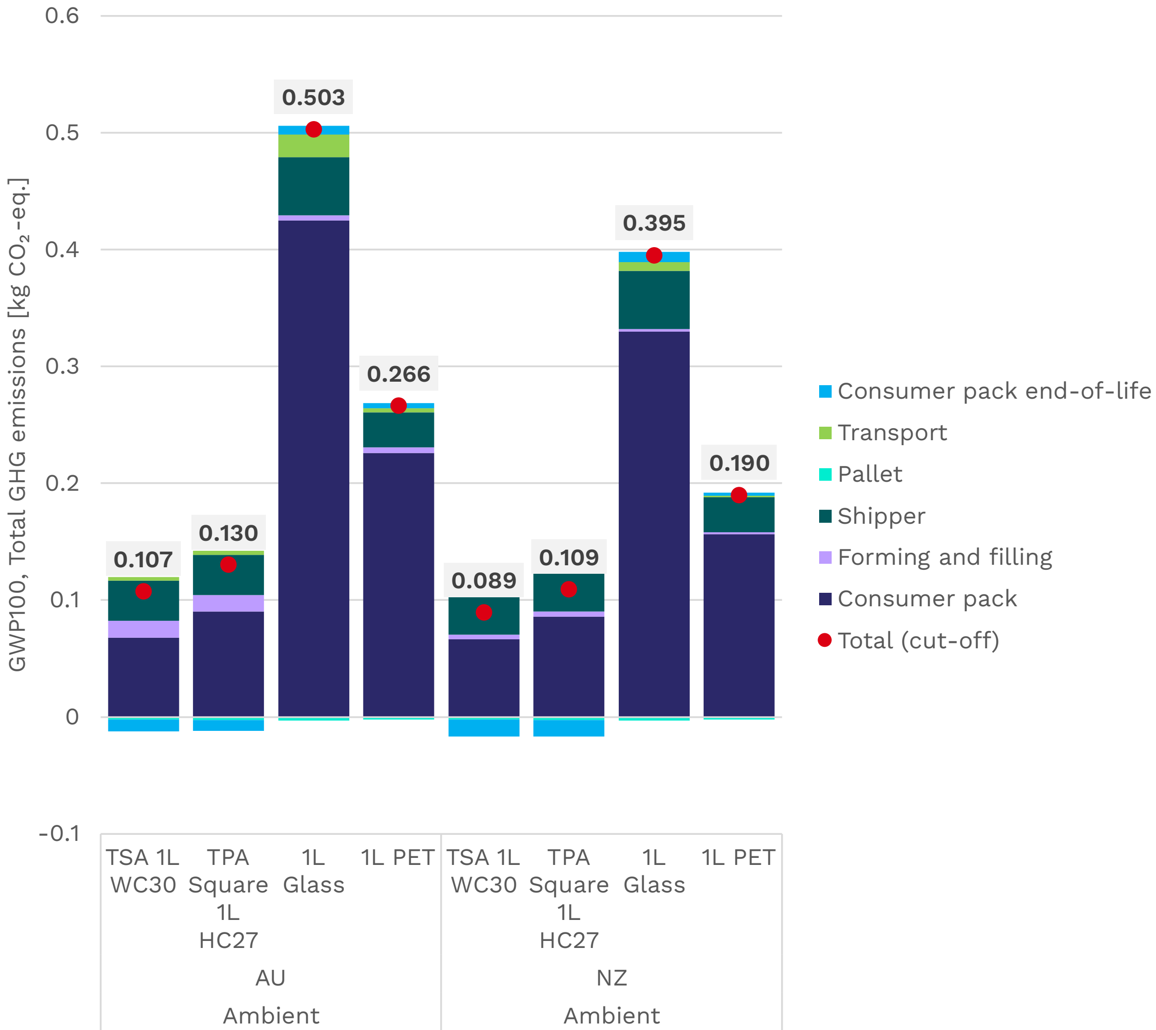


Figure 5-14: 1L Juice Ambient comparison carbon footprint results

- Glass package has the highest carbon footprint
- The TSA carton (lower aluminium mass compared to TPA) has the lowest carbon footprint
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand

1L Juice Chilled

Figure 5-15 compares Tetra Rex (TR), Tetra Prisma Aseptic (TPA), Tetra Stelo Aseptic (TSA), cartons and PET packaging used for 1L chilled juice. These packs are distributed in refrigerated trucks and use corrugated cardboard secondary packaging and wooden pallets.

Key packaging characteristics:

- TR carton has a carton mass of 16.7g (no aluminium layer and no closure)
- TSA: 30.2g carton, 1.3g closure
- TPA Square: 31.3g carton and 3.9g closure (carton has a thicker aluminium layer compared to others in this comparison)
- PET package: 38.3g bottle and 3.5g closure

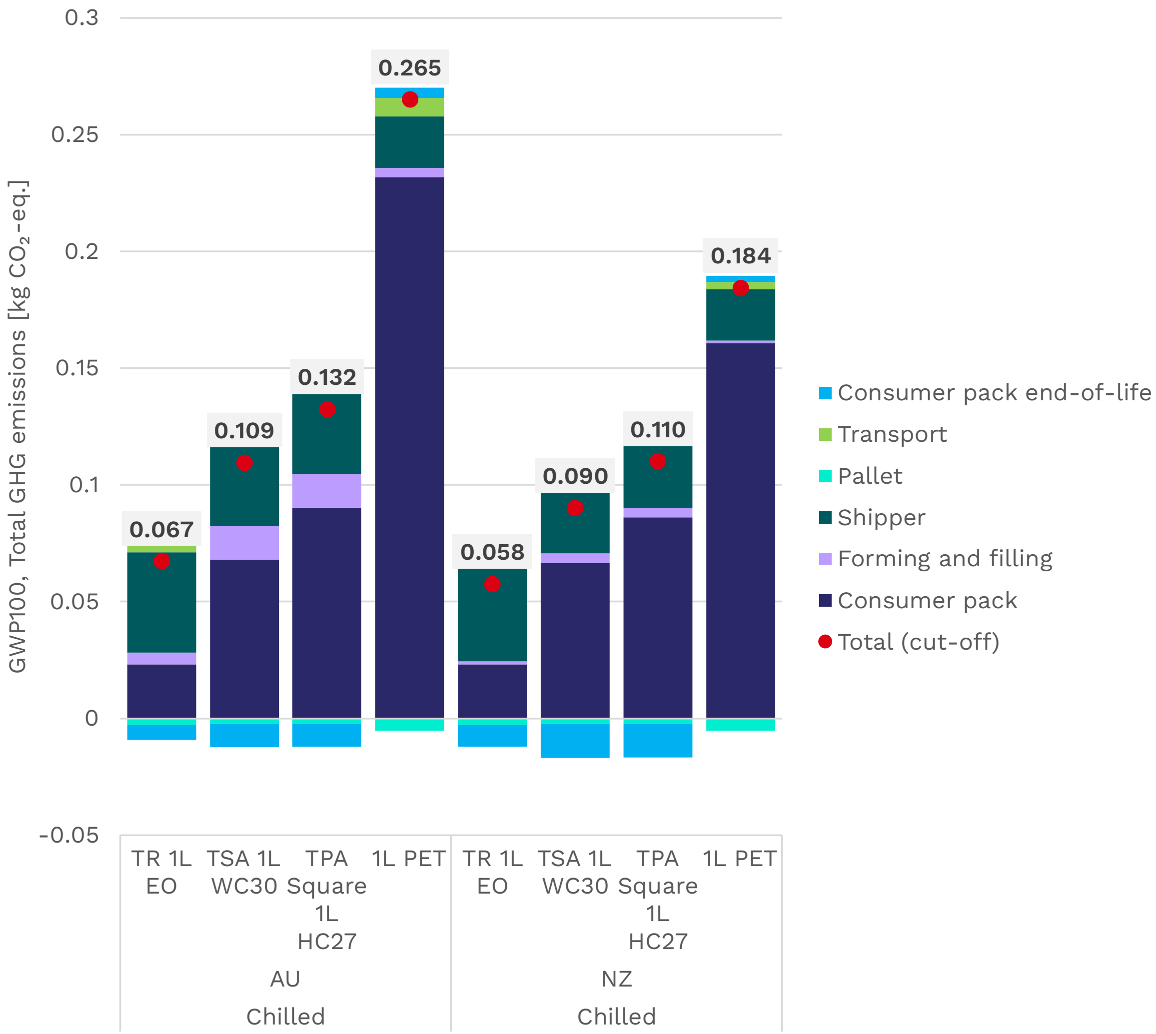


Figure 5-15: 1L Juice Chilled comparison carbon footprint results

- PET package have the highest carbon footprint, significantly higher than other packaging
- TR carton has the lowest carbon footprint
- PET package in New Zealand has a lower carbon footprint compared to Australia (by 31%)

1.5L Juice Ambient

Figure 5-16 compares Tetra Brik Aseptic (TBA), and PET packaging used for 1.5L ambient juice. These packs are distributed in corrugated cardboard secondary packaging and wooden pallets.

Key packaging characteristics:

- TBA Edge carton: 30.8g carton and 3.3g closure
- PET package: 61.6g bottle and 3.2g closure. This package is a scaled-up version from a 1.25L

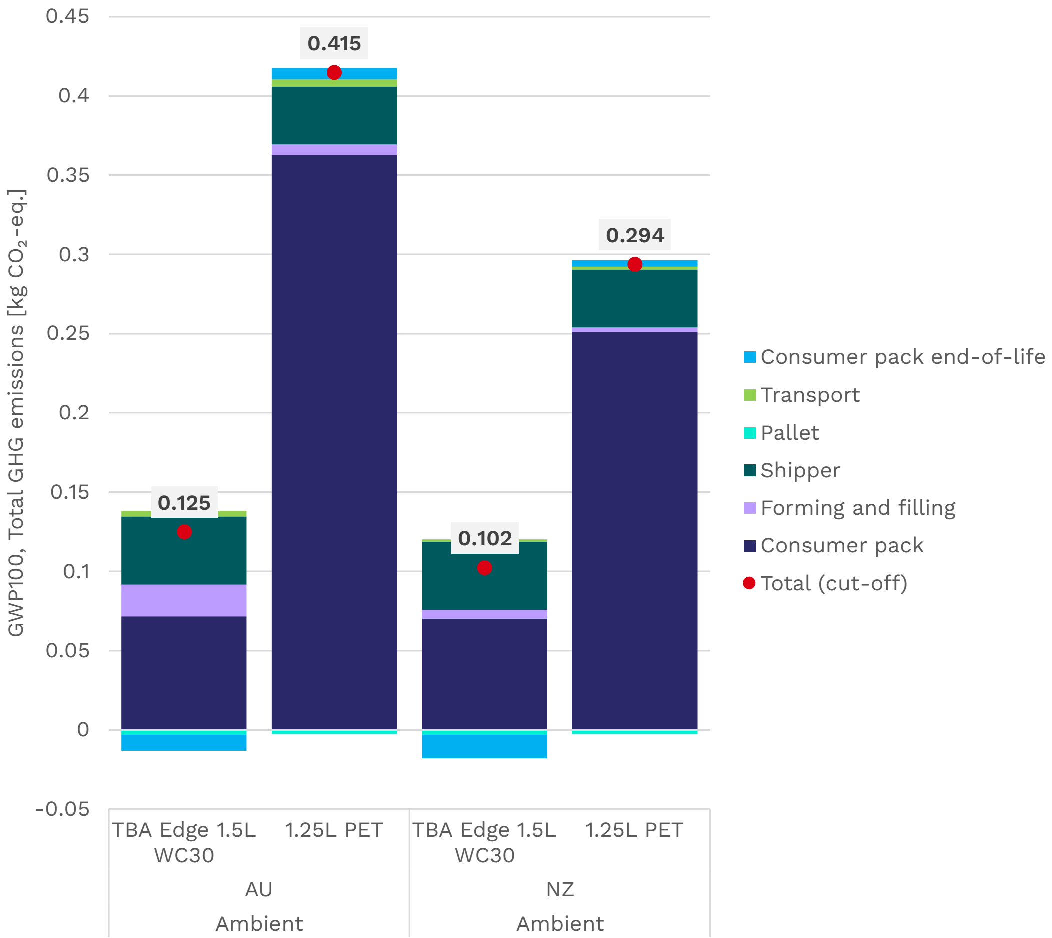


Figure 5-16: 1.5L Juice Ambient comparison carbon footprint results

- Cartons have the lower carbon footprint compared to PET packaging
- Carbon footprints of packaging in Australia are significantly higher than in New Zealand

2L Juice Chilled

Figure 5-17 compares three versions of Tetra Rex (TR), PET and HDPE packaging used for 2L chilled juice. These packs are distributed in refrigerated trucks and use corrugated cardboard secondary packaging and wooden pallets.

Key packaging characteristics:

- TR: 29.3g carton and 4.1g closure with plant-based plastic (bio-HDPE closure and bio-LDPE laminate) version
- PET package: 67.6g bottle and 3.4g closure
- HDPE package: 38.5g bottle and 2.8g closure

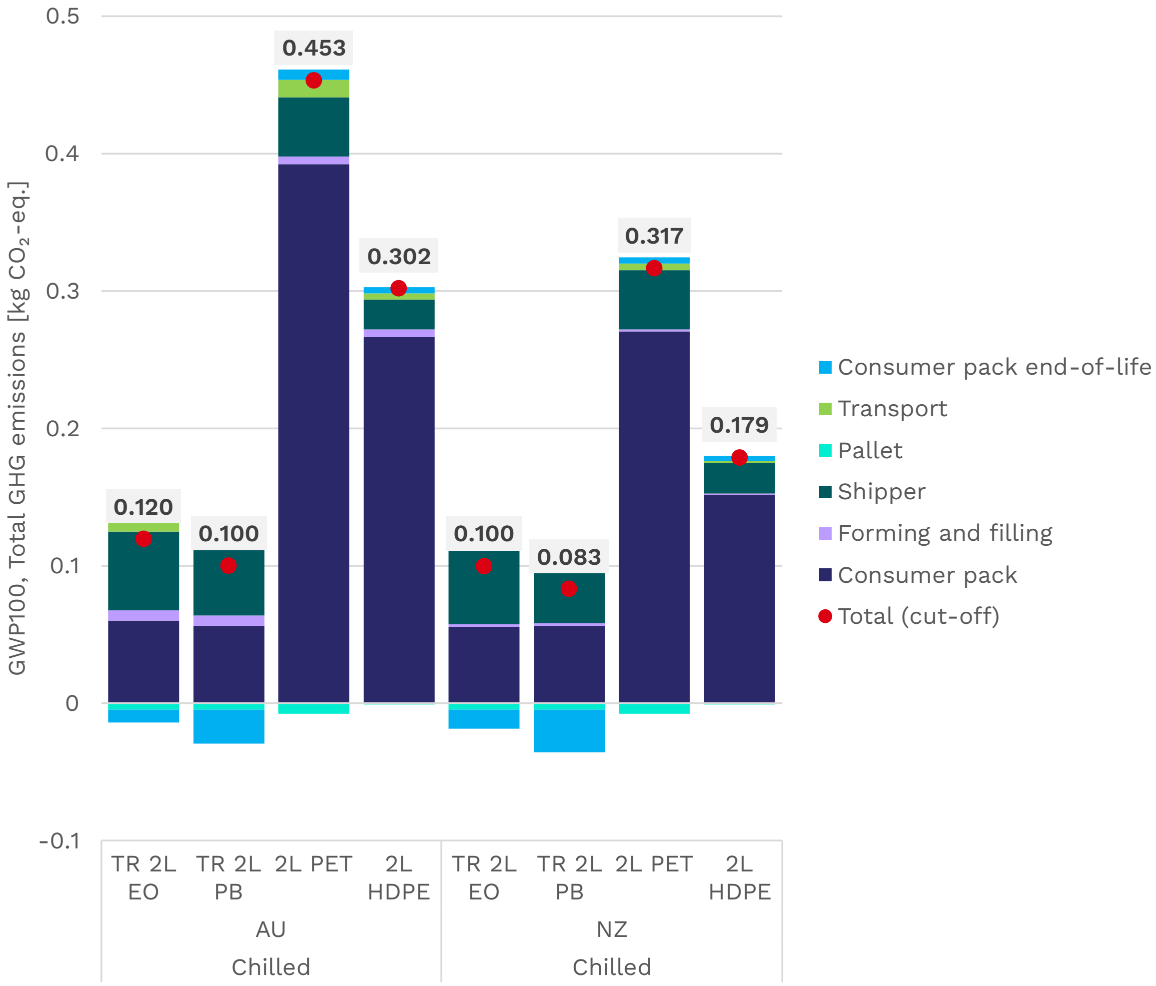


Figure 5-17: 2L Juice Chilled comparison carbon footprint results

- Plant-based versions of cartons have a lower carbon footprint
- PET package has the highest carbon footprint, followed by HDPE
- Carbon footprints of PET and HDPE packaging in Australia are significantly higher than in New Zealand

5.2. Hotspot analysis

Hotspot analysis examines the percentage contribution of each process to the total carbon footprint (Section 5.2.1). Percentage contributions should therefore be understood within the context of the relative impact per product and not assumed to imply that the impacts from that process are higher for a particular product. Therefore, products with lower overall impact (total carbon footprint) will show higher percentage contributions from each process.

Furthermore, two cartons (one aseptic and one non-aseptic) have been analysed assuming they are produced at each of the Tetra Pak manufacturing sites in this study (Section 5.2.2).

5.2.1. Carbon hotspots for packages

Analysis has been conducted for the following packages in the Australian market, representing one of each material type in this study (Table 5-1):

- Aseptic carton: TBA Slim 1L HC23 (ambient milk)
- Plant based non-aseptic carton: TT 1L C38 PB
- Non-aseptic cartons: TT 1L C38 (chilled milk)
- Glass package (1L chilled milk)
- Aluminium package (250mL chilled RTD Coffee and FSN)
- PET package (1L chilled milk)
- rPET package (1L chilled milk)
- HDPE package (1L chilled milk)

Table 5-1: Percentage breakdown of carbon footprint hotspots in the life cycle of packaging formats in Australia

Product	TBA Slim 1L HC23 (%)	TT 1L C38 PB (%)	TT 1L C38 (%)	1L Glass (%)	237mL Aluminium can (%)	1L PET (%)	1L rPET (%)	1L HDPE (%)
Consumer pack – Raw materials	49.3	63.6	42.3	55.8	60.6	59.5	9.87	40.3
Consumer pack - Manufacture	0.467	2.48	0.715	1.89E-04	24.5	0.0734	0.120	0.0826
Consumer pack - Electricity	6.92	10.1	11.1	20.1	0	33.8	69.9	47.3
Consumer pack - Thermal Energy	0.757	1.84E-04	1.57E-04	8.72	0	0.0720	4.13	0.0170
Consumer pack - Transport	13.6	27.8	24.2	3.35	1.58	0.534	0.832	0.567
Other	0.349	-1.83	0.777	0.586	2.48	-3.65	-1.96	0.303
Secondary pack - Material	-12.1	7.63	6.52	0.938	-3.58	1.52	2.79	1.93
Secondary pack - Electricity	0	5.99	5.12	0.736	0	1.19	2.19	1.52
Secondary pack - Reuse	0	3.08	2.63	0.379	0	0.614	1.13	0.781
Secondary pack - Transport	0.688	2.28	1.95	0.280	0.205	0.453	0.833	0.577
Secondary pack - EoL	35.4	0.0578	0.0494	0.00710	10.5	0.0115	0.0212	0.0146
Forming and filling	12.0	9.71	8.30	0.900	3.30	1.46	2.68	1.86
Pallet (tertiary pack)	-1.74	-7.36	-6.29	-0.905	-0.482	-1.47	-2.69	-1.86
Transport	2.48	18.9	16.1	7.68	0.791	4.16	7.40	5.10
Consumer pack end-of-life	-8.17	-42.4	-13.5	1.46	0.0859	1.76	2.76	1.51
Total carbon footprint (kg CO_2 eq./pack)	**0.119**	**0.0527**	**0.0617**	**0.429**	**0.117**	**0.265**	**0.144**	**0.208**

For most packaging options, the raw materials of the consumer pack are the largest contributor to the carbon footprint, typically making up 40–85% of the total footprint per package.

For cartons, biogenic carbon sequestered in paper and bio-based plastics is accounted for in the end-of-life stage, along with biogenic carbon emissions released at this stage. As a result, the consumer pack raw material stage reflects only fossil-based carbon emissions from materials, while the end-of-life stage reflects biogenic carbon sequestration for all cartons. Consequently, the relative percentage of impact from the plant-based carton (TT 1L C38 PB) for raw material and end-of-life stages are both significant.

The rPET bottle is made entirely from recycled plastic. Since this study applies the cut-off approach, the recycled content of the rPET bottle is treated as burden-free. As a result, the raw material carbon footprint comes only from the bottle's cap and label. The main source of carbon footprint for rPET is electricity used during manufacturing.

Electricity used in producing the consumer pack is usually the next largest contributor to the carbon footprint. For 6 out of the 8 packs compared, consumer pack electricity accounted for more than 10% of the total footprint.

The forming and filling stage of Tetra Pak cartons contributes over 10% of the total carbon footprint per carton. This is because Tetra Pak cartons require an additional forming step, converting laminates into cartons.

5.2.2. Tetra Pak carton production

Table 5-2 and Table 5-3 examines carbon footprint of producing Tetra Pak cartons across different manufacturing facilities/locations, including Europe (RER) as an average. The parameter investigated is electricity and its impact on carbon footprint for carton production. The breakdown includes carbon footprint contribution from raw materials, transport and manufacture of the cartons. Downstream stages are not included in the analysis. Two examples of Tetra Pak cartons are examined - TBA Edge 1.5L LC30 (aseptic) and TT 1L C38 (non-aseptic), both used for packaging milk.

Variations in electricity carbon emission factors result in notable differences in manufacturing stage impacts: packs produced in India exhibit the highest carbon footprint, while those produced in Sweden exhibit the lowest. This reflects the high carbon intensity of the Indian electricity grid compared to Sweden's low carbon electricity grid. Overall, the difference between maximum and minimum carbon footprint results is 8% for aseptic cartons and 28% for non-aseptic cartons.

Table 5-2: Breakdown of Tetra Pak carton footprint for production of cartons (milk carton - TBA Edge 1.5L LC30)

Country	Material (%)	Manufacture (%)	Transport (%)	Electricity (%)	Thermal Energy (%)	Carbon footprint of production (kg CO_2 eq./pack)
BR (Brazil)	79.59	0.83	17.47	2.42	0.23	**0.0647**
CN (China)	76.00	0.79	16.68	6.23	0.31	**0.0677**
DE (Germany)	77.99	0.81	17.12	3.92	0.21	**0.0660**
FR (France)	80.57	0.84	17.69	0.70	0.22	**0.0639**
HU (Hungary)	78.88	0.82	17.32	2.79	0.22	**0.0652**
IN (India)	74.15	0.77	16.28	8.66	0.22	**0.0694**
IT (Italy)	78.41	0.81	17.21	3.40	0.21	**0.0656**
RER (Europe)	78.93	0.82	17.33	2.75	0.22	**0.0652**
SE (Sweden)	81.14	0.84	17.81	0.00	0.22	**0.0634**
TR (Turkey)	77.32	0.80	16.97	4.70	0.22	**0.0666**
VN (Vietnam)	76.84	0.80	16.87	5.32	0.20	**0.0670**

Table 5-3: Breakdown of Tetra Pak carton footprint for production of cartons (milk carton - TT 1L C38)

Country	Material (%)	Manufacture (%)	Transport (%)	Electricity (%)	Thermal Energy (%)	Carbon footprint of production (kg CO_2 eq./pack)
BR (Brazil)	70.66	1.52	20.55	9.32	0.00	**0.0288**
CN (China)	59.98	1.29	17.45	21.32	0.00	**0.0339**
DE (Germany)	65.47	1.41	19.04	14.25	0.00	**0.0311**
FR (France)	74.10	1.59	21.56	2.80	0.00	**0.0275**
HU (Hungary)	68.27	1.47	19.86	10.47	0.00	**0.0298**
IN (India)	55.12	1.19	16.03	27.91	0.00	**0.0369**
IT (Italy)	66.77	1.44	19.42	12.56	0.00	**0.0305**
RER (Europe)	68.42	1.47	19.90	10.33	0.00	**0.0297**
SE (Sweden)	76.21	1.64	22.17	0.00	0.00	**0.0267**
TR (Turkey)	63.49	1.37	18.47	16.75	0.00	**0.0321**
VN (Vietnam)	62.07	1.33	18.06	18.62	0.00	**0.0328**

5.3. Results and Interpretation

Cartons were found to have the lowest carbon footprints among all beverage packaging types analysed for Australia. In New Zealand, cartons are among the packaging options with the lowest carbon footprints.

Glass packaging had the highest carbon footprint, even when modelled with 70% recycled content. Similarly, aluminium cans with 70% recycled content still showed significantly higher carbon footprints compared to cartons.

In the absence of glass and aluminium packaging, PET had the next highest carbon footprint, while rPET packaging showed a substantially lower footprint than PET. For 750 mL and 1.5 L chilled milk in New Zealand, rPET packaging had similar carbon footprints to cartons. HDPE results were generally lower than PET, and in categories where pouches were available, they showed higher carbon footprints than cartons. Because New Zealand's electricity grid has a lower carbon emission factor than Australia's, packaging manufactured and filled in New Zealand has a lower carbon footprint than that produced and filled in Australia. Biogenic carbon sequestered in consumer packaging is included within end-of-life to avoid negative results showing as part of consumer packaging results.

5.3.1. Consumer Packs

5.3.1.1 Cartons

For all packaging systems, the production of the consumer pack has the largest impact on carbon footprint. The scale of this impact depends on the mass of the pack and the material it is made of. For example, cartons of larger mass (combination of carton and closure) tend to have higher carbon footprints compared to cartons with lower mass.

Across all volumes and all functions (chilled or ambient), cartons have lower carbon footprint results compared to most other packaging options. Tetra Pak cartons' carbon footprint outperforms all other packaging types for comparisons in Australia. The magnitude of this difference varied by the relative performance of other packaging types, as well as whether the carton is aseptic and therefore contains additional barrier layers. For packages compared in New Zealand, cartons perform similarly or better than other types of packaging.

As expected, cartons with closures have a higher carbon footprint than those without.

Aseptic versus non-aseptic cartons
Aseptic Tetra Pak cartons have higher carbon footprints than non-aseptic (short shelf life or fresh) versions. The aluminium layer in aseptic cartons increases carbon footprint. Thicker aluminium layers also contribute to a higher footprint, as some cartons contain more aluminium.

Use of bio-based materials

The assessment results are based on several factors including the system boundary, material carbon emission factors, composition of packaging, and the end-of-life modelling approach applied in this study. The life cycle stages considered include raw material extraction and processing, packaging manufacture, filling, distribution, and end-of-life. The end-of-life approach for materials containing biogenic content results in the release of biogenic carbon from the portion of bio-based plastics that is recycled, and either the release or sequestration of biogenic carbon from the portion of bio-based plastics that are landfilled. This release or sequestration depends on the degradable organic carbon fraction (DOC_f) of the material.

- In comparisons that include closures, some Tetra Pak cartons with a bio-based plastic layer (bio-LDPE) and a bio-based plastic closure (bio-HDPE) show a lower carbon footprint than versions without bio-based plastics. However, this reduction is only significant for non-aseptic cartons (e.g., Tetra Top and Tetra Rex). The percentage differences in carbon footprint for the plant-based versions, relative to their fossil-based counterparts, are presented below. A positive percentage indicates a reduction in carbon footprint for cartons with bio-based plastics, while a negative percentage indicates an increase compared with cartons containing fossil-based layers and closures. 1L Milk Ambient - TBA Edge: Australia: -1%; New Zealand: 3%
- 1L Milk Chilled – TT: Australia: 17%; New Zealand: 25%
- 300mL RTD Coffee and FSN Ambient – TPA Edge: Australia: -4%; New Zealand: 0%
- 500mL RTD Coffee and FSN Chilled - TT: Australia: 36%; New Zealand: 35%
- 300mL Juice Chilled – TPA Edge: Australia: -4%; New Zealand: 0%
- 2L Juice Chilled - TR: Australia: 16%; New Zealand: 17%

Non-aseptic cartons (i.e., those without an aluminium barrier layer) incorporating a bio-based plastic layer and closure exhibit a significantly lower carbon footprint compared with equivalent cartons using fossil-based plastics. The differences in results are subject to parameters such as the end-of-life modelling approach (based on end-of-life treatment rates, DOC_f and release of biogenic carbon), material carbon emission factors, and package composition, rather than solely based on the use of bio-based plastics. For example, the TR cartons compared for the 2L Juice Chilled comparison has lower mass for the bio-LDPE layer compared to the version without bio-based plastics, and thus lower overall mass compared to the fossil-based carton.

For aseptic cartons, however, no differences in carbon footprint are observed when using bio-based or fossil-based carton layers and closures. Differences in composition and end-of-life treatment rates occur for the aseptic cartons as well. For example, in the 1 L ambient milk comparison, the TBA Edge carton with bio-based plastics has a higher-mass closure than the fossil-based version. Despite this difference, the carbon footprint contribution from the aluminium barrier layer is sufficiently large in both carton versions that the impact of the bio-based plastics is effectively overshadowed, resulting in no meaningful difference between the two.

In chilled beverage comparisons, cartons without an aluminium barrier layer consistently perform better than those with aluminium layers, showing notable differences in carbon footprint. This further highlights the influence of aluminium on the carbon footprint of cartons. For Australian cases, aseptic cartons with bio-based materials have higher carbon footprints due to a combination of manufacturing location (carbon emission factors of electricity grids), higher recycling rates in Australia compared to New Zealand, and the end-of-life modelling approach that releases biogenic carbon during recycling. However, the differences in carbon footprint among these aseptic cartons are insignificant.

Carton manufacturing
Tetra Pak cartons are manufactured overseas and then transported to Australia and New Zealand. Therefore, the consumer packaging impacts in both countries are the same, except for transport-related differences.

The largest share of the carbon footprint for cartons comes from the raw material inputs, followed by electricity used in manufacturing. The overall carbon footprint depends on several factors, including the package function (aseptic or chilled) and associated carton composition, the presence and composition of closures, and the electricity carbon emission factor at the manufacturing locations.

5.3.1.2 Glass packaging

In the size classes and beverage categories where they occur, glass packages have the highest carbon footprint due to how heavy the packs must be to remain intact during transportation (see the 250mL, 500mL and 1L Juice Ambient comparisons in Section 5.1.3). Despite glass packaging having a baseline recycled content of 70%, glass production carbon intensity was high.

5.3.1.3 Aluminium packaging

Similarly, in the size classes and beverage categories where they occur, aluminium packages have the highest carbon footprint (see the 250mL RTD Coffee and FSN Ambient comparison in Section 5.1.2). This is mainly due to the high carbon emission factor for aluminium despite 70% recycled content. Recycled content and emission factors of aluminium are investigated in section 5.4.4. This shows that it is possible to have lower carbon footprints when increasing recycled content and using low-carbon aluminium input. However, for the scenarios investigated in this study, cartons continue to outperform aluminium cans across all beverage categories and size classes.

5.3.1.4 PET, rPET and HDPE packaging

In the absence of glass and aluminium packaging, PET packaging had the highest carbon footprint (for example, see the '1.5L Milk Chilled' comparison in Section 5.1.1). PET packaging has the highest carbon footprint due to its higher bottle mass and relatively higher carbon emission intensity compared with rPET and carton materials.

HDPE consumer packs generally showed the third-highest footprint, following glass and PET (see the '1L Milk Chilled' comparison in Section 5.1.1. The carbon footprint of rPET bottles was much lower than that of virgin PET and varied significantly depending on the location of manufacture and mass of packaging.

Notable differences in total life cycle carbon footprints were observed for rPET between Australia and New Zealand. Compared to New Zealand, rPET packaging in Australia had higher carbon footprints across several beverage categories and size classes. The percentage values represent the extent to which Australia's carbon footprints exceeded those of New Zealand:

- 750mL Milk Chilled: 64%
- 1L Milk Chilled: 63%
- 1.5L Milk Chilled: 65%
- 500mL RTD Coffee and FSN Ambient and Chilled: 53%

Producing rPET packaging in New Zealand results in a lower carbon footprint than in Australia when average grid electricity is used. This is because New Zealand's electricity is largely generated from renewable sources, leading to a lower electricity carbon emission factor. In fact, in some comparisons, the rPET packaging was better than or close to non-aseptic and plant-based versions of cartons for New Zealand scenarios.

5.3.1.5 Pouches

In the size classes where they occur, pouches have a higher carbon footprint compared to cartons (see section 5.1.3 for '250mL Juice Ambient' comparison). This finding contrasts with the previous Tetra Pak Oceania study where pouches have lowest carbon footprint in some cases. Most cartons did not have a closure whilst the pouch in this study had a closure. The pouch also uses more carbon-intensive materials such as aluminium (global average carbon emission factor) and PET in their laminate layers. The aluminium layer for pouches in this study matches the lowest layer thickness of Tetra Pak cartons. The scenario is for 250mL but uses a 200mL pouch that is not scaled (to reduce uncertainty added by scaling up the pouch mass). The main drivers of pouch carbon footprint in this study, and the reasons why pouches have higher carbon footprints compared to the previous study, are the aluminium carbon emission factor and the inclusion of a closure.

5.3.2. Consumer End-of-Life

Consumer end-of-life impacts are dependent on the material composition of the consumer pack and the country where the pack would be disposed of. Both New Zealand and Australia have relatively high recycling rates for materials such as glass, aluminium and PET (see Section 3.8). Meanwhile cartons have very low recycling rates across Australia (29%) and New Zealand (1%). Materials that are not recycled are landfilled.

Plastics, glass, and aluminium are all inert materials which do not break down in a landfill and so have a low carbon footprint impact at end-of-life. Impact until the materials reach end-of-waste-state is included. This includes processing of waste materials sent for recycling at material recycling facilities (MRF). Due to differences in electricity carbon intensity, impacts from material recycling facilities are higher for Australia compared to New Zealand. The impact overall is minor.

5.3.2.1 Impact of end-of-life approach of cartons

At end-of-life, cartons in Australia and New Zealand are typically landfilled or recycled. In this study, the biogenic carbon sequestered by the cartons is included in the consumer end-of-life category. The end-of-life modelling approach used aligns with ISO 14067 Annex E.3 for the treatment of biogenic carbon. The approaches used influence the end-of-life impact of cartons as follows:

Landfill: The landfill rates for Australia and New Zealand are 71% and 99% respectively. Paperboard has a DOCf of 21% (i.e. 21% of biogenic carbon from paperboard is released in the landfill). We assume that bio-HDPE and bio-LDPE in closures and laminate coating do not biodegrade in landfill (DOCf of 0%) as they behave similarly to fossil-fuel-based plastics. The model assumes the same landfill gas capture rate in New Zealand and Australia. The base case for all cartons is 68% landfill gas capture rate, hence a substantial amount of the methane produced by cartons breaking down is captured (and burned) while a smaller proportion is able to escape into the atmosphere.

Of the % sent to landfill, a proportion of biogenic carbon is released to air from paperboard, while all biogenic carbon remains sequestered from closures. As such, some of the biogenic carbon would remain sequestered in landfills for the 100-year time horizon considered in this study (e.g. for bio-LDPE and bio-HDPE).

Recycle: The recycling rates for Australia and New Zealand are 29% and 1% respectively. New Zealand has a low recycling rate as there is no curb-side collection of cartons.

When recycling, an artificial release of biogenic carbon is modelled for materials with biogenic carbon content (paperboard, bio-HDPE and bio-LDPE). This results in net-zero biogenic carbon.

All biogenic carbon associated with the % sent for recycling is released artificially.

The same approach is applied to cardboard secondary packaging, although with recycling rate of 70% for both Australia and New Zealand.

The net carbon release/sequestration is dependent on the amount of paper within the carton, the amount of bio-HDPE in closure and bio-LDPE in carton laminate, and the country where the packaging is landfilled (hence the landfill rate). Coincidently, end-of-life carbon footprint across Australia and New Zealand are similar and overall minor for most cartons. The modelling approach to artificially release biogenic carbon from materials aligns with the conservative approach for this study.

5.3.3. Forming and Filling

Data for filling packaging is sourced from the Tetra Pak Oceania study (thinkstep-anz, 2021).

For all pack types, forming and filling have minor carbon footprint impact, however, impact is influenced by electricity use. As such, packs filled in Australia have larger filling impact compared to when filled in New Zealand.

5.3.4. Transport (Distribution)

Transport has a low relative impact on carbon footprint results, due to the low mass of most of the consumer packs and the exclusion of the beverage mass from the transportation impacts (as this is assumed to be part of the life cycle of the beverage itself). Transport is higher for packages of higher mass, such as glass.

Low carbon footprint results occur regardless of whether the package is delivered in chilled or ambient conditions, with a small increase in carbon footprint (up to 2% increase in total carbon footprint) during chilled distribution.

The carbon footprint from distribution, while low, reflects differences in distance assumptions between Australia and New Zealand. Packaging is distributed over a shorter distance in New Zealand compared to Australia (Section 3.6).

5.3.5. Secondary Packaging (Shipper)

The net carbon footprint for secondary packaging is low for most pack types. The carbon footprints become noticeable where the mass of secondary packaging per functional unit is high. Assumptions are made based on Tetra Pak data to fill in data gaps for competitor products, where similar size classes are assigned the same secondary pack data as Tetra Pak cartons.

The secondary packaging data varied across products, with some packages containing corrugated cardboard and plastic wrap (or a mix of the two), while others used reusable crates. Therefore, the carbon footprint from secondary packaging depends on whether consumer packaging is distributed in corrugated cardboard boxes or reusable plastic crates and the quantities of packages within. However, secondary packaging choice remains outside Tetra Pak’s control.

5.3.6. Tertiary Packaging (Pallet)

The net carbon footprints for pallets are very low for the pack types in this study – net carbon sequestration is observed overall.

Palletisation data was used for Tetra Pak cartons. Pallet data for alternative packaging were based on a mix of palletising data from Tetra Pak and assumptions. The number of secondary packages on pallets varied depending on product category and size class. More units of smaller secondary packages are possible on pallets compared to larger secondary packages. It is also assumed that the wooden pallets are reusable for all packages included in this study (5 times before they are disposed of).

As with secondary packaging solutions, the optimisation of packaging on pallets is outside Tetra Pak's control. Due to the low relative carbon footprint from pallets, changing the tertiary packaging values will not change the conclusions.

5.3.7. Other Indicators

The results for other indicators are shown in Annex F in the form of total life cycle impacts. This illustrates how the cartons performed relative to other packaging types, specifically highlighting where Tetra Pak cartons are:

- Minimum in the comparison - I.e., cartons have the lowest impact
- Less than 1% of minimum in group- I.e., cartons have the lowest-equal impact
- Have results that are greater than 50% of minimum in group - I.e., differences in impact are significant
- Greater than 10% of minimum in group - i.e., notable difference
- Greater than 1% of minimum in group - I.e., no difference compared to the lowest in the comparison)

This demonstrates that:

- AP: Beverage cartons have the lowest acidification potential (AP) in all Australian packaging categories compared in this study. In New Zealand, beverage cartons are second behind rPET due to the highly renewable electricity mix in New Zealand.
- EP-fw: The preference order identified by the eutrophication of freshwater (EP-fw) indicator varies by packaging category. When looking across packaging categories, beverage cartons are broadly comparable to HDPE, rPET, PET and aluminium cans. Glass has the lowest EP-fw in several packaging categories, most notably in 1L chilled milk in Australia, but this finding does not apply to all categories.
- EP-fm: rPET has the lowest marine eutrophication (EP-fm). Beverage cartons generally have the second-lowest EP-fm, though there are exceptions in a few packaging categories: HDPE performs best for 2L chilled milk in New Zealand, PET performs best for 1L ambient juice in New Zealand, and the 200mL Australian juice pouch is lowest-equal with the TBA Base Crystal 200mL paper straw in its category.
- EP-tr: In most packaging categories, rPET has the lowest terrestrial eutrophication (EP-tr), though the plant-based TR 1L OSO34 PB outperforms rPET in the 1L fresh milk category in Australia. Beverage cartons are generally second, alongside HDPE and pouches. In most categories, the EP-tr results for beverage cartons are somewhat lower than PET and considerably lower than glass and aluminium cans.

- POCP: rPET has the lowest summer smog (POCP). While comparable to beverage cartons in Australia, this finding is more pronounced in New Zealand with its largely renewable electricity mix. Beverage cartons generally have the second-lowest POCP and the lowest in most categories where rPET packs are not found. In some categories – particularly the 1.5L and 2L categories in New Zealand – the POCP for beverage cartons is similar to HDPE and PET. Glass and aluminium cans have the highest POCP.
- ADP-mm: rPET has the lowest mineral resource depletion (minerals & metals) (ADP-mm). Beverage cartons generally have the second-lowest ADP-mm results, though HDPE and PET are comparable to or outperform cartons in some packaging categories. Glass and aluminium cans have the highest ADP-mm.
- ADP-fossil: Beverage cartons have the lowest depletion of fossil fuels (ADP-fossil). The only exceptions are the 750mL and 1.5L milk category in New Zealand where rPET has a lower ADP-fossil score. These results align well with carbon footprint, as was expected, given fossil fuel emissions are a primary driver of climate change.
- Blue water: Beverage cartons have the lowest blue water consumption across all packaging categories compared in this study.

5.4. Sensitivity Analysis

Sensitivity analyses test the sensitivity of the final result towards variations in parameter values. Because of the large number of beverage categories and packaging size classes, sensitivity analyses have only been performed for select comparisons from Section 5.1. The findings from these analyses are expected to translate well to all other beverage categories and size classes. These categories and size classes have been selected due to the fact that they contain the packaging options where the second-lowest GWP (PET, rPET and pouch) is the closest to the carton GWP.

5.4.1. DOC_f and Landfill Gas Capture Rate Variation Scenarios

Since landfill rates for cartons are high for both Australia and New Zealand, this analysis investigates the impact on carbon footprint for landfilling at end-of-life. Varying the DOC_f of the laminated paper between 0% (no degradation, i.e., behaves as plastic), 21% (baseline) and 50% (high degradation, i.e. behaves as paper). Scenario analyses were performed for the potential range of different DOC_f values:

- 0% was selected as the lowest value, which assumes that the aluminium and plastic layers on either side of the paperboard manage to stop it from breaking down during the 100-year time horizon considered in this study.
- 50% was selected as the highest possible value, which is the approximate value for uncoated paper in landfill (thinkstep-anz, 2021).
- A value of 21% was used as the base case (Eleazer, et al., 1997).

The above is coupled with investigating the carbon footprint when varying the landfill gas collection at the landfill of between 0%, 68% (used for base case) and 90%, and setting the carton recycling to a minimum of 0% (no recycling) and a maximum of 80% (world best-practice), and thus landfill rate of 100% and 20% respectively.

Table 5-4 outlines the comparisons undertaken. The baseline case for this comparison is TBA Edge 1L LC30 used for packaging chilled milk from Section 5.1.1. For the scenarios where the landfill rate is not 100%, recycling is assumed for the remainder. Resulting carbon footprints are illustrated in Figure 5-18.

Table 5-4: End-of-life landfill related scenarios analysis parameters

Scenario	DOC_f	Landfill rate (Lr)	Landfill gas capture rate (GC)
Baseline*	21	0%	N/A
DOC_f 0% Lr 20% GC 0%	0	20	0
DOC_f 0% Lr 20% GC 68%	0	20	68
DOC_f 0% Lr 20% GC 90%	0	20	90
DOC_f 0% Lr 100% GC 0%	0	100	0
DOC_f 0% Lr 100% GC 68%	0	100	68
DOC_f 0% Lr 100% GC 90%	0	100	90
DOC_f 21% Lr 20% GC 0%	21	20	0
DOC_f 21% Lr 20% GC 68%	21	20	68
DOC_f 21% Lr 20% GC 90%	21	20	90
DOC_f 21% Lr 100% GC 0%	21	100	0
DOC_f 21% Lr 100% GC 68%	21	100	68
DOC_f 21% Lr 100% GC 90%	21	100	90
DOC_f 50% Lr 20% GC 0%	50	20	0
DOC_f 50% Lr 20% GC 68%	50	20	68
DOC_f 50% Lr 20% GC 90%	50	20	90
DOC_f 50% Lr 100% GC 0%	50	100	0
DOC_f 50% Lr 100% GC 0%	50	100	68
DOC_f 50% Lr 100% GC 90%	50	100	90

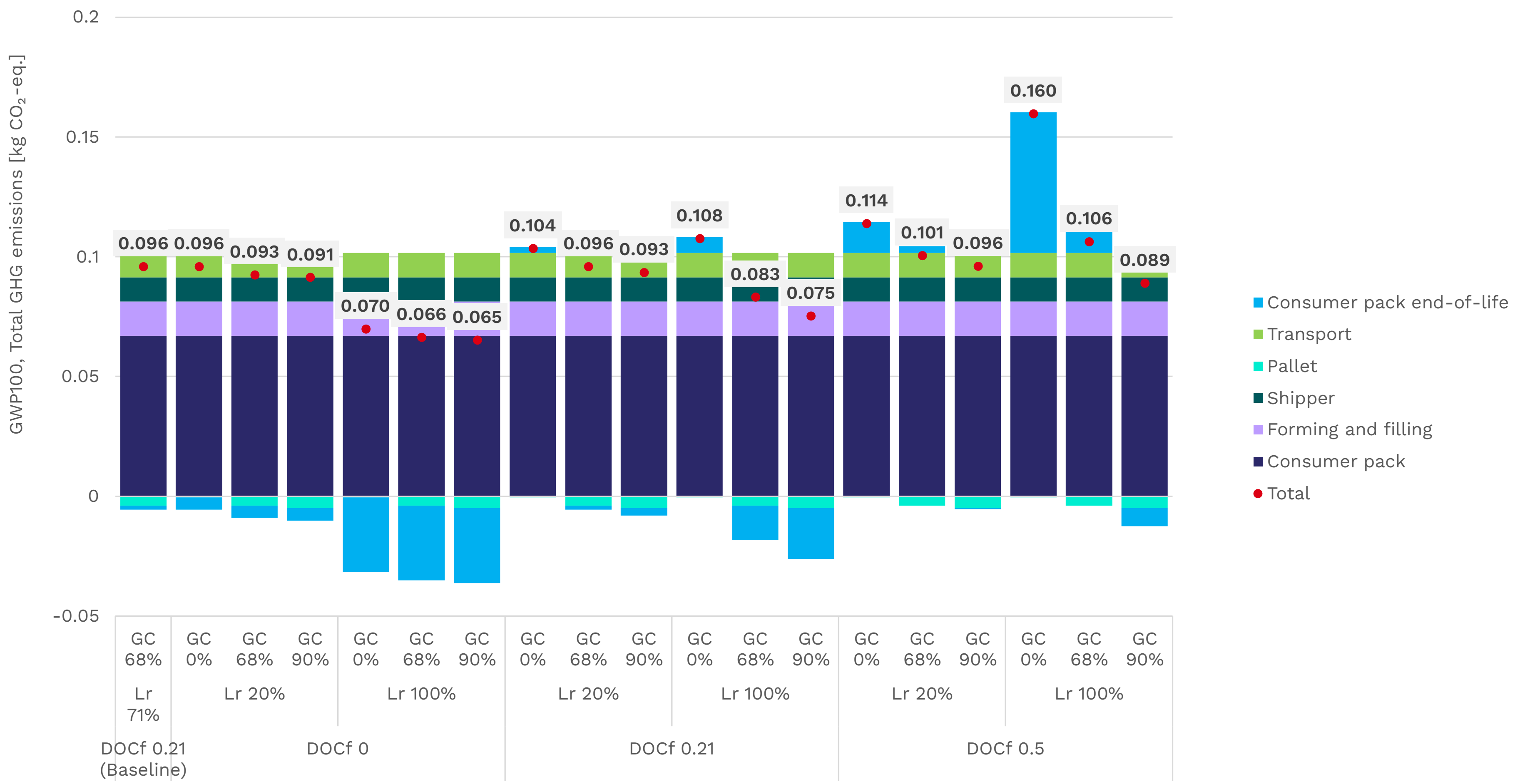


Figure 5-18: Scenario analyses for varying DOCf, landfill and landfill gas capture rates

As expected, carbon footprint increases as the DOC_f increases, owing to greater amounts of methane produced in the landfill. Scenarios with 90% gas capture rate yield lower carbon footprint than when gas capture rate is 0%. However, a combination of high landfill rate and high gas capture rate can result in lower carbon footprint compared to the baseline. The closest carbon footprint impact to the baseline occurs where DOC_f is 21% with landfill rate of 20% and 0% landfill gas capture.

The scenario with the highest carbon footprint for carton is 50% DOC_f with a 100% landfill rate and a 0% landfill gas capture rate. This represents a single carton that is put in a landfill without gas capture. This would likely only be achieved if the package was first ground to powder or delaminated, and does not represent market-average performance.

The scenario with the lowest carbon footprint has 0% DOC_f (i.e. no degradation) with a 100% landfill rate (landfill gas capture rate is irrelevant as there is no degradation). This low carbon footprint is due to sequestration of carbon in paper in landfill. However, this scenario is considered unlikely because even though the paper in the carton is coated in plastic (which will decrease biodegradation), it is likely that some of the plastic barrier layer would be damaged in the landfill, exposing at least some of the paper to degradation. The rate of landfill, DOC_f of the paper in cartons and landfill gas capture rates impact on carbon footprint.

To refine the DOC_f value applicable for cartons, it is recommended that a desktop bioreactor study be carried out on various cartons (with holes pierced in the laminate layer to simulate municipal comingled waste).

5.4.2. Recycling Allocation Method: Cut-off vs Substitution

The baseline scenario in this report uses the cut-off method for allocation of recycled materials between product life cycles. This means that the impacts of previous and future uses of recycled materials are not considered within the system boundary. The analysis in this section applies the substitution approach instead.

As a general rule, the cut-off method favours products with high recycled content irrespective of the recycling rate at end-of-life, whereas the substitution method penalises products that do not produce enough recycled content at end-of-life to manufacture themselves again (i.e., products are penalised if they have a net deficit of recycled content over the full product life cycle).

Due to the changing recycling landscape in Australia and New Zealand, these analyses compare substitution allocation method to the baseline (cut-off) scenario: The recycling scenario provides credits for the share of recycling processed.

Results comparing the total carbon footprint when using the substitution and cut-off methods are provided in Figure 5-19, Figure 5-20 and Figure 5-21. A full set of results covering all the packaging in this study are provided in Annex G.

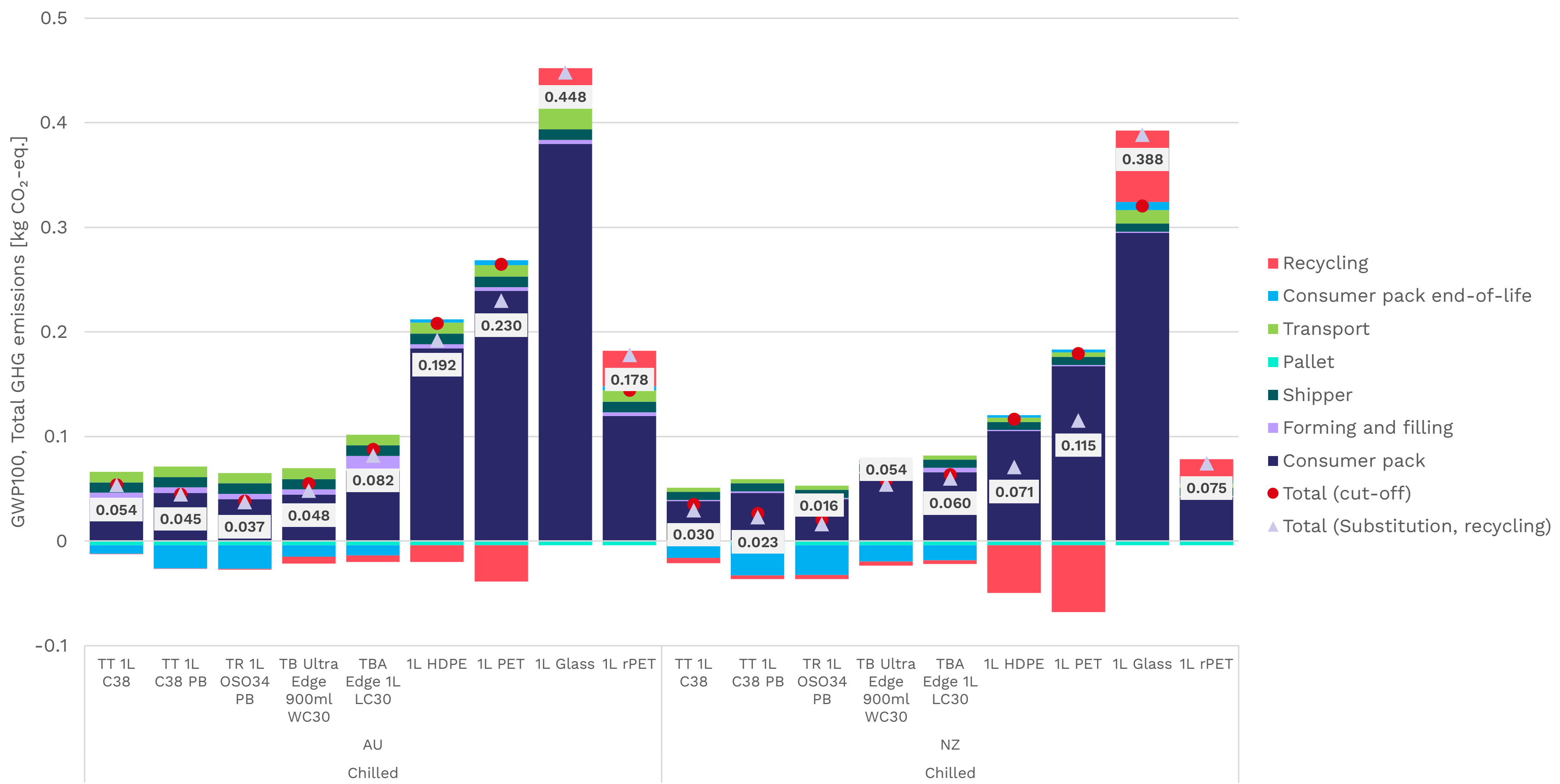


Figure 5-19: Results for 1L Milk Chilled packaging – substitution recycling methods

Figure 5-20: Results for 250mL packaging– RTD Coffee and FSN - substitution recycling methods

Note that while chilled and ambient RTD coffee and FSN are included together in the figure above, the only difference between them is the transport carbon footprint (chilled and ambient truck).

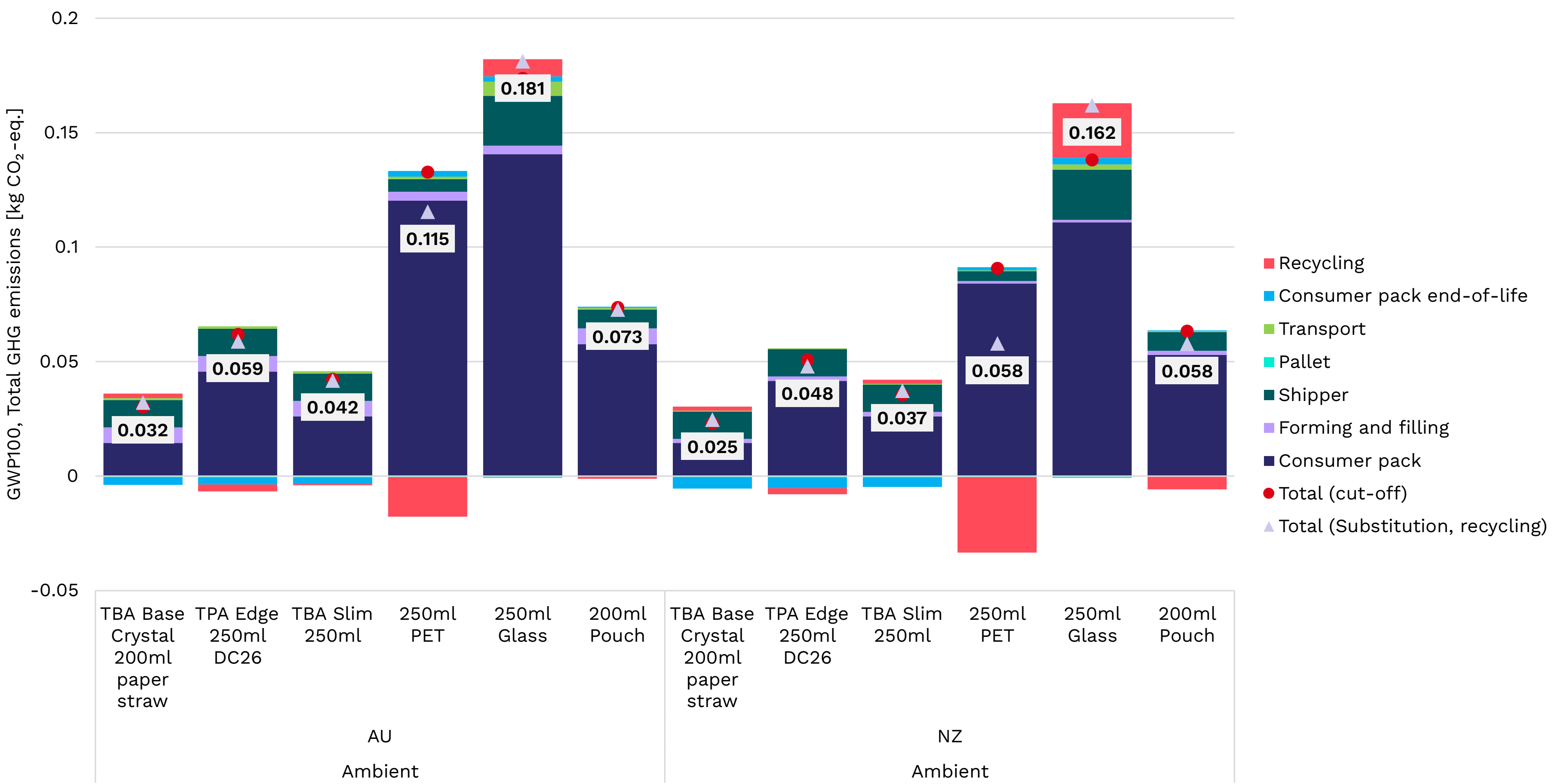


Figure 5-21: Results for 250mL packaging– Juice - substitution recycling methods

The above figures show that there is essentially no change in results between allocation methods for cartons and pouches, i.e., the results for cartons and pouches are insensitive to the choice of recycling allocation method. This is expected because both cartons and pouches are manufactured from virgin materials and (currently) have low recycling rates at end-of-life.

The biggest shift in results between the cut-off method and the substitution methods is for 100% rPET, whose carbon footprint increases considerably using the substitution method, bringing its carbon footprint closer to that of virgin PET as more virgin material is needed to 'top up' the 100% recycled input than can be collected through current waste and recycling infrastructure.

Aluminium and glass packaging (with 70% recycled content in base case) also exhibit significant differences between the substitution and cut-off approach results.

In general, using the substitution method results in PET, glass and aluminium packaging systems to have a lower carbon footprint. This effect is more pronounced in the New Zealand systems due to (a) the higher recycling rate for PET in New Zealand compared to Australia, and (b) recycling of PET in New Zealand has a lower carbon footprint than in Australia due to the electricity grid being less carbon intensive. Other materials are not significantly impacted by the substitution method.

The outcome of this sensitivity analysis is that cartons have the lowest GWP of all packaging systems considered by this study, irrespective of which end-of-life allocation method is applied. Pouches have a comparable GWP to cartons in the categories where they exist. Overall, use of substitution method reinforces the conclusions of this study.

5.4.3. Recycle Content – Glass

Further to the baseline scenario (30% recycled content) included in the main results, the study investigates two other scenarios for varying glass recycled contents. The results for 1L and 250mL white milk are shown in Figure 5-22. Carbon footprint of glass packaging reduces with increasing recycled content. The 70% recycled package has much lower carbon footprint compared to 0% recycled content. Even with this level of improvement, other packaging materials such as cartons, outperform glass packaging (e.g. when comparing 1L chilled milk and 250mL ambient juice).

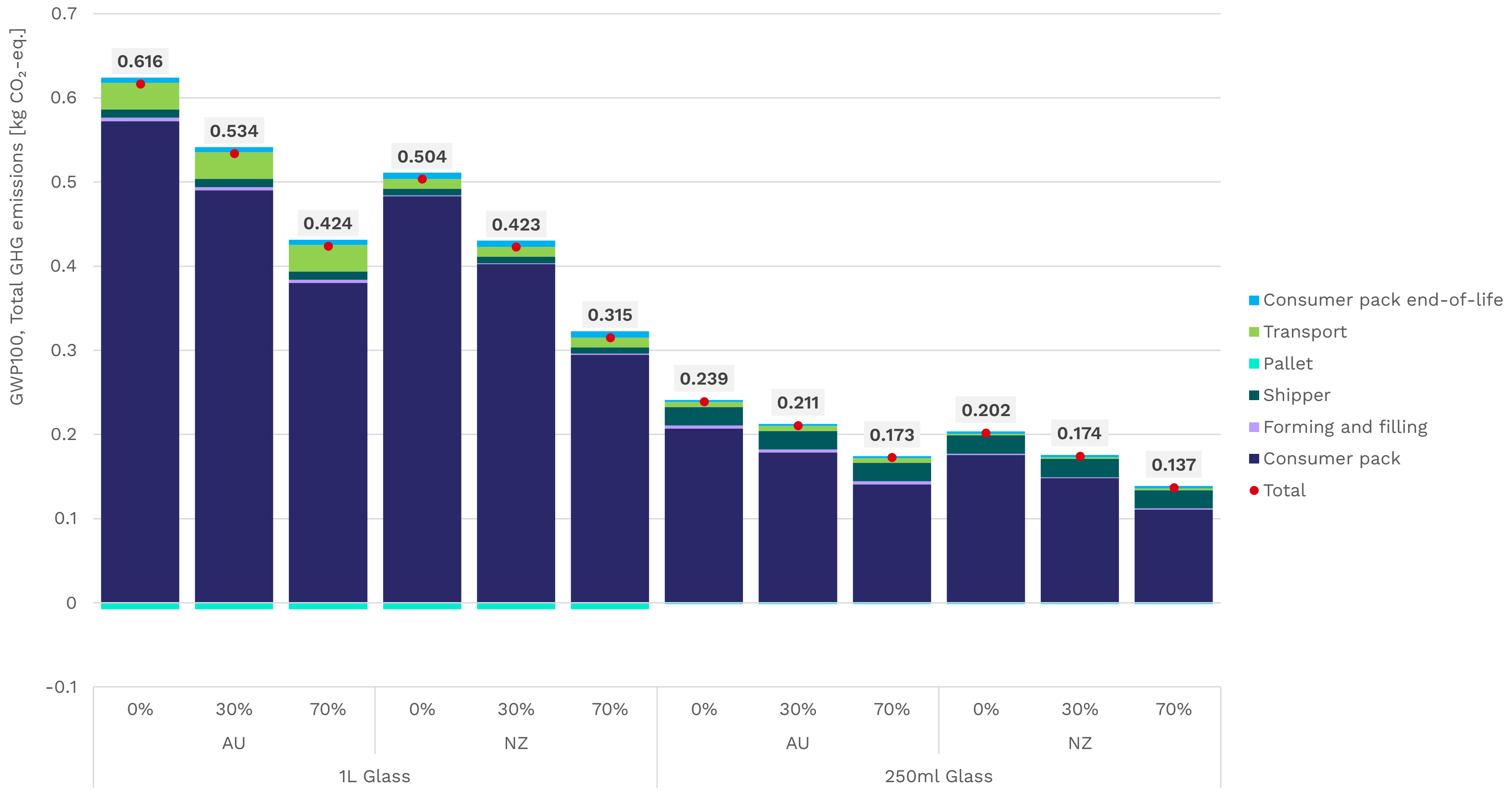


Figure 5-22: Scenarios with different glass recycled contents for a 1L and 250mL package

5.4.4. Recycled content and emission factor– Aluminium

The carbon footprint of aluminium varies significantly, primarily based on the electricity used for the electrolysis of alumina (Hasanbeigi, et al., 2021) and recycled content. In the baseline scenarios within this report, 70% recycled aluminium (30% virgin aluminium) is assumed to be purchased from the global market (i.e. the electricity mix used is a global average weighted by the amount of aluminium produced). The global average emission factor for aluminium cans used in the baseline case for aluminium cans is 15.1 kg CO_2/kg of aluminium based on 2022 IAI data (International Aluminium, 2024). The aluminium mix sourced from the European market is used for sensitivity analysis and has carbon emission factor of 8.81 kg CO_2/kg of aluminium.

This study includes the following scenarios:

- Virgin aluminium input with aluminium sourced from global market
- Virgin aluminium input with aluminium sourced from the European market
- Recycled content of aluminium cans: 0% (virgin aluminium) and 70% (baseline). These values were assumed to represent the minimum and maximum recycled content available in the market, reflecting worst- and best-case scenarios.

The carbon footprint of the 250mL aluminium can (scaled from 237mL) used in the RTD Coffee and FSN-Ambient scenarios, with varying aluminium sources and recycled contents, is shown in Figure 5-23. A significant improvement in carbon footprint is achieved by using the European aluminium mix and increasing the recycled content of aluminium. However, even with these improvements, cartons still perform better than aluminium cans.

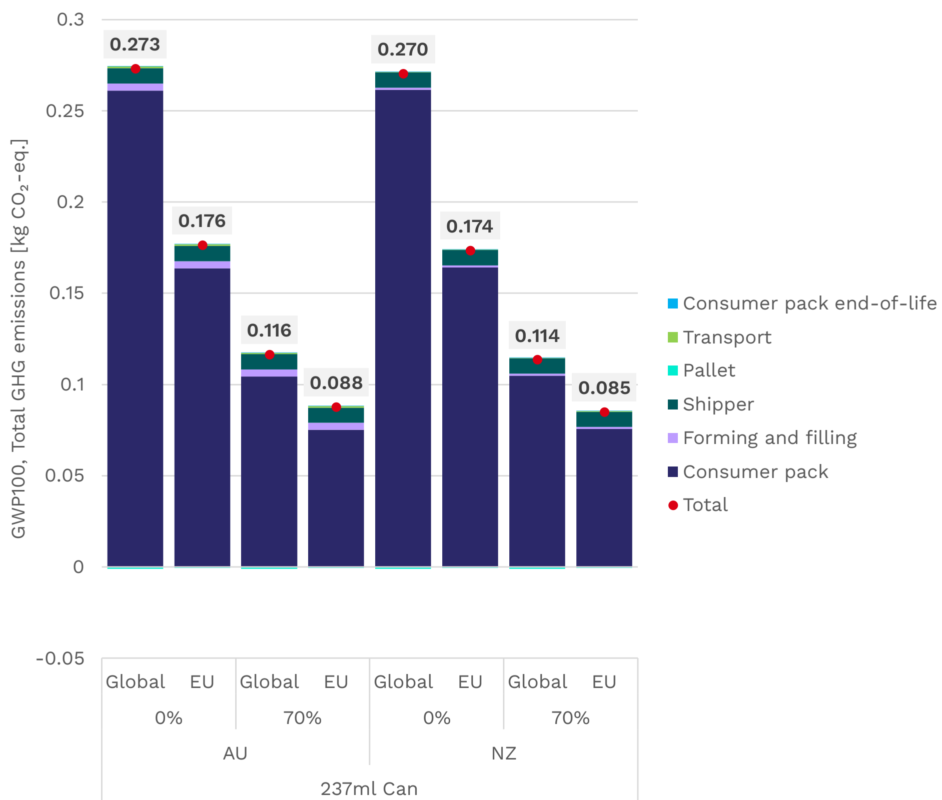


Figure 5-23: Carbon footprint of 250mL RTD coffee and FSN aluminium can with differing recycled contents

5.4.5. Treatment of biogenic carbon when recycling

Sensitivity analysis was performed for a Tetra Pak carton that contained bio-LDPE laminate, TBA Edge 1L LW30 PB, to examine the effect of modelling the release of biogenic carbon at end-of-life when such cartons are recycled. Besides the baseline scenario included in the main results (Figure 5-4), three other scenarios for each country were investigated:

- Biogenic carbon in bio-based plastic laminate and closure is modelled as released upon recycling, default recycling rate in AU (29%) and NZ (1%) (baseline scenario)
- Biogenic carbon modelled as not released, default recycling rate in AU and NZ
- Biogenic carbon modelled as released, with increased recycling rate (80%)
- Biogenic carbon modelled as not released, with increased recycling rate (80%)

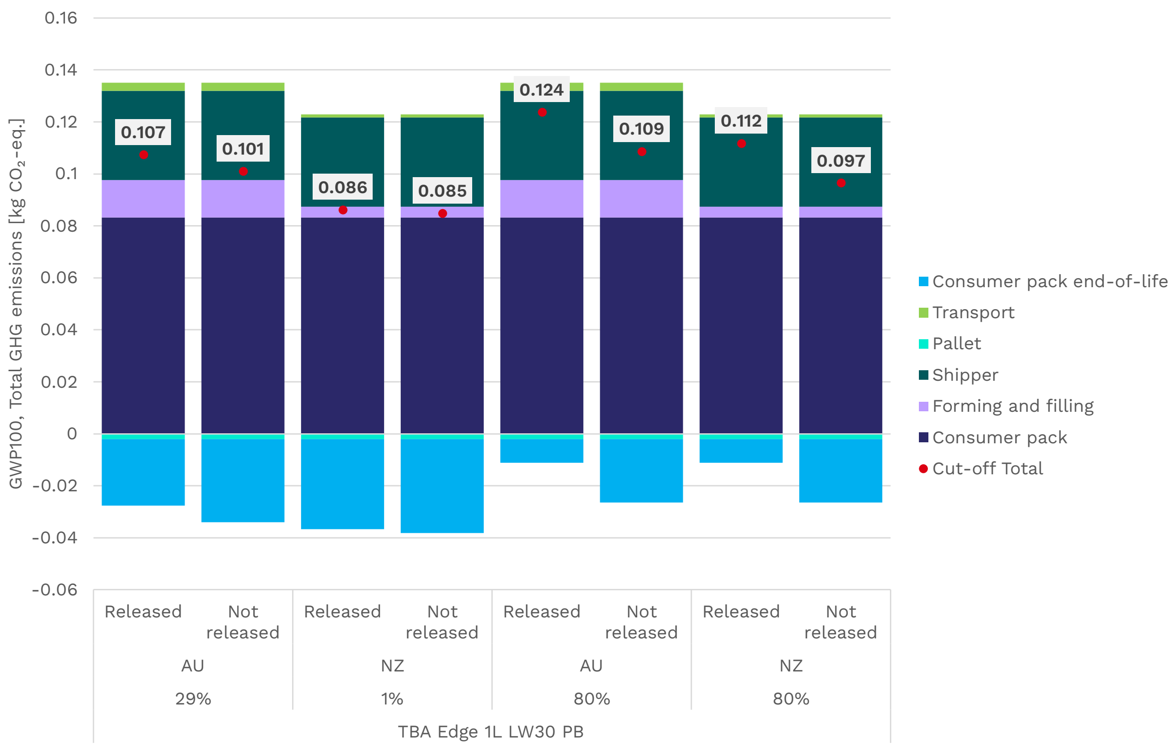


Figure 5-24: Carbon footprint of TBA Edge 1L LW30 PB with different treatment of biogenic carbon upon recycling (Released = biogenic carbon is released when recycling; Not released = biogenic carbon is not released when recycling)

With the default recycling rates (29% for Australia and 1% for New Zealand), there is no difference in carbon footprint between releasing and not releasing biogenic carbon in both countries. Therefore, the choice of modelling the treatment of biogenic carbon at end-of-life is insignificant. At elevated carton recycling rates (80%), the disparity in carbon footprint becomes pronounced, with Australia and New Zealand experiencing a 12% and 14% reduction. Consequently, modelling approach employed in this study only affects the carbon footprint at very high recycling rates—much higher than those currently reported for cartons in either country.

5.4.6. Distribution distance

Sensitivity analysis was conducted for a Tetra Pak carton (TT 1L C38) with a bio-LDPE laminate to assess the effect of distribution distance on carbon footprint. An additional scenario was modelled for both Australia and New Zealand, using a distribution distance of 400 km.

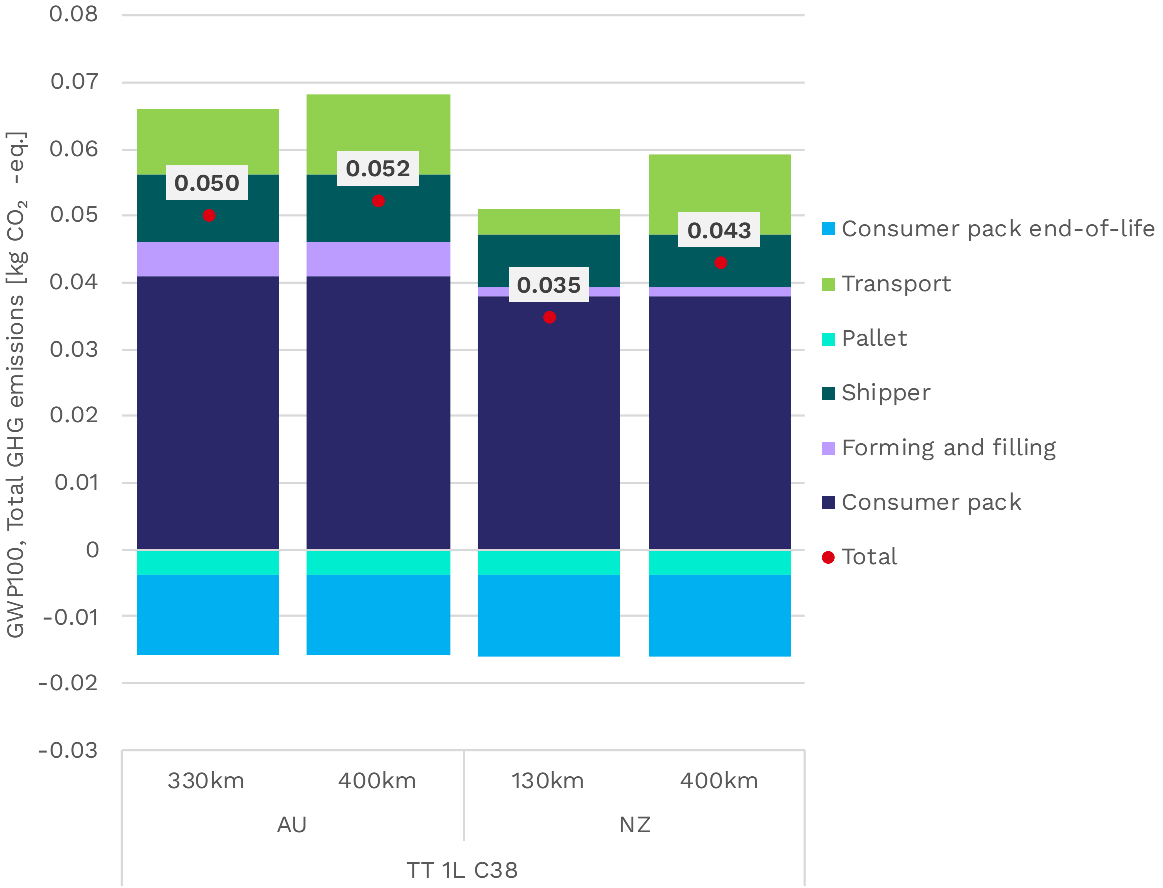


Figure 5-25: Carbon footprint of TT 1L C38 with differing distribution distances

Increasing distance by 70km for Australia leads to a 4% increase in carbon footprint, while a 270km increase for New Zealand increases the carbon footprint by 19%. Results show that greater distribution distance leads to a higher carbon footprint.

5.5. Comparison to Other Studies

The results from this study were compared to several other studies, including those from the previous study, as a sense-check.

Studies used for comparison in this section included critically reviewed LCA studies, peer-reviewed scientific journal articles, and meta-analysis studies. Preference was given to LCA studies analysing packaging solutions for non-carbonated beverages to match the current scope of this study commissioned by Tetra Pak. The full list of studies and packaging systems against which a comparison is made can be seen in Table 5-5.

Table 5-5: List of studies and packaging systems compared

Study	Material	Country	Specific Packaging System
(De Feo, et al., 2022)	Carton	IT	Aseptic carton (0.2L)*
(Franklin Associates, 2015)	Carton	CA	Tetra Prisma Aseptic (0.18L)*
	Carton	US	Tetra Prisma Aseptic (0.18L)*
	Carton	CA	Tetra Prisma Aseptic (1L)
	Carton	US	Tetra Prisma Aseptic (1L)
	PET bottle	CA	PET bottle, preform (1L)
	PET bottle	US	PET bottle, preform (1L)
	Pouch	CA	Pouch (0.177L)
	Pouch	US	Pouch (0.177L)
(Institute for Energy and Environmental Research (IFEU), 2017)	Carton	SE	Carton (1L)
	PET bottle	SE	PET (1L)
(Sphera, 2020)	Aluminium can	EU	Aluminium can (0.25L)
	Carton	BR	Beverage carton (0.2L)
	Carton	BR	Beverage carton (1L)
	Glass bottle	EU	Glass bottle (single use) (0.25L)
	Glass bottle	EU	Glass bottle (single use) (1L)
(Stefanin, et al., 2020)	PET bottle	IT	PET (1L)
	rPET Bottle	IT	rPET (1L)
(TERI, 2022)	Aluminium can	IN	Aluminium can (alcoholic, might be carbonated) (0.25L)
	Carton	IN	Carton (multi-layered packaging) (0.2L)
	Glass bottle	IN	Glass bottle (carbonated) (0.2L)
	PET bottle	IN	PET bottle (non-alcoholic, might be carbonated) (0.2L)
(thinkstep-anz, 2021)	PET	AU	1L Aseptic PET AU
	PET	NZ	1L Aseptic PET NZ
	rPET	AU	1L Aseptic rPET AU
	rPET	NZ	1L Aseptic rPET NZ
	Carton	AU	1L Aseptic Carton AU
	Carton	NZ	1L Aseptic Carton NZ
	Pouch	AU	200mL Aseptic Pouch – straw NZ
	Carton	NZ	200mL Aseptic Carton NZ

Study	Material	Country	Specific Packaging System
This study	Aluminium can	AU/NZ	237mL can, ambient, RTD Coffee and RSN*
	Cartons	AU/NZ	250mL aseptic cartons
	Carton	AU/NZ	TBA 1L edge LC30 for milk
	Carton	AU/MZ	TPA 1L square HC27, juice
	Glass bottle	AU/NZ	250mL glass ambient, juice
	Glass bottle	AU/NZ	1L glass, ambient and chilled juice
	PET bottle	AU/NZ	250mL PET ambient, juice
	PET bottle	AU/NZ	1L PET, ambient, juice
	PET bottle	AU/NZ	PET 1L, chilled, milk
	Pouch	AU/NZ	200mL pouch ambient, juice*
	rPET Bottle	AU/NZ	1L rPET, chilled, milk

*These packaging systems were scaled to have equivalent volumes of the size classes in this comparison

For these comparisons, the cradle-to-grave carbon footprint of the consumer packs was compared with other studies. The following life cycle stages were included: Consumer Pack, Forming and Filling and Consumer EOL (see Section 5.1). These life cycle stages were chosen to align the scope across all studies, with certain modules (e.g., distribution) excluded.

Since this study was conducted on a per-consumer-pack basis, other studies were scaled to provide carbon footprints for the 1 L and 250mL volumes selected for comparison. Note that the 250mL results have been normalised to 1L.

5.5.1. Literature comparisons

Figure 5-26 and Figure 5-27 compare carbon footprints across different studies.

Figure 5-26 shows 1L glass, PET and rPET bottles and the 1L cartons in this study compared with similar packaging systems from other studies. In general, similar trends in the carbon footprints of packaging materials are observed. One exception is rPET for New Zealand which is low primarily due to New Zealand's electricity carbon emission factor.

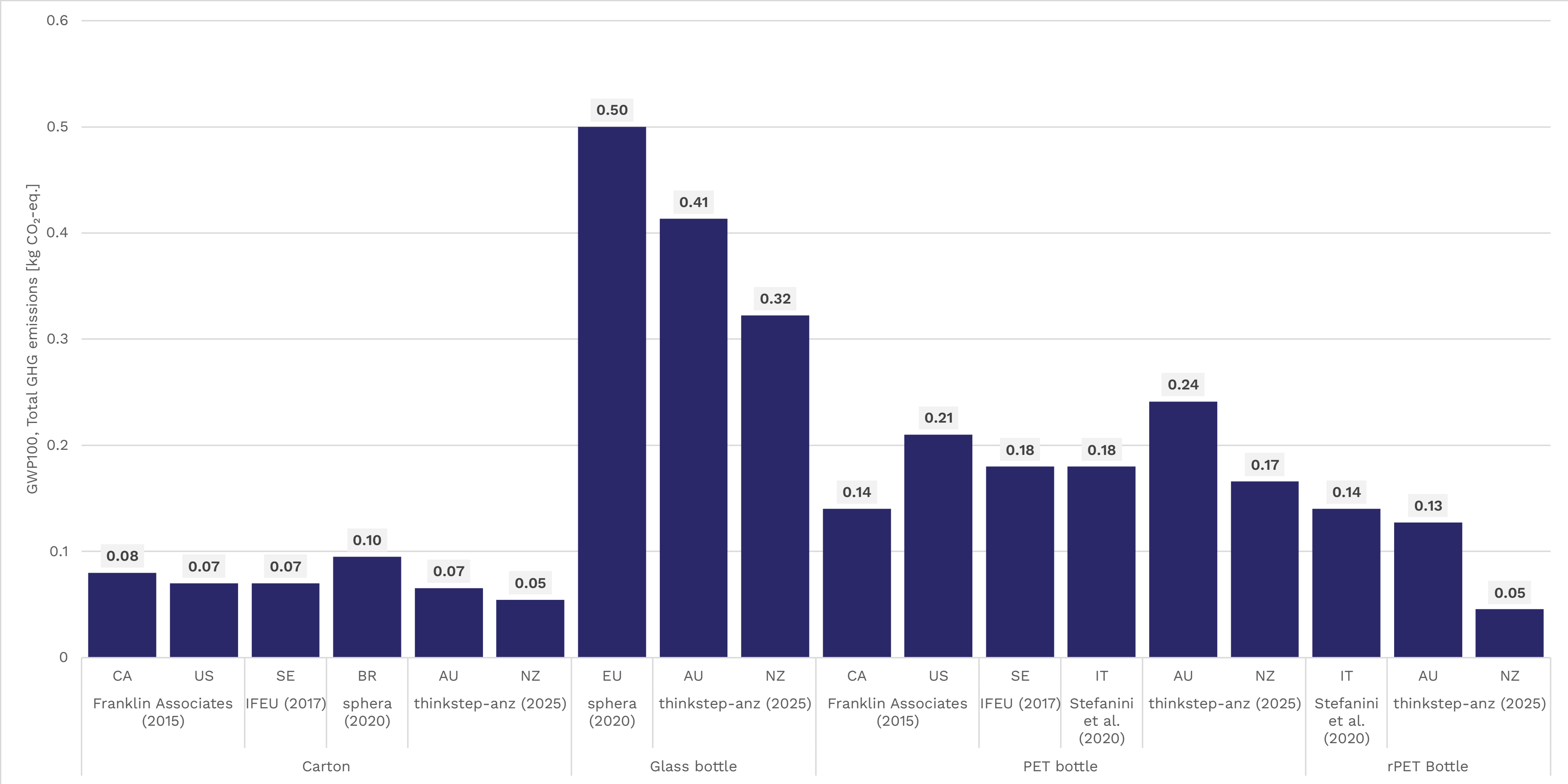


Figure 5-26: 1L Comparison of carbon footprint to other studies

Figure 5-27 illustrates the comparison of 250mL cartons, glass bottles, PET bottles, pouches, and 237mL aluminium cans in this study compared with similar packaging systems normalised to 1L. The studies show similar trends in the carbon footprints of packaging materials, except for pouches (differences in mass and layer compositions).

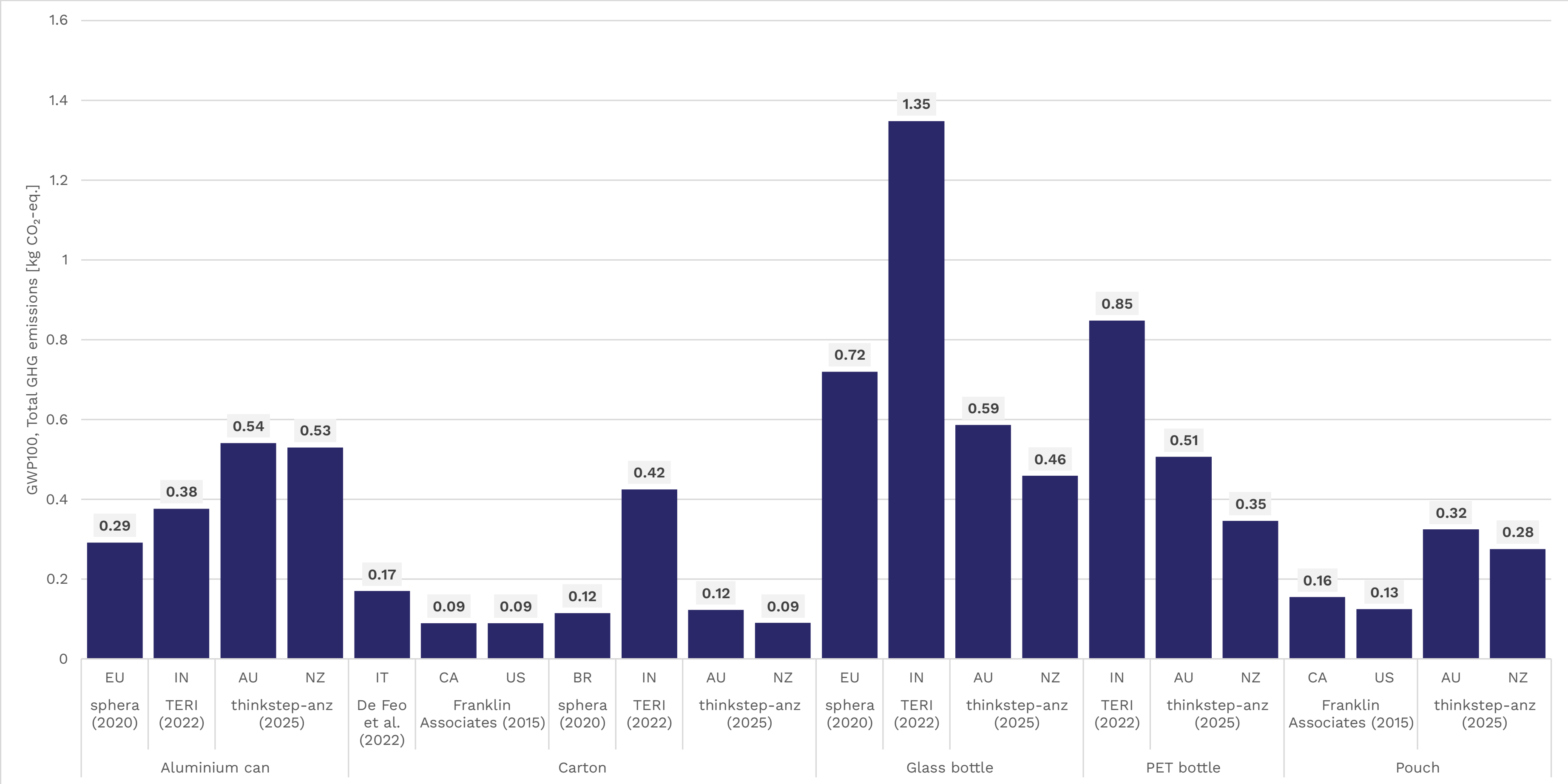


Figure 5-27: Comparison of carbon footprint (250mL scaled to 1L) across studies

Notable differences in teardowns, modelling assumptions, datasets used and end-of-life pathways between studies are outlined below:

- Most studies applied the cut-off methodology for end-of-life allocation; however, the substitution method was used in TERI (2022) and Sphera (2020) studies
  - The TERI study assumed 54% recycling and 45% incineration for cans. This study was commissioned by Ball Corporation, a manufacturer of aluminium cans in India.
  - The Sphera study was also commissioned by Ball Corporation for packaging in Brazil, and assumed recycling rates of 66%, 43% and 69% for glass, carton and aluminium can packaging respectively.
- Plastic granulate from China (used in this study) has a larger carbon footprint than plastic granulate from Europe and North America, which accounts for the higher footprint for PET bottles.
- The carbon footprint of rPET (when using a cut-off approach) is largely dependent on the carbon intensity of the electricity grid. The New Zealand electricity grid is lower carbon than the grid in both Italy and Australia, which leads to New Zealand rPET having a low GWP.
- Carbon footprint of the packaging options considered in the TERI (2022) study were generally higher than those in other studies, and this is attributed to the more carbon-intensive grid in India compared to other countries in this comparison.
- The IFEU report assumed a 25% rPET content for PET bottles.
- The carbon footprint of aluminium cans is dependent on their recycled content. Recycled aluminium content of the cans in the Sphera (2020) study was 55%, recycled aluminium content of the cans in the TERI (2022) study was 76%, and the cans in this study assume recycled aluminium (70% recycled aluminium content). The results for cans from TERI are significantly lower than those from this study.
- Similarly, the carbon footprint of glass bottles is dependent on their recycled content. Recycled glass content of the bottle in the Sphera (2020) study was 40%; while the bottles in this study assume 70% recycled glass content.
- End-of-life:
  - The IFEU (2017) report used the 50% allocation method for their baseline EOL scenario. This will not have a major impact on the results for cartons used in this study but will affect the PET bottle results due to their recycled content and recycling rate.
  - Europe and North America have different recycling, landfill and incineration rates compared to New Zealand and Australia, with both markets having waste incineration, as well as higher carton recycling rates than in this study.
  - The DOC_f of the cartons was assumed to be 0% in the Franklin Associates (2015) study and 30% in the IFEU (2017) study. This study used a DOC_f of 21%.

Overall, in comparison to other studies, this study shows:

- Similar carbon footprints for cartons
- Lower carbon footprint for glass and rPET packaging
- Higher carbon footprint from aluminium cans
- Mixed results for PET packaging carbon footprints – for 1L packages, PET packaging carbon footprint is similar for Australia but lower for New Zealand, while the 250mL packaging (scaled to 1L) shows lower carbon footprints from PET packaging for both Australia and New Zealand
- Higher carbon footprint for pouches.

5.5.2. Comparison between 2021 and 2025 studies

Figure 5-28 shows 1L glass, PET, and rPET bottles, along with the 1L cartons in this study, compared with similar packaging systems from the previous thinkstep-anz (2021) study.

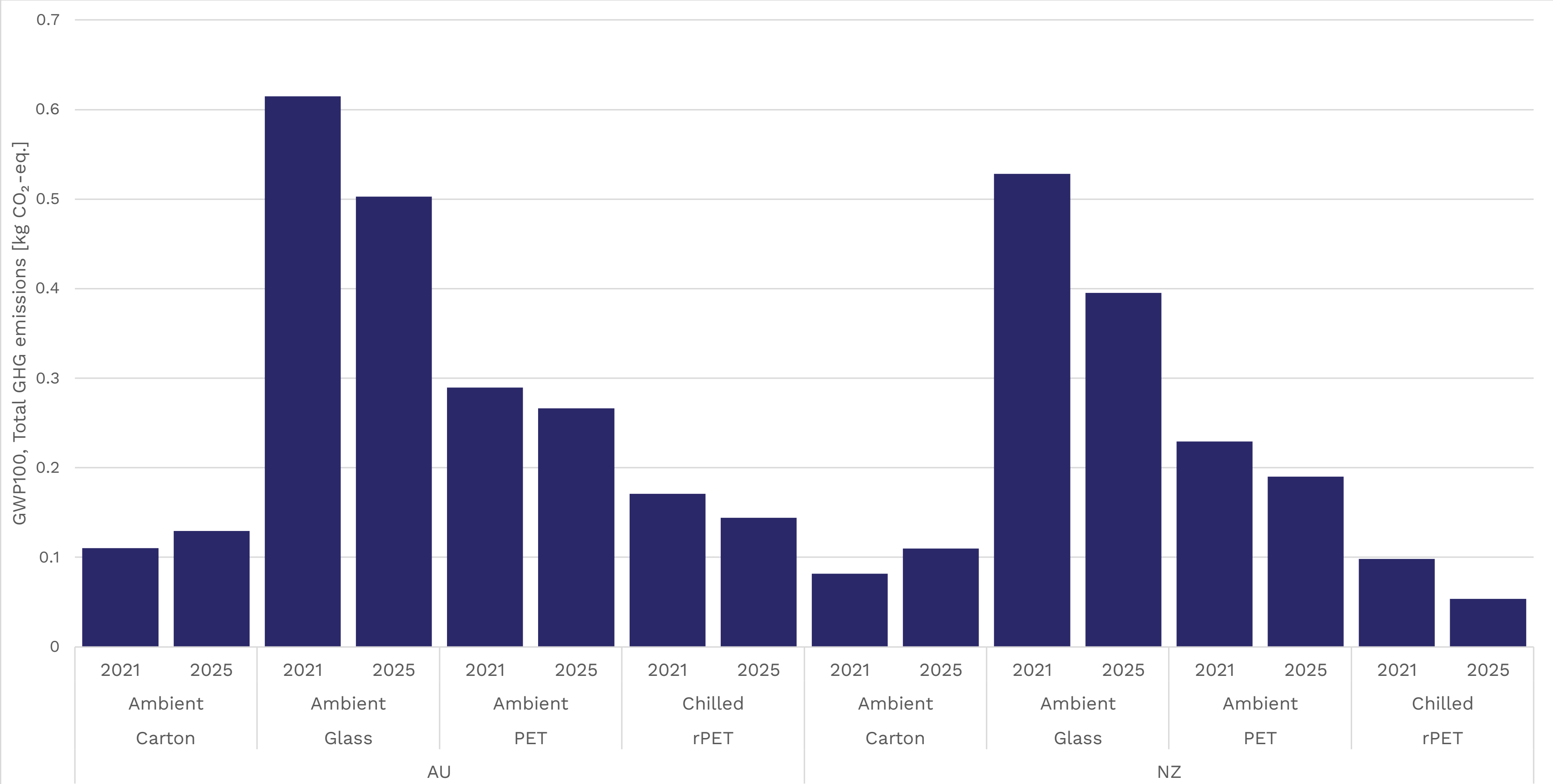


Figure 5-28: 1L Comparison of carbon footprint to previous thinkstep-anz (2021) study

Figure 5-29 shows 250mL cartons, pouches, and 237mL aluminium cans in this study compared with similar packaging systems in the previous thinkstep-anz (2021) study. The results from both studies have been normalised to 1L as volume of packaging differ across studies for aluminium cans.

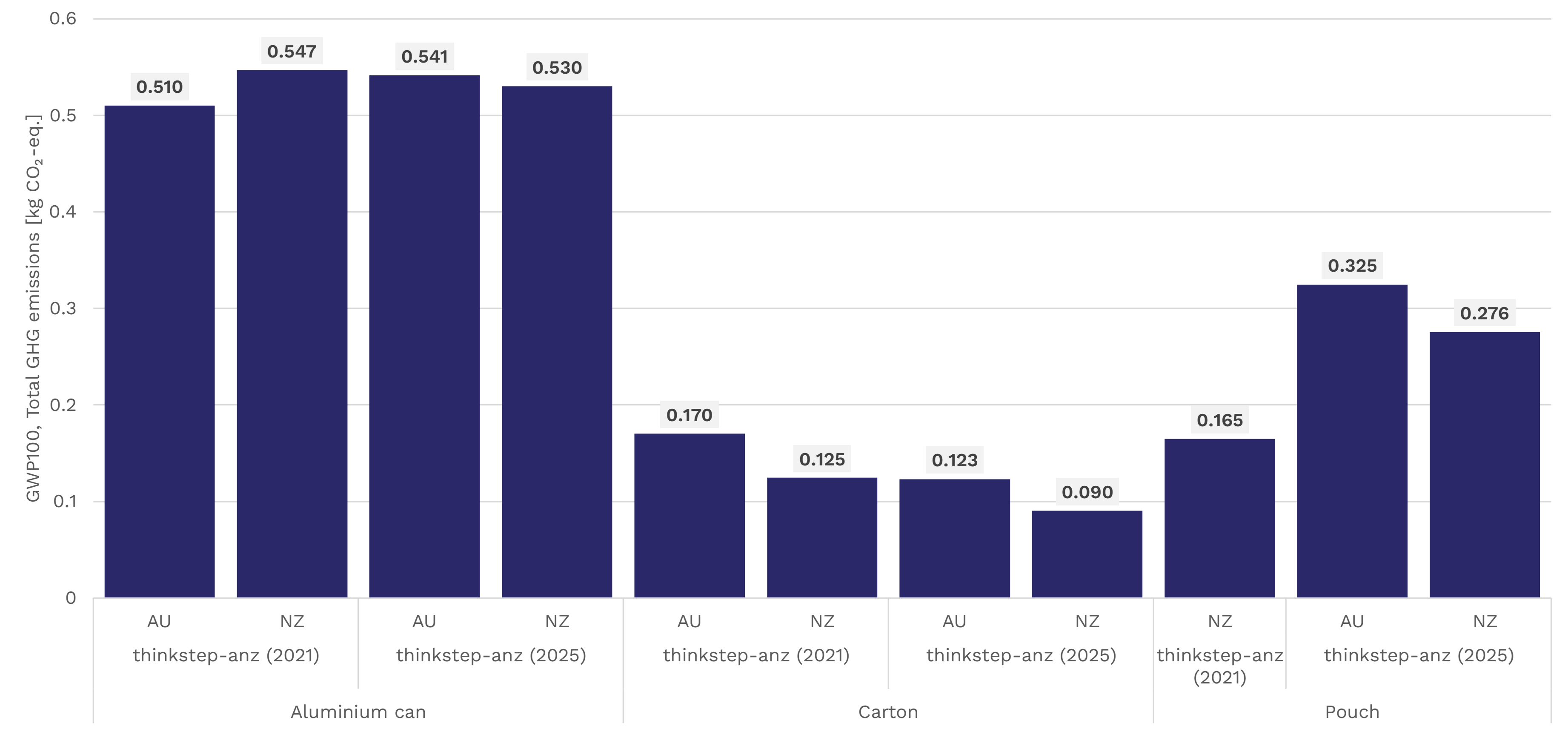


Figure 5-29: Comparison of carbon footprint (250mL scaled to 1L) to previous thinkstep-anz (2021) study

.

The carbon footprint results for 1L packaging in this study show a reduction for PET, rPET, and glass packaging compared to the 2021 study. However, the carbon footprint of cartons is higher in the 2025 study. The differences in carbon footprint between the 2021 and 2025 studies can be attributed to:

- Lightweighting of packages, such as PET and rPET bottles
- Increased recycling content for glass bottles (70% in current study against 20% (AU) and 45% (NZ) in previous study)
- A combination of higher carton mass and the increase in carbon emission factor for carton paperboard in this study.

When comparing the 250mL packaging, the carbon footprint of pouches is higher in this study compared to the 2021 study. Aluminium cans show no difference, while cartons have a lower carbon footprint in this study. The differences in carbon footprint between the two studies can be explained by the following:

- The higher mass of pouches in this study compared to the previous one. The use of a global average aluminium carbon emission factor also led to an increased carbon footprint.
- Lower mass of cartons in this study - the average mass of aseptic cartons in the 2021 study was higher compared to the average aseptic carton mass in this study.

For cartons, the comparison between the 2021 and 2025 studies are not ‘like-for-like’. Within the size classes compared, the cartons varied in mass and manufacturing location.

6. Data Quality Assessment

Inventory data quality is judged by its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied) and representativeness (geographical, temporal, and technological).

To cover these requirements and to ensure reliable results, first-hand industry data in combination with consistent background LCA information from the MLC database were used. The LCI datasets from the MLC database are widely distributed and used with the LCA FE Software. The datasets have been used in LCA models worldwide in industrial and scientific applications in internal as well as in many critically reviewed and published studies. In the process of providing these datasets they are cross-checked with other databases and values from industry and science.

6.1. Representativeness

- **Temporal:** All primary data were collected from October 2024 and November 2024, with manufacturing data representing the year 2024. All secondary data come from the MLC databases and are representative of the year 2024. Furthermore, this study is specific to the packaging options and technology available in Australia and New Zealand in 2024. Competitor packaging masses are averages of three packs (three brands) per beverage category, size class and material. In some cases, it was not possible to procure three brands from the market, hence the average is not made of three packs. As the study intended to compare the product systems for the reference year 2024, temporal representativeness is considered to be high for collected Tetra Pak data and acceptable for competitor data.
- **Geographical:** All primary measured data were collected specific to the countries under study. Where possible, secondary data were used specific to the countries under study (e.g. energy for manufacture, transport). Where country-specific or region-specific data were unavailable, proxy data were used. Assumptions had to be made on the supply chains of competitor packs. In these cases, the decisions made have been in favour of benefitting the competitor. For example, manufacturing processes such as blow moulding PET preforms and HDPE bottles in Australia/New Zealand (i.e. country of filling) instead of China or other countries. Geographical representativeness is considered acceptable, particularly given the conservative approach applied.
- **Technological:** All primary and secondary data were modelled to be specific to the technologies or technology mixes under study. Where technology-specific data were unavailable, proxy data were used. For example, a generic blow moulding dataset (with the ability to use country specific energy datasets) were used as proxy for plastic bottle manufacture. Technological representativeness is considered to be high.

6.2. Precision and Completeness

- **Precision:** As most the relevant foreground data are measured data, or calculated based on primary information sources of the owner of the technology, precision is considered to be high. It is noted that the scaling applied for some packs to achieve the required size class relies on the assumptions and methods given in Section 3.2.3.
  Average annual production data was used to model the manufacture of Tetra Pak cartons in their respective locations. All background data are sourced from MLC databases with the documented precision. Manufacture of non-carton packages utilised industry-average data from the MLC database. The authors do not expect this to adversely impact on precision.
- **Completeness:** Each foreground process was checked for mass balance and completeness of the emission inventory. No data were knowingly omitted, except shrink wrap for all pallets. Completeness of foreground unit process data is considered to be high. All background data are sourced from MLC databases with the documented completeness.

6.3. Consistency and Reproducibility

- **Consistency:** To ensure data consistency, all primary data were collected with the same level of detail, while all background data were sourced from the MLC databases.
- **Reproducibility:** Reproducibility is supported as much as possible through the disclosure of input-output data (e.g., packaging purchased for the study and resulting averages per packaging material and size class), dataset choices, and modelling approaches in this report. Based on this information, any third party should be able to approximate the results of this study using the same data and modelling approaches.

6.4. Model Completeness and Consistency

6.4.1. Completeness

All relevant process steps for each product system were considered and modelled to represent each specific situation. The process chain is considered sufficiently complete and detailed with regards to the goal and scope of this study.

6.4.2. Consistency

All assumptions, methods and data are consistent with each other and with the study's goal and scope. Differences in background data quality were minimised by exclusively using LCI data from the MLC databases. System boundaries, allocation rules, and impact assessment methods have been applied consistently throughout the study.

7. Interpretation

7.1. Identification of Relevant Findings

7.1.1. Overview of Assessed Options

Tetra Pak packaging options were assessed against different packaging materials including PET bottles, rPET bottles, HDPE bottles, pouches, aluminium cans and glass bottles. Various recycled contents were included for aluminium and glass in sensitivity analysis.

Different classes of packaging types were defined, according to performance, i.e. fresh and aseptic for beverages, and to size, from 250mL to 2L. Tetra Pak packaging is compared against alternative packaging options within those classes. In some cases, it was necessary to compare across fresh and aseptic categories aligned with market practices.

7.1.2. Comparison of Tetra Pak Cartons with Other Packaging Options

For all comparisons in Australia, cartons are shown to have the lowest carbon footprint. The difference in carbon footprint between cartons and the alternative packaging options with the next lowest carbon footprint ranged between 6% and 297% (percentage difference of less than 5% is not considered significant in this study).

For New Zealand comparisons, other packaging options are preferable for some comparisons, most notably rPET formats. The difference in carbon footprint between cartons and the packaging with the next lowest carbon footprint ranged between 22% and 334% for New Zealand. In the 1.5L chilled milk comparison, the rPET packaging is only 3% lower in carbon footprint, thus comparable to the carbon footprint of the Tetra Pak carton.

Beverage cartons also have a strong environmental performance relative to other beverage package formats across a range of environmental indicators. Across their full life cycle, beverage cartons have the lowest water consumption (blue water consumption) and produce the lowest emissions that contribute to acidification.

7.1.3. Detailed Assessment of Tetra Pak Carton Components

Tetra Pak packages are also analysed as part of this report in more detail to identify the impact of the different materials used within a carton.

A summary of the specifications of the cartons analysed can be found in Annex C (confidential). Looking at products within the same size class, the carbon footprint results are similar between cartons, with a few notable exceptions.

- Non-aseptic cartons, i.e. used for beverages with a short shelf life, do not have an aluminium inner barrier layer and have lower impact (carbon footprint and other environmental impact indicators) than the aseptic products of the same size class.
- Cartons without closures perform better (lower carbon footprint) than cartons with closures.

- The non-aseptic plant-based carton versions (bio-LDPE laminate layer and bio-HDPE closure derived from sugarcane) generally have better results compared to fossil-based versions.

7.1.4. Contribution of Life Cycle Stages to Overall Carbon Footprint

- The consumer pack manufacturing stage has the largest contribution towards carbon footprint.
- For the lower-carbon footprint products, the carbon footprint from the secondary packaging (shipper) is significant, however, this depends on the number of primary units contained within a secondary package and the mass and material of the secondary package. For larger packaging formats which are packaged in mass-intensive secondary packaging containing a smaller number of units, secondary packaging carbon footprint from corrugated cardboard is significant.
- The combination of biogenic carbon sequestration from raw materials and consumer end-of-life stage for cartons generally result in a small net sequestration. This is driven by high landfill rates, DOC_f of materials and the modelling choice to release biogenic carbon when material with biogenic carbon content is recycled.
- Forming and filling, and distribution are less significant for all packaging in the study. However, cartons have higher carbon footprint compared to other options and impact is driven by electricity and the grids at forming and filling locations.
- Tertiary packaging (pallet) carbon footprint is minor compared to other life cycle stages.

7.2. Assumptions and Limitations

The main assumptions used in the modelling for this report as well as the datasets used are described in detail in Section 3. Areas where the data used were of lower quality or where there were data gaps are summarised below:

- Measurements (mass) were taken for three different brands of a packaging based on beverage, material type and size class and used to calculate an average packaging to represent the market. Replicates of the same package were not purchased and included in the packaging average. In some cases, three brands were not available in market.
- All pouches have been assumed to have come from China. This is a conservative approach as China's national electricity mix is relatively carbon intensive compared to other regions.
- The supply chains for all competitor packs have been assumed based on current packaging trends and generic manufacturing data. Individual packaging manufacturers may have different material sources and different production efficiencies and therefore different results.
- For alternative packaging, proxy European or Chinese data was used in place of Australia/New Zealand datasets as material and manufacturing datasets from the two countries are limited (see Section 3.9. In general, European production has a lower carbon footprint than Chinese production.
- Raw materials for the non-carton packaging options are based on datasets available in the MLC database as no primary data was available. The MLC Database is based on industry data and provides a reliable proxy for primary data.
- Forming and filling data used in the Tetra Pak Oceania study (thinkstep-anz, 2021) is reused for this study. The data used is also consistent with previous thinkstep-anz

work for other companies. To help counteract uncertainty, the estimates made are conservative so as not to overestimate the impacts of a given packaging system.

- Secondary and tertiary packaging data is based on palletisation modelling and teardowns. Package-specific data is utilised where possible, resulting in unique scenarios. Tetra Pak cartons data is conservative so as not to benefit cartons.
- It is assumed that the DOC_f of laminated paper is 21%, based on a previous study (Eleazer, et al., 1997). There is uncertainty in this value, and a sensitivity analysis is performed to assess its effect on the conclusions.
- There is potential uncertainty around the methane capture rate in landfills. This has been discussed in Section 3.8.3.2 and tested through sensitivity analysis in Section 5.4.1.
- Both Australia and New Zealand have well-established recycling cultures for materials such as aluminium, glass and plastics. Therefore, recycling rates of these materials are high. However, Australia and New Zealand have high landfill rates for cartons and pouches. Counterintuitively, an increased recycling rate would increase the GWP of cartons for the baseline scenario (due to artificial release when it leaves the system as opposed to being sequestered in the landfill). However, an increased recycling rate would decrease the GWP of the worst-case DOC_f scenario.
- At the end-of-life, materials for recycling are assumed to be sorted, washed and/or crushed which are processes expected within a material recovery facility (MRF). Data for MRF is based on literature.
- The glass bottles assessed in the study are all clear glass bottles, as clear glass is typically used for milk and juice– the product categories considered with glass packaging in this study.
- There is relatively high uncertainty in the results for aluminium cans as aluminium is an electricity-intensive material to manufacture. This means that the carbon footprints of primary aluminium can vary from approximately 5 kg CO_2e/kg to over 20 kg CO_2e/kg (World Aluminium, 2017). The global mix selected for this study is towards the higher end of that range, due to the prevalence of coal-fired electricity in the global aluminium production mix. Selecting a high recycled content (70%) helps to counter this uncertainty, as tested by the sensitivity analysis on recycled content. Aluminium mix used for Tetra Pak cartons reflect a three-year running average and has lower carbon footprint compared to the global average.
- Due to market availability, some packaging sizes were not uniformly available across all materials. Thus, scaling of mass based on existing packaging was required. Packaging (bottle) masses were scaled linearly for some packaging.
- It is assumed that all packaging options fulfil the equivalent function of protecting the product and that there is no difference in shelf-life. While packaging material choice makes a difference to the shelf life, shelf-life is not considered in this study. The retail stage and refrigeration at retail are also excluded in this study as robust data is unavailable.

7.3. Results of Sensitivity Analysis

Sensitivity analyses were used to test if the conclusions of this study would change with different input data and/or methodological choices. The analyses conducted considered:

- Carton end-of-life, specifically:
  - The share of cartons sent to landfill and recycling.
  - When sent to landfill, how much of the biogenic carbon in the carton degrades (based on DOC_f) and how much of it is released to air as carbon dioxide and methane (based on landfill capture rates).
- Recycling allocation method: Cut-off vs substitution
- Recycled content of glass.
- Sourcing of aluminium: use of aluminium with higher and lower recycled contents and use of globally and European sourced aluminium.
- Comparing the modelling approach of releasing biogenic carbon during carton recycling with that of sequestering biogenic carbon during recycling.
- Distribution distance.

The analyses showed that:

- If the landfill rate of cartons was high (in this case 100%), variations in the DOC_f of laminated paper had a significant impact on carbon footprint results, especially when the landfill gas capture rate was low. Increasing the recycling rate makes the uncertainty in the DOC_f less significant, due to fewer cartons making it to landfill. Landfill rates are high for cartons in Australia and New Zealand (proportion that is not recycled is assumed to be landfilled).
- Carbon footprint increases as the DOC_f increases, owing to greater amounts of methane produced in the landfill.
- The highest carbon footprint for cartons is achieved with 50% DOC_f, a 0% recycling rate/100% landfill rate, and a 0% landfill gas capture rate.
- The 'cut-off' vs 'substitution' end-of-life scenarios were analysed to assess the impact of using different end-of-life allocation methods. Due to low recycled content and recycling rates of cartons and pouches, these packaging types do not change significantly from the 'cut-off' scenario. However, the GWP of rPET increases significantly, as the amount of recyclable material recovered at end-of-life is insufficient to meet the 100% recycled content and a top-up of virgin material is required to manufacture the next bottle. The 'substitution' scenario, therefore, does not change the findings reached in Section 5.1
- Significant reduction in carbon footprint is observed when increasing the recycled content of glass bottles. While remarkable savings were made, the carbon footprint of cartons still outperformed glass packaging, even when compared to aseptic cartons.
- The aluminium carbon emission factor is a significant driver of carbon footprint for aluminium cans as well as aseptic cartons. Significant reductions in carbon footprints are observed when using aluminium with higher recycled contents.
- At end-of-life, the modelling approach of releasing biogenic carbon during carton recycling was found to be insignificant, as recycling rates were too low to make a material difference. However, this approach is conservative and aligns with the goal and scope of the study.
- Distribution distance is a driver for carbon footprint - higher carbon footprint occurs as a result of increasing distribution distance. In this study, distribution carbon footprint is minor.

Overall outcomes:

- Cartons maintain their position as a lower-carbon beverage packaging option under most scenarios, particularly in Australia.
- Variations in material sourcing and end-of-life treatment impact carbon footprint results but do not alter the general trends.
- Glass and aluminium packaging are highly sensitive to changes in their respective recycled contents. Recycled materials offer improvements by reducing environmental impacts (e.g. carbon footprint) due to extracting and processing raw materials. Additionally, the recycling process requires less thermal energy, e.g. for melting glass.

7.4. Conclusions, Limitations, and Recommendations

7.4.1. Conclusions

- The results of this study show that cartons are the consumer packaging solution with the lowest carbon footprint for beverages in Australia. However, in some comparisons in New Zealand, recycled PET bottles show similarly low carbon footprints for consumer packaging (e.g., 750mL and 1.5L bottles).
- The study shows that the consumer packaging manufacture (i.e., life cycle stages from raw material manufacture to packaging manufacture) has the highest carbon footprint compared to other life cycle stages.
- Glass, aluminium and plastic materials have relatively high recycling rates in Australia and New Zealand compared to cartons and pouches. For packaging made of these materials, their end-of-life carbon footprint is minor where the cut-off recycling approach is used to model end-of-life. Overall, carbon footprint from end-of-life for cartons is also immaterial for this study.
- For cartons, the paperboard, bio-LDPE laminate and bio-HDPE closure (where used) have lower carbon footprint than other packaging types, especially for non-aseptic (short shelf life or fresh beverages) cartons. However, aluminium in the laminate drives carbon footprint for aseptic cartons.
- In some cases, both aseptic and non-aseptic cartons are included in chilled comparisons. This study confirms the need to match packaging to function. Milk is distributed in Tetra Pak aseptic and non-aseptic packaging, whilst being refrigerated. While carbon footprint from refrigeration during transport is minor, the aseptic cartons yield a higher carbon footprint (and other environmental impacts) compared to the use of non-aseptic cartons.
- Assumptions have been made to model the manufacture and distribution of competitor packaging types where no primary data was available. These include assuming the material supply chain, location of manufacture and filling data. These estimations have been made based on underlying data and previous work by thinkstep-anz.
- Following a Data Quality Assessment, the data used has been deemed to be of sufficient quality and representative of the packaging market in Australia and New Zealand. Where assumptions have been required, they have been justified in the Life Cycle Inventory (LCI) and the most significant assumptions have been discussed in Section 7.2. Tetra Pak LCI is based on primary data.
- With the current political and social climate, climate change is becoming an increasingly pressing issue. Both producers and consumers want to be sure that the products that they are making and using are packaged in a way which has the lowest effect on carbon footprint. This study shows that beverage producers who are looking for a packaging solution with the lowest GWP should consider cartons.
- The outcome of sensitivity analysis shows that cartons have the lowest or one of the lowest carbon footprints of all packaging systems considered by this study, irrespective of which end-of-life allocation method is applied. Results are sensitive to material recycled content (for glass and aluminium packaging) and transport (distribution) distance.

7.4.2. Limitations

This study does not support the following interpretation and conclusions:

- This study does not allow for comparisons of packaging solutions across different size classes.
- Other than mass data, competitor data such as material emission factors and material sourcing (e.g., aluminium, plastics or bioplastics, etc.) are assumed.
- This study is specific to the packaging options and technology available in Australia and New Zealand in 2024 and is not necessarily transferrable to other markets. Future changes in packaging technology and available packaging options may result in these results becoming out of date.
- The study relies on mass data collected from competitor products found in the market. Up to three different brands were sought to create an average package for a beverage category, material type, size class and function (whether aseptic or non-aseptic). In some cases, three brands were not available in market.
- Although not examined in this study, a combination of chilling during distribution (included in study) and in-store chilling (excluded in study) could have a significant impact when considering the different functions of cartons. Exclusion of in-store chilling is a possible limitation in this study.
- The carbon footprint, or GWP100 indicator used (from the IPCC's Sixth Assessment Report) looks at Global Warming Potential across a 100-year timeframe, as required by ISO 14067:2018 as a base case. Considering shorter or longer-term timeframes may have different results.
- While this study investigates a variety of environmental impacts, it does not investigate toxicological impacts of materials on human health, the impact of microplastics (those that do not biodegrade completely), nor does it focus on matters such as the global marine plastic pollution crisis or material circularity.
- Biogenic carbon at end-of-life was treated in accordance with ISO 14067 (Annex E.3) and EN 16485. This modelling approach has a significant impact on the study's carbon footprint results.
  - When packaging containing biogenic carbon is sent to landfill, some of the carbon is modelled as an emission. These emissions, and their associated carbon footprint impacts, are calculated based on the fraction of degradable organic carbon (DOC_f) and the landfill gas capture rate. Since landfill rates are high in Australia and New Zealand, this aspect of the modelling influences overall results.
  - When materials containing biogenic carbon are recycled, the carbon is treated as an artificial emission of CO_2 to air. This approach complies with ISO 14067 (Annex E.3) and EN 16485. It also ensures that any incineration of bio-based materials in subsequent product life cycles can be treated as carbon neutral (which is common practice in national greenhouse gas inventories). For Australia, where recycling rate for cartons is relatively high compared to New Zealand (29% for Australia and 1% for New Zealand), this modelling choice influences overall results and reflects a conservative approach. If this artificial release was not included, the life cycle carbon footprint from cartons would be lower.

7.4.3. Recommendations

The following are recommended to reduce carbon footprint of cartons:

- Source material with low carbon emission factors, among other LCA indicators, focusing on aluminium, paperboard and cap materials.
- Source plant-based materials where possible (for non-aseptic packages used for short-life or fresh beverages) and ensure suppliers provide third-party certified LCA data for use in Tetra Pak LCA studies.
- Source materials with the highest available recycled content (thus low carbon emission factor) and ensure suppliers provide independent verification of the recycled content.
- Reduce manufacturing-related carbon footprint by utilising low-carbon electricity at production sites.
- Evaluate the potential to recycle post-consumer cartons into other products and the environmental impacts of such activities.
- Packaging chilled products in aseptic cartons results in higher environmental impacts, thus, consider packaging in non-aseptic packaging for beverages that need to be chilled.

The following are recommended to improve future LCA studies:

- Carry out a market survey to understand retail and consumers' behaviour when packaging products for chilled and ambient conditions.
- Consider a study on material circularity (e.g. by assessing packaging with Material Circularity Index).
- collect primary operational data at retail and use stages in Australia and New Zealand (refrigeration energy, loss rates, etc.).
- Expand scope of plastic packaging materials included in the comparative study by identifying non-PET packaging.
- Similar to a recommendation of the 2021 study, a desktop bioreactor study is recommended. A study on various cartons with holes pierced in the laminate layer (to simulate municipal co-mingled recycling where glass and other sharp objects may be present in the recycling stream) could be conducted to further refine the DOC_f value used.
- Include scenario analysis with the 50% allocation method for end-of-life modelling.
- Develop a rigorous methodology for comparative packaging claims. This includes ensuring three brands are acquired for all packs within scope (including Tetra Pak cartons), and collection of detailed manufacturing data for competitor packaging manufacture within Oceania.

8. References

APCO. (2023). *Australian Packaging Material Flow Analysis for 2020-21: Final report – system wide material flows.* Prepared by Institute for Sustainable Futures, University of Technology Sydney on behalf of the Australian Packaging Covenant Organisation. Sydney: APCO.

Australian Department of Industry, Science, Energy and Resources. (2021). *National Greenhouse Accounts Factors, Australian National Greenhouse Accounts.*

Barlaz, M., Chanton, J., & Green, R. (2009). Controls on landfill gas collection efficiency: instantaneous and lifetime performance. *Journal of the Air & Waste Management Association, 59*, 1399–1404.

Bjørn, A., & Hauschild, M. (2015). Introducing carrying capacity-based normalisation in LCA: framework and development of references at midpoint level. *The International Journal of Life Cycle Assessment, 20*(7), 1005-1018. Retrieved 02 16, 2022, from http://link.springer.com/10.1007/s11367-015-0899-2

Braskem. (2023). *Braskem's Life Cycle Assessment: I'm GreenTM Bio-Based HDPE.* Retrieved from Braskem: https://www.braskem.com.br/imgreen/carbon-footprint

CEN. (2014). *EN 16485:2014 - Round and sawn timber. Environmental Product Declarations. Product category rules for wood and wood-based products for use in construction.* Brussels: European Committee for Standardization.

CEN. (2019). *EN 15804:2012+A2:2019 Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products.* Brussels: European Committee for Standardization.

Costa, A., Encarnação, T., Tavares, R., Todo Bom, T., & Mateus, A. (2023). Bioplastics: Innovation for Green Transition. . *Polymers*, 15(3) 517.

Cucina, M., de Nisi, P., Trombino, L., & Tambone, F. (2021). Degradation of bioplastics in organic waste by mesophilic anaerobic digestion, composting and soil incubation. *Waste Management, 134*, 67-77.

DCCEEW. (2024). *Energy Recovery.* Retrieved from Department of Climate Change, Energy, the Environment and Water: https://www.dcceew.gov.au/environment/protection/waste/publications/national-waste-resource-recovery-reporting/energy-recovery-2024

DCCEEW. (2025). *National Inventory Report 2023, Volume I, Page 428, Table 7.8.* Retrieved from Department of Climate Change, Energy, the Environment and Water: https://www.dcceew.gov.au/sites/default/files/documents/national-inventory-report-2023-volume-1.pdf

De Feo, G., Ferrara, C., & Minichini, F. (2022). Comparison between the perceived and actual environmental sustainability of beverage packagings in glass, plastic, and aluminium. *Journal of Cleaner Production, 333*, 130158.

Deviatkin, I., Khan, M., Ernst, E., & Horttanainen, M. (2019). Wooden and Plastic Pallets: A Review of Life Cycle Assessment (LCA) Studies. *Sustainability*, 11, 5750.

Eleazer, W., Odle Ill, W., Wang, Y.-S, & Barlaz, M. (1997). Biodegradability of municipal solid waste components in laboratory-scale landfills. *Environmental Science & Technology, 31*(3), 911-917.

EPD International. (2024). *PCR 2019-13: Product Group Classification: Multiple CPC, Packaging, Version 1.1.3.* Stockholm: International EPD® System.

European Commission. (2022). *Biobased plastic sustainable sourcing content.* Luxembourg: European Commission.

FEFCO and CCB. (2018). *European database for corrugated board life cycle studies, FEFCO Corrugated Packaging and Cepi Container Board.* Retrieved from FEFCO: file:///C:/Users/Gaya/Downloads/LCA%20Report%202019_revised_%20p%2037.pdf

Franklin Associates. (2015). *Life cycle assessment of shelf-stable container systems for non-carbonated juice drinks and tea in the U.S. and Canada.* Unpublished report for Tetra Pak which has been critically reviewed by a panel of experts.

Franklin Associates. (2018). *Life cycle impacts for postconsumer recycled resins: PET, HDPE, and PP.* Retrieved from https://plasticsrecycling.org/wp-content/uploads/2024/08/2018-APR-LCI-report.pdf

Germani, M., Marconi, M., & Landi, D. (2019). Analyzing the environmental sustainability of glass bottles reuse in an Italian wine consortium,. *Procedia CIRP, 80*, 399-404.

GHG Protocol. (2011). Retrieved from Product Life Cycle Accounting and Reporting Standard: https://ghgprotocol.org/sites/default/files/standards/Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf

Glass Packaging Forum. (2021). *Product Stewardship Scheme: Accreditation Report 2020-2021.* Hastings: Glass Packaging Forum. Retrieved from Glass Packaging Forum: https://www.glassforum.org.nz/wp-content/uploads/2022/03/GPF_Accreditation-Report_2020_2021_Web.pdf

Guinée, J. B., Gorrée, M., Heijungs, R., Huppes, G., Kleijn, R., de Koning, A., . . . Huijbregts, M. (2002). *Handbook on life cycle assessment. Operational guide to the ISO standards.* Dordrecht: Kluwer.

Hasanbeigi, A., Springer, C., & Shi, D. (2021). *Aluminum Climate Impact - An International Benchmarking of Energy and CO2 Intensities.* Florida, United States: Global Efficiency Intelligence. Retrieved from Global Efficiency.

Haupt et al. (2018b). Modular Life Cycle Assessment of Municipal Solid Waste Management. *Waste Management*, 79, 815-827.

Haupt, M., Kägi, T., & Hellweg, S. (2018a). Life Cycle Inventories of Waste Management Processes. *Data in Brief*, 19, 1441-1457.

Institute for Energy and Environmental Research (IFEU). (2017). *Comparative Life Cycle Assessment of Tetra Pak® carton packages and alternative packaging systems for liquid food on the Nordic market.* Heidelberg: Tetra Pack International SA.

International Aluminium. (2024). *Aluminium industry reports decline in greenhouse gas emissions*. Retrieved from International Aluminium: https://international-aluminium.org/aluminium-industry-reports-decline-in-greenhouse-gas-emissions/

IPCC. (2021). *Climate Change 2021: The Physical Science Basis.* Geneva, Switzerland: IPCC.

Islam, M., Xayachak, T., Haque, N., Lau, D., Bhuiyan, M., & Pramanik, B. (2024). Impact of bioplastics on environment from its production to end-of-life. *Process Safety and Environmental Protection, 188*, 151-166.

ISO. (2006a). *ISO 14040: Environmental management – Life cycle assessment – Principles and framework.* Geneva: International Organization for Standardization.

ISO. (2006b). *ISO 14044: Environmental management – Life cycle assessment – Requirements and guidelines.* Geneva: International Organization for Standardization.

ISO. (2018). *ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification.* Geneva: International Organization for Standardization.

JRC. (2010). *ILCD Handbook: General guide for Life Cycle Assessment – Detailed guidance. EUR 24708 EN* (1st ed.). Luxembourg: Joint Research Centre.

Lamberti, M., & Escher, F. (2007). Aluminium Foil as a Food Packaging Material in Comparison with Other Materials. *Food Reviews International, 23*, 407-433.

Micales, J., & Skog, K. (1997). The Decomposition of Forest Products in Landfills. *International Biodeterioration & Biodegradation, 39*, 145-158.

Ministry for the Environment. (2015). *New Zealand's Greenhouse Gas Inventory 1990-2013 p. 299*. Retrieved from Ministry for the Environment: https://environment.govt.nz/assets/Publications/Files/national-inventory-report-updated-29-July-2015.pdf#page=332

Ministry for the Environment. (2021). *New Zealand's Greenhouse Gas Inventory 1990-2019. p. 377.* Retrieved from Ministry for the Environment: https://environment.govt.nz/assets/Publications/New-Zealands-Greenhouse-Gas-Inventory-1990-2019-Volume-1-Chapters-1-15.pdf#page=401

Ministry for the Environment. (2024). *New Zealand's Greenhouse Gas Inventory 1990-2022.* Wellington: Ministry for the Environment.

Posch, M. S. (2008). The role of atmospheric dispersion models and ecosystem sensitivity in the determination of characterisation factors for acidifying and eutrophying emissions in LCIA. *International Journal of Life Cycle Assessment, 13*, 477–486.

Ritzen, L., Sprecher, B., Bakker, C., & Balkenende, R. (2024). Sustainability of bio-based polyethylene: The influence of biomass sourcing and end-of-life. *Journal of Industrial Ecology, 28*, 1684-1698.

Robertson, G. L. (2013). Closures and sealing systems. In *Food packaging principles and practice, third ed.* (p 274). Boca Raton, FL: CRC Press.

Seppälä, J. P. (2006). Country-dependent Characterisation Factors for Acidification and Terrestrial Eutrophication Based on Accumulated Exceedance as an Impact Category Indicator. *International Journal of Life Cycle Assessment, 11*(6), 403-416.

Sphera. (2020). *Life cycle assessment of beverage packaging: Pathways to a circular, low-carbon future.*

Sphera. (2025). *2025 Dataset Documentation*. Retrieved from https://lcadatabase.sphera.com

Stefanin, R., Borghesi, G., & Ronzano, A. (2020). Plastic or glass: a new environmental assessment with a marine litter indicator for the comparison of pasteurized milk bottles. *International Journal of Life Cycle Assessment*, 26, 767–784.

Struijs, J. B. (2009). Aquatic Eutrophication. Chapter 6. In M. H. Goedkoop, *ReCiPe 2008 A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level. Report I: Characterisation factors, first edition.* Bilthoven, Netherlands: Dutch Ministry of Infrastructure and the Environment, RIVM.

TERI. (2022). *Sustainable Beverage Packaging Options in India: A Comparative Life Cycle Assessment Study.* New Delhi: The Energy and Resources Institute.

The Aluminium Association. (2024). *Amid Recycling Rate Decline, Aluminum Beverage Can Remains Most Recycled Drinks Package.* Retrieved from The Aluminium Association: https://www.aluminum.org/news/amid-recycling-rate-decline-aluminum-beverage-can-remains-most-recycled-drinks-package

thinkstep-anz. (2021). *LCA of Beverage and Food Packaging in Australia and New Zealand.*

TNO Biobased and Circular Technologies. (2024, November 26). *Phyllis2 database*. Retrieved from https://phyllis.nl/Browse/Standard/ECN-Phyllis

Tonini, D., Garcia-Gutierrez , P., & Nessi, S. (2021). *Environmental effects of plastic waste recycling, EUR 30668 EN,ISBN 978-92-76-41130-7, doi:10.2760/6309, JRC122455.* Luxembourg: Publications Office of the European Union.

Ülger-Vatansever, B., Onay, T., & Demirel, B. (2024). Evaluation of bioplastics biodegradation under simulated landfill conditions. *Environmental Science and Pollution Research , 31*(12), 17779-17787.

van Oers, L., de Koning, A., Guinée, J. B., & Huppes, G. (2002). *Abiotic resource depletion in LCA.* The Hague: Ministry of Transport, Public Works and Water Management.

van Zelm, R. M. (2008). European characterization factors for human health damage of PM10 and ozone in life cycle impact assessment. *Atmospheric Environment, 42*(3), 441-453.

WMO. (2014). *Scientific Assessment of Ozone Depletion: 2014, Global Ozone Research and .* Geneva, Switzerland: WMO.

World Integrated Trade Solution. (2025, March 19). *Australia and New Zealand Plastic or Rubber Imports by Country & Region 2022*. Retrieved from https://wits.worldbank.org/

World of Cans Inc. (2025). *How Aluminum Cans Are Made?* Retrieved from World of Cans, Inc.: https://worldofcans.com/pages/how-are-aluminum-cans-made

Yates, S. (2020). *Rethinking Rubbish and Recycling.* Auckland: Sunshine Yates Consulting.

Zulkarnain, I., Lai, L., Syakir, M., Rahman, A., Yusuff, S., & Hanafiah, M. (2021). Life cycle assessment of crushed glass abrasive manufacturing. *IOP Conference Series: Earth and Environmental Science, 880*, 012054.

List of figures

List of tables

Abbreviations and glossary

Term	Definition
ADP	Abiotic Depletion Potential
AP	Acidification Potential, Accumulated Exceedance
CEN	European Committee for Standardization
DOC_f	Degradable Organic Carbon Fraction
EoL	End-of-Life
EP	Eutrophication Potential
ff	fossil fuels
fw	fresh water
GaBi	Ganzheitliche Bilanzierung (German for holistic balancing)
GHG	Greenhouse Gas
GWP	Global Warming Potential (Climate Change)
HDPE	High-Density Polyethylene
ILCD	International Cycle Data System
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LCA FE	Life Cycle Assessment for Experts (software)
LDPE	Low-Density Polyethylene
MLC	Managed LCA Content database
m&m	minerals and metals
MRF	Materials Recovery Facility
NMVOC	Non-Methane Volatile Organic Compound
ODP	Depletion potential of the stratospheric ozone layer
PET	Polyethylene Terephthalate
PM	Potential incidence of disease due to PM emissions
POCP	Formation potential of tropospheric ozone
PP	Polypropylene
TB	Tetra Brik
TBA	Tetra Brick Aseptic

Term	Definition
TGA	Tetra Gemina Aseptic
TPA	Tetra Prisma Aseptic
TR	Tetra Rex
TSA	Tetra Stelo Aseptic
TT	Tetra Top
VOC	Volatile Organic Compound

Glossary

Life cycle

A view of a product system as "consecutive and interlinked stages … from raw material acquisition or generation from natural resources to final disposal" (ISO 14040:2006, section 3.1). This includes all material and energy inputs as well as emissions to air, land and water.

Life Cycle Assessment (LCA)

"Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle" (ISO 14040:2006, section 3.2)

Life Cycle Inventory (LCI)

"Phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle" (ISO 14040:2006, section 3.3)

Life Cycle Impact Assessment (LCIA)

"Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product" (ISO 14040:2006, section 3.4)

Life cycle interpretation

"Phase of life cycle assessment in which the findings of either the inventory analysis or the impact assessment, or both, are evaluated in relation to the defined goal and scope in order to reach conclusions and recommendations" (ISO 14040:2006, section 3.5)

Environmental Product Declaration (EPD)

"Independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impacts of products."

Product Category Rule (PCR)

"Defines the rules and requirements for EPDs of a certain product category."

Functional / Declared unit

"Quantified performance of a product system for use as a reference unit." (ISO 14040:2006, section 3.20)

Functional unit = LCA/EPD covers entire life cycle "cradle to grave."

Declared unit = LCA/EPD is not based on a full "cradle to grave" LCA, common in construction product EPDs.

Allocation

"Partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems" (ISO 14040:2006, section 3.17)

Foreground system

"Those processes of the system that are specific to it … and/or directly affected by decisions analysed in the study." (JRC, 2010, 97) This typically includes first-tier suppliers, the manufacturer itself and any downstream life cycle stages where the manufacturer can exert significant influence. As a general rule, specific (primary) data should be used for the foreground system.

Background system

"Those processes, where due to the averaging effect across the suppliers, a homogenous market with average (or equivalent, generic data) can be assumed to appropriately represent the respective process … and/or those processes that are operated as part of the system but that are not under direct control or decisive influence of the producer of the good…." (JRC, 2010, 97-98) As a general rule, secondary data are appropriate for the background system, particularly where primary data are difficult to collect.

Closed-loop and open-loop allocation of recycled material

"An open-loop allocation procedure applies to open-loop product systems where the material is recycled into other product systems and the material undergoes a change to its inherent properties."

"A closed-loop allocation procedure applies to closed-loop product systems. It also applies to open-loop product systems where no changes occur in the inherent properties of the recycled material. In such cases, the need for allocation is avoided since the use of secondary material displaces the use of virgin (primary) materials."

(ISO 14044:2006, section 4.3.4.3.3)

Critical Review

"Process intended to ensure consistency between a life cycle assessment and the principles and requirements of the International Standards on life cycle assessment" (ISO 14044:2006, section 3.45).

Applicability and limitations

Restrictions and intended purpose

This report has been prepared by thinkstep-anz with all reasonable skill and diligence within the agreed scope, time and budget available for the work. thinkstep-anz does not accept responsibility of any kind to any third parties who make use of its contents. Any such party relies on the report at its own risk. Interpretations, analyses, or statements of any kind made by a third party and based on this report are beyond thinkstep-anz's responsibility.

If you have any suggestions, complaints, or any other feedback, please contact us at: feedback@thinkstep-anz.com

Legal interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Annex A ISO 14067 GWP Results

A.1. ISO 14067 GWP Results

The Total GWP results within the body of this report are based on the sum of fossil GHG emissions, biogenic GHG emissions, biogenic GHG removals, aircraft GHG emissions, and land use change GHG emissions. These are calculated using AR6 CFs (IPCC, 2021) and considers all GHGs from IPCC Assessment Report 6 (AR6) (IPCC, 2021).

Results for all ISO 14067 GWP indicators are provided in Annex A.

Annex A ISO 14067 Results

A.1. ISO 14067 GWP100, Total Results

Annex Table A-1 Results per pack for GWP100, Total GHG emissions [kg CO_2-eq.]

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
750ml Milk	**Chilled**	**AU**	TR 750ml OSO34	0.0163	0.00512	0.0100	-0.00388	0.00978	0.0159	0.0532
			750ml PET	0.207	0.00386	0.0100	-0.00388	0.0107	0.00401	0.232
			750ml rPET	0.113	0.00386	0.0100	-0.00388	0.0106	0.00381	0.137
750ml Milk	**Chilled**	**NZ**	TR 750ml OSO34	0.0145	0.00137	0.00774	-0.00388	0.00385	0.0128	0.0364
			750ml PET	0.143	0.00107	0.00774	-0.00388	0.00421	0.00234	0.154
			750ml rPET	0.0385	0.00107	0.00774	-0.00388	0.00416	0.00221	0.0498
1L Milk	**Ambient**	**AU**	TBA Slim 1L HC23	0.0408	0.0143	0.0287	-0.00207	0.00296	0.0233	0.108
			TBA Edge 1L LC30	0.0333	0.0143	0.0344	-0.00213	0.00307	0.0230	0.106
			TBA Edge 1L LW30 PB	0.0278	0.0143	0.0344	-0.00213	0.00308	0.0289	0.106
			TBA Square 1L HC27	0.0548	0.0143	0.0344	-0.00213	0.00321	0.0234	0.128
1L Milk	**Ambient**	**NZ**	TBA Slim 1L HC23	0.0379	0.00409	0.0287	-0.00207	0.00116	0.0187	0.0885
			TBA Edge 1L LC30	0.0321	0.00409	0.0344	-0.00213	0.00121	0.0185	0.0882
			TBA Edge 1L LW30 PB	0.0278	0.00409	0.0344	-0.00213	0.00121	0.0199	0.0853
			TBA Square 1L HC27	0.0506	0.00409	0.0344	-0.00213	0.00126	0.0188	0.107
1L Milk	**Chilled**	**AU**	TT 1L C38	0.0124	0.00512	0.0100	-0.00388	0.00995	0.0195	0.0531
			TT 1L C38 PB	-0.00203	0.00512	0.0100	-0.00388	0.00995	0.0248	0.0440
			TR 1L OSO34 PB	0.00137	0.00512	0.0100	-0.00388	0.00990	0.0238	0.0463
			TB Ultra Edge 900ml	0.00887	0.00512	0.0100	-0.00388	0.0104	0.0252	0.0557
			TBA Edge 1L LC30	0.0333	0.0143	0.0100	-0.00388	0.0102	0.0230	0.0869
			1L HDPE	0.184	0.00386	0.0100	-0.00388	0.0106	0.00314	0.208

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			1L PET	0.239	0.00386	0.0100	-0.00388	0.0110	0.00466	0.265
			1L Glass	0.380	0.00386	0.0100	-0.00388	0.0330	0.00625	0.429
			1L rPET	0.119	0.00386	0.0100	-0.00388	0.0107	0.00398	0.144
1L Milk	**Chilled**	**NZ**	TT 1L C38	0.00936	0.00137	0.00774	-0.00388	0.00392	0.0157	0.0342
			TT 1L C38 PB	-0.00203	0.00137	0.00774	-0.00388	0.00392	0.0184	0.0255
			TR 1L OSO34 PB	0.00137	0.00137	0.00774	-0.00388	0.00390	0.0183	0.0288
			TB Ultra Edge 900ml	0.0312	0.00137	0.00774	-0.00388	0.00408	0.0204	0.0609
			TBA Edge 1L LC30	0.0321	0.00409	0.00774	-0.00388	0.00403	0.0185	0.0626
			1L HDPE	0.105	0.00107	0.00774	-0.00388	0.00419	0.00240	0.117
			1L PET	0.167	0.00107	0.00774	-0.00388	0.00434	0.00275	0.179
			1L Glass	0.295	0.00107	0.00774	-0.00388	0.0130	0.00773	0.321
			1L rPET	0.0421	0.00107	0.00774	-0.00388	0.00420	0.00232	0.0536
1.5L Milk	**Chilled**	**AU**	TBA Edge 1.5L WC30	0.0360	0.0200	0.0100	-0.00388	0.0103	0.0241	0.0965
			1.5L PET	0.296	0.00540	0.0100	-0.00388	0.0115	0.00570	0.325
			1.5L rPET	0.161	0.00540	0.0100	-0.00388	0.0114	0.00546	0.189
1.5L Milk	**Chilled**	**NZ**	TBA Edge 1.5L WC30	0.0346	0.00573	0.00774	-0.00388	0.00406	0.0194	0.0677
			1.5L PET	0.204	0.00149	0.00774	-0.00388	0.00454	0.00330	0.217
			1.5L rPET	0.0528	0.00149	0.00774	-0.00388	0.00448	0.00314	0.0658
2L Milk	**Chilled**	**AU**	TR 2L EO	0.0271	0.00768	0.0178	-0.00690	0.0171	0.0227	0.0855
			2L HDPE	0.205	0.00540	0.0178	-0.00690	0.0176	0.00347	0.242
2L Milk	**Chilled**	**NZ**	TR 2L EO	0.0227	0.00206	0.0138	-0.00690	0.00673	0.0182	0.0566
			2L HDPE	0.117	0.00149	0.0138	-0.00690	0.00691	0.00264	0.135
250ml RTD	**Ambient**	**AU**	TPA Edge 250ml DC26	0.0342	0.00682	0.0119	-6.13E-04	0.00113	0.00814	0.0616

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			TBA Base 250ml	0.00796	0.00682	0.0119	-5.82E-04	8.63E-04	0.00572	0.0327
			237ml Can	0.104	0.00386	0.00837	-5.65E-04	9.26E-04	1.00E-04	0.117
250ml RTD Coffee and FSN	**Chilled**	**AU**	237ml Can	0.104	0.00386	0.00837	-5.65E-04	0.00153	1.00E-04	0.117
250ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 250ml DC26	0.0302	0.00186	0.0119	-6.13E-04	4.43E-04	0.00652	0.0503
			TBA Base 250ml paper straw	0.00796	0.00186	0.0119	-5.82E-04	3.40E-04	0.00480	0.0263
			237ml Can	0.105	0.00114	0.00837	-5.65E-04	3.65E-04	1.00E-04	0.114
250ml RTD Coffee and FSN	**Chilled**	**NZ**	237ml Can	0.105	0.00114	0.00837	-5.65E-04	6.04E-04	1.00E-04	0.115
300ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 300ml DC26	0.0317	0.00663	0.0159	-7.39E-04	0.00132	0.00863	0.0634
			TPA Edge 300ml DC26 PB	0.0316	0.00663	0.0159	-7.39E-04	0.00132	0.0110	0.0657
			300ml PET	0.143	0.00470	0.0167	-7.19E-04	0.00173	0.00280	0.168
300ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 300ml DC26	0.0277	0.00220	0.0159	-7.39E-04	5.20E-04	0.00691	0.0525
			TPA Edge 300ml DC26 PB	0.0276	0.00220	0.0159	-7.39E-04	5.20E-04	0.00699	0.0525
			300ml PET	0.0997	0.00191	0.0167	-7.19E-04	6.80E-04	0.00167	0.120
330ml RTD Coffee and FSN	**Ambient**	**AU**	TT C38 330ml	0.0151	0.00663	0.0159	-9.86E-04	0.00140	0.00909	0.0471
			TPA Square 330ml	0.0398	0.00663	0.0159	-8.63E-04	0.00143	0.00927	0.0722

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			330ml PET	0.173	0.00470	0.0167	-7.19E-04	0.00189	0.00336	0.199
			375ml PET	0.140	0.00470	0.0161	-7.86E-04	0.00174	0.00275	0.165
330ml RTD Coffee and FSN	**Ambient**	**NZ**	TT C38 330ml	0.0121	0.00220	0.0159	-9.86E-04	5.53E-04	0.00731	0.0371
			TPA Square 330ml DC26	0.0358	0.00220	0.0159	-8.63E-04	5.62E-04	0.00742	0.0610
			330ml PET	0.120	0.00191	0.0167	-7.19E-04	7.46E-04	0.00198	0.141
			375ml PET	0.0992	0.00191	0.0161	-7.86E-04	6.84E-04	0.00165	0.119
500ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 500ml DC26	0.0411	0.00312	0.0263	-0.00127	0.00211	0.0139	0.0853
500ml RTD Coffee and FSN	**Chilled**	**AU**	TPA Edge 500ml DC26	0.0411	0.00312	0.0263	-0.00127	0.00350	0.0139	0.0867
			TT 500ml C38	0.0154	0.00312	0.0263	-0.00143	0.00339	0.0120	0.0588
			TT 500ml C38 PB	-0.00200	0.00312	0.0263	-0.00143	0.00339	0.0170	0.0464
			500ml rPET	0.0755	0.00470	0.0220	-0.00518	0.00693	0.00249	0.106
			500ml HDPE	0.135	0.00470	0.0220	-0.00518	0.00713	0.00232	0.166
			500ml PET	0.196	0.00470	0.0220	-0.00518	0.00761	0.00381	0.229
500ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 500ml DC26	0.0371	0.00175	0.0263	-0.00127	8.32E-04	0.0112	0.0759
500ml RTD Coffee and FSN	**Chilled**	**NZ**	TPA Edge 500ml DC26	0.0371	0.00175	0.0263	-0.00127	0.00138	0.0112	0.0765
			TT 500ml C38	0.0124	0.00175	0.0263	-0.00143	0.00134	0.00968	0.0500
			TT 500ml C38 PB	0.00112	0.00175	0.0263	-0.00143	0.00134	0.0123	0.0414
			500ml rPET	0.0277	0.00191	0.0220	-0.00518	0.00273	0.00147	0.0506

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			500ml HDPE	0.0776	0.00191	0.0220	-0.00518	0.00281	0.00177	0.101
			500ml PET	0.136	0.00191	0.0220	-0.00518	0.00300	0.00225	0.160
250ml Juice	**Ambient**	**AU**	TBA Base Crystal 200ml paper straw	0.00476	0.00682	0.0119	-4.48E-04	9.08E-04	0.00827	0.0322
			TPA Edge 250ml DC26	0.0342	0.00682	0.0119	-6.13E-04	0.00113	0.00814	0.0616
			TBA Slim 250ml	0.0153	0.00682	0.0119	-6.47E-04	9.90E-04	0.00774	0.0421
			250ml PET	0.120	0.00386	0.00555	-5.24E-04	0.00108	0.00238	0.132
			250ml Glass	0.141	0.00386	0.0218	-8.17E-04	0.00621	0.00223	0.174
			200ml Pouch	0.0576	0.00682	0.00824	-4.05E-04	7.72E-04	4.78E-04	0.0735
250ml Juice	**Ambient**	**NZ**	TBA Base Crystal 200ml paper straw	0.00476	0.00186	0.0119	-4.48E-04	3.58E-04	0.00666	0.0251
			TPA Edge 250ml DC26	0.0302	0.00186	0.0119	-6.13E-04	4.43E-04	0.00652	0.0503
			TBA Slim 250ml	0.0153	0.00186	0.0119	-6.47E-04	3.90E-04	0.00642	0.0352
			250ml PET	0.0841	0.00114	0.00423	-5.24E-04	4.27E-04	0.00145	0.0908
			250ml Glass	0.111	0.00114	0.0218	-8.17E-04	0.00244	0.00272	0.138
			200ml Pouch	0.0529	0.00186	0.00824	-4.05E-04	3.04E-04	4.12E-04	0.0633
300ml Juice	**Chilled**	**AU**	TPA Edge 300ml DC26	0.0317	0.00663	0.0159	-7.39E-04	0.00219	0.00863	0.0643
			TPA Edge 300ml DC26 PB	0.0316	0.00663	0.0159	-7.39E-04	0.00219	0.0110	0.0666
			300ml PET*	0.130	0.00386	0.0167	-0.00214	0.00400	0.00254	0.155
			300ml Glass*	0.159	0.00386	0.0218	-8.17E-04	0.0115	0.00258	0.198
300ml Juice	**Chilled**	**NZ**	TPA Edge 300ml DC26	0.0277	0.00220	0.0159	-7.39E-04	8.61E-04	0.00691	0.0528

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			TPA Edge 300ml DC26 PB	0.0276	0.00220	0.0159	-7.39E-04	8.61E-04	0.00699	0.0528
			300ml PET*	0.0902	0.00107	0.0167	-0.00214	0.00158	0.00151	0.109
			300ml Glass*	0.125	0.00107	0.0218	-8.17E-04	0.00452	0.00314	0.155
500ml Juice	**Ambient**	**AU**	TPA Edge 500ml DC26	0.0411	0.00312	0.0263	-0.00127	0.00211	0.0139	0.0853
			500ml PET	0.158	0.00470	0.0430	-0.00776	0.00636	0.00309	0.207
500ml Juice	**Ambient**	**NZ**	TPA Edge 500ml DC26	0.0371	0.00175	0.0263	-0.00127	8.32E-04	0.0112	0.0759
			500ml PET	0.110	0.00191	0.0430	-0.00776	0.00250	0.00183	0.151
500ml Juice	**Chilled**	**AU**	TPA Edge 500ml DC26	0.0411	0.00312	0.0263	-0.00127	0.00350	0.0139	0.0867
			500ml PET	0.146	0.00386	0.0430	-0.00776	0.0104	0.00284	0.198
500ml Juice	**Chilled**	**NZ**	TPA Edge 500ml DC26	0.0371	0.00175	0.0263	-0.00127	0.00138	0.0112	0.0765
			500ml PET	0.101	0.00107	0.0430	-0.00776	0.00410	0.00167	0.143
1L Juice	**Ambient**	**AU**	TSA 1L WC30	0.0332	0.0143	0.0344	-0.00213	0.00309	0.0236	0.106
			TPA Square 1L HC27	0.0563	0.0143	0.0344	-0.00248	0.00340	0.0234	0.129
			1L Glass	0.422	0.00470	0.0497	-0.00293	0.0193	0.0102	0.503
			1L PET	0.226	0.00470	0.0302	-0.00209	0.00331	0.00437	0.266
1L Juice	**Ambient**	**NZ**	TSA 1L WC30	0.0318	0.00409	0.0344	-0.00213	0.00122	0.0190	0.0884
			TPA Square 1L HC27	0.0522	0.00409	0.0344	-0.00248	0.00134	0.0188	0.108
			1L Glass	0.327	0.00191	0.0497	-0.00293	0.00760	0.0118	0.395

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			1L PET	0.156	0.00191	0.0302	-0.00209	0.00130	0.00254	0.190
1L Juice	**Chilled**	**AU**	TR 1L EO	0.00177	0.00512	0.0430	-0.00291	0.00545	0.0143	0.0667
			TSA 1L WC30	0.0332	0.0143	0.0344	-0.00213	0.00513	0.0236	0.109
			TPA Square 1L HC27	0.0563	0.0143	0.0344	-0.00248	0.00564	0.0234	0.132
			1L PET	0.232	0.00386	0.0220	-0.00518	0.00795	0.00449	0.265
1L Juice	**Chilled**	**NZ**	TR 1L EO	0.00177	0.00137	0.0430	-0.00291	0.00215	0.0115	0.0569
			TSA 1L WC30	0.0318	0.00409	0.0344	-0.00213	0.00202	0.0190	0.0892
			TPA Square 1L HC27	0.0522	0.00409	0.0344	-0.00248	0.00222	0.0188	0.109
			1L PET	0.161	0.00107	0.0220	-0.00518	0.00313	0.00263	0.185
1.5L Juice	**Ambient**	**AU**	TBA Edge 1.5L WC30	0.0360	0.0200	0.0430	-0.00291	0.00377	0.0241	0.124
			1.25L PET	0.363	0.00659	0.0366	-0.00266	0.00459	0.00700	0.415
1.5L Juice	**Ambient**	**NZ**	TBA Edge 1.5L WC30	0.0346	0.00573	0.0430	-0.00291	0.00149	0.0194	0.101
			1.25L PET	0.251	0.00268	0.0366	-0.00266	0.00181	0.00405	0.293
2L Juice	**Chilled**	**AU**	TR 2L EO	0.0271	0.00768	0.0573	-0.00466	0.00854	0.0227	0.119
			TR 2L PB	-0.00544	0.00768	0.0573	-0.00466	0.00830	0.0282	0.0914
			2L PET	0.393	0.00540	0.0430	-0.00776	0.0127	0.00755	0.454
			2L HDPE	0.267	0.00540	0.0218	-8.17E-04	0.00460	0.00451	0.302
2L Juice	**Chilled**	**NZ**	TR 2L EO	0.0227	0.00206	0.0573	-0.00466	0.00337	0.0182	0.0990
			TR 2L PB	-0.00544	0.00206	0.0573	-0.00466	0.00327	0.0219	0.0744
			2L PET	0.271	0.00149	0.0430	-0.00776	0.00502	0.00435	0.317
			2L HDPE	0.151	0.00149	0.0218	-8.17E-04	0.00181	0.00345	0.179

A.2. ISO 14067 GWP100, Fossil Results

Annex Table A-1 Results per pack for GWP100, Fossil GHG emissions [kg CO_2-eq.]

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
750ml Milk	**Chilled**	**AU**	TR 750ml OSO34	0.0395	0.00511	0.0100	0.00464	0.00978	0.00119	0.0702
			750ml PET	0.207	0.00386	0.0100	0.00464	0.0107	0.00400	0.240
			750ml rPET	0.113	0.00386	0.0100	0.00464	0.0106	0.00379	0.146
750ml Milk	**Chilled**	**NZ**	TR 750ml OSO34	0.0376	0.00136	0.00769	0.00464	0.00385	0.00122	0.0564
			750ml PET	0.143	0.00106	0.00769	0.00464	0.00420	0.00232	0.163
			750ml rPET	0.0379	0.00106	0.00769	0.00464	0.00416	0.00219	0.0576
1L Milk	**Ambient**	**AU**	TBA Slim 1L HC23	0.0745	0.0143	0.0235	0.00247	0.00296	0.00172	0.119
			TBA Edge 1L LC30	0.0669	0.0143	0.0282	0.00254	0.00307	0.00152	0.117
			TBA Edge 1L LW30 PB	0.0662	0.0143	0.0282	0.00254	0.00308	0.00115	0.115
			TBA Square 1L HC27	0.0884	0.0143	0.0282	0.00254	0.00321	0.00184	0.138
1L Milk	**Ambient**	**NZ**	TBA Slim 1L HC23	0.0716	0.00407	0.0235	0.00247	0.00116	0.00167	0.104
			TBA Edge 1L LC30	0.0657	0.00407	0.0282	0.00254	0.00121	0.00155	0.103
			TBA Edge 1L LW30 PB	0.0662	0.00407	0.0282	0.00254	0.00121	0.00151	0.104
			TBA Square 1L HC27	0.0843	0.00407	0.0282	0.00254	0.00126	0.00176	0.122
1L Milk	**Chilled**	**AU**	TT 1L C38	0.0409	0.00511	0.0100	0.00464	0.00995	0.00132	0.0719
			TT 1L C38 PB	0.0366	0.00511	0.0100	0.00464	0.00995	9.74E-04	0.0673
			TR 1L OSO34 PB	0.0415	0.00511	0.0100	0.00464	0.00990	9.18E-04	0.0721
			TB Ultra Edge 900ml	0.0441	0.00511	0.0100	0.00464	0.0104	0.00162	0.0759
			TBA Edge 1L LC30	0.0669	0.0143	0.0100	0.00464	0.0102	0.00152	0.108
			1L HDPE	0.184	0.00386	0.0100	0.00464	0.0106	0.00313	0.216
			1L PET	0.239	0.00386	0.0100	0.00464	0.0110	0.00464	0.273
			1L Glass	0.380	0.00386	0.0100	0.00464	0.0330	0.00624	0.438
			1L rPET	0.119	0.00386	0.0100	0.00464	0.0107	0.00397	0.152

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
1L Milk	**Chilled**	**NZ**	TT 1L C38	0.0379	0.00136	0.00769	0.00464	0.00392	0.00138	0.0569
			TT 1L C38 PB	0.0366	0.00136	0.00769	0.00464	0.00392	0.00127	0.0555
			TR 1L OSO34 PB	0.0415	0.00136	0.00769	0.00464	0.00390	0.00119	0.0603
			TB Ultra Edge 900ml	0.0645	0.00136	0.00769	0.00464	0.00408	0.00169	0.0840
			TBA Edge 1L LC30	0.0657	0.00407	0.00769	0.00464	0.00403	0.00155	0.0877
			1L HDPE	0.105	0.00106	0.00769	0.00464	0.00419	0.00238	0.125
			1L PET	0.167	0.00106	0.00769	0.00464	0.00434	0.00272	0.187
			1L Glass	0.295	0.00106	0.00769	0.00464	0.0130	0.00772	0.329
			1L rPET	0.0415	0.00106	0.00769	0.00464	0.00420	0.00230	0.0614
1.5L Milk	**Chilled**	**AU**	TBA Edge 1.5L WC30	0.0712	0.0200	0.0100	0.00464	0.0103	0.00160	0.118
			1.5L PET	0.295	0.00540	0.0100	0.00464	0.0115	0.00568	0.332
			1.5L rPET	0.160	0.00540	0.0100	0.00464	0.0114	0.00544	0.197
1.5L Milk	**Chilled**	**NZ**	TBA Edge 1.5L WC30	0.0698	0.00570	0.00769	0.00464	0.00406	0.00163	0.0935
			1.5L PET	0.204	0.00148	0.00769	0.00464	0.00454	0.00327	0.226
			1.5L rPET	0.0519	0.00148	0.00769	0.00464	0.00448	0.00312	0.0733
2L Milk	**Chilled**	**AU**	TR 2L EO	0.0599	0.00767	0.0178	0.00825	0.0171	0.00187	0.113
			2L HDPE	0.205	0.00540	0.0178	0.00825	0.0175	0.00346	0.257
2L Milk	**Chilled**	**NZ**	TR 2L EO	0.0555	0.00204	0.0137	0.00825	0.00673	0.00173	0.0880
			2L HDPE	0.116	0.00148	0.0137	0.00825	0.00691	0.00261	0.149
250ml RTD	**Ambient**	**AU**	TPA Edge 250ml DC26	0.0455	0.00681	0.00980	7.32E-04	0.00113	8.47E-04	0.0648
			TBA Base 250ml paper	0.0158	0.00681	0.00980	6.96E-04	8.62E-04	3.18E-04	0.0343
			237ml Can	0.104	0.00385	0.00687	6.75E-04	9.26E-04	1.00E-04	0.116

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml RTD Coffee and FSN	**Chilled**	**AU**	237ml Can	0.104	0.00385	0.00687	6.75E-04	0.00153	1.00E-04	0.117
250ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 250ml DC26	0.0415	0.00185	0.00980	7.32E-04	4.43E-04	7.54E-04	0.0551
			TBA Base 250ml paper straw	0.0158	0.00185	0.00980	6.96E-04	3.40E-04	3.22E-04	0.0288
			237ml Can	0.105	0.00113	0.00687	6.75E-04	3.65E-04	1.00E-04	0.114
250ml RTD Coffee and FSN	**Chilled**	**NZ**	237ml Can	0.105	0.00113	0.00687	6.75E-04	6.04E-04	1.00E-04	0.114
300ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 300ml DC26	0.0438	0.00662	0.0131	8.83E-04	0.00132	8.80E-04	0.0666
			TPA Edge 300ml DC26 PB	0.0438	0.00662	0.0131	8.83E-04	0.00132	7.27E-04	0.0665
			300ml PET	0.143	0.00470	0.0137	8.60E-04	0.00173	0.00279	0.167
300ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 300ml DC26	0.0398	0.00219	0.0131	8.83E-04	5.20E-04	7.85E-04	0.0573
			TPA Edge 300ml DC26 PB	0.0398	0.00219	0.0131	8.83E-04	5.20E-04	7.84E-04	0.0573
			300ml PET	0.0995	0.00190	0.0137	8.60E-04	6.80E-04	0.00165	0.118
330ml RTD Coffee and FSN	**Ambient**	**AU**	TT C38 330ml	0.0282	0.00662	0.0131	0.00118	0.00140	7.79E-04	0.0513
			TPA Square 330ml	0.0526	0.00662	0.0131	0.00103	0.00143	9.38E-04	0.0757
			330ml PET	0.172	0.00470	0.0137	8.60E-04	0.00189	0.00335	0.197
			375ml PET	0.140	0.00470	0.0132	9.39E-04	0.00174	0.00274	0.163

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
330ml RTD Coffee and FSN	**Ambient**	**NZ**	TT C38 330ml	0.0252	0.00219	0.0131	0.00118	5.53E-04	7.42E-04	0.0430
			TPA Square 330ml DC26	0.0486	0.00219	0.0131	0.00103	5.62E-04	8.33E-04	0.0663
			330ml PET	0.120	0.00190	0.0137	8.60E-04	7.46E-04	0.00196	0.139
			375ml PET	0.0990	0.00190	0.0132	9.39E-04	6.84E-04	0.00164	0.117
500ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 500ml DC26	0.0609	0.00311	0.0216	0.00151	0.00211	0.00121	0.0904
500ml RTD Coffee and FSN	**Chilled**	**AU**	TPA Edge 500ml DC26	0.0609	0.00311	0.0216	0.00151	0.00350	0.00121	0.0918
			TT 500ml C38	0.0328	0.00311	0.0216	0.00171	0.00339	9.62E-04	0.0636
			TT 500ml C38 PB	0.0254	0.00311	0.0216	0.00171	0.00339	6.40E-04	0.0559
			500ml rPET	0.0754	0.00470	0.0180	0.00618	0.00693	0.00249	0.114
			500ml HDPE	0.135	0.00470	0.0180	0.00618	0.00713	0.00231	0.173
			500ml PET	0.195	0.00470	0.0180	0.00618	0.00761	0.00380	0.235
500ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 500ml DC26	0.0569	0.00174	0.0216	0.00151	8.31E-04	0.00113	0.0837
500ml RTD Coffee and FSN	**Chilled**	**NZ**	TPA Edge 500ml DC26	0.0569	0.00174	0.0216	0.00151	0.00138	0.00113	0.0843
			TT 500ml C38	0.0298	0.00174	0.0216	0.00171	0.00134	9.32E-04	0.0571
			TT 500ml C38 PB	0.0285	0.00174	0.0216	0.00171	0.00134	8.23E-04	0.0557
			500ml rPET	0.0273	0.00190	0.0180	0.00618	0.00273	0.00145	0.0576
			500ml HDPE	0.0774	0.00190	0.0180	0.00618	0.00281	0.00176	0.108
			500ml PET	0.136	0.00190	0.0180	0.00618	0.00300	0.00223	0.167

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml Juice	**Ambient**	**AU**	TBA Base Crystal 200ml paper straw	0.0144	0.00681	0.00980	5.35E-04	9.08E-04	5.54E-04	0.0330
			TPA Edge 250ml DC26	0.0455	0.00681	0.00980	7.32E-04	0.00113	8.47E-04	0.0648
			TBA Slim 250ml	0.0260	0.00681	0.00980	7.73E-04	9.90E-04	4.63E-04	0.0448
			250ml PET	0.120	0.00385	0.00554	6.26E-04	0.00108	0.00238	0.133
			250ml Glass	0.140	0.00385	0.0179	9.76E-04	0.00621	0.00222	0.171
			200ml Pouch	0.0576	0.00681	0.00676	4.84E-04	7.72E-04	4.77E-04	0.0729
250ml Juice	**Ambient**	**NZ**	TBA Base Crystal 200ml paper straw	0.0144	0.00185	0.00980	5.35E-04	3.58E-04	5.39E-04	0.0275
			TPA Edge 250ml DC26	0.0415	0.00185	0.00980	7.32E-04	4.43E-04	7.54E-04	0.0551
			TBA Slim 250ml	0.0260	0.00185	0.00980	7.73E-04	3.90E-04	4.59E-04	0.0393
			250ml PET	0.0839	0.00113	0.00423	6.26E-04	4.27E-04	0.00144	0.0918
			250ml Glass	0.111	0.00113	0.0179	9.76E-04	0.00244	0.00272	0.136
			200ml Pouch	0.0528	0.00185	0.00676	4.84E-04	3.04E-04	4.09E-04	0.0626
300ml Juice	**Chilled**	**AU**	TPA Edge 300ml DC26	0.0438	0.00662	0.0131	8.83E-04	0.00219	8.80E-04	0.0675
			TPA Edge 300ml DC26 PB	0.0438	0.00662	0.0131	8.83E-04	0.00219	7.27E-04	0.0673
			300ml PET*	0.130	0.00386	0.0137	0.00256	0.00400	0.00253	0.157
			300ml Glass*	0.159	0.00386	0.0179	9.76E-04	0.0115	0.00258	0.196
300ml Juice	**Chilled**	**NZ**	TPA Edge 300ml DC26	0.0398	0.00219	0.0131	8.83E-04	8.61E-04	7.85E-04	0.0576
			TPA Edge 300ml DC26 PB	0.0398	0.00219	0.0131	8.83E-04	8.61E-04	7.84E-04	0.0576
			300ml PET*	0.0901	0.00106	0.0137	0.00256	0.00158	0.00150	0.111
			300ml Glass*	0.125	0.00106	0.0179	9.76E-04	0.00452	0.00314	0.153

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
500ml Juice	**Ambient**	**AU**	TPA Edge 500ml DC26	0.0609	0.00311	0.0216	0.00151	0.00211	0.00121	0.0904
			500ml PET	0.158	0.00470	0.0353	0.00928	0.00636	0.00308	0.217
500ml Juice	**Ambient**	**NZ**	TPA Edge 500ml DC26	0.0569	0.00174	0.0216	0.00151	8.31E-04	0.00113	0.0837
			500ml PET	0.110	0.00190	0.0353	0.00928	0.00250	0.00181	0.161
500ml Juice	**Chilled**	**AU**	TPA Edge 500ml DC26	0.0609	0.00311	0.0216	0.00151	0.00350	0.00121	0.0918
			500ml PET	0.146	0.00386	0.0353	0.00928	0.0104	0.00283	0.208
500ml Juice	**Chilled**	**NZ**	TPA Edge 500ml DC26	0.0569	0.00174	0.0216	0.00151	0.00138	0.00113	0.0843
			500ml PET	0.101	0.00106	0.0353	0.00928	0.00410	0.00166	0.152
1L Juice	**Ambient**	**AU**	TSA 1L WC30	0.0677	0.0143	0.0282	0.00254	0.00309	0.00157	0.117
			TPA Square 1L HC27	0.0899	0.0143	0.0282	0.00297	0.00340	0.00184	0.141
			1L Glass	0.425	0.00470	0.0408	0.00351	0.0193	0.00710	0.500
			1L PET	0.226	0.00470	0.0248	0.00250	0.00331	0.00436	0.266
1L Juice	**Ambient**	**NZ**	TSA 1L WC30	0.0663	0.00407	0.0282	0.00254	0.00122	0.00160	0.104
			TPA Square 1L HC27	0.0858	0.00407	0.0282	0.00297	0.00134	0.00176	0.124
			1L Glass	0.330	0.00190	0.0408	0.00351	0.00760	0.00870	0.393
			1L PET	0.156	0.00190	0.0248	0.00250	0.00130	0.00252	0.189
1L Juice	**Chilled**	**AU**	TR 1L EO	0.0229	0.00511	0.0353	0.00348	0.00544	8.09E-04	0.0730
			TSA 1L WC30	0.0677	0.0143	0.0282	0.00254	0.00512	0.00157	0.119
			TPA Square 1L HC27	0.0899	0.0143	0.0282	0.00297	0.00564	0.00184	0.143

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			1L PET	0.232	0.00386	0.0180	0.00618	0.00795	0.00448	0.272
1L Juice	**Chilled**	**NZ**	TR 1L EO	0.0229	0.00136	0.0353	0.00348	0.00214	8.94E-04	0.0661
			TSA 1L WC30	0.0663	0.00407	0.0282	0.00254	0.00202	0.00160	0.105
			TPA Square 1L HC27	0.0858	0.00407	0.0282	0.00297	0.00222	0.00176	0.125
			1L PET	0.160	0.00106	0.0180	0.00618	0.00313	0.00260	0.191
1.5L Juice	**Ambient**	**AU**	TBA Edge 1.5L WC30	0.0712	0.0200	0.0353	0.00348	0.00377	0.00160	0.135
			1.25L PET	0.362	0.00658	0.0301	0.00318	0.00459	0.00697	0.413
1.5L Juice	**Ambient**	**NZ**	TBA Edge 1.5L WC30	0.0698	0.00570	0.0353	0.00348	0.00149	0.00163	0.117
			1.25L PET	0.251	0.00267	0.0301	0.00318	0.00181	0.00401	0.293
2L Juice	**Chilled**	**AU**	TR 2L EO	0.0599	0.00767	0.0471	0.00557	0.00854	0.00187	0.131
			TR 2L PB	0.0484	0.00767	0.0471	0.00557	0.00830	0.00111	0.118
			2L PET	0.392	0.00540	0.0353	0.00928	0.0127	0.00753	0.462
			2L HDPE	0.266	0.00540	0.0179	9.76E-04	0.00460	0.00450	0.299
2L Juice	**Chilled**	**NZ**	TR 2L EO	0.0555	0.00204	0.0471	0.00557	0.00337	0.00173	0.115
			TR 2L PB	0.0484	0.00204	0.0471	0.00557	0.00327	0.00145	0.108
			2L PET	0.270	0.00148	0.0353	0.00928	0.00502	0.00431	0.325
			2L HDPE	0.151	0.00148	0.0179	9.76E-04	0.00181	0.00341	0.177

A.3. ISO 14067 GWP100, Biogenic Emissions Results

Annex Table A-1 Results per pack for GWP100, Biogenic GHG emissions [kg CO_2-eq.]

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
750ml Milk	**Chilled**	**AU**	TR 750ml OSO34	0.0257	1.74E-04	1.79E-04	0.0105	1.62E-05	0.0147	0.0513
			750ml PET	0.00400	1.33E-04	1.79E-04	0.0105	1.77E-05	1.05E-04	0.0149
			750ml rPET	0.00343	1.33E-04	1.79E-04	0.0105	1.75E-05	9.96E-05	0.0144
750ml Milk	**Chilled**	**NZ**	TR 750ml OSO34	0.0265	2.19E-04	2.21E-04	0.0105	6.40E-06	0.0116	0.0490
			750ml PET	0.00475	1.66E-04	2.21E-04	0.0105	6.99E-06	1.99E-04	0.0158
			750ml rPET	0.00470	1.66E-04	2.21E-04	0.0105	6.91E-06	1.87E-04	0.0158
1L Milk	**Ambient**	**AU**	TBA Slim 1L HC23	0.0381	4.90E-04	0.0412	0.00562	4.90E-06	0.0216	0.107
			TBA Edge 1L LC30	0.0378	4.90E-04	0.0495	0.00578	5.09E-06	0.0215	0.115
			TBA Edge 1L LW30 PB	0.0864	4.90E-04	0.0495	0.00578	5.10E-06	0.0278	0.170
			TBA Square 1L HC27	0.0381	4.90E-04	0.0495	0.00578	5.32E-06	0.0216	0.115
1L Milk	**Ambient**	**NZ**	TBA Slim 1L HC23	0.0381	6.11E-04	0.0412	0.00562	1.93E-06	0.0170	0.103
			TBA Edge 1L LC30	0.0378	6.11E-04	0.0495	0.00578	2.00E-06	0.0170	0.111
			TBA Edge 1L LW30 PB	0.0864	6.11E-04	0.0495	0.00578	2.01E-06	0.0183	0.161
			TBA Square 1L HC27	0.0382	6.11E-04	0.0495	0.00578	2.10E-06	0.0170	0.111
1L Milk	**Chilled**	**AU**	TT 1L C38	0.0324	1.74E-04	1.79E-04	0.0105	1.65E-05	0.0182	0.0615
			TT 1L C38 PB	0.0617	1.74E-04	1.79E-04	0.0105	1.65E-05	0.0239	0.0965
			TR 1L OSO34 PB	0.0284	1.74E-04	1.79E-04	0.0105	1.64E-05	0.0229	0.0622
			TB Ultra Edge 900ml	0.0388	1.74E-04	1.79E-04	0.0105	1.72E-05	0.0236	0.0733
			TBA Edge 1L LC30	0.0378	4.90E-04	1.79E-04	0.0105	1.70E-05	0.0215	0.0705
			1L HDPE	0.00133	1.33E-04	1.79E-04	0.0105	1.77E-05	7.50E-05	0.0122
			1L PET	0.00455	1.33E-04	1.79E-04	0.0105	1.83E-05	1.21E-04	0.0155
			1L Glass	0.00340	1.33E-04	1.79E-04	0.0105	5.48E-05	2.05E-05	0.0143
			1L rPET	0.00358	1.33E-04	1.79E-04	0.0105	1.77E-05	1.04E-04	0.0145

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
1L Milk	**Chilled**	**NZ**	TT 1L C38	0.0324	2.19E-04	2.21E-04	0.0105	6.51E-06	0.0144	0.0577
			TT 1L C38 PB	0.0617	2.19E-04	2.21E-04	0.0105	6.51E-06	0.0171	0.0897
			TR 1L OSO34 PB	0.0284	2.19E-04	2.21E-04	0.0105	6.48E-06	0.0171	0.0564
			TB Ultra Edge 900ml	0.0373	2.19E-04	2.21E-04	0.0105	6.78E-06	0.0187	0.0669
			TBA Edge 1L LC30	0.0378	6.11E-04	2.21E-04	0.0105	6.70E-06	0.0170	0.0661
			1L HDPE	0.00418	1.66E-04	2.21E-04	0.0105	6.96E-06	2.10E-04	0.0153
			1L PET	0.00540	1.66E-04	2.21E-04	0.0105	7.21E-06	2.33E-04	0.0165
			1L Glass	0.00416	1.66E-04	2.21E-04	0.0105	2.16E-05	1.69E-05	0.0151
			1L rPET	0.00489	1.66E-04	2.21E-04	0.0105	6.98E-06	1.97E-04	0.0160
1.5L Milk	**Chilled**	**AU**	TBA Edge 1.5L WC30	0.0401	6.87E-04	1.79E-04	0.0105	1.71E-05	0.0225	0.0740
			1.5L PET	0.00572	1.85E-04	1.79E-04	0.0105	1.91E-05	1.49E-04	0.0168
			1.5L rPET	0.00493	1.85E-04	1.79E-04	0.0105	1.89E-05	1.43E-04	0.0160
1.5L Milk	**Chilled**	**NZ**	TBA Edge 1.5L WC30	0.0402	8.56E-04	2.21E-04	0.0105	6.74E-06	0.0178	0.0696
			1.5L PET	0.00680	2.32E-04	2.21E-04	0.0105	7.54E-06	2.80E-04	0.0180
			1.5L rPET	0.00678	2.32E-04	2.21E-04	0.0105	7.45E-06	2.66E-04	0.0180
2L Milk	**Chilled**	**AU**	TR 2L EO	0.0365	2.62E-04	3.18E-04	0.0187	2.84E-05	0.0209	0.0767
			2L HDPE	0.00144	1.85E-04	3.18E-04	0.0187	2.92E-05	8.28E-05	0.0208
2L Milk	**Chilled**	**NZ**	TR 2L EO	0.0366	3.28E-04	3.92E-04	0.0187	1.12E-05	0.0165	0.0725
			2L HDPE	0.00468	2.32E-04	3.92E-04	0.0187	1.15E-05	2.31E-04	0.0242
250ml RTD	**Ambient**	**AU**	TPA Edge 250ml DC26	0.0133	2.30E-04	0.0172	0.00166	1.87E-06	0.00731	0.0397
			TBA Base 250ml paper	0.00795	2.30E-04	0.0172	0.00158	1.43E-06	0.00541	0.0324
			237ml Can	1.34E-06	1.34E-04	0.0120	0.00153	1.54E-06	9.79E-08	0.0137

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml RTD Coffee and FSN	**Chilled**	**AU**	237ml Can	1.34E-06	1.34E-04	0.0120	0.00153	2.55E-06	9.79E-08	0.0137
250ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 250ml DC26	0.0134	2.89E-04	0.0172	0.00166	7.35E-07	0.00578	0.0383
			TBA Base 250ml paper straw	0.00795	2.89E-04	0.0172	0.00158	5.63E-07	0.00448	0.0315
			237ml Can	1.79E-06	1.66E-04	0.0120	0.00153	6.05E-07	9.79E-08	0.0137
250ml RTD Coffee and FSN	**Chilled**	**NZ**	237ml Can	1.79E-06	1.66E-04	0.0120	0.00153	1.00E-06	9.79E-08	0.0137
300ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 300ml DC26	0.0141	2.37E-04	0.0229	0.00201	2.19E-06	0.00776	0.0470
			TPA Edge 300ml DC26 PB	0.0380	2.37E-04	0.0229	0.00201	2.19E-06	0.0103	0.0734
			300ml PET	0.00274	1.73E-04	0.0241	0.00195	2.86E-06	7.28E-05	0.0290
300ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 300ml DC26	0.0141	2.89E-04	0.0229	0.00201	8.62E-07	0.00614	0.0454
			TPA Edge 300ml DC26 PB	0.0381	2.89E-04	0.0229	0.00201	8.62E-07	0.00623	0.0695
			300ml PET	0.00326	2.06E-04	0.0241	0.00195	1.13E-06	1.42E-04	0.0297
330ml RTD Coffee and FSN	**Ambient**	**AU**	TT C38 330ml	0.0154	2.37E-04	0.0229	0.00267	2.33E-06	0.00831	0.0495
			TPA Square 330ml	0.0150	2.37E-04	0.0229	0.00234	2.37E-06	0.00834	0.0488
			330ml PET	0.00330	1.73E-04	0.0241	0.00195	3.14E-06	8.76E-05	0.0296
			375ml PET	0.00262	1.73E-04	0.0232	0.00213	2.88E-06	7.13E-05	0.0282

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
330ml RTD Coffee and FSN	**Ambient**	**NZ**	TT C38 330ml	0.0154	2.89E-04	0.0229	0.00267	9.18E-07	0.00658	0.0478
			TPA Square 330ml DC26	0.0151	2.89E-04	0.0229	0.00234	9.32E-07	0.00660	0.0472
			330ml PET	0.00392	2.06E-04	0.0241	0.00195	1.24E-06	1.68E-04	0.0303
			375ml PET	0.00310	2.06E-04	0.0232	0.00213	1.13E-06	1.41E-04	0.0288
500ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 500ml DC26	0.0228	1.23E-04	0.0378	0.00344	3.50E-06	0.0127	0.0769
500ml RTD Coffee and FSN	**Chilled**	**AU**	TPA Edge 500ml DC26	0.0228	1.23E-04	0.0378	0.00344	5.81E-06	0.0127	0.0769
			TT 500ml C38	0.0202	1.23E-04	0.0378	0.00389	5.63E-06	0.0111	0.0731
			TT 500ml C38 PB	0.0192	1.23E-04	0.0378	0.00389	5.63E-06	0.0163	0.0773
			500ml rPET	0.00223	1.73E-04	0.0316	0.0140	1.15E-05	6.50E-05	0.0481
			500ml HDPE	0.00102	1.73E-04	0.0316	0.0140	1.19E-05	5.55E-05	0.0469
			500ml PET	0.00375	1.73E-04	0.0316	0.0140	1.26E-05	9.92E-05	0.0496
500ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 500ml DC26	0.0228	1.39E-04	0.0378	0.00344	1.38E-06	0.0100	0.0742
500ml RTD Coffee and FSN	**Chilled**	**NZ**	TPA Edge 500ml DC26	0.0228	1.39E-04	0.0378	0.00344	2.29E-06	0.0100	0.0742
			TT 500ml C38	0.0202	1.39E-04	0.0378	0.00389	2.22E-06	0.00877	0.0708
			TT 500ml C38 PB	0.0200	1.39E-04	0.0378	0.00389	2.22E-06	0.0115	0.0733
			500ml rPET	0.00304	2.06E-04	0.0316	0.0140	4.54E-06	1.24E-04	0.0490
			500ml HDPE	0.00304	2.06E-04	0.0316	0.0140	4.67E-06	1.56E-04	0.0490
			500ml PET	0.00446	2.06E-04	0.0316	0.0140	4.98E-06	1.91E-04	0.0505

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml Juice	**Ambient**	**AU**	TBA Base Crystal 200ml paper straw	0.0112	2.30E-04	0.0172	0.00122	1.51E-06	0.00772	0.0376
			TPA Edge 250ml DC26	0.0133	2.30E-04	0.0172	0.00166	1.87E-06	0.00731	0.0397
			TBA Slim 250ml	0.0113	2.30E-04	0.0172	0.00176	1.64E-06	0.00728	0.0378
			250ml PET	0.00228	1.34E-04	1.06E-04	0.00142	1.80E-06	6.15E-05	0.00400
			250ml Glass	0.00120	1.34E-04	0.0313	0.00222	1.03E-05	8.34E-06	0.0349
			200ml Pouch	8.10E-04	2.30E-04	0.0119	0.00110	1.28E-06	8.07E-06	0.0140
250ml Juice	**Ambient**	**NZ**	TBA Base Crystal 200ml paper straw	0.0112	2.89E-04	0.0172	0.00122	5.93E-07	0.00612	0.0360
			TPA Edge 250ml DC26	0.0134	2.89E-04	0.0172	0.00166	7.35E-07	0.00578	0.0383
			TBA Slim 250ml	0.0113	2.89E-04	0.0172	0.00176	6.47E-07	0.00596	0.0365
			250ml PET	0.00273	1.66E-04	1.26E-04	0.00142	7.08E-07	1.23E-04	0.00457
			250ml Glass	0.00147	1.66E-04	0.0313	0.00222	4.05E-06	9.31E-06	0.0352
			200ml Pouch	0.00156	2.89E-04	0.0119	0.00110	5.04E-07	2.46E-05	0.0149
300ml Juice	**Chilled**	**AU**	TPA Edge 300ml DC26	0.0141	2.37E-04	0.0229	0.00201	3.63E-06	0.00776	0.0470
			TPA Edge 300ml DC26 PB	0.0380	2.37E-04	0.0229	0.00201	3.63E-06	0.0103	0.0735
			300ml PET*	0.00249	1.33E-04	0.0241	0.00581	6.65E-06	6.61E-05	0.0326
			300ml Glass*	0.00140	1.33E-04	0.0313	0.00222	1.90E-05	1.07E-05	0.0351
300ml Juice	**Chilled**	**NZ**	TPA Edge 300ml DC26	0.0141	2.89E-04	0.0229	0.00201	1.43E-06	0.00614	0.0454
			TPA Edge 300ml DC26 PB	0.0381	2.89E-04	0.0229	0.00201	1.43E-06	0.00623	0.0695
			300ml PET*	0.00296	1.66E-04	0.0241	0.00581	2.62E-06	1.29E-04	0.0332
			300ml Glass*	0.00170	1.66E-04	0.0313	0.00222	7.50E-06	1.39E-05	0.0354

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
500ml Juice	**Ambient**	**AU**	TPA Edge 500ml DC26	0.0228	1.23E-04	0.0378	0.00344	3.50E-06	0.0127	0.0769
			500ml PET	0.00302	1.73E-04	0.0619	0.0211	1.05E-05	8.03E-05	0.0863
500ml Juice	**Ambient**	**NZ**	TPA Edge 500ml DC26	0.0228	1.39E-04	0.0378	0.00344	1.38E-06	0.0100	0.0742
			500ml PET	0.00359	2.06E-04	0.0619	0.0211	4.15E-06	1.56E-04	0.0870
500ml Juice	**Chilled**	**AU**	TPA Edge 500ml DC26	0.0228	1.23E-04	0.0378	0.00344	5.81E-06	0.0127	0.0769
			500ml PET	0.00282	1.33E-04	0.0619	0.0211	1.73E-05	7.41E-05	0.0860
500ml Juice	**Chilled**	**NZ**	TPA Edge 500ml DC26	0.0228	1.39E-04	0.0378	0.00344	2.29E-06	0.0100	0.0742
			500ml PET	0.00335	1.66E-04	0.0619	0.0211	6.81E-06	1.42E-04	0.0867
1L Juice	**Ambient**	**AU**	TSA 1L WC30	0.0392	4.90E-04	0.0495	0.00578	5.13E-06	0.0220	0.117
			TPA Square 1L HC27	0.0384	4.90E-04	0.0495	0.00674	5.64E-06	0.0216	0.117
			1L Glass	0.00385	1.73E-04	0.0716	0.00796	3.20E-05	0.00315	0.0868
			1L PET	0.00436	1.73E-04	0.0434	0.00568	5.49E-06	1.14E-04	0.0537
1L Juice	**Ambient**	**NZ**	TSA 1L WC30	0.0393	6.11E-04	0.0495	0.00578	2.02E-06	0.0174	0.113
			TPA Square 1L HC27	0.0385	6.11E-04	0.0495	0.00674	2.22E-06	0.0170	0.112
			1L Glass	0.00470	2.06E-04	0.0716	0.00796	1.26E-05	0.00316	0.0876
			1L PET	0.00522	2.06E-04	0.0434	0.00568	2.16E-06	2.15E-04	0.0547
1L Juice	**Chilled**	**AU**	TR 1L EO	0.0235	1.74E-04	0.0619	0.00790	9.05E-06	0.0135	0.107
			TSA 1L WC30	0.0392	4.90E-04	0.0495	0.00578	8.52E-06	0.0220	0.117
			TPA Square 1L HC27	0.0384	4.90E-04	0.0495	0.00674	9.36E-06	0.0216	0.117

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			1L PET	0.00446	1.33E-04	0.0316	0.0140	1.32E-05	1.17E-04	0.0503
1L Juice	**Chilled**	**NZ**	TR 1L EO	0.0235	2.19E-04	0.0619	0.00790	3.56E-06	0.0106	0.104
			TSA 1L WC30	0.0393	6.11E-04	0.0495	0.00578	3.35E-06	0.0174	0.113
			TPA Square 1L HC27	0.0385	6.11E-04	0.0495	0.00674	3.69E-06	0.0170	0.112
			1L PET	0.00530	1.66E-04	0.0316	0.0140	5.20E-06	2.23E-04	0.0513
1.5L Juice	**Ambient**	**AU**	TBA Edge 1.5L WC30	0.0401	6.87E-04	0.0619	0.00790	6.26E-06	0.0225	0.133
			1.25L PET	0.00699	2.43E-04	0.0527	0.00722	7.61E-06	1.83E-04	0.0673
1.5L Juice	**Ambient**	**NZ**	TBA Edge 1.5L WC30	0.0402	8.56E-04	0.0619	0.00790	2.46E-06	0.0178	0.129
			1.25L PET	0.00832	2.89E-04	0.0527	0.00722	3.00E-06	3.43E-04	0.0689
2L Juice	**Chilled**	**AU**	TR 2L EO	0.0365	2.62E-04	0.0825	0.0126	1.42E-05	0.0209	0.153
			TR 2L PB	0.0698	2.62E-04	0.0825	0.0126	1.38E-05	0.0271	0.192
			2L PET	0.00760	1.85E-04	0.0619	0.0211	2.12E-05	1.98E-04	0.0910
			2L HDPE	0.00187	1.85E-04	0.0313	0.00222	7.65E-06	1.08E-04	0.0357
2L Juice	**Chilled**	**NZ**	TR 2L EO	0.0366	3.28E-04	0.0825	0.0126	5.59E-06	0.0165	0.149
			TR 2L PB	0.0698	3.28E-04	0.0825	0.0126	5.43E-06	0.0204	0.186
			2L PET	0.00905	2.32E-04	0.0619	0.0211	8.34E-06	3.68E-04	0.0927
			2L HDPE	0.00604	2.32E-04	0.0313	0.00222	3.01E-06	3.03E-04	0.0401

A.4. ISO 14067 GWP100, Biogenic Removal Results

Annex Table A-1 Results per pack for GWP100, Biogenic GHG removal [kg CO_2-eq.]

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
750ml Milk	**Chilled**	**AU**	TR 750ml OSO34	-0.0489	-1.69E-04	-1.44E-04	-0.0191	-1.47E-05	-1.11E-05	-0.0683
			750ml PET	-0.00382	-1.28E-04	-1.44E-04	-0.0191	-1.60E-05	-9.18E-05	-0.0233
			750ml rPET	-0.00329	-1.28E-04	-1.44E-04	-0.0191	-1.59E-05	-8.73E-05	-0.0228
750ml Milk	**Chilled**	**NZ**	TR 750ml OSO34	-0.0497	-2.12E-04	-1.82E-04	-0.0191	-5.78E-06	-2.05E-05	-0.0692
			750ml PET	-0.00456	-1.60E-04	-1.82E-04	-0.0191	-6.32E-06	-1.78E-04	-0.0242
			750ml rPET	-0.00445	-1.60E-04	-1.82E-04	-0.0191	-6.25E-06	-1.68E-04	-0.0241
1L Milk	**Ambient**	**AU**	TBA Slim 1L HC23	-0.0720	-4.74E-04	-0.0363	-0.0102	-4.51E-06	-1.53E-05	-0.119
			TBA Edge 1L LC30	-0.0716	-4.74E-04	-0.0436	-0.0105	-4.68E-06	-1.12E-05	-0.126
			TBA Edge 1L LW30 PB	-0.142	-4.74E-04	-0.0436	-0.0105	-4.69E-06	-2.25E-07	-0.197
			TBA Square 1L HC27	-0.0720	-4.74E-04	-0.0436	-0.0105	-4.89E-06	-1.77E-05	-0.127
1L Milk	**Ambient**	**NZ**	TBA Slim 1L HC23	-0.0720	-5.91E-04	-0.0363	-0.0102	-1.78E-06	-1.40E-05	-0.119
			TBA Edge 1L LC30	-0.0716	-5.91E-04	-0.0436	-0.0105	-1.84E-06	-5.79E-06	-0.126
			TBA Edge 1L LW30 PB	-0.142	-5.91E-04	-0.0436	-0.0105	-1.85E-06	-2.25E-07	-0.197
			TBA Square 1L HC27	-0.0720	-5.91E-04	-0.0436	-0.0105	-1.93E-06	-1.98E-05	-0.127
1L Milk	**Chilled**	**AU**	TT 1L C38	-0.0610	-1.69E-04	-1.44E-04	-0.0191	-1.49E-05	-1.05E-05	-0.0804
			TT 1L C38 PB	-0.110	-1.69E-04	-1.44E-04	-0.0191	-1.49E-05	-1.84E-07	-0.129
			TR 1L OSO34 PB	-0.0670	-1.69E-04	-1.44E-04	-0.0191	-1.49E-05	-1.77E-07	-0.0864
			TB Ultra Edge 900ml	-0.0741	-1.69E-04	-1.44E-04	-0.0191	-1.56E-05	-1.12E-05	-0.0935
			TBA Edge 1L LC30	-0.0716	-4.74E-04	-1.44E-04	-0.0191	-1.54E-05	-1.12E-05	-0.0913
			1L HDPE	-0.00114	-1.28E-04	-1.44E-04	-0.0191	-1.60E-05	-6.57E-05	-0.0206
			1L PET	-0.00434	-1.28E-04	-1.44E-04	-0.0191	-1.66E-05	-1.06E-04	-0.0238
			1L Glass	-0.00324	-1.28E-04	-1.44E-04	-0.0191	-4.95E-05	-5.68E-06	-0.0227
			1L rPET	-0.00343	-1.28E-04	-1.44E-04	-0.0191	-1.60E-05	-9.12E-05	-0.0229

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
1L Milk	**Chilled**	**NZ**	TT 1L C38	-0.0611	-2.12E-04	-1.82E-04	-0.0191	-5.89E-06	-1.42E-05	-0.0806
			TT 1L C38 PB	-0.110	-2.12E-04	-1.82E-04	-0.0191	-5.89E-06	-1.84E-07	-0.130
			TR 1L OSO34 PB	-0.0670	-2.12E-04	-1.82E-04	-0.0191	-5.86E-06	-1.77E-07	-0.0865
			TB Ultra Edge 900ml	-0.0707	-2.12E-04	-1.82E-04	-0.0191	-6.13E-06	-7.07E-06	-0.0902
			TBA Edge 1L LC30	-0.0716	-5.91E-04	-1.82E-04	-0.0191	-6.05E-06	-5.79E-06	-0.0915
			1L HDPE	-0.00391	-1.60E-04	-1.82E-04	-0.0191	-6.29E-06	-1.89E-04	-0.0235
			1L PET	-0.00517	-1.60E-04	-1.82E-04	-0.0191	-6.52E-06	-2.09E-04	-0.0248
			1L Glass	-0.00403	-1.60E-04	-1.82E-04	-0.0191	-1.95E-05	-5.63E-06	-0.0235
			1L rPET	-0.00463	-1.60E-04	-1.82E-04	-0.0191	-6.31E-06	-1.77E-04	-0.0243
1.5L Milk	**Chilled**	**AU**	TBA Edge 1.5L WC30	-0.0755	-6.63E-04	-1.44E-04	-0.0191	-1.55E-05	-1.19E-05	-0.0954
			1.5L PET	-0.00547	-1.79E-04	-1.44E-04	-0.0191	-1.73E-05	-1.31E-04	-0.0250
			1.5L rPET	-0.00474	-1.79E-04	-1.44E-04	-0.0191	-1.71E-05	-1.25E-04	-0.0243
1.5L Milk	**Chilled**	**NZ**	TBA Edge 1.5L WC30	-0.0755	-8.28E-04	-1.82E-04	-0.0191	-6.10E-06	-7.09E-06	-0.0956
			1.5L PET	-0.00652	-2.24E-04	-1.82E-04	-0.0191	-6.82E-06	-2.51E-04	-0.0263
			1.5L rPET	-0.00642	-2.24E-04	-1.82E-04	-0.0191	-6.73E-06	-2.39E-04	-0.0262
2L Milk	**Chilled**	**AU**	TR 2L EO	-0.0694	-2.53E-04	-2.56E-04	-0.0339	-2.57E-05	-1.93E-05	-0.104
			2L HDPE	-0.00123	-1.79E-04	-2.56E-04	-0.0339	-2.64E-05	-7.26E-05	-0.0357
2L Milk	**Chilled**	**NZ**	TR 2L EO	-0.0695	-3.18E-04	-3.24E-04	-0.0339	-1.01E-05	-2.09E-05	-0.104
			2L HDPE	-0.00439	-2.24E-04	-3.24E-04	-0.0339	-1.04E-05	-2.07E-04	-0.0391
250ml RTD	**Ambient**	**AU**	TPA Edge 250ml DC26	-0.0247	-2.22E-04	-0.0151	-0.00301	-1.72E-06	-1.07E-05	-0.0430
			TBA Base 250ml paper	-0.0158	-2.22E-04	-0.0151	-0.00286	-1.31E-06	-2.11E-06	-0.0340
			237ml Can	-1.23E-06	-1.29E-04	-0.0106	-0.00278	-1.41E-06	-9.00E-08	-0.0135

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml RTD Coffee and FSN	**Chilled**	**AU**	237ml Can	-1.23E-06	-1.29E-04	-0.0106	-0.00278	-2.30E-06	-9.00E-08	-0.0135
250ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 250ml DC26	-0.0248	-2.80E-04	-0.0151	-0.00301	-6.76E-07	-1.85E-05	-0.0432
			TBA Base 250ml paper straw	-0.0158	-2.80E-04	-0.0151	-0.00286	-5.18E-07	-1.41E-07	-0.0340
			237ml Can	-1.64E-06	-1.61E-04	-0.0106	-0.00278	-5.56E-07	-9.00E-08	-0.0135
250ml RTD Coffee and FSN	**Chilled**	**NZ**	237ml Can	-1.64E-06	-1.61E-04	-0.0106	-0.00278	-9.08E-07	-9.00E-08	-0.0135
300ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 300ml DC26	-0.0262	-2.28E-04	-0.0202	-0.00363	-2.01E-06	-1.10E-05	-0.0503
			TPA Edge 300ml DC26 PB	-0.0589	-2.28E-04	-0.0202	-0.00363	-2.01E-06	-6.45E-06	-0.0830
			300ml PET	-0.00262	-1.66E-04	-0.0212	-0.00354	-2.63E-06	-6.39E-05	-0.0276
300ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 300ml DC26	-0.0263	-2.79E-04	-0.0202	-0.00363	-7.92E-07	-1.86E-05	-0.0504
			TPA Edge 300ml DC26 PB	-0.0589	-2.79E-04	-0.0202	-0.00363	-7.92E-07	-1.84E-05	-0.0830
			300ml PET	-0.00312	-1.98E-04	-0.0212	-0.00354	-1.04E-06	-1.27E-04	-0.0282
330ml RTD Coffee and FSN	**Ambient**	**AU**	TT C38 330ml	-0.0285	-2.28E-04	-0.0202	-0.00485	-2.14E-06	-8.44E-06	-0.0538
			TPA Square 330ml	-0.0279	-2.28E-04	-0.0202	-0.00424	-2.17E-06	-1.16E-05	-0.0526
			330ml PET	-0.00315	-1.66E-04	-0.0212	-0.00354	-2.89E-06	-7.68E-05	-0.0281
			375ml PET	-0.00250	-1.66E-04	-0.0204	-0.00386	-2.65E-06	-6.25E-05	-0.0270

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
330ml RTD Coffee and FSN	Ambient	NZ	TT C38 330ml	-0.0285	-2.79E-04	-0.0202	-0.00485	-8.44E-07	-1.40E-05	-0.0538
			TPA Square 330ml DC26	-0.0280	-2.79E-04	-0.0202	-0.00424	-8.57E-07	-1.86E-05	-0.0527
			330ml PET	-0.00375	-1.98E-04	-0.0212	-0.00354	-1.14E-06	-1.51E-04	-0.0288
			375ml PET	-0.00297	-1.98E-04	-0.0204	-0.00386	-1.04E-06	-1.26E-04	-0.0276
500ml RTD Coffee and FSN	Ambient	AU	TPA Edge 500ml DC26	-0.0427	-1.18E-04	-0.0333	-0.00623	-3.22E-06	-1.31E-05	-0.0824
500ml RTD Coffee and FSN	Chilled	AU	TPA Edge 500ml DC26	-0.0427	-1.18E-04	-0.0333	-0.00623	-5.25E-06	-1.31E-05	-0.0824
			TT 500ml C38	-0.0376	-1.18E-04	-0.0333	-0.00704	-5.09E-06	-9.65E-06	-0.0781
			TT 500ml C38 PB	-0.0455	-1.18E-04	-0.0333	-0.00704	-5.09E-06	-1.26E-07	-0.0860
			500ml rPET	-0.00213	-1.66E-04	-0.0278	-0.0254	-1.04E-05	-5.70E-05	-0.0556
			500ml HDPE	-8.80E-04	-1.66E-04	-0.0278	-0.0254	-1.07E-05	-4.86E-05	-0.0543
			500ml PET	-0.00358	-1.66E-04	-0.0278	-0.0254	-1.14E-05	-8.70E-05	-0.0570
500ml RTD Coffee and FSN	Ambient	NZ	TPA Edge 500ml DC26	-0.0427	-1.33E-04	-0.0333	-0.00623	-1.27E-06	-1.87E-05	-0.0824
500ml RTD Coffee and FSN	Chilled	NZ	TPA Edge 500ml DC26	-0.0427	-1.33E-04	-0.0333	-0.00623	-2.07E-06	-1.87E-05	-0.0824
			TT 500ml C38	-0.0377	-1.33E-04	-0.0333	-0.00704	-2.01E-06	-1.41E-05	-0.0782
			TT 500ml C38 PB	-0.0463	-1.33E-04	-0.0333	-0.00704	-2.01E-06	-1.26E-07	-0.0868
			500ml rPET	-0.00288	-1.98E-04	-0.0278	-0.0254	-4.10E-06	-1.12E-04	-0.0564
			500ml HDPE	-0.00285	-1.98E-04	-0.0278	-0.0254	-4.22E-06	-1.40E-04	-0.0564
			500ml PET	-0.00427	-1.98E-04	-0.0278	-0.0254	-4.50E-06	-1.71E-04	-0.0578

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml Juice	**Ambient**	**AU**	TBA Base Crystal 200ml paper straw	-0.0209	-2.22E-04	-0.0151	-0.00220	-1.38E-06	-4.36E-06	-0.0384
			TPA Edge 250ml DC26	-0.0247	-2.22E-04	-0.0151	-0.00301	-1.72E-06	-1.07E-05	-0.0430
			TBA Slim 250ml	-0.0221	-2.22E-04	-0.0151	-0.00318	-1.51E-06	-3.35E-06	-0.0406
			250ml PET	-0.00217	-1.29E-04	-1.02E-04	-0.00258	-1.65E-06	-5.39E-05	-0.00504
			250ml Glass	-0.00115	-1.29E-04	-0.0276	-0.00402	-9.46E-06	-3.06E-06	-0.0329
			200ml Pouch	-7.44E-04	-2.22E-04	-0.0104	-0.00199	-1.18E-06	-7.07E-06	-0.0134
250ml Juice	**Ambient**	**NZ**	TBA Base Crystal 200ml paper straw	-0.0209	-2.80E-04	-0.0151	-0.00220	-5.45E-07	-2.65E-07	-0.0385
			TPA Edge 250ml DC26	-0.0248	-2.80E-04	-0.0151	-0.00301	-6.76E-07	-1.85E-05	-0.0432
			TBA Slim 250ml	-0.0221	-2.80E-04	-0.0151	-0.00318	-5.94E-07	-2.15E-07	-0.0407
			250ml PET	-0.00261	-1.61E-04	-1.21E-04	-0.00258	-6.51E-07	-1.11E-04	-0.00558
			250ml Glass	-0.00142	-1.61E-04	-0.0276	-0.00402	-3.73E-06	-5.07E-06	-0.0332
			200ml Pouch	-0.00149	-2.80E-04	-0.0104	-0.00199	-4.63E-07	-2.20E-05	-0.0142
300ml Juice	**Chilled**	**AU**	TPA Edge 300ml DC26	-0.0262	-2.28E-04	-0.0202	-0.00363	-3.28E-06	-1.10E-05	-0.0503
			TPA Edge 300ml DC26 PB	-0.0589	-2.28E-04	-0.0202	-0.00363	-3.28E-06	-6.45E-06	-0.0830
			300ml PET*	-0.00238	-1.28E-04	-0.0212	-0.0105	-6.01E-06	-5.79E-05	-0.0343
			300ml Glass*	-0.00133	-1.28E-04	-0.0276	-0.00402	-1.72E-05	-4.52E-06	-0.0331
300ml Juice	**Chilled**	**NZ**	TPA Edge 300ml DC26	-0.0263	-2.79E-04	-0.0202	-0.00363	-1.29E-06	-1.86E-05	-0.0504
			TPA Edge 300ml DC26 PB	-0.0589	-2.79E-04	-0.0202	-0.00363	-1.29E-06	-1.84E-05	-0.0830
			300ml PET*	-0.00283	-1.60E-04	-0.0212	-0.0105	-2.37E-06	-1.15E-04	-0.0348
			300ml Glass*	-0.00165	-1.60E-04	-0.0276	-0.00402	-6.78E-06	-8.76E-06	-0.0334

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
500ml Juice	**Ambient**	**AU**	TPA Edge 500ml DC26	-0.0427	-1.18E-04	-0.0333	-0.00623	-3.22E-06	-1.31E-05	-0.0824
			500ml PET	-0.00288	-1.66E-04	-0.0545	-0.0382	-9.69E-06	-7.04E-05	-0.0958
500ml Juice	**Ambient**	**NZ**	TPA Edge 500ml DC26	-0.0427	-1.33E-04	-0.0333	-0.00623	-1.27E-06	-1.87E-05	-0.0824
			500ml PET	-0.00343	-1.98E-04	-0.0545	-0.0382	-3.82E-06	-1.39E-04	-0.0965
500ml Juice	**Chilled**	**AU**	TPA Edge 500ml DC26	-0.0427	-1.18E-04	-0.0333	-0.00623	-5.25E-06	-1.31E-05	-0.0824
			500ml PET	-0.00269	-1.28E-04	-0.0545	-0.0382	-1.56E-05	-6.49E-05	-0.0956
500ml Juice	**Chilled**	**NZ**	TPA Edge 500ml DC26	-0.0427	-1.33E-04	-0.0333	-0.00623	-2.07E-06	-1.87E-05	-0.0824
			500ml PET	-0.00321	-1.60E-04	-0.0545	-0.0382	-6.15E-06	-1.27E-04	-0.0962
1L Juice	**Ambient**	**AU**	TSA 1L WC30	-0.0739	-4.74E-04	-0.0436	-0.0105	-4.72E-06	-1.17E-05	-0.128
			TPA Square 1L HC27	-0.0722	-4.74E-04	-0.0436	-0.0122	-5.19E-06	-1.77E-05	-0.128
			1L Glass	-0.00663	-1.66E-04	-0.0630	-0.0144	-2.94E-05	-9.62E-06	-0.0842
			1L PET	-0.00417	-1.66E-04	-0.0382	-0.0103	-5.04E-06	-1.00E-04	-0.0529
1L Juice	**Ambient**	**NZ**	TSA 1L WC30	-0.0739	-5.91E-04	-0.0436	-0.0105	-1.86E-06	-7.08E-06	-0.129
			TPA Square 1L HC27	-0.0723	-5.91E-04	-0.0436	-0.0122	-2.04E-06	-1.98E-05	-0.129
			1L Glass	-0.00751	-1.98E-04	-0.0630	-0.0144	-1.16E-05	-1.58E-05	-0.0851
			1L PET	-0.00500	-1.98E-04	-0.0382	-0.0103	-1.99E-06	-1.93E-04	-0.0539
1L Juice	**Chilled**	**AU**	TR 1L EO	-0.0448	-1.69E-04	-0.0545	-0.0143	-8.18E-06	-4.18E-06	-0.114
			TSA 1L WC30	-0.0739	-4.74E-04	-0.0436	-0.0105	-7.70E-06	-1.17E-05	-0.128
			TPA Square 1L HC27	-0.0722	-4.74E-04	-0.0436	-0.0122	-8.46E-06	-1.77E-05	-0.129

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			1L PET	-0.00426	-1.28E-04	-0.0278	-0.0254	-1.19E-05	-1.03E-04	-0.0577
1L Juice	**Chilled**	**NZ**	TR 1L EO	-0.0448	-2.12E-04	-0.0545	-0.0143	-3.22E-06	-2.99E-07	-0.114
			TSA 1L WC30	-0.0739	-5.91E-04	-0.0436	-0.0105	-3.03E-06	-7.08E-06	-0.129
			TPA Square 1L HC27	-0.0723	-5.91E-04	-0.0436	-0.0122	-3.33E-06	-1.98E-05	-0.129
			1L PET	-0.00508	-1.60E-04	-0.0278	-0.0254	-4.70E-06	-2.00E-04	-0.0586
1.5L Juice	**Ambient**	**AU**	TBA Edge 1.5L WC30	-0.0755	-6.63E-04	-0.0545	-0.0143	-5.75E-06	-1.19E-05	-0.145
			1.25L PET	-0.00669	-2.32E-04	-0.0464	-0.0131	-7.00E-06	-1.61E-04	-0.0666
1.5L Juice	**Ambient**	**NZ**	TBA Edge 1.5L WC30	-0.0755	-8.28E-04	-0.0545	-0.0143	-2.27E-06	-7.09E-06	-0.145
			1.25L PET	-0.00798	-2.77E-04	-0.0464	-0.0131	-2.76E-06	-3.07E-04	-0.0681
2L Juice	**Chilled**	**AU**	TR 2L EO	-0.0694	-2.53E-04	-0.0726	-0.0229	-1.28E-05	-1.93E-05	-0.165
			TR 2L PB	-0.132	-2.53E-04	-0.0726	-0.0229	-1.25E-05	-2.09E-07	-0.228
			2L PET	-0.00728	-1.79E-04	-0.0545	-0.0382	-1.91E-05	-1.74E-04	-0.100
			2L HDPE	-0.00161	-1.79E-04	-0.0276	-0.00402	-6.91E-06	-9.45E-05	-0.0335
2L Juice	**Chilled**	**NZ**	TR 2L EO	-0.0695	-3.18E-04	-0.0726	-0.0229	-5.05E-06	-2.09E-05	-0.165
			TR 2L PB	-0.132	-3.18E-04	-0.0726	-0.0229	-4.91E-06	-2.09E-07	-0.228
			2L PET	-0.00868	-2.24E-04	-0.0545	-0.0382	-7.54E-06	-3.30E-04	-0.102
			2L HDPE	-0.00566	-2.24E-04	-0.0276	-0.00402	-2.72E-06	-2.71E-04	-0.0378

A.5. ISO 14067 GWP100, Emissions from Land Use Change Results

Annex Table A-1 Results per pack for GWP100, Emissions from land use change (dLUC) [kg CO_2-eq.]

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
750ml Milk	**Chilled**	**AU**	TR 750ml OSO34	6.40E-05	1.80E-07	4.67E-06	2.73E-05	2.53E-07	1.12E-06	9.75E-05
			750ml PET	3.83E-05	1.39E-07	4.67E-06	2.73E-05	2.76E-07	4.31E-07	7.11E-05
			750ml rPET	7.21E-05	1.39E-07	4.67E-06	2.73E-05	2.73E-07	4.07E-07	1.05E-04
750ml Milk	**Chilled**	**NZ**	TR 750ml OSO34	7.23E-05	1.94E-07	1.47E-05	2.73E-05	9.97E-08	1.54E-06	1.16E-04
			750ml PET	3.86E-05	1.49E-07	1.47E-05	2.73E-05	1.09E-07	4.65E-07	8.13E-05
			750ml rPET	3.68E-04	1.49E-07	1.47E-05	2.73E-05	1.08E-07	4.39E-07	4.11E-04
1L Milk	**Ambient**	**AU**	TBA Slim 1L HC23	1.61E-04	5.18E-07	1.85E-04	1.46E-05	7.77E-08	1.64E-06	3.63E-04
			TBA Edge 1L LC30	1.59E-04	5.18E-07	2.22E-04	1.50E-05	8.06E-08	1.61E-06	3.98E-04
			TBA Edge 1L LW30 PB	0.0171	5.18E-07	2.22E-04	1.50E-05	8.08E-08	1.60E-06	0.0173
			TBA Square 1L HC27	1.69E-04	5.18E-07	2.22E-04	1.50E-05	8.43E-08	1.66E-06	4.08E-04
1L Milk	**Ambient**	**NZ**	TBA Slim 1L HC23	1.61E-04	5.56E-07	1.85E-04	1.46E-05	3.06E-08	2.25E-06	3.63E-04
			TBA Edge 1L LC30	1.59E-04	5.56E-07	2.22E-04	1.50E-05	3.17E-08	2.21E-06	3.99E-04
			TBA Edge 1L LW30 PB	0.0171	5.56E-07	2.22E-04	1.50E-05	3.18E-08	2.21E-06	0.0173
			TBA Square 1L HC27	1.69E-04	5.56E-07	2.22E-04	1.50E-05	3.32E-08	2.27E-06	4.09E-04
1L Milk	**Chilled**	**AU**	TT 1L C38	8.20E-05	1.80E-07	4.67E-06	2.73E-05	2.58E-07	1.36E-06	1.16E-04
			TT 1L C38 PB	0.00950	1.80E-07	4.67E-06	2.73E-05	2.58E-07	1.35E-06	0.00953
			TR 1L OSO34 PB	-0.00161	1.80E-07	4.67E-06	2.73E-05	2.56E-07	1.25E-06	-0.00158
			TB Ultra Edge 900ml	9.82E-05	1.80E-07	4.67E-06	2.73E-05	2.68E-07	1.77E-06	1.32E-04
			TBA Edge 1L LC30	1.59E-04	5.18E-07	4.67E-06	2.73E-05	2.65E-07	1.61E-06	1.93E-04
			1L HDPE	2.04E-05	1.39E-07	4.67E-06	2.73E-05	2.75E-07	4.12E-07	5.32E-05
			1L PET	4.50E-05	1.39E-07	4.67E-06	2.73E-05	2.85E-07	5.04E-07	7.79E-05
			1L Glass	1.45E-05	1.39E-07	4.67E-06	2.73E-05	8.53E-07	1.92E-06	4.94E-05
			1L rPET	7.45E-05	1.39E-07	4.67E-06	2.73E-05	2.76E-07	4.28E-07	1.07E-04

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
1L Milk	**Chilled**	**NZ**	TT 1L C38	8.20E-05	1.94E-07	1.47E-05	2.73E-05	1.01E-07	1.87E-06	1.26E-04
			TT 1L C38 PB	0.00950	1.94E-07	1.47E-05	2.73E-05	1.01E-07	1.87E-06	0.00954
			TR 1L OSO34 PB	-0.00161	1.94E-07	1.47E-05	2.73E-05	1.01E-07	1.72E-06	-0.00157
			TB Ultra Edge 900ml	1.42E-04	1.94E-07	1.47E-05	2.73E-05	1.06E-07	2.43E-06	1.87E-04
			TBA Edge 1L LC30	1.59E-04	5.56E-07	1.47E-05	2.73E-05	1.04E-07	2.21E-06	2.04E-04
			1L HDPE	2.23E-05	1.49E-07	1.47E-05	2.73E-05	1.08E-07	4.61E-07	6.50E-05
			1L PET	4.53E-05	1.49E-07	1.47E-05	2.73E-05	1.12E-07	5.45E-07	8.81E-05
			1L Glass	1.58E-05	1.49E-07	1.47E-05	2.73E-05	3.36E-07	2.62E-06	6.09E-05
			1L rPET	3.78E-04	1.49E-07	1.47E-05	2.73E-05	1.09E-07	4.62E-07	4.21E-04
1.5L Milk	**Chilled**	**AU**	TBA Edge 1.5L WC30	1.49E-04	7.26E-07	4.67E-06	2.73E-05	2.67E-07	1.69E-06	1.84E-04
			1.5L PET	5.49E-05	1.93E-07	4.67E-06	2.73E-05	2.98E-07	6.09E-07	8.80E-05
			1.5L rPET	1.05E-04	1.93E-07	4.67E-06	2.73E-05	2.95E-07	5.80E-07	1.38E-04
1.5L Milk	**Chilled**	**NZ**	TBA Edge 1.5L WC30	1.49E-04	7.79E-07	1.47E-05	2.73E-05	1.05E-07	2.32E-06	1.94E-04
			1.5L PET	5.53E-05	2.08E-07	1.47E-05	2.73E-05	1.17E-07	6.57E-07	9.83E-05
			1.5L rPET	5.38E-04	2.08E-07	1.47E-05	2.73E-05	1.16E-07	6.26E-07	5.81E-04
2L Milk	**Chilled**	**AU**	TR 2L EO	9.97E-05	2.70E-07	8.31E-06	4.86E-05	4.42E-07	1.61E-06	1.59E-04
			2L HDPE	2.24E-05	1.93E-07	8.31E-06	4.86E-05	4.54E-07	4.55E-07	8.04E-05
2L Milk	**Chilled**	**NZ**	TR 2L EO	9.97E-05	2.91E-07	2.62E-05	4.86E-05	1.74E-07	2.20E-06	1.77E-04
			2L HDPE	2.54E-05	2.08E-07	2.62E-05	4.86E-05	1.79E-07	5.08E-07	1.01E-04
250ml RTD	**Ambient**	**AU**	TPA Edge 250ml DC26	7.68E-05	2.38E-07	7.70E-05	4.32E-06	2.96E-08	5.93E-07	1.59E-04
			TBA Base 250ml paper	3.63E-05	2.38E-07	7.70E-05	4.10E-06	2.27E-08	3.50E-07	1.18E-04
			237ml Can	2.58E-05	1.44E-07	5.39E-05	3.98E-06	2.43E-08	6.53E-08	8.39E-05

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml RTD Coffee and FSN	Chilled	AU	237ml Can	2.58E-05	1.44E-07	5.39E-05	3.98E-06	3.97E-08	6.53E-08	8.39E-05
250ml RTD Coffee and FSN	Ambient	NZ	TPA Edge 250ml DC26	7.68E-05	2.57E-07	7.70E-05	4.32E-06	1.16E-08	8.01E-07	1.59E-04
			TBA Base 250ml paper straw	3.63E-05	2.57E-07	7.70E-05	4.10E-06	8.93E-09	4.73E-07	1.18E-04
			237ml Can	2.58E-05	1.54E-07	5.39E-05	3.98E-06	9.58E-09	6.53E-08	8.39E-05
250ml RTD Coffee and FSN	Chilled	NZ	237ml Can	2.58E-05	1.54E-07	5.39E-05	3.98E-06	1.56E-08	6.53E-08	8.39E-05
300ml RTD Coffee and FSN	Ambient	AU	TPA Edge 300ml DC26	7.36E-05	2.65E-07	1.03E-04	5.21E-06	3.47E-08	6.26E-07	1.83E-04
			TPA Edge 300ml DC26 PB	0.00870	2.65E-07	1.03E-04	5.21E-06	3.47E-08	6.21E-07	0.00881
			300ml PET	2.65E-05	2.09E-07	1.08E-04	5.07E-06	4.54E-08	3.05E-07	1.40E-04
300ml RTD Coffee and FSN	Ambient	NZ	TPA Edge 300ml DC26	7.36E-05	2.81E-07	1.03E-04	5.21E-06	1.37E-08	8.47E-07	1.83E-04
			TPA Edge 300ml DC26 PB	0.00870	2.81E-07	1.03E-04	5.21E-06	1.37E-08	8.47E-07	0.00881
			300ml PET	2.67E-05	2.20E-07	1.08E-04	5.07E-06	1.79E-08	3.30E-07	1.40E-04
330ml RTD Coffee and FSN	Ambient	AU	TT C38 330ml	4.16E-05	2.65E-07	1.03E-04	6.94E-06	3.69E-08	6.46E-07	1.52E-04
			TPA Square 330ml	9.17E-05	2.65E-07	1.03E-04	6.07E-06	3.75E-08	6.73E-07	2.02E-04
			330ml PET	3.22E-05	2.09E-07	1.08E-04	5.07E-06	4.98E-08	3.64E-07	1.46E-04
			375ml PET	2.66E-05	2.09E-07	1.04E-04	5.54E-06	4.56E-08	3.02E-07	1.37E-04

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
330ml RTD Coffee and FSN	Ambient	NZ	TT C38 330ml	4.16E-05	2.81E-07	1.03E-04	6.94E-06	1.45E-08	8.82E-07	1.53E-04
			TPA Square 330ml DC26	9.17E-05	2.81E-07	1.03E-04	6.07E-06	1.48E-08	9.10E-07	2.02E-04
			330ml PET	3.24E-05	2.20E-07	1.08E-04	5.07E-06	1.96E-08	3.93E-07	1.46E-04
			375ml PET	2.67E-05	2.20E-07	1.04E-04	5.54E-06	1.80E-08	3.27E-07	1.37E-04
500ml RTD Coffee and FSN	Ambient	AU	TPA Edge 500ml DC26	1.15E-04	1.50E-07	1.69E-04	8.93E-06	5.55E-08	9.95E-07	2.94E-04
500ml RTD Coffee and FSN	Chilled	AU	TPA Edge 500ml DC26	1.15E-04	1.50E-07	1.69E-04	8.93E-06	9.05E-08	9.95E-07	2.94E-04
			TT 500ml C38	5.39E-05	1.50E-07	1.69E-04	1.01E-05	8.78E-08	8.52E-07	2.34E-04
			TT 500ml C38 PB	-0.00113	1.50E-07	1.69E-04	1.01E-05	8.78E-08	8.42E-07	-9.50E-04
			500ml rPET	4.61E-05	2.09E-07	1.42E-04	3.64E-05	1.79E-07	2.69E-07	2.25E-04
			500ml HDPE	1.51E-05	2.09E-07	1.42E-04	3.64E-05	1.85E-07	3.05E-07	1.94E-04
			500ml PET	3.64E-05	2.09E-07	1.42E-04	3.64E-05	1.97E-07	4.12E-07	2.16E-04
500ml RTD Coffee and FSN	Ambient	NZ	TPA Edge 500ml DC26	1.15E-04	1.58E-07	1.69E-04	8.93E-06	2.18E-08	1.35E-06	2.94E-04
500ml RTD Coffee and FSN	Chilled	NZ	TPA Edge 500ml DC26	1.15E-04	1.58E-07	1.69E-04	8.93E-06	3.57E-08	1.35E-06	2.94E-04
			TT 500ml C38	5.39E-05	1.58E-07	1.69E-04	1.01E-05	3.46E-08	1.16E-06	2.34E-04
			TT 500ml C38 PB	-0.00113	1.58E-07	1.69E-04	1.01E-05	3.46E-08	1.16E-06	-9.50E-04
			500ml rPET	2.32E-04	2.20E-07	1.42E-04	3.64E-05	7.07E-08	2.91E-07	4.11E-04
			500ml HDPE	1.65E-05	2.20E-07	1.42E-04	3.64E-05	7.27E-08	3.41E-07	1.96E-04
			500ml PET	3.66E-05	2.20E-07	1.42E-04	3.64E-05	7.76E-08	4.46E-07	2.16E-04

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml Juice	**Ambient**	**AU**	TBA Base Crystal 200ml paper straw	3.39E-05	2.38E-07	7.70E-05	3.15E-06	2.39E-08	5.73E-07	1.15E-04
			TPA Edge 250ml DC26	7.68E-05	2.38E-07	7.70E-05	4.32E-06	2.96E-08	5.93E-07	1.59E-04
			TBA Slim 250ml	6.59E-05	2.38E-07	7.70E-05	4.56E-06	2.60E-08	4.92E-07	1.48E-04
			250ml PET	2.20E-05	1.44E-07	1.42E-06	3.69E-06	2.85E-08	2.64E-07	2.75E-05
			250ml Glass	6.84E-06	1.44E-07	1.40E-04	5.75E-06	1.63E-07	6.82E-07	1.54E-04
			200ml Pouch	9.39E-06	2.38E-07	5.31E-05	2.85E-06	2.03E-08	1.01E-07	6.57E-05
250ml Juice	**Ambient**	**NZ**	TBA Base Crystal 200ml paper straw	3.39E-05	2.57E-07	7.70E-05	3.15E-06	9.40E-09	7.85E-07	1.15E-04
			TPA Edge 250ml DC26	7.68E-05	2.57E-07	7.70E-05	4.32E-06	1.16E-08	8.01E-07	1.59E-04
			TBA Slim 250ml	6.59E-05	2.57E-07	7.70E-05	4.56E-06	1.02E-08	6.68E-07	1.48E-04
			250ml PET	2.25E-05	1.54E-07	1.42E-06	3.69E-06	1.12E-08	2.87E-07	2.81E-05
			250ml Glass	7.28E-06	1.54E-07	1.40E-04	5.75E-06	6.42E-08	9.23E-07	1.54E-04
			200ml Pouch	2.40E-05	2.57E-07	5.31E-05	2.85E-06	7.99E-09	1.07E-07	8.03E-05
300ml Juice	**Chilled**	**AU**	TPA Edge 300ml DC26	7.36E-05	2.65E-07	1.03E-04	5.21E-06	5.66E-08	6.26E-07	1.83E-04
			TPA Edge 300ml DC26 PB	0.00870	2.65E-07	1.03E-04	5.21E-06	5.66E-08	6.21E-07	0.00881
			300ml PET*	2.40E-05	1.39E-07	1.08E-04	1.51E-05	1.04E-07	2.77E-07	1.48E-04
			300ml Glass*	7.63E-06	1.39E-07	1.40E-04	5.75E-06	2.97E-07	7.79E-07	1.55E-04
300ml Juice	**Chilled**	**NZ**	TPA Edge 300ml DC26	7.36E-05	2.81E-07	1.03E-04	5.21E-06	2.23E-08	8.47E-07	1.83E-04
			TPA Edge 300ml DC26 PB	0.00870	2.81E-07	1.03E-04	5.21E-06	2.23E-08	8.47E-07	0.00881
			300ml PET*	2.42E-05	1.49E-07	1.08E-04	1.51E-05	4.08E-08	2.99E-07	1.48E-04
			300ml Glass*	8.13E-06	1.49E-07	1.40E-04	5.75E-06	1.17E-07	1.06E-06	1.55E-04

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
500ml Juice	**Ambient**	**AU**	TPA Edge 500ml DC26	1.15E-04	1.50E-07	1.69E-04	8.93E-06	5.55E-08	9.95E-07	2.94E-04
			500ml PET	2.95E-05	2.09E-07	2.77E-04	5.47E-05	1.67E-07	3.35E-07	3.62E-04
500ml Juice	**Ambient**	**NZ**	TPA Edge 500ml DC26	1.15E-04	1.58E-07	1.69E-04	8.93E-06	2.18E-08	1.35E-06	2.94E-04
			500ml PET	2.97E-05	2.20E-07	2.77E-04	5.47E-05	6.58E-08	3.63E-07	3.62E-04
500ml Juice	**Chilled**	**AU**	TPA Edge 500ml DC26	1.15E-04	1.50E-07	1.69E-04	8.93E-06	9.05E-08	9.95E-07	2.94E-04
			500ml PET	2.69E-05	1.39E-07	2.77E-04	5.47E-05	2.69E-07	3.07E-07	3.59E-04
500ml Juice	**Chilled**	**NZ**	TPA Edge 500ml DC26	1.15E-04	1.58E-07	1.69E-04	8.93E-06	3.57E-08	1.35E-06	2.94E-04
			500ml PET	2.71E-05	1.49E-07	2.77E-04	5.47E-05	1.06E-07	3.32E-07	3.59E-04
1L Juice	**Ambient**	**AU**	TSA 1L WC30	1.49E-04	5.18E-07	2.22E-04	1.50E-05	8.13E-08	1.65E-06	3.88E-04
			TPA Square 1L HC27	1.88E-04	5.18E-07	2.22E-04	1.75E-05	8.94E-08	1.66E-06	4.30E-04
			1L Glass	1.87E-05	2.09E-07	3.21E-04	2.07E-05	5.07E-07	2.20E-06	3.63E-04
			1L PET	4.18E-05	2.09E-07	1.94E-04	1.47E-05	8.69E-08	4.69E-07	2.51E-04
1L Juice	**Ambient**	**NZ**	TSA 1L WC30	1.49E-04	5.56E-07	2.22E-04	1.50E-05	3.20E-08	2.27E-06	3.89E-04
			TPA Square 1L HC27	1.88E-04	5.56E-07	2.22E-04	1.75E-05	3.52E-08	2.27E-06	4.30E-04
			1L Glass	2.01E-05	2.20E-07	3.21E-04	2.07E-05	2.00E-07	2.97E-06	3.65E-04
			1L PET	4.26E-05	2.20E-07	1.94E-04	1.47E-05	3.42E-08	5.06E-07	2.52E-04
1L Juice	**Chilled**	**AU**	TR 1L EO	7.58E-05	1.80E-07	2.77E-04	2.05E-05	1.41E-07	9.87E-07	3.75E-04
			TSA 1L WC30	1.49E-04	5.18E-07	2.22E-04	1.50E-05	1.33E-07	1.65E-06	3.88E-04
			TPA Square 1L HC27	1.88E-04	5.18E-07	2.22E-04	1.75E-05	1.46E-07	1.66E-06	4.30E-04

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			1L PET	4.32E-05	1.39E-07	1.42E-04	3.64E-05	2.06E-07	4.83E-07	2.22E-04
1L Juice	**Chilled**	**NZ**	TR 1L EO	7.58E-05	1.94E-07	2.77E-04	2.05E-05	5.55E-08	1.36E-06	3.75E-04
			TSA 1L WC30	1.49E-04	5.56E-07	2.22E-04	1.50E-05	5.23E-08	2.27E-06	3.89E-04
			TPA Square 1L HC27	1.88E-04	5.56E-07	2.22E-04	1.75E-05	5.75E-08	2.27E-06	4.30E-04
			1L PET	4.34E-05	1.49E-07	1.42E-04	3.64E-05	8.10E-08	5.22E-07	2.23E-04
1.5L Juice	**Ambient**	**AU**	TBA Edge 1.5L WC30	1.49E-04	7.26E-07	2.77E-04	2.05E-05	9.91E-08	1.69E-06	4.49E-04
			1.25L PET	6.78E-05	2.93E-07	2.36E-04	1.87E-05	1.21E-07	7.47E-07	3.24E-04
1.5L Juice	**Ambient**	**NZ**	TBA Edge 1.5L WC30	1.49E-04	7.79E-07	2.77E-04	2.05E-05	3.90E-08	2.32E-06	4.50E-04
			1.25L PET	6.82E-05	3.08E-07	2.36E-04	1.87E-05	4.75E-08	8.06E-07	3.24E-04
2L Juice	**Chilled**	**AU**	TR 2L EO	9.97E-05	2.70E-07	3.69E-04	3.28E-05	2.21E-07	1.61E-06	5.04E-04
			TR 2L PB	0.00806	2.70E-07	3.69E-04	3.28E-05	2.15E-07	1.55E-06	0.00846
			2L PET	7.32E-05	1.93E-07	2.77E-04	5.47E-05	3.30E-07	8.02E-07	4.06E-04
			2L HDPE	2.93E-05	1.93E-07	1.40E-04	5.75E-06	1.19E-07	5.93E-07	1.76E-04
2L Juice	**Chilled**	**NZ**	TR 2L EO	9.97E-05	2.91E-07	3.69E-04	3.28E-05	8.71E-08	2.20E-06	5.04E-04
			TR 2L PB	0.00806	2.91E-07	3.69E-04	3.28E-05	8.46E-08	2.14E-06	0.00846
			2L PET	7.36E-05	2.08E-07	2.77E-04	5.47E-05	1.30E-07	8.65E-07	4.07E-04
			2L HDPE	3.21E-05	2.08E-07	1.40E-04	5.75E-06	4.69E-08	6.62E-07	1.79E-04

A.6. ISO 14067 GWP100, Aircraft Emissions Results

Annex Table A-1 Results per pack for GWP100, Air craft emissions [kg CO_2-eq.]

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
750ml Milk	**Chilled**	**AU**	TR 750ml OSO34	2.88E-09	1.63E-09	1.31E-09	2.23E-09	3.36E-11	1.92E-10	8.28E-09
			750ml PET	3.53E-08	1.22E-09	1.31E-09	2.23E-09	3.66E-11	9.78E-10	4.11E-08
			750ml rPET	1.85E-08	1.22E-09	1.31E-09	2.23E-09	3.62E-11	9.29E-10	2.42E-08
750ml Milk	**Chilled**	**NZ**	TR 750ml OSO34	2.40E-09	6.13E-10	7.78E-10	2.23E-09	1.32E-11	1.65E-10	6.20E-09
			750ml PET	1.80E-08	4.68E-10	7.78E-10	2.23E-09	1.44E-11	5.42E-10	2.20E-08
			750ml rPET	1.89E-09	4.68E-10	7.78E-10	2.23E-09	1.43E-11	5.11E-10	5.89E-09
1L Milk	**Ambient**	**AU**	TBA Slim 1L HC23	1.77E-08	4.50E-09	4.81E-09	1.19E-09	1.03E-11	2.72E-10	2.85E-08
			TBA Edge 1L LC30	1.69E-08	4.50E-09	5.78E-09	1.22E-09	1.07E-11	2.26E-10	2.86E-08
			TBA Edge 1L LW30 PB	1.84E-08	4.50E-09	5.78E-09	1.22E-09	1.07E-11	1.19E-10	3.00E-08
			TBA Square 1L HC27	2.45E-08	4.50E-09	5.78E-09	1.22E-09	1.12E-11	2.99E-10	3.63E-08
1L Milk	**Ambient**	**NZ**	TBA Slim 1L HC23	1.69E-08	1.73E-09	4.81E-09	1.19E-09	4.06E-12	2.04E-10	2.48E-08
			TBA Edge 1L LC30	1.66E-08	1.73E-09	5.78E-09	1.22E-09	4.21E-12	1.77E-10	2.55E-08
			TBA Edge 1L LW30 PB	1.84E-08	1.73E-09	5.78E-09	1.22E-09	4.22E-12	1.63E-10	2.73E-08
			TBA Square 1L HC27	2.34E-08	1.73E-09	5.78E-09	1.22E-09	4.40E-12	2.23E-10	3.24E-08
1L Milk	**Chilled**	**AU**	TT 1L C38	3.23E-09	1.63E-09	1.31E-09	2.23E-09	3.42E-11	2.02E-10	8.64E-09
			TT 1L C38 PB	5.46E-09	1.63E-09	1.31E-09	2.23E-09	3.42E-11	1.01E-10	1.08E-08
			TR 1L OSO34 PB	1.98E-09	1.63E-09	1.31E-09	2.23E-09	3.40E-11	9.51E-11	7.28E-09
			TB Ultra Edge 900ml	1.72E-09	1.63E-09	1.31E-09	2.23E-09	3.56E-11	2.36E-10	7.16E-09
			TBA Edge 1L LC30	1.69E-08	4.50E-09	1.31E-09	2.23E-09	3.51E-11	2.26E-10	2.52E-08
			1L HDPE	5.65E-08	1.22E-09	1.31E-09	2.23E-09	3.65E-11	7.33E-10	6.20E-08
			1L PET	4.00E-08	1.22E-09	1.31E-09	2.23E-09	3.78E-11	1.13E-09	4.59E-08
			1L Glass	3.27E-08	1.22E-09	1.31E-09	2.23E-09	1.13E-10	5.80E-10	3.82E-08
			1L rPET	1.94E-08	1.22E-09	1.31E-09	2.23E-09	3.66E-11	9.71E-10	2.52E-08

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
1L Milk	**Chilled**	**NZ**	TT 1L C38	2.42E-09	6.13E-10	7.78E-10	2.23E-09	1.35E-11	1.72E-10	6.23E-09
			TT 1L C38 PB	5.46E-09	6.13E-10	7.78E-10	2.23E-09	1.35E-11	1.37E-10	9.23E-09
			TR 1L OSO34 PB	1.98E-09	6.13E-10	7.78E-10	2.23E-09	1.34E-11	1.28E-10	5.74E-09
			TB Ultra Edge 900ml	1.65E-08	6.13E-10	7.78E-10	2.23E-09	1.40E-11	1.94E-10	2.03E-08
			TBA Edge 1L LC30	1.66E-08	1.73E-09	7.78E-10	2.23E-09	1.38E-11	1.77E-10	2.15E-08
			1L HDPE	1.34E-08	4.68E-10	7.78E-10	2.23E-09	1.44E-11	5.64E-10	1.75E-08
			1L PET	2.06E-08	4.68E-10	7.78E-10	2.23E-09	1.49E-11	6.36E-10	2.47E-08
			1L Glass	1.39E-08	4.68E-10	7.78E-10	2.23E-09	4.46E-11	8.16E-10	1.82E-08
			1L rPET	2.18E-09	4.68E-10	7.78E-10	2.23E-09	1.44E-11	5.38E-10	6.21E-09
1.5L Milk	**Chilled**	**AU**	TBA Edge 1.5L WC30	1.74E-08	6.30E-09	1.31E-09	2.23E-09	3.54E-11	2.39E-10	2.75E-08
			1.5L PET	5.05E-08	1.71E-09	1.31E-09	2.23E-09	3.95E-11	1.39E-09	5.72E-08
			1.5L rPET	2.63E-08	1.71E-09	1.31E-09	2.23E-09	3.91E-11	1.33E-09	3.29E-08
1.5L Milk	**Chilled**	**NZ**	TBA Edge 1.5L WC30	1.70E-08	2.43E-09	7.78E-10	2.23E-09	1.39E-11	1.88E-10	2.26E-08
			1.5L PET	2.58E-08	6.53E-10	7.78E-10	2.23E-09	1.56E-11	7.64E-10	3.02E-08
			1.5L rPET	2.39E-09	6.53E-10	7.78E-10	2.23E-09	1.54E-11	7.27E-10	6.79E-09
2L Milk	**Chilled**	**AU**	TR 2L EO	3.27E-09	2.44E-09	2.33E-09	3.97E-09	5.86E-11	3.13E-10	1.24E-08
			2L HDPE	6.33E-08	1.71E-09	2.33E-09	3.97E-09	6.02E-11	8.09E-10	7.22E-08
2L Milk	**Chilled**	**NZ**	TR 2L EO	2.08E-09	9.19E-10	1.38E-09	3.97E-09	2.31E-11	2.23E-10	8.60E-09
			2L HDPE	1.49E-08	6.53E-10	1.38E-09	3.97E-09	2.37E-11	6.20E-10	2.15E-08
250ml RTD	**Ambient**	**AU**	TPA Edge 250ml DC26	1.08E-08	2.15E-09	2.01E-09	3.53E-10	3.92E-12	1.54E-10	1.55E-08
			TBA Base 250ml paper	4.55E-09	2.15E-09	2.01E-09	3.35E-10	3.00E-12	4.55E-11	9.09E-09
			237ml Can	1.15E-07	1.21E-09	1.40E-09	3.25E-10	3.23E-12	6.44E-12	1.18E-07

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml RTD Coffee and FSN	Chilled	AU	237ml Can	1.15E-07	1.21E-09	1.40E-09	3.25E-10	5.27E-12	6.44E-12	1.18E-07
250ml RTD Coffee and FSN	Ambient	NZ	TPA Edge 250ml DC26	9.69E-09	8.07E-10	2.01E-09	3.53E-10	1.54E-12	1.12E-10	1.30E-08
			TBA Base 250ml paper straw	4.55E-09	8.07E-10	2.01E-09	3.35E-10	1.18E-12	3.48E-11	7.74E-09
			237ml Can	1.15E-07	4.77E-10	1.40E-09	3.25E-10	1.27E-12	6.44E-12	1.17E-07
250ml RTD Coffee and FSN	Chilled	NZ	237ml Can	1.15E-07	4.77E-10	1.40E-09	3.25E-10	2.07E-12	6.44E-12	1.17E-07
300ml RTD Coffee and FSN	Ambient	AU	TPA Edge 300ml DC26	9.11E-09	2.05E-09	2.67E-09	4.25E-10	4.60E-12	1.59E-10	1.44E-08
			TPA Edge 300ml DC26 PB	9.33E-09	2.05E-09	2.67E-09	4.25E-10	4.60E-12	1.15E-10	1.46E-08
			300ml PET	2.42E-08	1.40E-09	2.81E-09	4.14E-10	6.01E-12	6.82E-10	2.95E-08
300ml RTD Coffee and FSN	Ambient	NZ	TPA Edge 300ml DC26	8.04E-09	8.56E-10	2.67E-09	4.25E-10	1.81E-12	1.15E-10	1.21E-08
			TPA Edge 300ml DC26 PB	8.25E-09	8.56E-10	2.67E-09	4.25E-10	1.81E-12	1.15E-10	1.23E-08
			300ml PET	1.23E-08	6.42E-10	2.81E-09	4.14E-10	2.37E-12	3.86E-10	1.66E-08
330ml RTD Coffee and FSN	Ambient	AU	TT C38 330ml	2.83E-09	2.05E-09	2.67E-09	5.67E-10	4.89E-12	1.33E-10	8.25E-09
			TPA Square 330ml	1.40E-08	2.05E-09	2.67E-09	4.96E-10	4.97E-12	1.69E-10	1.94E-08
			330ml PET	2.91E-08	1.40E-09	2.81E-09	4.14E-10	6.60E-12	8.18E-10	3.45E-08
			375ml PET	2.30E-08	1.40E-09	2.70E-09	4.52E-10	6.05E-12	6.68E-10	2.82E-08

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
330ml RTD Coffee and FSN	**Ambient**	**NZ**	TT C38 330ml	2.02E-09	8.56E-10	2.67E-09	5.67E-10	1.93E-12	1.03E-10	6.22E-09
			TPA Square 330ml DC26	1.29E-08	8.56E-10	2.67E-09	4.96E-10	1.96E-12	1.21E-10	1.70E-08
			330ml PET	1.49E-08	6.42E-10	2.81E-09	4.14E-10	2.60E-12	4.59E-10	1.92E-08
			375ml PET	1.19E-08	6.42E-10	2.70E-09	4.52E-10	2.38E-12	3.83E-10	1.61E-08
500ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 500ml DC26	1.54E-08	8.60E-10	4.41E-09	7.29E-10	7.35E-12	2.05E-10	2.16E-08
500ml RTD Coffee and FSN	**Chilled**	**AU**	TPA Edge 500ml DC26	1.54E-08	8.60E-10	4.41E-09	7.29E-10	1.20E-11	2.05E-10	2.16E-08
			TT 500ml C38	2.96E-09	8.60E-10	4.41E-09	8.24E-10	1.16E-11	1.59E-10	9.22E-09
			TT 500ml C38 PB	4.01E-09	8.60E-10	4.41E-09	8.24E-10	1.16E-11	6.63E-11	1.02E-08
			500ml rPET	1.22E-08	1.40E-09	3.69E-09	2.98E-09	2.38E-11	6.07E-10	2.09E-08
			500ml HDPE	4.05E-08	1.40E-09	3.69E-09	2.98E-09	2.45E-11	5.42E-10	4.91E-08
			500ml PET	3.31E-08	1.40E-09	3.69E-09	2.98E-09	2.61E-11	9.27E-10	4.21E-08
500ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 500ml DC26	1.44E-08	4.82E-10	4.41E-09	7.29E-10	2.90E-12	1.52E-10	2.02E-08
500ml RTD Coffee and FSN	**Chilled**	**NZ**	TPA Edge 500ml DC26	1.44E-08	4.82E-10	4.41E-09	7.29E-10	4.73E-12	1.52E-10	2.02E-08
			TT 500ml C38	2.14E-09	4.82E-10	4.41E-09	8.24E-10	4.59E-12	1.24E-10	7.98E-09
			TT 500ml C38 PB	4.92E-09	4.82E-10	4.41E-09	8.24E-10	4.59E-12	8.91E-11	1.07E-08
			500ml rPET	1.51E-09	6.42E-10	3.69E-09	2.98E-09	9.37E-12	3.39E-10	9.17E-09
			500ml HDPE	9.78E-09	6.42E-10	3.69E-09	2.98E-09	9.65E-12	4.17E-10	1.75E-08
			500ml PET	1.69E-08	6.42E-10	3.69E-09	2.98E-09	1.03E-11	5.21E-10	2.47E-08

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
250ml Juice	**Ambient**	**AU**	TBA Base Crystal 200ml paper straw	9.22E-10	2.15E-09	2.01E-09	2.58E-10	3.16E-12	8.42E-11	5.43E-09
			TPA Edge 250ml DC26	1.08E-08	2.15E-09	2.01E-09	3.53E-10	3.92E-12	1.54E-10	1.55E-08
			TBA Slim 250ml	6.94E-09	2.15E-09	2.01E-09	3.72E-10	3.45E-12	6.82E-11	1.15E-08
			250ml PET	2.00E-08	1.21E-09	9.15E-10	3.01E-10	3.77E-12	5.77E-10	2.30E-08
			250ml Glass	1.25E-08	1.21E-09	3.66E-09	4.70E-10	2.16E-11	2.13E-10	1.81E-08
			200ml Pouch	2.09E-08	2.15E-09	1.38E-09	2.33E-10	2.69E-12	9.55E-11	2.48E-08
250ml Juice	**Ambient**	**NZ**	TBA Base Crystal 200ml paper straw	9.22E-10	8.07E-10	2.01E-09	2.58E-10	1.25E-12	5.91E-11	4.06E-09
			TPA Edge 250ml DC26	9.69E-09	8.07E-10	2.01E-09	3.53E-10	1.54E-12	1.12E-10	1.30E-08
			TBA Slim 250ml	6.94E-09	8.07E-10	2.01E-09	3.72E-10	1.36E-12	4.98E-11	1.02E-08
			250ml PET	1.02E-08	4.77E-10	5.60E-10	3.01E-10	1.49E-12	3.36E-10	1.19E-08
			250ml Glass	5.88E-09	4.77E-10	3.66E-09	4.70E-10	8.52E-12	2.92E-10	1.08E-08
			200ml Pouch	1.89E-08	8.07E-10	1.38E-09	2.33E-10	1.06E-12	8.17E-11	2.14E-08
300ml Juice	**Chilled**	**AU**	TPA Edge 300ml DC26	9.11E-09	2.05E-09	2.67E-09	4.25E-10	7.50E-12	1.59E-10	1.44E-08
			TPA Edge 300ml DC26 PB	9.33E-09	2.05E-09	2.67E-09	4.25E-10	7.50E-12	1.15E-10	1.46E-08
			300ml PET*	2.20E-08	1.22E-09	2.81E-09	1.23E-09	1.37E-11	6.18E-10	2.79E-08
			300ml Glass*	1.40E-08	1.22E-09	3.66E-09	4.70E-10	3.94E-11	2.55E-10	1.96E-08
300ml Juice	**Chilled**	**NZ**	TPA Edge 300ml DC26	8.04E-09	8.56E-10	2.67E-09	4.25E-10	2.96E-12	1.15E-10	1.21E-08
			TPA Edge 300ml DC26 PB	8.25E-09	8.56E-10	2.67E-09	4.25E-10	2.96E-12	1.15E-10	1.23E-08
			300ml PET*	1.12E-08	4.68E-10	2.81E-09	1.23E-09	5.41E-12	3.50E-10	1.61E-08
			300ml Glass*	6.37E-09	4.68E-10	3.66E-09	4.70E-10	1.55E-11	3.42E-10	1.13E-08

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
500ml Juice	**Ambient**	**AU**	TPA Edge 500ml DC26	1.54E-08	8.60E-10	4.41E-09	7.29E-10	7.35E-12	2.05E-10	2.16E-08
			500ml PET	2.66E-08	1.40E-09	7.22E-09	4.47E-09	2.21E-11	7.51E-10	4.05E-08
500ml Juice	**Ambient**	**NZ**	TPA Edge 500ml DC26	1.44E-08	4.82E-10	4.41E-09	7.29E-10	2.90E-12	1.52E-10	2.02E-08
			500ml PET	1.36E-08	6.42E-10	7.22E-09	4.47E-09	8.72E-12	4.24E-10	2.64E-08
500ml Juice	**Chilled**	**AU**	TPA Edge 500ml DC26	1.54E-08	8.60E-10	4.41E-09	7.29E-10	1.20E-11	2.05E-10	2.16E-08
			500ml PET	2.49E-08	1.22E-09	7.22E-09	4.47E-09	3.57E-11	6.92E-10	3.85E-08
500ml Juice	**Chilled**	**NZ**	TPA Edge 500ml DC26	1.44E-08	4.82E-10	4.41E-09	7.29E-10	4.73E-12	1.52E-10	2.02E-08
			500ml PET	1.26E-08	4.68E-10	7.22E-09	4.47E-09	1.41E-11	3.88E-10	2.52E-08
1L Juice	**Ambient**	**AU**	TSA 1L WC30	1.66E-08	4.50E-09	5.78E-09	1.22E-09	1.08E-11	2.34E-10	2.83E-08
			TPA Square 1L HC27	2.47E-08	4.50E-09	5.78E-09	1.43E-09	1.18E-11	2.99E-10	3.67E-08
			1L Glass	3.71E-08	1.40E-09	8.35E-09	1.69E-09	6.72E-11	6.83E-10	4.93E-08
			1L PET	3.85E-08	1.40E-09	5.07E-09	1.20E-09	1.15E-11	1.07E-09	4.73E-08
1L Juice	**Ambient**	**NZ**	TSA 1L WC30	1.62E-08	1.73E-09	5.78E-09	1.22E-09	4.25E-12	1.84E-10	2.51E-08
			TPA Square 1L HC27	2.36E-08	1.73E-09	5.78E-09	1.43E-09	4.67E-12	2.23E-10	3.28E-08
			1L Glass	1.61E-08	6.42E-10	8.35E-09	1.69E-09	2.65E-11	9.35E-10	2.77E-08
			1L PET	1.96E-08	6.42E-10	5.07E-09	1.20E-09	4.54E-12	5.88E-10	2.71E-08
1L Juice	**Chilled**	**AU**	TR 1L EO	8.18E-10	1.63E-09	7.22E-09	1.67E-09	1.87E-11	1.09E-10	1.15E-08
			TSA 1L WC30	1.66E-08	4.50E-09	5.78E-09	1.22E-09	1.76E-11	2.34E-10	2.84E-08
			TPA Square 1L HC27	2.47E-08	4.50E-09	5.78E-09	1.43E-09	1.93E-11	2.99E-10	3.67E-08

Comparison group	Distribution	Country	Product	Consumer pack	Forming and filling	Shipper	Pallet	Transport	Consumer pack end-of-life	Total (cut-off)
			1L PET	3.94E-08	1.22E-09	3.69E-09	2.98E-09	2.73E-11	1.10E-09	4.84E-08
1L Juice	**Chilled**	**NZ**	TR 1L EO	8.18E-10	6.13E-10	7.22E-09	1.67E-09	7.36E-12	9.71E-11	1.04E-08
			TSA 1L WC30	1.62E-08	1.73E-09	5.78E-09	1.22E-09	6.93E-12	1.84E-10	2.51E-08
			TPA Square 1L HC27	2.36E-08	1.73E-09	5.78E-09	1.43E-09	7.62E-12	2.23E-10	3.28E-08
			1L PET	2.01E-08	4.68E-10	3.69E-09	2.98E-09	1.07E-11	6.08E-10	2.79E-08
1.5L Juice	**Ambient**	**AU**	TBA Edge 1.5L WC30	1.74E-08	6.30E-09	7.22E-09	1.67E-09	1.31E-11	2.39E-10	3.28E-08
			1.25L PET	6.18E-08	1.96E-09	6.15E-09	1.53E-09	1.60E-11	1.71E-09	7.32E-08
1.5L Juice	**Ambient**	**NZ**	TBA Edge 1.5L WC30	1.70E-08	2.43E-09	7.22E-09	1.67E-09	5.18E-12	1.88E-10	2.85E-08
			1.25L PET	3.16E-08	8.99E-10	6.15E-09	1.53E-09	6.30E-12	9.37E-10	4.11E-08
2L Juice	**Chilled**	**AU**	TR 2L EO	3.27E-09	2.44E-09	9.63E-09	2.68E-09	2.93E-11	3.13E-10	1.84E-08
			TR 2L PB	2.27E-09	2.44E-09	9.63E-09	2.68E-09	2.85E-11	1.15E-10	1.72E-08
			2L PET	6.72E-08	1.71E-09	7.22E-09	4.47E-09	4.37E-11	1.84E-09	8.25E-08
			2L HDPE	8.24E-08	1.71E-09	3.66E-09	4.70E-10	1.58E-11	1.05E-09	8.93E-08
2L Juice	**Chilled**	**NZ**	TR 2L EO	2.08E-09	9.19E-10	9.63E-09	2.68E-09	1.16E-11	2.23E-10	1.55E-08
			TR 2L PB	2.27E-09	9.19E-10	9.63E-09	2.68E-09	1.12E-11	1.56E-10	1.57E-08
			2L PET	3.43E-08	6.53E-10	7.22E-09	4.47E-09	1.72E-11	1.00E-09	4.77E-08
			2L HDPE	1.93E-08	6.53E-10	3.66E-09	4.70E-10	6.22E-12	8.11E-10	2.49E-08
750ml Milk	**Chilled**	**AU**	750ml rPET (Transport scenario)	1.85E-08	1.22E-09	1.31E-09	2.23E-09	1.26E-11	9.29E-10	2.42E-08

Annex B Life cycle inventory data

Life cycle inventory data is provided in Annex B and contains the following information per tab.

B.1. Packaging composition - individual product brands

Packaging composition - average per beverage, size class and country.

B.2. Packaging composition - average per beverage

Packaging composition - individual product brands.

B.3. Packaging metrics - Tetra Pak packs

Packaging metrics - Tetra Pak packs.

B.4. Packaging metrics – competitor packs

Packaging metrics – competitor packs.

B.5. Secondary packaging data and assumptions

Secondary packaging assumptions.

B.6. Tertiary packaging data and assumptions

Tertiary packaging assumptions.

B.7. Filling data assumptions

Filling data assumptions.

Annex B Life cycle inventory data

B.1. Packaging composition - average per beverage

Primary material masses for all beverage classes and sizes in Oceania

Beverage	Volume (mL)	Packaging type	Component	Primary material	Mass (g)
Milk	**1000**	**1L HDPE**	Bottle	HDPE	34.1
			Cap	HDPE	3.44
			Label	PP	0.800
Milk	**1000**	**1L PET**	Bottle	PET	38.6
			Cap	HDPE	2.97
			Label	PP	4.31
Milk	**1000**	**1L Glass**	Bottle	Glass	461
			Cap	St stamp and bend	4.92
			Label	PP	0.130
Milk	**2000**	**2L HDPE**	Bottle	HDPE	38.5
			Cap insert	PE low density (LDPE) film	0.280
			Cap	HDPE	2.68
			Label	PP	0.839
Milk	**750**	**750ml PET**	Bottle	PET	34.3
			Cap	HDPE	3.73

Beverage	Volume (mL)	Packaging type	Component	Primary material	Mass (g)
			Label	PP	1.18
Milk	**1500**	**1.5L PET**	Bottle	PET	50.1
			Cap	HDPE	3.68
			Label	PP	1.60
Milk	**1500**	**1.5L rPET**	Bottle	PET	48.7
			Cap	HDPE	3.13
			Label	PP	0.885
Milk	**750**	**750ml rPET**	Bottle	PET	33.3
			Cap	HDPE	3.06
			Label	PP	0.665
Milk	**1000**	**1L rPET**	Bottle	PET	34.1
			Cap	HDPE	3.78
			Label	PP	0.990
RTD Coffee and FSN	**237**	**237ml Can**	Bottle	Al can	12.4
RTD Coffee and FSN	**300**	**300ml PET**	Bottle	PET	22.5
			Cap	HDPE	3.68
			Label	PP	1.56
RTD Coffee and FSN	**330**	**330ml PET**	Bottle	PET	27.8
			Cap	HDPE	2.96
			Label	PP	2.32
RTD Coffee and FSN	**500**	**500ml rPET**	Bottle	PET	20.9
			Cap	HDPE	2.71
			Label	PP	0.878

Beverage	Volume (mL)	Packaging type	Component	Primary material	Mass (g)
RTD Coffee and FSN	**500**	**500ml HDPE**	Bottle	HDPE	24.0
			Cap	HDPE	3.55
			Label	PP	0.790
RTD Coffee and FSN	**350**	**500ml PET**	Bottle	PET	31.5
			Cap	HDPE	3.91
			Label	PP	2.09
RTD Coffee and FSN	**375**	**375ml PET**	Bottle	PET	21.3
			Cap	HDPE	2.01
			Label	PP	4.17
Juice	**250**	**250ml PET**	Bottle	PET	17.4
			Cap insert	PE low density (LDPE) film	0.140
			Cap	HDPE	5.11
			Label	PP	1.50
Juice	**250**	**250ml Glass**	Bottle	Glass	159
			Cap	St stamp and bend	4.14
			Label	PP	0.677
Juice	**200**	**200ml Pouch**	Cap	PP	3.65
			Pouch	Aluminium foil	1.23
			Pouch	PE low density (LDPE) film	5.01
			Straw	PP	0.443
Juice	**1000**	**1L Glass**	Bottle	Glass	510
			Cap	St stamp and bend	4.12

Beverage	Volume (mL)	Packaging type	Component	Primary material	Mass (g)
			Label	Cardboard / paper	2.04
			Label	PP	1.69
			Label	PVC	0.397
Juice	**1000**	**1L PET**	Bottle	PET	37.5
			Cap insert	PE low density (LDPE) film	0.217
			Cap	HDPE	3.81
			Label	PP	1.09
Juice	**1000**	**1L PET**	Bottle	PET	38.3
			Cap	HDPE	3.50
			Label	PP	2.11
Juice	**1500**	**2L PET**	Bottle	PET	67.6
			Cap	HDPE	3.37
			Label	PP	1.94
Juice	**350**	**350ml PET**	Bottle	PET	20.5
			Cap	HDPE	3.54
			Label	PP	1.20
Juice	**500**	**500ml PET**	Bottle	PET	23.6
			Cap	HDPE	3.54
			Label	PP	0.802
Juice	**2000**	**2L HDPE**	Bottle	HDPE	50.1
			Cap	HDPE	3.84
			Label	PP	1.17
Juice	**500**	**500ml PET**	Bottle	PET	25.2
			Cap	HDPE	3.06

Beverage	Volume (mL)	Packaging type	Component	Primary material	Mass (g)
			Label	PP	2.28
Juice	**1250**	**1.25L PET**	Bottle	PET	61.6
			Cap	HDPE	3.25
			Label	PP	3.05
Juice	**350**	**350ml Glass**	Bottle	Glass	182
			Cap	St stamp and bend	3.44
			Label	PP	1.06
			Label	PVC	0.317

Annex B Life cycle inventory data

B.2. Packaging composition - individual product brands

Primary material masses for products used in Oceania

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
Milk	**1000**	**A2**	**1L HDPE**	Bottle	HDPE	34.8
				Cap	HDPE	2.86
				Cap	HDPE	0.573
				Label	PP	0.687
Milk	**1000**	**Paris Creek Farms**	**1L HDPE**	Bottle	HDPE	34.0
				Cap	HDPE	2.96
				Cap	HDPE	0.557
				Label	PP	0.680
Milk	**1000**	**Pauls Smarter White**	**1L HDPE**	Bottle	HDPE	33.4
				Cap	HDPE	2.82
				Cap	HDPE	0.543
				Label	PP	1.03
Milk	**1000**	**Vitasoy**	**1L PET**	Bottle	PET	37.1
				Cap	HDPE	2.45
				Cap	HDPE	0.530
				Label	PP	4.62
Milk	**1000**	**Inside Out**	**1L PET**	Bottle	PET	45.5

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Cap	HDPE	2.84
				Cap	HDPE	0.563
				Label	PP	3.82
Milk	**1000**	**Little island coconut**	**1L PET**	Bottle	PET	29.2
				Cap	HDPE	2.37
				Cap	HDPE	0.427
				Label	PP	4.40
Milk	**1000**	**Boring Oat Milk**	**1L PET**	Bottle	PET	42.4
				Cap	HDPE	2.33
				Cap	HDPE	0.393
				Label	PP	4.37
Milk	**1000**	**Fleurieu Milk**	**1L Glass**	Bottle	Glass	461
				Cap	St stamp and	4.92
				Label	PP	0.130
Milk	**2000**	**Zymil**	**2L HDPE**	Bottle	HDPE	38.8
				Cap	HDPE	2.31
				Cap	HDPE	0.560
				Cap insert	PE low density	0.220
				Label	PP	0.910
Milk	**2000**	**Coles**	**2L HDPE**	Bottle	HDPE	38.4
				Cap	HDPE	2.29
				Cap	HDPE	0.367
				Cap insert	PE low density	0.313

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Label	PP	0.737
Milk	**2000**	**Pura**	**2L HDPE**	Bottle	HDPE	38.3
				Cap	HDPE	2.16
				Cap	HDPE	0.343
				Cap insert	PE low density	0.307
				Label	PP	0.870
Milk	**750**	**Farmhouse Gold**	**750ml PET**	Bottle	PET	34.3
				Cap	HDPE	3.18
				Cap	HDPE	0.550
				Label	PP	1.18
Milk	**1500**	**Farmhouse Gold**	**1.5L PET**	Bottle	PET	50.1
				Cap	HDPE	3.13
				Cap	HDPE	0.550
				Label	PP	1.60
Milk	**1500**	**Lewis Rd Creamery**	**1.5L rPET**	Bottle	PET	49.3
				Cap	HDPE	2.82
				Cap	HDPE	0.257
				Label	PP	0.840
Milk	**1500**	**Puhoi**	**1.5L rPET**	Bottle	PET	48.1
				Cap	HDPE	2.92
				Cap	HDPE	0.263
				Label	PP	0.930
Milk	**750**	**Lewis Rd Creamery**	**750ml rPET**	Bottle	PET	33.4

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Cap	HDPE	2.79
				Cap	HDPE	0.223
				Label	PP	0.483
Milk	**750**	**Puhoi**	**750ml rPET**	Bottle	PET	33.1
				Cap	HDPE	2.87
				Cap	HDPE	0.240
				Label	PP	0.847
Milk	**1000**	**Hunt&Brew**	**1L rPET**	Bottle	PET	34.1
				Cap	HDPE	3.22
				Cap	HDPE	0.560
				Label	PP	0.990
RTD Coffee and FSN	**237**	**Boss Coffee**	**237ml Can**	Bottle	Al can	0
RTD Coffee	**220**	**Starbucks Double shot**	**237ml Can**	Bottle	Al can	12.8
RTD Coffee	**240**	**All Press Latte**	**237ml Can**	Bottle	Al can	11.9
RTD Coffee and FSN	**300**	**Coach**	**300ml PET**	Bottle	PET	21.5
				Cap	HDPE	3.03
				Cap	HDPE	0.580
				Label	PP	1.32
RTD Coffee and FSN	**280**	**Starbucks Frappuccino**	**300ml PET**	Bottle	PET	23.1
				Cap	HDPE	3.17
				Cap	HDPE	0.530

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Label	PP	1.80
RTD Coffee	**300**	**Farmer's Union Iced**	**300ml PET**	Bottle	PET	23.0
				Cap	HDPE	3.18
				Cap	HDPE	0.563
				Label	0	
RTD Coffee	**330**	**Vitasoy**	**330ml PET**	Bottle	PET	21.8
				Cap	HDPE	2.48
				Cap	HDPE	0.530
				Label	PP	2.23
RTD Coffee and FSN	**330**	**Prepd Mango Smoothie**	**330ml PET**	Bottle	PET	32.0
				Cap	HDPE	2.49
				Cap	HDPE	0.550
				Label	PP	0.440
				Label	PP	2.04
RTD Coffee and FSN	**330**	**Atkins**	**330ml PET**	Bottle	PET	29.7
				Cap	HDPE	2.34
				Cap	HDPE	0.470
				Label	PP	2.27
RTD Coffee and FSN	**500**	**Dare**	**500ml rPET**	Bottle	PET	20.9
				Cap	HDPE	2.33

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Cap	HDPE	0.383
				Label	PP	0.873
RTD Coffee and FSN	**500**	**Dairy Farmers Chocolate Milk**	**500ml rPET**	Bottle	PET	20.9
				Cap	HDPE	2.32
				Cap	HDPE	0.383
				Label	PP	0.883
RTD Coffee and FSN	**500**	**Ice Break**	**500ml HDPE**	Bottle	HDPE	27.0
				Cap	HDPE	3.00
				Cap	HDPE	0.543
				Label	PP	0.790
RTD Coffee and FSN	**500**	**Fleurieru Milk**	**500ml HDPE**	Bottle	HDPE	21.0
				Cap	HDPE	2.98
				Cap	HDPE	0.570
				Label	PP	0.790
RTD Coffee	**350**	**Up&Go Energize**	**500ml PET**	Bottle	PET	30.7
				Cap	HDPE	4.07
				Cap	HDPE	0.533
				Label	PP	3.03
RTD Coffee	**350**	**Nedds**	**500ml PET**	Bottle	PET	31.7
				Cap	HDPE	2.78
				Cap	HDPE	0.523
				Label	PP	2.47

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
RTD Coffee	**350**	**Farmers Union Iced**	**500ml PET**	Bottle	PET	32.2
				Cap	HDPE	3.25
				Cap	HDPE	0.570
				Label	PP	0.770
RTD Coffee and FSN	**375**	**Musashi**	**375ml PET**	Bottle	PET	19.4
				Label	PP	3.99
				Cap	HDPE	0.520
				Label	PP	3.16
RTD Coffee and FSN	**375**	**Manshake**	**375ml PET**	Bottle	PET	26.0
				Cap	HDPE	2.29
				Cap	HDPE	0.470
				Label	PP	2.46
RTD Coffee and FSN	**375**	**Crankt**	**375ml PET**	Bottle	PET	18.5
				Cap	HDPE	2.34
				Cap	HDPE	0.420
				Label	PP	2.90
Juice	**250**	**Berri**	**250ml PET**	Bottle	PET	18.9
				Cap	HDPE	1.13
				Cap	HDPE	5.07
				Label	PP	0.353
				Cap insert	PE low density (LDPE) film	0.130
Juice	**300**	**v8**	**250ml PET**	Bottle	PET	16.6

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Cap	HDPE	3.26
				Cap	HDPE	0.527
				Label	PP	2.14
Juice	**250**	**Pop Tops 30% Fruit Drink**	**250ml PET**	Bottle	PET	16.7
				Cap	HDPE	4.18
				Cap insert	PE low density (LDPE) film	0.150
				Cap	HDPE	0.917
				Label	PP	0.203
				Cap	HDPE	0.233
				Label	PP	1.82
Juice	**250**	**Sunraysia**	**250ml Glass**	Cap	St stamp and bend	4.11
				Bottle	Glass	155
Juice	**250**	**Murray Valley**	**250ml Glass**	Bottle	Glass	164
				Cap	St stamp and bend	4.17
				Label	PP	0.677
Juice	**200**	**Sunraysia organic**	**200ml Pouch**	Pouch	PE low density (LDPE) film	4.87
				Straw	PP	0.347
				Straw	PP	0.0533
				Straw	PP	0.0433
				Pouch	Aluminium foil	1.19

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
Juice	**200**	**Homegrown**	**200ml Pouch**	Pouch	PE low density (LDPE) film	5.16
				Cap	PP	3.65
				Pouch	Aluminium foil	1.26
Juice	**1000**	**Sunraysia**	**1L Glass**	Bottle	Glass	458
				Cap	St stamp and bend	5.42
				Label	PP	2.45
Juice	**1000**	**Ashton Valley**	**1L Glass**	Bottle	Glass	550
				Cap	St stamp and bend	4.08
				Label	PP	1.72
Juice	**1000**	**Auldwood**	**1L Glass**	Bottle	Glass	560
				Cap	St stamp and bend	3.99
				Label	PP	0.897
Juice	**1000**	**Poppa Pete's organics**	**1L Glass**	Bottle	Glass	473
				Cap	St stamp and bend	5.94
				Label	Cardboard / paper	2.04
Juice	**1000**	**Kombucha**	**1L Glass**	Cap	St stamp and bend	1.15
				Label	Cardboard / paper	
				Label	PVC	0.397

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
Juice	**1000**	**Woolworths**	**1L PET**	Bottle	PET	38.1
				Cap	HDPE	2.81
				Cap	HDPE	0.530
				Label	PP	0.817
Juice	**1000**	**P&N**	**1L PET**	Bottle	PET	41.5
				Cap	HDPE	3.58
				Cap	HDPE	0.697
				Cap	HDPE	0.510
				Label	PP	1.31
				Cap insert	PE low density (LDPE) film	0.217
Juice	**1000**	**Bickford**	**1L PET**	Bottle	PET	33.0
				Cap	HDPE	2.79
				Cap	HDPE	0.517
				Label	PP	1.14
Juice	**1000**	**Impressed**	**1L PET**	Bottle	PET	35.1
				Cap	HDPE	2.81
				Cap	HDPE	0.520
				Label	PP	3.69
Juice	**1000**	**Emma & Tom's**	**1L PET**	Bottle	PET	45.3
				Cap	HDPE	2.91
				Cap	HDPE	0.557
				Label	PP	0.997
Juice	**1000**	**Juice Brothers**	**1L PET**	Bottle	PET	34.6
				Cap	HDPE	3.15
				Cap	HDPE	0.550

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Label	PP	1.64
Juice	**1500**	**Original**	**2L PET**	Bottle	PET	65.2
				Cap	HDPE	2.46
				Cap	HDPE	0.600
				Label	PP	2.37
Juice	**2000**	**Presha Fruit**	**2L PET**	Bottle	PET	69.3
				Cap	HDPE	2.76
				Cap	HDPE	0.527
				Label	PP	1.88
Juice	**2000**	**Coles**	**2L PET**	Bottle	PET	68.3
				Cap	HDPE	3.17
				Cap	HDPE	0.610
				Label	PP	1.21
				Label	PP	0.350
Juice	**350**	**Perkii**	**350ml PET**	Bottle	PET	17.5
				Cap	HDPE	2.79
				Cap	HDPE	0.527
				Label	PP	2.23
Juice	**350**	**YouJuice**	**350ml PET**	Bottle	PET	27.4
				Cap	HDPE	3.16
				Cap	HDPE	0.620
				Label	PP	0.570
				Label	PP	0.300
Juice	**350**	**Boost**	**350ml PET**	Bottle	PET	16.5
				Cap	HDPE	3.00
				Cap	HDPE	0.530

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Label	PP	0.497
Juice	**500**	**Nippys**	**500ml PET**	Bottle	PET	23.0
				Cap	HDPE	2.47
				Cap	HDPE	0.613
				Label	PP	0.780
Juice	**500**	**Mildura**	**500ml PET**	Bottle	PET	22.3
				Cap	HDPE	3.21
				Cap	HDPE	0.570
				Label	PP	0.620
Juice	**500**	**Coles**	**500ml PET**	Bottle	PET	25.5
				Cap	HDPE	3.16
				Cap	HDPE	0.607
				Label	PP	0.657
				Label	PP	0.350
Juice	**2000**	**Coles**	**2L HDPE**	Bottle	HDPE	47.7
				Cap	HDPE	2.83
				Cap	HDPE	0.570
				Label	PP	0.887
Juice	**2000**	**Daily Juice**	**2L HDPE**	Bottle	HDPE	55.3
				Cap	HDPE	4.03
				Cap	HDPE	0.560
				Label	PP	1.05
Juice	**2000**	**Nippy's**	**2L HDPE**	Bottle	HDPE	47.1
				Cap	HDPE	2.97
				Cap	HDPE	0.567
				Label	PP	1.57

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
Juice	**500**	**Ribena**	**500ml PET**	Bottle	PET	23.3
				Cap	HDPE	2.80
				Cap	HDPE	0.457
				Label	PP	2.43
Juice	**450**	**Nippy's**	**500ml PET**	Bottle	PET	19.5
				Cap	HDPE	3.04
				Cap	HDPE	0.527
				Label	PP	1.93
Juice	**500**	**Aloe mate**	**500ml PET**	Bottle	PET	32.7
				Cap	HDPE	1.86
				Cap	HDPE	0.493
				Label	PP	2.49
Juice	**1250**	**Just juice bubbles**	**1.25L PET**	Bottle	PET	52.2
				Cap	HDPE	1.95
				Cap	HDPE	0.353
				Label	PP	1.05
Juice	**1250**	**H2 Juice**	**1.25L PET**	Bottle	PET	78.4
				Cap	HDPE	3.27
				Cap	HDPE	0.497
				Label	PP	4.26
Juice	**1250**	**v8 Breakfast Juice**	**1.25L PET**	Bottle	PET	54.1
				Cap	HDPE	3.16
				Cap	HDPE	0.523
				Label	PP	3.84
Juice	**350**	**Chia Sister's Fruit Smoothie**	**350ml Glass**	Bottle	Glass	182

Beverage	Volume (mL)	Product	Packaging type	Component	Primary material	Mass (g)
				Cap	St stamp and bend	0.987
				Label	Cardboard / paper	
				Cap	St stamp and bend	0.260
				Label	PVC	0.317
Juice	**360**	**Wild One Organic Juice**	**350ml Glass**	Bottle	Glass	189
				Cap	St stamp and bend	4.81
				Label	PP	0.823
Juice	**350**	**Joe's Classics**	**350ml Glass**	Bottle	Glass	175
				Cap	St stamp and bend	4.26
				Label	PP	1.30

Annex B Life cycle inventory data

B.3. Packaging metrics - Tetra Pak packs

Packaging metrics for Tetra Pak packs in Oceania

Beverage	Volume (mL)	Pack	Pack mass (g)	Volume to mass ratio (ml/g)	Plastic per litre (g/L)
Milk	750	Tetra Rex 750ml OSO34 Chilled	22.0	34.1	8.61
Milk	1000	Tetra Brik Slim Aseptic 1L HC23 Ambient	33.2	30.1	9.04
Milk	1000	Tetra Brik Edge Aseptic 1L LC30 Ambient ·	30.7	32.6	6.63
Milk	1000	Tetra Brik Edge Aseptic 1L LW30 Ambient	30.9	32.3	6.88
Milk	1000	Tetra Brik Square Aseptic 1L HC27	35.2	28.4	10.5
Milk	1000	Tetra Top 1L C38 Chilled	25.3	39.5	6.18
Milk	1000	Tetra Top 1L C38 Chilled - plant based	25.3	39.5	6.18
Milk	1000	Tetra Rex 1L OSO34 Chilled - plant based	24.3	41.2	6.76
Milk	900	Tetra Brik Ultra Edge 900ml WC30	33.1	27.2	7.35
Milk	1500	Tetra Brik Edge Aseptic 1.5L Ambient	32.1	46.7	4.69
Juice	2000	Tetra Rex 2L	33.4	59.8	5.70
Juice	250	Tetra Prisma Edge Aseptic 250ml DC26 -	14.7	17.0	25.1
RTD Coffee	250	Tetra Brik Base Aseptic 250ml paper	6.93	36.1	4.99
RTD Coffee	300	Tetra Prisma Edge Aseptic 300ml DC26 -	15.2	19.7	21.5
RTD Coffee	300	Tetra Prisma Edge Aseptic 300ml DC26 -	15.2	19.7	21.5
RTD Coffee	330	Tetra Top C38 330ml - carton	13.7	24.1	15.0

Beverage	Volume (mL)	Pack	Pack mass (g)	Volume to mass ratio (ml/g)	Plastic per litre (g/L)
RTD Coffee	330	Tetra Prisma SQ Aseptic 330ml DC26 -	16.5	20.0	20.7
RTD Coffee	500	Tetra Prisma Edge Aseptic 500ml DC26 -	22.2	22.5	15.4
RTD Coffee	500	Tetra Top 500ml C38 - carton	17.4	28.8	11.3
RTD Coffee	500	Tetra Top 500ml C38 - plant based	17.4	28.8	11.3
Juice	200	Tetra Brik Base Crystal Aseptic 200ml	10.7	18.7	13.0
Milk	250	Tetra Brik Slim Aseptic 250ml Ambient	9.86	25.4	7.93
Juice	1000	Tetra Stelo Aseptic 1L WC - carton	31.5	31.7	6.93
Juice	1000	Tetra Pak Square Aseptic 1L HC27	35.2	28.4	10.5
Juice	1000	Tetra Rex 1L - carton	16.7	60.0	2.46
Juice	2000	Tetra Rex 2L - plant based	28.7	69.7	3.34

Annex B Life cycle inventory data

B.4. Packaging metrics - competitor packs

Packaging metrics for competitor packs in Oceania

Beverage	Volume (mL)	Pack	Pack mass (g)	Volume to mass ratio (ml/g)	Plastic per litre (g/L)
Milk	**1000**	**1L HDPE**	38.3	26.1	38.3
Milk	**1000**	**1L PET**	45.8	21.8	45.8
Milk	**1000**	**1L Glass**	466	2.15	0.130
Milk	**2000**	**2L HDPE**	42.3	47.3	21.2
Milk	**750**	**750ml PET**	39.2	19.1	52.2
Milk	**1500**	**1.5L PET**	55.3	27.1	36.9
Milk	**1500**	**1.5L rPET**	52.7	28.4	35.2
Milk	**750**	**750ml rPET**	37.0	20.3	49.3
Milk	**1000**	**1L rPET**	38.9	25.7	38.9
RTD Coffee and FSN	**237**	**237ml Can**	12.4	19.2	0
RTD Coffee and FSN	**300**	**300ml PET**	27.8	10.8	92.6
RTD Coffee and FSN	**330**	**330ml PET**	33.1	9.97	100
RTD Coffee and FSN	**500**	**500ml rPET**	24.5	20.4	49.0
RTD Coffee and FSN	**500**	**500ml HDPE**	28.3	17.6	56.7
RTD Coffee and FSN	**350**	**500ml PET**	37.5	9.33	107
RTD Coffee and FSN	**375**	**375ml PET**	27.5	13.6	73.3
Juice	**250**	**250ml PET**	24.1	10.4	96.5

Beverage	Volume (mL)	Pack	Pack mass (g)	Volume to mass ratio (ml/g)	Plastic per litre (g/L)
Juice	**250**	**250ml Glass**	164	1.53	2.71
Juice	**200**	**200ml Pouch**	10.3	19.3	45.5
Juice	**1000**	**1L Glass**	519	1.93	2.08
Juice	**1000**	**1L PET**	42.6	23.4	42.6
Juice	**1000**	**1L PET**	43.9	22.8	43.9
Juice	**1500**	**2L PET**	72.9	20.6	48.6
Juice	**350**	**350ml PET**	25.2	13.9	72.0
Juice	**500**	**500ml PET**	28.0	17.9	55.9
Juice	**2000**	**2L HDPE**	55.1	36.3	27.5
Juice	**500**	**500ml PET**	30.5	16.4	61.0
Juice	**1250**	**1.25L PET**	67.9	18.4	54.3
Juice	**350**	**350ml Glass**	187	1.88	3.93

Annex B Life cycle inventory data

B.5.1. Secondary packaging assumptions for competitor packs

Secondary packaging assumptions used for all competitor packs in Oceania

Beverage	Volume (mL)	Country	Pack	Material	Mass (g)	Number of packs	Use cycles
Milk	**1000**	**AU/NZ**	**1L HDPE**	HDPE tray	1,580	16.0	50
Milk	**1000**	**AU/NZ**	**1L PET**	HDPE tray	1,580	16.0	50
Milk	**1000**	**AU/NZ**	**1L Glass**	HDPE tray	1,580	16.0	50
Milk	**2000**	**AU/NZ**	**2L HDPE**	HDPE tray	1,580	9.00	50
Milk	**750**	**AU/NZ**	**750ml PET**	HDPE tray	1,580	16.0	50
Milk	**1500**	**AU/NZ**	**1.5L PET**	HDPE tray	1,580	16.0	50
Milk	**1500**	**AU/NZ**	**1.5L rPET**	HDPE tray	1,580	16.0	50
Milk	**750**	**AU/NZ**	**750ml rPET**	HDPE tray	1,580	16.0	50
Milk	**1000**	**AU/NZ**	**1L rPET**	HDPE tray	1,580	16.0	50
RTD Coffee and FSN	**237**	**AU/NZ**	**237ml Can**	Carton box	175	24.0	1
RTD Coffee and FSN	**300**	**AU/NZ**	**300ml PET**	Carton box	87.7	6.00	1
RTD Coffee and FSN	**330**	**AU/NZ**	**330ml PET**	Carton box	87.7	6.00	1
RTD Coffee and FSN	**500**	**AU/NZ**	**500ml rPET**	Carton box	230	12.0	1
RTD Coffee and FSN	**500**	**AU/NZ**	**500ml HDPE**	Carton box	230	12.0	1
RTD Coffee and FSN	**350**	**AU/NZ**	**500ml PET**	Carton box	230	12.0	1
RTD Coffee and FSN	**375**	**AU/NZ**	**375ml PET**	Carton box	84.3	6.00	1
Juice	**250**	**AU/NZ**	**250ml PET**	Plastic wrap	7.36	6.00	1

Beverage	Volume (mL)	Country	Pack	Material	Mass (g)	Number of packs	Use cycles
Juice	**250**	**AU/NZ**	**250ml Glass**	Carton box	228	12.0	1
Juice	**200**	**AU/NZ**	**200ml Pouch**	Carton box	172	24.0	1
Juice	**1000**	**AU/NZ**	**1L Glass**	Carton box	260	6.00	1
Juice	**1000**	**AU/NZ**	**1L PET**	Carton box	158	6.00	1
Juice	**1000**	**AU/NZ**	**1L PET**	Carton box	230	12.0	1
Juice	**1500**	**AU/NZ**	**2L PET**	Carton box	300	8.00	1
Juice	**350**	**AU/NZ**	**350ml PET**	Carton box	87.7	6.00	1
Juice	**500**	**AU/NZ**	**500ml PET**	Carton box	300	8.00	1
Juice	**2000**	**AU/NZ**	**2L HDPE**	Carton box	228	12.0	1
Juice	**500**	**AU/NZ**	**500ml PET**	Carton box	300	8.00	1
Juice	**1250**	**AU/NZ**	**1.25L PET**	Carton box	192	6.00	1
Juice	**350**	**AU/NZ**	**350ml Glass**	Carton box	228	12.0	1.00

Annex B Life cycle inventory data

B.5.2. Secondary packaging assumptions for Tetra Pak cartons

Secondary packaging used for all Tetra Pak packs in Oceania

Beverage	Volume (mL)	Country	Pack	Material	Mass (g)	Number of packs	Use cycles
Milk	**1000**	**AU/NZ**	**Tetra Brik Slim Aseptic 1L HC23 Ambient**	Carton box	300	12.0	1
Milk	**1000**	**AU/NZ**	**Tetra Brik Edge Aseptic 1L LC30 Ambient - carton**	Carton box	300	10.0	1
Milk	**1000**	**AU/NZ**	**Tetra Brik Edge Aseptic 1L LW30 Ambient - plant based**	Carton box	300	10.0	1
Milk	**1000**	**AU/NZ**	**Tetra Brik Square Aseptic 1L HC27 Ambient**	Carton box	300	10.0	1
Milk	**1000**	**AU/NZ**	**Tetra Top 1L C38 Chilled**	HDPE tray	1,580	16.0	50
Milk	**1000**	**AU/NZ**	**Tetra Top 1L C38 Chilled - plant based**	HDPE tray	1,580	16.0	50
Milk	**1000**	**AU/NZ**	**Tetra Rex 1L OSO34 Chilled - plant based**	HDPE tray	1,580	16.0	50
Milk	**1500**	**AU/NZ**	**Tetra Brik Edge Aseptic 1.5L Ambient WC30 - carton**	HDPE tray	1,580	16.0	50
Milk	**900**	**AU/NZ**	**Tetra Brik Ultra Edge 900ml WC30 Chilled**	HDPE tray	1,580	16.0	50
Milk	**750**	**AU/NZ**	**Tetra Rex 750ml OSO34 Chilled**	HDPE tray	1,580	16.0	50
Milk	**250**	**AU/NZ**	**Tetra Brik Slim Aseptic 250ml Ambient**	Carton box	250	24.0	1
RTD Coffee and FSN	**300**	**AU/NZ**	**Tetra Prisma Edge Aseptic 300ml DC26 - carton**	Carton box	250	18.0	1
RTD Coffee and FSN	**300**	**AU/NZ**	**Tetra Prisma Edge Aseptic 300ml DC26 - plant based**	Carton box	250	18.0	1
RTD Coffee and FSN	**330**	**AU/NZ**	**Tetra Prisma SQ Aseptic 330ml DC26 - carton**	Carton box	250	18.0	1

Beverage	Volume (mL)	Country	Pack	Material	Mass (g)	Number of packs	Use cycles
RTD Coffee and FSN	330	AU/NZ	Tetra Top C38 330ml - carton	Carton box	250	18.0	1
RTD Coffee and FSN	500	AU/NZ	Tetra Prisma Edge Aseptic 500ml DC26 - carton	Carton box	275	12.0	1
RTD Coffee and FSN	500	AU/NZ	Tetra Top 500ml C38 - carton	Carton box	275	12.0	1
RTD Coffee and FSN	500	AU/NZ	Tetra Top 500ml C38 - plant based	Carton box	275	12.0	1
RTD Coffee and FSN	250	AU/NZ	Tetra Brik Base Aseptic 250ml paper straw	Carton box	250	24.0	1
Juice	200	AU/NZ	Tetra Brik Base Crystal Aseptic 200ml paper straw - carton	Carton box	250	24.0	1
Juice	250	AU/NZ	Tetra Prisma Edge Aseptic 250ml DC26 - carton	Carton box	250	24.0	1
Juice	1000	AU/NZ	Tetra Stelo Aseptic 1L WC - carton	Carton box	300	10.0	1
Juice	1000	AU/NZ	Tetra Rex 1L - carton	Carton box	300	8.00	1
Juice	2000	AU/NZ	Tetra Rex 2L	Carton box	300	6.00	1
Juice	2000	AU/NZ	Tetra Rex 2L - plant based	Carton box	300	6.00	1
Juice	1000	AU/NZ	Tetra Pak Square Aseptic 1L HC27	Carton box	300	10.0	1

Annex B Life cycle inventory data

B.6.1. Tertiary packaging assumptions for competitor packs

Tertiary packaging assumptions used for all competitor packs in Oceania

Beverage	Volume (mL)	Country	Pack	Material	Mass (g)	Number of secondary packages	Use cycles
Milk	1000	AU/NZ	1L HDPE	Wooden pallet	38,500	36	5
Milk	1000	AU/NZ	1L PET	Wooden pallet	38,500	36	5
Milk	1000	AU/NZ	1L Glass	Wooden pallet	38,500	36	5
Milk	2000	AU/NZ	2L HDPE	Wooden pallet	38,500	36	5
Milk	750	AU/NZ	750ml PET	Wooden pallet	38,500	36	5
Milk	1500	AU/NZ	1.5L PET	Wooden pallet	38,500	36	5
Milk	1500	AU/NZ	1.5L rPET	Wooden pallet	38,500	36	5
Milk	750	AU/NZ	750ml rPET	Wooden pallet	38,500	36	5
Milk	1000	AU/NZ	1L rPET	Wooden pallet	38,500	36	5
RTD Coffee and FSN	237	AU/NZ	237ml Can	Wooden pallet	38,500	165	5
RTD Coffee and FSN	300	AU/NZ	300ml PET	Wooden pallet	38,500	518	5
RTD Coffee and FSN	330	AU/NZ	330ml PET	Wooden pallet	38,500	518	5
RTD Coffee and FSN	500	AU/NZ	500ml rPET	Wooden pallet	38,500	36	5
RTD Coffee and FSN	500	AU/NZ	500ml HDPE	Wooden pallet	38,500	36	5
RTD Coffee and FSN	350	AU/NZ	500ml PET	Wooden pallet	38,500	36	5
RTD Coffee and FSN	375	AU/NZ	375ml PET	Wooden pallet	38,500	474	5
Juice	250	AU/NZ	250ml PET	Wooden pallet	38,500	711	5

Juice	**250**	**AU/NZ**	**250ml Glass**	Wooden pallet	38,500	228	5
Juice	**200**	**AU/NZ**	**200ml Pouch**	Wooden pallet	38,500	230	5
Juice	**1000**	**AU/NZ**	**1L Glass**	Wooden pallet	38,500	127	5
Juice	**1000**	**AU/NZ**	**1L PET**	Wooden pallet	38,500	178	5
Juice	**1000**	**AU/NZ**	**1L PET**	Wooden pallet	38,500	36	5
Juice	**1500**	**AU/NZ**	**2L PET**	Wooden pallet	38,500	36	5
Juice	**350**	**AU/NZ**	**350ml PET**	Wooden pallet	38,500	174	5
Juice	**500**	**AU/NZ**	**500ml PET**	Wooden pallet	38,500	36	5
Juice	**2000**	**AU/NZ**	**2L HDPE**	Wooden pallet	38,500	228	5
Juice	**500**	**AU/NZ**	**500ml PET**	Wooden pallet	38,500	36	5
Juice	**1250**	**AU/NZ**	**1.25L PET**	Wooden pallet	38,500	140	5
Juice	**350**	**AU/NZ**	**350ml Glass**	Wooden pallet	38,500	228	5

Annex B Life cycle inventory data

B.6.2. Tertiary packaging assumptions for Tetra Pak cartons

Tertiary packaging assumptions used for all Tetra Pak cartons in Oceania

Beverage	Volume (mL)	Country	Pack	Material	Mass (g)	Number of secondary packages	Use cycles
Milk	1000	AU/NZ	Tetra Brik Slim Aseptic 1L HC23 Ambient	Wooden pallet	38,500	90	5
Milk	1000	AU/NZ	Tetra Brik Edge Aseptic 1L LC30 Ambient - carton	Wooden pallet	38,500	105	5
Milk	1000	AU/NZ	Tetra Brik Edge Aseptic	Wooden pallet	38,500	105	5
Milk	1000	AU/NZ	Tetra Brik Square	Wooden pallet	38,500	105	5
Milk	1000	AU/NZ	Tetra Top 1L C38	Wooden pallet	38,500	36	5
Milk	1000	AU/NZ	Tetra Top 1L C38	Wooden pallet	38,500	36	5
Milk	1000	AU/NZ	Tetra Rex 1L OSO34	Wooden pallet	38,500	36	5
Milk	1500	AU/NZ	Tetra Brik Edge Aseptic	Wooden pallet	38,500	36	5
Milk	900	AU/NZ	Tetra Brik Ultra Edge	Wooden pallet	38,500	36	5
Milk	750	AU/NZ	Tetra Rex 750ml OSO34	Wooden pallet	38,500	36	5
Milk	250	AU/NZ	Tetra Brik Slim Aseptic	Wooden pallet	38,500	144	5
RTD Coffee	300	AU/NZ	Tetra Prisma Edge	Wooden pallet	38,500	168	5
RTD Coffee	300	AU/NZ	Tetra Prisma Edge	Wooden pallet	38,500	168	5

Beverage	Volume (mL)	Country	Pack	Material	Mass (g)	Number of secondary packages	Use cycles
RTD Coffee	330	AU/NZ	Tetra Prisma SQ	Wooden pallet	38,500	144	5
RTD Coffee	330	AU/NZ	Tetra Top C38 330ml -	Wooden pallet	38,500	126	5
RTD Coffee	500	AU/NZ	Tetra Prisma Edge	Wooden pallet	38,500	147	5
RTD Coffee	500	AU/NZ	Tetra Top 500ml C38 -	Wooden pallet	38,500	130	5
RTD Coffee	500	AU/NZ	Tetra Top 500ml C38 -	Wooden pallet	38,500	130	5
RTD Coffee	250	AU/NZ	Tetra Brik Base Aseptic	Wooden pallet	38,500	160	5
Juice	200	AU/NZ	Tetra Brik Base Crystal	Wooden pallet	38,500	208	5
Juice	250	AU/NZ	Tetra Prisma Edge	Wooden pallet	38,500	152	5
Juice	1000	AU/NZ	Tetra Stelo Aseptic 1L	Wooden pallet	38,500	105	5
Juice	1000	AU/NZ	Tetra Rex 1L - carton	Wooden pallet	38,500	96	5
Juice	2000	AU/NZ	Tetra Rex 2L	Wooden pallet	38,500	80	5
Juice	2000	AU/NZ	Tetra Rex 2L - plant	Wooden pallet	38,500	80	5
Juice	1000	AU/NZ	Tetra Pak Square	Wooden pallet	38,500	90	5

Annex B Life cycle inventory data

B.7. Filling data assumptions

Filling data assumptions for all competitor packs in Oceania

Beverage	Volume (mL)	Country	Pack	Electricity (kWh)	Water (L)	Natural gas (MJ)	Hydrogen peroxide (L)
Milk	**1000**	**AU/NZ**	**1L HDPE**	0.00454	0.00118	0	1.10E-04
Milk	**1000**	**AU/NZ**	**1L PET**	0.00454	0.00118	0	1.10E-04
Milk	**1000**	**AU/NZ**	**1L Glass**	0.00454	0.00118	0	1.10E-04
Milk	**2000**	**AU/NZ**	**2L HDPE**	0.00636	0.00165	0	1.50E-04
Milk	**750**	**AU/NZ**	**750ml PET**	0.00454	0.00118	0	1.10E-04
Milk	**1500**	**AU/NZ**	**1.5L PET**	0.00636	0.00165	0	1.50E-04
Milk	**1500**	**AU/NZ**	**1.5L rPET**	0.00636	0.00165	0	1.50E-04
Milk	**750**	**AU/NZ**	**750ml rPET**	0.00454	0.00118	0	1.10E-04
Milk	**1000**	**AU/NZ**	**1L rPET**	0.00454	0.00118	0	1.10E-04
RTD Coffee	**237**	**AU/NZ**	**237ml Can**	0.00442	8.80E-04	0	1.50E-04
RTD Coffee	**300**	**AU/NZ**	**300ml PET**	0.00454	0.00118	0.00111	4.50E-04
RTD Coffee	**330**	**AU/NZ**	**330ml PET**	0.00454	0.00118	0.00111	4.50E-04
RTD Coffee	**500**	**AU/NZ**	**500ml rPET**	0.00454	0.00118	0.00111	4.50E-04
RTD Coffee	**500**	**AU/NZ**	**500ml HDPE**	0.00454	0.00118	0.00111	4.50E-04
RTD Coffee	**350**	**AU/NZ**	**500ml PET**	0.00454	0.00118	0.00111	4.50E-04
RTD Coffee	**375**	**AU/NZ**	**375ml PET**	0.00454	0.00118	0.00111	4.50E-04
Juice	**250**	**AU/NZ**	**250ml PET**	0.00442	8.80E-04	0	1.50E-04

Beverage	Volume (mL)	Country	Pack	Electricity (kWh)	Water (L)	Natural gas (MJ)	Hydrogen peroxide (L)
Juice	**250**	**AU/NZ**	**250ml Glass**	0.00442	8.80E-04	0	1.50E-04
Juice	**200**	**AU/NZ**	**200ml Pouch**	0.00806	8.80E-04	9.40E-04	1.50E-04
Juice	**1000**	**AU/NZ**	**1L Glass**	0.00454	0.00118	0.00111	4.50E-04
Juice	**1000**	**AU/NZ**	**1L PET**	0.00454	0.00118	0.00111	4.50E-04
Juice	**1000**	**AU/NZ**	**1L PET**	0.00454	0.00118	0	1.10E-04
Juice	**1500**	**AU/NZ**	**2L PET**	0.00636	0.00165	0	1.50E-04
Juice	**350**	**AU/NZ**	**350ml PET**	0.00454	0.00118	0	1.10E-04
Juice	**500**	**AU/NZ**	**500ml PET**	0.00454	0.00118	0	1.10E-04
Juice	**2000**	**AU/NZ**	**2L HDPE**	0.00636	0.00165	0	1.50E-04
Juice	**500**	**AU/NZ**	**500ml PET**	0.00454	0.00118	0.00111	4.50E-04
Juice	**1250**	**AU/NZ**	**1.25L PET**	0.00636	0.00165	0.00156	6.30E-04
Juice	**350**	**AU/NZ**	**350ml Glass**	0.00454	0.00118	0	1.10E-04

Annex B Life cycle inventory data

B.8.1. Primary packaging material transport distance assumptions for competitor packs

Primary packaging material transport distance assumptions for competitor packs in Oceania

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
Milk	**750**	**Australia**	**750ml PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Milk	**750**	**Australia**	**750ml rPET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Milk	**750**	**New Zealand**	**750ml PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Milk	**750**	**New Zealand**	**750ml rPET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Milk	**1000**	**Australia**	**1L HDPE**	Local	Melbourne	HDPE	330	0
						HDPE	330	0
						PP	330	0
Milk	**1000**	**Australia**	**1L PET**	Local	Melbourne	PET	330	0

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						HDPE	330	0
						PP	330	0
Milk	**1000**	**Australia**	**1L Glass**	Local	Melbourne	Glass	330	0
						St stamp and bend	330	0
						PP	330	0
Milk	**1000**	**Australia**	**1L rPET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Milk	**1000**	**New Zealand**	**1L HDPE**	Local	Auckland	HDPE	325	0
						HDPE	325	0
						PP	325	0
Milk	**1000**	**New Zealand**	**1L PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Milk	**1000**	**New Zealand**	**1L Glass**	Local	Auckland	Glass	325	0
						St stamp and bend	325	0
						PP	325	0
Milk	**1000**	**New Zealand**	**1L rPET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Milk	**1500**	**Australia**	**1.5L PET**	Local	Melbourne	PET	330	0
						HDPE	330	0

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						PP	330	0
Milk	**1500**	**Australia**	**1.5L rPET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Milk	**1500**	**New Zealand**	**1.5L PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Milk	**1500**	**New Zealand**	**1.5L rPET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Milk	**2000**	**Australia**	**2L HDPE**	Local	Melbourne	HDPE	330	0
						PE low density (LDPE)	330	0
						HDPE	330	0
						PP	330	0
Milk	**2000**	**New Zealand**	**2L HDPE**	Local	Auckland	HDPE	325	0
						PE low density (LDPE) film	325	0
						HDPE	325	0
						PP	325	0
RTD Coffee	**237**	**Australia**	**237ml Can**	China	Melbourne	Al can	480	10342

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
RTD Coffee and FSN	**237**	**Australia**	**237ml Can**	China	Melbourne	Al can	480	10342
RTD Coffee and FSN	**237**	**New Zealand**	**237ml Can**	China	Auckland	Al can	675	12295
RTD Coffee and FSN	**237**	**New Zealand**	**237ml Can**	China	Auckland	Al can	675	12295
RTD Coffee and FSN	**300**	**Australia**	**300ml PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
RTD Coffee and FSN	**300**	**New Zealand**	**300ml PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
RTD Coffee and FSN	**330**	**Australia**	**330ml PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
RTD	**375**	**Australia**	**375ml PET**	Local	Melbourne	PET	330	0

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						HDPE	330	0
						PP	330	0
RTD	**330**	**New Zealand**	**330ml PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
RTD	**375**	**New Zealand**	**375ml PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
RTD Coffee and FSN	**500**	**Australia**	**500ml rPET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
RTD Coffee and FSN	**500**	**Australia**	**500ml HDPE**	Local	Melbourne	HDPE	330	0
						HDPE	330	0
						PP	330	0
RTD	**350**	**Australia**	**500ml PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
RTD Coffee and FSN	**500**	**New Zealand**	**500ml rPET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
RTD	**500**	**New Zealand**	**500ml HDPE**	Local	Auckland	HDPE	325	0
						HDPE	325	0
						PP	325	0
RTD Coffee	**350**	**New Zealand**	**500ml PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Juice	**250**	**Australia**	**250ml PET**	Local	Melbourne	PET	330	0
						PE low density (LDPE) film	330	0
						HDPE	330	0
						PP	330	0
Juice	**250**	**Australia**	**250ml Glass**	Local	Melbourne	Glass	330	0
						St stamp and bend	330	0
						PP	330	0
Juice	**200**	**Australia**	**200ml Pouch**	Local	Melbourne	PP	330	0
						Aluminium foil	480	10342
						PE low density (LDPE) film	330	0

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						PP	330	0
Juice	**250**	**New Zealand**	**250ml PET**	Local	Auckland	PET	325	0
						PE low density (LDPE)	325	0
						HDPE	325	0
						PP	325	0
Juice	**250**	**New Zealand**	**250ml Glass**	Local	Auckland	Glass	325	0
						St stamp and bend	325	0
						PP	325	0
Juice	**200**	**New Zealand**	**200ml Pouch**	Local	Auckland	PP	325	0
						Aluminium foil	675	12295
						PE low density (LDPE) film	325	0
						PP	325	0
Juice	**350**	**Australia**	**350ml PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Juice	**350**	**Australia**	**350ml Glass**	Local	Melbourne	Glass	330	0
						St stamp and bend	330	0
						PP	330	0
						PVC	330	0
Juice	**350**	**New Zealand**	**350ml PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
Juice	**350**	**New Zealand**	**350ml Glass**	Local	Auckland	Glass	325	0
						St stamp and bend	325	0
						PP	325	0
						PVC	325	0
Juice	**500**	**Australia**	**500ml PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Juice	**500**	**New Zealand**	**500ml PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Juice	**500**	**Australia**	**500ml PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Juice	**500**	**New Zealand**	**500ml PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Juice	**1000**	**Australia**	**1L Glass**	Local	Melbourne	Glass	330	0
						St stamp and bend	330	0
						Cardboard / paper	330	0
						PP	330	0
						PVC	330	0
Juice	**1000**	**Australia**	**1L PET**	Local	Melbourne	PET	330	0
						PE low density (LDPE) film	330	0
						HDPE	330	0

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						PP	330	0
Juice	**1000**	**New Zealand**	**1L Glass**	Local	Auckland	Glass	325	0
						St stamp and bend	325	0
						Cardboard / paper	325	0
						PP	325	0
						PVC	325	0
Juice	**1000**	**New Zealand**	**1L PET**	Local	Auckland	PET	325	0
						PE low density (LDPE) film	325	0
						HDPE	325	0
						PP	325	0
Juice	**1000**	**Australia**	**1L PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Juice	**1000**	**New Zealand**	**1L PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Juice	**1250**	**Australia**	**1.25L PET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0
Juice	**1250**	**New Zealand**	**1.25L PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Juice	**1500**	**Australia**	**2L PET**	Local	Melbourne	PET	330	0
						HDPE	330	0

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						PP	330	0
Juice	**2000**	**Australia**	**2L HDPE**	Local	Melbourne	HDPE	330	0
						HDPE	330	0
						PP	330	0
Juice	**1500**	**New Zealand**	**2L PET**	Local	Auckland	PET	325	0
						HDPE	325	0
						PP	325	0
Juice	**2000**	**New Zealand**	**2L HDPE**	Local	Auckland	HDPE	325	0
						HDPE	325	0
						PP	325	0
Milk	**750**	**Australia**	**750ml rPET**	Local	Melbourne	PET	330	0
						HDPE	330	0
						PP	330	0

Annex B Life cycle inventory data

B.8.2 Primary packaging material transport distance assumptions for Tetra Pak cartons

Primary packaging material transport distance assumptions for Tetra Pak cartons in Oceania

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
Milk	**750**	**Australia**	**Tetra Rex 750ml OSO34 Chilled**	Sweden	Melbourne	Paper	622	25443
						PE low density (LDPE) film	615	49706
						HDPE	1060	47124
Milk	**750**	**New**	**Tetra Rex**	Sweden	Melbourne	Paper	622	25443
						PE low density (LDPE) film	615	49706
						HDPE	1060	47124
Milk	**1000**	**Australia**	**Tetra Brik**	Sweden	Sydney	Paper	342	36353
						PE low density (LDPE) film	335	12664
						Aluminium foil	780	10918
						HDPE	780	10918
Milk	**1000**	**Australia**	**Tetra Brik**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
Milk	**1000**	**Australia**	**Tetra Brik**	Sweden	Melbourne	Paper	342	37516
						Bio LDPE film	335	13827
						Aluminium foil	780	12081
						HDPE (sugar cane)	630	35684
Milk	**1000**	**Australia**	**Tetra Brik**	Sweden	Melbourne	Paper	462	34099
						PE low density (LDPE) film	455	44830
						Aluminium foil	900	42081
						HDPE	900	42081
Milk	**1000**	**New**	**Tetra Brik**	Sweden	Sydney	Paper	342	36353
						PE low density (LDPE) film	335	12664
						Aluminium foil	780	10918
						HDPE	780	10918
Milk	**1000**	**New**	**Tetra Brik**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
Milk	**1000**	**New**	**Tetra Brik**	Sweden	Melbourne	Paper	342	37516
						Bio LDPE film	335	13827
						Aluminium foil	780	12081
						HDPE (sugar cane)	630	35684
Milk	**1000**	**New**	**Tetra Brik**	Sweden	Melbourne	Paper	462	34099
						PE low density (LDPE) film	455	44830

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						Aluminium foil	900	42081
						HDPE	900	42081
Milk	**1000**	**Australia**	**Tetra Top 1L**	Sweden	Melbourne	Paper	72	32097
						PE low density (LDPE) film	65	41514
						HDPE	510	38933
Milk	**1000**	**Australia**	**Tetra Top 1L**	Sweden	Melbourne	Paper	72	32097
						Bio LDPE film	65	41514
						HDPE (sugar cane)	360	30265
Milk	**1000**	**Australia**	**Tetra Rex 1L**	Sweden	Melbourne	Paper	142	33490
						Bio LDPE film	135	11927
						HDPE (sugar cane)	430	31658
Milk	**900**	**Australia**	**Tetra Brik**	Sweden	Melbourne	Paper	102	27487
						PE low density (LDPE) film	95	36740
						Aluminium foil	540	34158
						HDPE	540	34158
Milk	**1000**	**Australia**	**Tetra Brik**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
Milk	**1000**	**New Zealand**	**Tetra Top 1L C38 Chilled**	Sweden	Melbourne	Paper	72	32097
						PE low density (LDPE) film	65	41514
						HDPE	510	38933

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
Milk	**1000**	**New Zealand**	**Tetra Top 1L C38 Chilled - plant based**	Sweden	Melbourne	Paper	72	32097
						Bio LDPE film	65	41514
						HDPE (sugar cane)	360	30265
Milk	**1000**	**New Zealand**	**Tetra Rex 1L OSO34 Chilled - plant based**	Sweden	Melbourne	Paper	142	33490
						Bio LDPE film	135	11927
						HDPE (sugar cane)	430	31658
Milk	**900**	**New Zealand**	**Tetra Brik Ultra Edge 900ml WC30 Chilled**	Sweden	Melbourne	Paper	102	27487
						PE low density (LDPE) film	95	36740
						Aluminium foil	540	34158
						HDPE	540	34158
Milk	**1000**	**New**	**Tetra Brik**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
Milk	**1500**	**Australia**	**Tetra Brik**	Sweden	Melbourne	Paper	812	26385

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						PE low density (LDPE) film	805	47696
						Aluminium foil	1250	45115
						HDPE	1250	45115
Milk	**1500**	**New**	**Tetra Brik**	Sweden	Melbourne	Paper	812	26385
						PE low density (LDPE) film	805	47696
						Aluminium foil	1250	45115
						HDPE	1250	45115
Juice	**2000**	**Australia**	**Tetra Rex 2L**	Sweden	Melbourne	Paper	622	25443
						HDPE	1060	47124
						PE low density (LDPE) film	615	49706
Juice	**2000**	**New**	**Tetra Rex 2L**	Sweden	Melbourne	Paper	622	25443
						HDPE	1060	47124
						PE low density (LDPE) film	615	49706
Juice	**250**	**Australia**	**Tetra Prisma Edge Aseptic**	Sweden	Melbourne	Paper	342	37516
						Aluminium foil	780	12081
						PE low density (LDPE) film	335	13827
						HDPE	780	12081
RTD	**250**	**Australia**	**Tetra Brik**	Sweden	Melbourne	Paper	1042	27158
						PE low density (LDPE) film	1035	40474
						Aluminium foil	1480	37892
						Cardboard / paper	1042	27158

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
Juice	**250**	**New Zealand**	**Tetra Prisma Edge Aseptic 250ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						Aluminium foil	780	12081
						PE low density (LDPE) film	335	13827
						HDPE	780	12081
RTD Coffee and FSN	**250**	**New Zealand**	**Tetra Brik Base Aseptic 250ml paper straw**	Sweden	Melbourne	Paper	1042	27158
						PE low density (LDPE) film	1035	40474
						Aluminium foil	1480	37892
						Cardboard / paper	1042	27158
RTD Coffee and FSN	**300**	**Australia**	**Tetra Prisma Edge Aseptic 300ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
RTD Coffee and FSN	**300**	**Australia**	**Tetra Prisma Edge Aseptic 300ml DC26 - plant based**	Sweden	Melbourne	Paper	342	37516
						Bio LDPE film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**300**	**New Zealand**	**Tetra Prisma Edge Aseptic 300ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**300**	**New Zealand**	**Tetra Prisma Edge Aseptic 300ml DC26 - plant based**	Sweden	Melbourne	Paper	342	37516
						Bio LDPE film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD	**330**	**Australia**	**Tetra Top**	Sweden	Melbourne	Paper	72	32097
						PE low density (LDPE) film	65	41514

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						HDPE	510	38933
RTD	**330**	**Australia**	**Tetra Prisma**	Sweden	Melbourne	Paper	362	34877
						PE low density (LDPE) film	355	11897
						Aluminium foil	800	10823
						HDPE	800	10823
RTD Coffee and FSN	**330**	**New Zealand**	**Tetra Top C38 330ml - carton**	Sweden	Melbourne	Paper	72	32097
						PE low density (LDPE) film	65	41514
						HDPE	510	38933
RTD Coffee and FSN	**330**	**New Zealand**	**Tetra Prisma SQ Aseptic 330ml DC26 - carton**	Sweden	Melbourne	Paper	362	34877
						PE low density (LDPE) film	355	11897
						Aluminium foil	800	10823
						HDPE	800	10823
RTD Coffee and FSN	**500**	**Australia**	**Tetra Prisma Edge Aseptic 500ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
RTD Coffee and FSN	**500**	**Australia**	**Tetra Prisma Edge Aseptic 500ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**500**	**Australia**	**Tetra Top 500ml C38 - carton**	Sweden	Melbourne	Paper	72	32097
						PE low density (LDPE) film	65	41514
						HDPE	510	38933
RTD Coffee and FSN	**500**	**Australia**	**Tetra Top 500ml C38 - plant based**	Sweden	Melbourne	Paper	72	32097
						Bio LDPE film	65	41514
						HDPE (sugar cane)	360	30265
RTD Coffee and FSN	**500**	**New Zealand**	**Tetra Prisma Edge Aseptic 500ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
RTD Coffee and FSN	**500**	**New Zealand**	**Tetra Prisma Edge Aseptic 500ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**500**	**New Zealand**	**Tetra Top 500ml C38 - carton**	Sweden	Melbourne	Paper	72	32097
						PE low density (LDPE) film	65	41514
						HDPE	510	38933
RTD Coffee and FSN	**500**	**New Zealand**	**Tetra Top 500ml C38 - plant based**	Sweden	Melbourne	Paper	72	32097
						Bio LDPE film	65	41514
						HDPE (sugar cane)	360	30265
Juice	**200**	**Australia**	**Tetra Brik Base Crystal Aseptic 200ml paper straw - carton**	Sweden	Melbourne	Paper	562	27252
						PE low density (LDPE) film	555	39962

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						Cardboard / paper	562	27252
Juice	**250**	**Australia**	**Tetra Prisma Edge Aseptic 250ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						Aluminium foil	780	12081
						PE low density (LDPE) film	335	13827
						HDPE	780	12081
Milk	**250**	**Australia**	**Tetra Brik Slim Aseptic 250ml Ambient**	Sweden	Melbourne	Paper	362	34877
						PE low density (LDPE) film	355	11897
						Aluminium foil	800	10823
						Cardboard / paper	362	34877
Juice	**200**	**New Zealand**	**Tetra Brik Base Crystal Aseptic 200ml paper straw - carton**	Sweden	Melbourne	Paper	562	27252
						PE low density (LDPE) film	555	39962
						Cardboard / paper	562	27252

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
Juice	**250**	**New Zealand**	**Tetra Prisma Edge Aseptic 250ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						Aluminium foil	780	12081
						PE low density (LDPE) film	335	13827
						HDPE	780	12081
Milk	**250**	**New Zealand**	**Tetra Brik Slim Aseptic 250ml Ambient**	Sweden	Melbourne	Paper	362	34877
						PE low density (LDPE) film	355	11897
						Aluminium foil	800	10823
						Cardboard / paper	362	34877
RTD Coffee and FSN	**300**	**Australia**	**Tetra Prisma Edge Aseptic 300ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
RTD Coffee and FSN	**300**	**Australia**	**Tetra Prisma Edge Aseptic 300ml DC26 - plant based**	Sweden	Melbourne	Paper	342	37516
						Bio LDPE film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**300**	**New Zealand**	**Tetra Prisma Edge Aseptic 300ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**300**	**New Zealand**	**Tetra Prisma Edge Aseptic 300ml DC26 - plant based**	Sweden	Melbourne	Paper	342	37516
						Bio LDPE film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**500**	**Australia**	**Tetra Prisma Edge Aseptic 500ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**500**	**New Zealand**	**Tetra Prisma Edge Aseptic 500ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**500**	**Australia**	**Tetra Prisma Edge Aseptic 500ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081
RTD Coffee and FSN	**500**	**New Zealand**	**Tetra Prisma Edge Aseptic 500ml DC26 - carton**	Sweden	Melbourne	Paper	342	37516
						PE low density (LDPE) film	335	13827
						Aluminium foil	780	12081
						HDPE	780	12081

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
Juice	**1000**	**Australia**	**Tetra Stelo Aseptic 1L WC - carton**	Sweden	Melbourne	Paper	562	27252
						Aluminium foil	1000	37381
						PE low density (LDPE) film	555	39962
						HDPE	1000	37381
Juice	**1000**	**Australia**	**Tetra Pak Square Aseptic 1L HC27**	Sweden	Leongatha	Paper	412	27343
						HDPE	850	20487
						PE low density (LDPE) film	405	23069
						Aluminium foil	850	20487
Juice	**1000**	**New Zealand**	**Tetra Stelo Aseptic 1L WC - carton**	Sweden	Melbourne	Paper	562	27252
						Aluminium foil	1000	37381
						PE low density (LDPE) film	555	39962
						HDPE	1000	37381
Juice	**1000**	**New Zealand**	**Tetra Pak Square Aseptic 1L HC27**	Sweden	Leongatha	Paper	412	27343
						HDPE	850	20487

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						PE low density (LDPE) film	405	23069
						Aluminium foil	850	20487
Juice	**1000**	**Australia**	**Tetra Rex 1L - carton**	Sweden	Brisbane	Paper	142	31447
						PE low density (LDPE) film	135	9884
Juice	**1000**	**Australia**	**Tetra Stelo Aseptic 1L WC - carton**	Sweden	Melbourne	Paper	562	27252
						Aluminium foil	1000	37381
						PE low density (LDPE) film	555	39962
						HDPE	1000	37381
Juice	**1000**	**Australia**	**Tetra Pak Square Aseptic 1L HC27**	Sweden	Leongatha	Paper	412	27343
						HDPE	850	20487
						PE low density (LDPE) film	405	23069
						Aluminium foil	850	20487
Juice	**1000**	**New Zealand**	**Tetra Rex 1L - carton**	Sweden	Brisbane	Paper	142	31447
						PE low density (LDPE) film	135	9884
Juice	**1000**	**New Zealand**	**Tetra Stelo Aseptic 1L WC - carton**	Sweden	Melbourne	Paper	562	27252

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						Aluminium foil	1000	37381
						PE low density (LDPE) film	555	39962
						HDPE	1000	37381
Juice	**1000**	**New Zealand**	**Tetra Pak Square Aseptic 1L HC27**	Sweden	Leongatha	Paper	412	27343
						HDPE	850	20487
						PE low density (LDPE) film	405	23069
						Aluminium foil	850	20487
Milk	**1500**	**Australia**	**Tetra Brik Edge Aseptic 1.5L Ambient WC30 - carton**	Sweden	Melbourne	Paper	812	26385
						PE low density (LDPE) film	805	47696
						Aluminium foil	1250	45115
						HDPE	1250	45115
Milk	**1500**	**New Zealand**	**Tetra Brik Edge Aseptic 1.5L Ambient WC30 - carton**	Sweden	Melbourne	Paper	812	26385

Beverage	Volume (mL)	Country	Pack	Manufacturing facility	Filling facility	Material	Road distance to filling facility (km)	Sea distance to filling facility (km)
						PE low density (LDPE) film	805	47696
						Aluminium foil	1250	45115
						HDPE	1250	45115
Juice	**2000**	**Australia**	**Tetra Rex 2L**	Sweden	Melbourne	Paper	622	25443
						HDPE	1060	47124
						PE low density (LDPE) film	615	49706
Juice	**2000**	**Australia**	**Tetra Rex 2L - plant based**	Sweden	Melbourne	Paper	622	25443
						Bio LDPE film	615	49706
						HDPE (sugar cane)	910	26565
Juice	**2000**	**New Zealand**	**Tetra Rex 2L**	Sweden	Melbourne	Paper	622	25443
						HDPE	1060	47124
						PE low density (LDPE) film	615	49706
Juice	**2000**	**New Zealand**	**Tetra Rex 2L - plant based**	Sweden	Melbourne	Paper	622	25443
						Bio LDPE film	615	49706
						HDPE (sugar cane)	910	26565

Annex B Life cycle inventory data

B.9. Secondary packaging material transport distance assumptions

Secondary packaging material transport distance assumptions for all packs in Oceania

Packaging	Country	Road distance to filling facility (km)	Sea distance to filling facility (km)
Carton box	Australia	300	0
HDPE tray	Australia	300	0
Plastic wrap	Australia	300	0
Carton box	New Zealand	300	0
HDPE tray	New Zealand	300	0
Plastic wrap	New Zealand	300	0

Annex B Life cycle inventory data

B.10. Tertiary packaging material transport distance assumptions

Tertiary packaging material transport distance assumptions for all packs in Oceania

Material	Country	Road distance to filling facility (km)	Sea distance to filling facility (km)
Wooden Pallet	**Australia**	300	0
Wooden Pallet	**New Zealand**	300	0

Annex B Life cycle inventory data

B.11. Product distribution distance assumptions

Product distribution transport distance assumptions for all packs in Oceania

Country	Road distance to customer (km)	Sea distance to customer (km)
Australia	330	0
New Zealand	130	0

Annex C Carton specifications (Confidential)

This annex provides confidential data that is edacted from the report before it is made public. The data is available in a separate PDF Annex C (v2.0):

- C.1 Lamination data
- C.2 Converting data
- C.3 Tetra Pak carton specifications
- C.4 Tetra Pak cap and straw specifications

The biogenic carbon within the different cartons and distribution packaging is shown below. Distribution packaging includes cardboard cartons for some packaging types.

C.1. Lamination data

Site lamination data per 1000m2 of laminate are given in PDF

Please note that HC27/HC/SC denote cap design and do not affect layer specifications.

If the component is a pack, then masses 1-4 show the relative layer density (in gsm) of each layer.

C.2. Converting data

Please see separate Annex C for this data.

C.3. Tetra Pak carton specifications

Please see separate Annex C for this data.

C.4. Tetra Pak cap and straw specifications

Please see separate Annex C for this data.

Annex D Biogenic Carbon in Product

Biogenic content can be found in Tetra Pak's cartons (paperboard, bio-HDPE and bio-LDPE) and in secondary packaging (corrugated cardboard boxes)

Biogenic carbon calculations are based on the mass of the material with biogenic content within the packaging, and the expected biogenic carbon content (TNO Biobased and Circular Technologies, 2024) per material (Annex Table D-1). Straws are excluded from the calculation (insignificant in terms of mass).

Results are provided for biogenic carbon sequestered in:

- Tetra Pak products (g of carbon per consumer pack)
- Secondary packaging (g of carbon per consumer pack)
- Tertiary packaging (g of carbon per consumer pack)

Annex Table D-1: Carbon content per biomaterial

Material	Biogenic carbon sequestered (kg C/kg of material)
Paperboard (laminate)	0.50
Bio-LDPE (laminate)	0.857
BioPE (caps)	0.862
Bio-HDPE	0.856
Corrugated cardboard	0.437
Wooden pallets	0.499

Annex E Paperboard carbon footprint (Confidential)

Please see separate Annex E (v2.0) for this confidential data.

Annex F Environmental indicator results

Other environmental impact indicators calculated using EF3.1 are provided in Annex F (v2.0).

.

Annex F Other indicator results

F. Environmental indicator results for all products

Cell colour legend (for Tetra Pak cartons)

> 50% of minimum in group
> 10% of minimum in group
> 1% of minimum in group
< 1% of minimum in group
Minimum in group

Annex Table F-1 Results for environmental indicators per pack

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
750ml Milk	**Chilled**	**AU**	TR 750ml OSO34	2.52E-13	6.95E-04	4.96E-07	1.69E-04	0.00183	4.96E-04	7.13E-09	1.28	0.242	0.0533
			750ml PET	1.10E-12	0.00129	8.45E-07	2.53E-04	0.00276	7.65E-04	1.16E-08	4.37	1.51	0.232
			750ml rPET	1.45E-12	8.56E-04	7.08E-07	1.79E-04	0.00196	5.02E-04	1.02E-08	2.03	0.707	0.137
750ml Milk	**Chilled**	**NZ**	TR 750ml OSO34	1.67E-13	6.19E-04	4.62E-07	1.47E-04	0.00161	4.42E-04	7.18E-09	1.13	0.487	0.0365
			750ml PET	2.23E-13	8.72E-04	6.32E-07	1.58E-04	0.00182	5.02E-04	9.67E-09	3.45	2.94	0.154
			750ml rPET	1.14E-13	3.89E-04	5.09E-07	7.22E-05	9.19E-04	2.07E-04	4.71E-09	0.971	2.41	0.0498

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
1L Milk	**Ambient**	**AU**	TBA Slim 1L HC23	4.88E-13	8.89E-04	1.08E-06	2.10E-04	0.00222	6.08E-04	2.22E-08	1.90	0.706	0.108
			TBA Edge 1L LC30	4.74E-13	8.10E-04	1.12E-06	2.08E-04	0.00219	5.92E-04	2.42E-08	1.76	0.702	0.106
			TBA Edge 1L LW30 PB	1.80E-09	9.14E-04	5.02E-06	3.10E-04	0.00321	6.58E-04	2.87E-08	1.42	1.26	0.106
			TBA Square 1L HC27	5.39E-13	0.00109	1.20E-06	2.64E-04	0.00280	7.59E-04	2.53E-08	2.19	0.819	0.128
1L Milk	**Ambient**	**NZ**	TBA Slim 1L HC23	3.25E-13	8.12E-04	1.10E-06	1.93E-04	0.00205	5.62E-04	2.19E-08	1.72	0.966	0.0885
			TBA Edge 1L LC30	3.34E-13	7.43E-04	1.15E-06	1.94E-04	0.00204	5.52E-04	2.39E-08	1.60	0.924	0.0882
			TBA Edge 1L LW30 PB	1.80E-09	8.55E-04	5.06E-06	2.97E-04	0.00308	6.22E-04	2.85E-08	1.28	1.46	0.0852

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			TBA Square 1L HC27	3.61E-13	0.00100	1.22E-06	2.46E-04	0.00262	7.08E-04	2.49E-08	2.00	1.11	0.107
1L Milk	**Chilled**	**AU**	TT 1L C38	3.45E-13	7.03E-04	5.61E-07	1.73E-04	0.00186	5.05E-04	8.59E-09	1.34	0.285	0.0531
			TT 1L C38 PB	1.33E-09	7.16E-04	3.44E-06	2.38E-04	0.00246	5.28E-04	1.14E-08	0.978	0.674	0.0440
			TR 1L OSO34 PB	4.88E-10	6.59E-04	1.60E-06	1.77E-04	0.00179	4.66E-04	8.57E-09	1.11	0.412	0.0464
			TB Ultra Edge 900ml WC30	2.44E-13	7.24E-04	6.43E-07	1.83E-04	0.00197	5.39E-04	9.12E-09	1.37	0.248	0.0557
			TBA Edge 1L LC30	4.51E-13	8.55E-04	6.50E-07	1.97E-04	0.00212	5.83E-04	1.10E-08	1.71	0.556	0.0869
			1L HDPE	1.45E-12	0.00186	8.52E-07	2.24E-04	0.00244	7.42E-04	1.15E-08	4.29	1.08	0.208
			1L PET	1.23E-12	0.00152	9.76E-07	2.88E-04	0.00314	8.76E-04	1.32E-08	5.05	1.71	0.265

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			1L Glass	1.04E-12	0.00263	1.79E-07	7.76E-04	0.00850	0.00165	4.14E-08	6.31	0.939	0.429
			1L rPET	1.50E-12	9.16E-04	7.44E-07	1.87E-04	0.00204	5.28E-04	1.06E-08	2.16	0.739	0.144
1L Milk	**Chilled**	**NZ**	TT 1L C38	2.19E-13	6.29E-04	5.40E-07	1.51E-04	0.00163	4.52E-04	8.15E-09	1.15	0.472	0.0342
			TT 1L C38 PB	1.33E-09	6.60E-04	3.44E-06	2.20E-04	0.00227	4.86E-04	1.11E-08	0.830	0.796	0.0255
			TR 1L OSO34 PB	4.88E-10	6.03E-04	1.60E-06	1.59E-04	0.00161	4.24E-04	8.21E-09	0.958	0.534	0.0288
			TB Ultra Edge 900ml WC30	2.34E-13	7.58E-04	6.43E-07	1.81E-04	0.00196	5.44E-04	9.91E-09	1.41	0.607	0.0609
			TBA Edge 1L LC30	2.70E-13	7.55E-04	6.62E-07	1.70E-04	0.00184	5.15E-04	1.05E-08	1.46	0.828	0.0626
			1L HDPE	1.50E-13	0.00157	5.24E-07	1.64E-04	0.00188	5.74E-04	8.64E-09	3.40	2.33	0.117

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			1L PET	2.52E-13	0.00106	7.22E-07	1.83E-04	0.00210	5.85E-04	1.10E-08	4.03	3.32	0.179
			1L Glass	1.27E-13	0.00212	1.72E-07	6.39E-04	0.00711	0.00129	3.36E-08	4.99	2.40	0.320
			1L rPET	1.19E-13	4.34E-04	5.32E-07	7.69E-05	9.75E-04	2.23E-04	4.95E-09	1.07	2.50	0.0536
1.5L Milk	**Chilled**	**AU**	TBA Edge 1.5L WC30	5.52E-13	9.97E-04	6.87E-07	2.45E-04	0.00264	7.13E-04	1.18E-08	1.87	0.563	0.0966
			1.5L PET	1.53E-12	0.00174	1.16E-06	3.44E-04	0.00375	0.00104	1.58E-08	6.03	2.15	0.324
			1.5L rPET	2.06E-12	0.00112	9.70E-07	2.38E-04	0.00261	6.66E-04	1.39E-08	2.66	0.986	0.189
1.5L Milk	**Chilled**	**NZ**	TBA Edge 1.5L WC30	3.18E-13	8.72E-04	6.99E-07	2.12E-04	0.00231	6.30E-04	1.12E-08	1.57	0.921	0.0677
			1.5L PET	3.02E-13	0.00115	8.74E-07	2.13E-04	0.00246	6.77E-04	1.31E-08	4.75	4.17	0.217
			1.5L rPET	1.44E-13	4.65E-04	7.01E-07	8.98E-05	0.00117	2.53E-04	5.99E-09	1.17	3.42	0.0657

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
2L Milk	**Chilled**	**AU**	TR 2L EO	3.85E-13	0.00112	7.77E-07	2.61E-04	0.00282	7.63E-04	1.10E-08	2.12	0.372	0.0855
			2L HDPE	1.68E-12	0.00215	9.93E-07	2.72E-04	0.00297	8.96E-04	1.41E-08	5.03	1.25	0.242
2L Milk	**Chilled**	**NZ**	TR 2L EO	1.85E-13	0.00100	7.56E-07	2.25E-04	0.00245	6.76E-04	1.02E-08	1.81	0.663	0.0565
			2L HDPE	1.96E-13	0.00180	6.25E-07	1.97E-04	0.00226	6.89E-04	1.07E-08	3.97	2.67	0.135
250ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 250ml DC26	2.74E-13	5.01E-04	4.74E-07	1.03E-04	0.00109	3.03E-04	9.68E-09	1.07	0.389	0.0616
			TBA Base 250ml paper straw	1.68E-13	2.19E-04	3.18E-07	6.14E-05	6.45E-04	1.70E-04	7.55E-09	0.528	0.214	0.0327
			237ml Can	1.51E-13	5.85E-04	1.84E-07	1.17E-04	0.00126	4.00E-04	1.70E-08	1.40	0.657	0.117
	Chilled	**AU**	237ml Can	1.51E-13	5.89E-04	1.84E-07	1.19E-04	0.00128	4.05E-04	1.70E-08	1.41	0.657	0.118
250ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 250ml DC26	1.63E-13	4.49E-04	4.59E-07	9.16E-05	9.82E-04	2.72E-04	9.45E-09	0.958	0.572	0.0503

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			TBA Base 250ml paper straw	1.07E-13	1.90E-04	3.28E-07	5.51E-05	5.83E-04	1.53E-04	7.42E-09	0.463	0.310	0.0263
			237ml Can	1.18E-13	5.74E-04	1.85E-07	1.15E-04	0.00125	3.96E-04	1.69E-08	1.37	0.711	0.114
	Chilled	NZ	237ml Can	1.18E-13	5.75E-04	1.85E-07	1.16E-04	0.00126	3.98E-04	1.69E-08	1.37	0.711	0.114
300ml RTD Coffee and FSN	Ambient	AU	TPA Edge 300ml DC26	2.71E-13	5.07E-04	5.48E-07	1.07E-04	0.00114	3.14E-04	1.14E-08	1.12	0.389	0.0635
			TPA Edge 300ml DC26 PB	8.11E-10	5.61E-04	2.30E-06	1.53E-04	0.00161	3.42E-04	1.35E-08	0.979	0.645	0.0657
			300ml PET	7.57E-13	8.97E-04	8.14E-07	1.75E-04	0.00189	5.24E-04	1.42E-08	3.04	1.10	0.169
300ml RTD Coffee and FSN	Ambient	NZ	TPA Edge 300ml DC26	1.67E-13	4.58E-04	5.35E-07	9.68E-05	0.00103	2.85E-04	1.11E-08	1.01	0.562	0.0525
			TPA Edge 300ml DC26 PB	8.11E-10	5.13E-04	2.29E-06	1.43E-04	0.00151	3.13E-04	1.33E-08	0.871	0.818	0.0525
			300ml PET	1.77E-13	6.29E-04	6.69E-07	1.18E-04	0.00133	3.62E-04	1.30E-08	2.47	2.06	0.120
330ml RTD Coffee and FSN	Ambient	AU	TT C38 330ml	2.86E-13	4.31E-04	5.26E-07	1.05E-04	0.00111	2.99E-04	1.10E-08	0.933	0.280	0.0472

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			TPA Square 330ml DC26	3.07E-13	5.63E-04	5.70E-07	1.18E-04	0.00125	3.47E-04	1.20E-08	1.23	0.464	0.0722
			330ml PET	8.92E-13	0.00104	9.16E-07	2.04E-04	0.00220	6.13E-04	1.56E-08	3.59	1.31	0.199
			375ml PET	7.19E-13	9.15E-04	7.98E-07	1.72E-04	0.00185	5.18E-04	1.38E-08	3.03	1.06	0.164
330ml RTD Coffee and FSN	**Ambient**	**NZ**	TT C38 330ml	1.94E-13	3.87E-04	5.16E-07	9.53E-05	0.00101	2.73E-04	1.08E-08	0.834	0.431	0.0371
			TPA Square 330ml DC26	2.02E-13	5.14E-04	5.59E-07	1.07E-04	0.00115	3.17E-04	1.18E-08	1.12	0.636	0.0610
			330ml PET	2.03E-13	7.24E-04	7.48E-07	1.37E-04	0.00154	4.21E-04	1.42E-08	2.91	2.45	0.141
			375ml PET	1.74E-13	6.63E-04	6.50E-07	1.19E-04	0.00133	3.66E-04	1.27E-08	2.49	1.97	0.119
500ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 500ml DC26	3.26E-13	6.67E-04	8.35E-07	1.53E-04	0.00161	4.39E-04	1.78E-08	1.48	0.546	0.0852
	Chilled	**AU**	TPA Edge 500ml DC26	3.26E-13	6.77E-04	8.36E-07	1.57E-04	0.00166	4.49E-04	1.78E-08	1.49	0.546	0.0866
			TT 500ml C38	2.91E-13	5.17E-04	7.55E-07	1.37E-04	0.00144	3.80E-04	1.62E-08	1.14	0.336	0.0588
			TT 500ml C38 PB	3.34E-10	4.48E-04	1.47E-06	1.45E-04	0.00144	3.64E-04	1.57E-08	0.867	0.389	0.0463

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			500ml rPET	9.95E-13	6.11E-04	7.86E-07	1.44E-04	0.00155	3.91E-04	1.58E-08	1.59	0.582	0.106
			500ml HDPE	1.10E-12	0.00138	9.38E-07	1.87E-04	0.00201	5.91E-04	1.73E-08	3.31	0.897	0.166
			500ml PET	1.06E-12	0.00123	1.10E-06	2.54E-04	0.00274	7.50E-04	1.95E-08	4.23	1.51	0.229
500ml RTD Coffee and FSN	Ambient	NZ	TPA Edge 500ml DC26	2.57E-13	6.34E-04	8.29E-07	1.45E-04	0.00153	4.19E-04	1.76E-08	1.39	0.658	0.0758
	Chilled	NZ	TPA Edge 500ml DC26	2.57E-13	6.38E-04	8.30E-07	1.47E-04	0.00155	4.23E-04	1.76E-08	1.40	0.658	0.0764
			TT 500ml C38	2.35E-13	4.83E-04	7.49E-07	1.28E-04	0.00135	3.58E-04	1.60E-08	1.06	0.428	0.0500
			TT 500ml C38 PB	3.34E-10	4.47E-04	1.49E-06	1.41E-04	0.00140	3.57E-04	1.63E-08	0.909	0.437	0.0413
			500ml rPET	1.55E-13	3.13E-04	6.62E-07	7.62E-05	8.82E-04	2.02E-04	1.24E-08	0.910	1.66	0.0506
			500ml HDPE	1.85E-13	0.00117	7.08E-07	1.45E-04	0.00161	4.71E-04	1.54E-08	2.68	1.79	0.101
			500ml PET	2.76E-13	8.51E-04	9.08E-07	1.70E-04	0.00191	5.17E-04	1.79E-08	3.41	2.81	0.160
250ml Juice	Ambient	AU	TBA Base Crystal 200ml paper straw	1.74E-13	2.40E-04	3.68E-07	6.54E-05	6.89E-04	1.83E-04	7.83E-09	0.530	0.177	0.0322
			TPA Edge 250ml DC26	2.74E-13	5.01E-04	4.74E-07	1.03E-04	0.00109	3.03E-04	9.68E-09	1.07	0.389	0.0616

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			TBA Slim 250ml	1.99E-13	2.86E-04	3.73E-07	7.33E-05	7.72E-04	2.09E-04	8.54E-09	0.642	0.279	0.0421
			250ml PET	6.20E-13	8.32E-04	5.07E-07	1.38E-04	0.00151	4.38E-04	6.36E-09	2.57	0.851	0.133
			250ml Glass	4.24E-13	9.59E-04	3.97E-07	2.83E-04	0.00306	6.10E-04	3.52E-08	2.45	0.516	0.174
			200ml Pouch	2.21E-13	4.02E-04	3.80E-07	7.22E-05	7.74E-04	4.04E-04	1.03E-08	1.31	0.416	0.0735
250ml Juice	Ambient	NZ	TBA Base Crystal 200ml paper straw	1.13E-13	2.11E-04	3.88E-07	5.91E-05	6.27E-04	1.66E-04	7.70E-09	0.465	0.273	0.0251
			TPA Edge 250ml DC26	1.63E-13	4.49E-04	4.59E-07	9.16E-05	9.82E-04	2.72E-04	9.45E-09	0.958	0.572	0.0503
			TBA Slim 250ml	1.38E-13	2.57E-04	3.88E-07	6.69E-05	7.09E-04	1.91E-04	8.41E-09	0.575	0.375	0.0352
			250ml PET	1.16E-13	6.00E-04	3.62E-07	8.90E-05	0.00103	2.98E-04	5.36E-09	2.08	1.69	0.0908
			250ml Glass	9.79E-14	7.96E-04	3.96E-07	2.44E-04	0.00267	5.00E-04	3.26E-08	2.02	1.04	0.138
			200ml Pouch	8.75E-14	3.57E-04	3.47E-07	6.11E-05	6.67E-04	3.73E-04	1.02E-08	1.19	0.594	0.0633
300ml Juice	Chilled	AU	TPA Edge 300ml DC26	2.72E-13	5.13E-04	5.49E-07	1.10E-04	0.00117	3.20E-04	1.14E-08	1.13	0.389	0.0643

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			TPA Edge 300ml DC26 PB	8.11E-10	5.67E-04	2.30E-06	1.56E-04	0.00164	3.48E-04	1.35E-08	0.990	0.645	0.0666
			300ml PET*	7.07E-13	8.36E-04	7.66E-07	1.70E-04	0.00183	5.01E-04	1.37E-08	2.82	1.01	0.155
			300ml Glass*	4.74E-13	0.00114	4.15E-07	3.35E-04	0.00363	7.20E-04	3.27E-08	2.83	0.546	0.198
300ml Juice	**Chilled**	**NZ**	TPA Edge 300ml DC26	1.67E-13	4.60E-04	5.35E-07	9.80E-05	0.00104	2.87E-04	1.12E-08	1.01	0.562	0.0529
			TPA Edge 300ml DC26 PB	8.11E-10	5.15E-04	2.29E-06	1.44E-04	0.00152	3.16E-04	1.33E-08	0.875	0.818	0.0529
			300ml PET*	1.76E-13	5.83E-04	6.35E-07	1.14E-04	0.00128	3.45E-04	1.27E-08	2.28	1.89	0.109
			300ml Glass*	1.03E-13	9.30E-04	4.08E-07	2.81E-04	0.00309	5.77E-04	2.97E-08	2.31	1.15	0.155
500ml Juice	**Ambient**	**AU**	TPA Edge 500ml DC26	3.26E-13	6.67E-04	8.35E-07	1.53E-04	0.00161	4.39E-04	1.78E-08	1.48	0.546	0.0852
			500ml PET	9.54E-13	0.00108	1.30E-06	2.39E-04	0.00254	6.90E-04	2.70E-08	3.80	1.37	0.208
500ml Juice	**Ambient**	**NZ**	TPA Edge 500ml DC26	2.57E-13	6.34E-04	8.29E-07	1.45E-04	0.00153	4.19E-04	1.76E-08	1.39	0.658	0.0758

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			500ml PET	3.21E-13	7.83E-04	1.14E-06	1.74E-04	0.00191	5.08E-04	2.57E-08	3.14	2.42	0.152
500ml Juice	**Chilled**	**AU**	TPA Edge 500ml DC26	3.26E-13	6.77E-04	8.36E-07	1.57E-04	0.00166	4.49E-04	1.78E-08	1.49	0.546	0.0866
			500ml PET	9.06E-13	0.00102	1.25E-06	2.39E-04	0.00255	6.75E-04	2.64E-08	3.57	1.29	0.198
500ml Juice	**Chilled**	**NZ**	TPA Edge 500ml DC26	2.57E-13	6.38E-04	8.30E-07	1.47E-04	0.00155	4.23E-04	1.76E-08	1.40	0.658	0.0764
			500ml PET	3.07E-13	7.19E-04	1.11E-06	1.70E-04	0.00186	4.85E-04	2.52E-08	2.91	2.29	0.143
1L Juice	**Ambient**	**AU**	TSA 1L WC30	4.93E-13	8.79E-04	1.14E-06	2.34E-04	0.00247	6.61E-04	2.44E-08	1.80	0.674	0.107
			TPA Square 1L HC27	5.65E-13	0.00108	1.21E-06	2.47E-04	0.00261	7.13E-04	2.56E-08	2.21	0.828	0.129
			1L Glass	1.25E-12	0.00292	9.75E-07	8.62E-04	0.00937	0.00184	5.94E-08	7.24	1.27	0.503
			1L PET	1.20E-12	0.00132	1.32E-06	2.76E-04	0.00297	8.23E-04	2.40E-08	4.74	1.77	0.266

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
1L Juice	**Ambient**	**NZ**	TSA 1L WC30	3.50E-13	8.10E-04	1.17E-06	2.19E-04	0.00232	6.20E-04	2.41E-08	1.64	0.902	0.0884
			TPA Square 1L HC27	3.86E-13	9.98E-04	1.22E-06	2.28E-04	0.00242	6.62E-04	2.52E-08	2.01	1.12	0.108
			1L Glass	2.77E-13	0.00243	9.72E-07	7.45E-04	0.00819	0.00151	5.12E-08	5.95	2.84	0.395
			1L PET	2.95E-13	9.04E-04	1.11E-06	1.87E-04	0.00210	5.70E-04	2.22E-08	3.83	3.27	0.190
1L Juice	**Chilled**	**AU**	TR 1L EO	2.70E-13	4.00E-04	9.96E-07	1.32E-04	0.00136	3.46E-04	2.33E-08	1.08	0.419	0.0667
			TSA 1L WC30	4.94E-13	8.93E-04	1.14E-06	2.41E-04	0.00255	6.75E-04	2.45E-08	1.83	0.674	0.109
			TPA Square 1L HC27	5.65E-13	0.00110	1.21E-06	2.54E-04	0.00269	7.28E-04	2.56E-08	2.24	0.828	0.132
			1L PET	1.23E-12	0.00139	1.22E-06	2.90E-04	0.00313	8.57E-04	2.12E-08	4.87	1.77	0.265
1L Juice	**Chilled**	**NZ**	TR 1L EO	2.24E-13	3.67E-04	1.01E-06	1.22E-04	0.00125	3.22E-04	2.31E-08	0.996	0.492	0.0569
			TSA 1L WC30	3.50E-13	8.16E-04	1.17E-06	2.21E-04	0.00235	6.25E-04	2.42E-08	1.65	0.902	0.0892
			TPA Square 1L HC27	3.86E-13	0.00100	1.22E-06	2.31E-04	0.00246	6.68E-04	2.52E-08	2.03	1.12	0.109

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			1L PET	3.06E-13	9.49E-04	1.00E-06	1.91E-04	0.00216	5.84E-04	1.93E-08	3.91	3.30	0.184
1.5L Juice	**Ambient**	**AU**	TBA Edge 1.5L WC30	6.04E-13	9.79E-04	1.29E-06	2.68E-04	0.00283	7.51E-04	2.88E-08	2.04	0.759	0.124
			1.25L PET	1.88E-12	0.00206	1.91E-06	4.25E-04	0.00458	0.00126	3.32E-08	7.40	2.78	0.415
1.5L Juice	**Ambient**	**NZ**	TBA Edge 1.5L WC30	4.10E-13	8.87E-04	1.32E-06	2.48E-04	0.00263	6.95E-04	2.84E-08	1.83	1.07	0.101
			1.25L PET	4.39E-13	0.00139	1.58E-06	2.83E-04	0.00320	8.62E-04	3.03E-08	5.97	5.18	0.294
2L Juice	**Chilled**	**AU**	TR 2L EO	4.24E-13	0.00106	1.55E-06	2.91E-04	0.00306	8.00E-04	3.29E-08	2.23	0.614	0.119
			TR 2L PB	1.40E-09	9.60E-04	4.56E-06	3.56E-04	0.00361	8.06E-04	3.63E-08	1.52	0.956	0.0914
			2L PET	2.09E-12	0.00225	2.12E-06	4.89E-04	0.00527	0.00143	3.80E-08	8.15	3.05	0.453
			2L HDPE	2.04E-12	0.00254	1.45E-06	3.02E-04	0.00326	9.97E-04	2.35E-08	5.90	1.62	0.302
2L Juice	**Chilled**	**NZ**	TR 2L EO	2.97E-13	9.85E-04	1.57E-06	2.69E-04	0.00283	7.47E-04	3.26E-08	2.05	0.816	0.0990
			TR 2L PB	1.40E-09	9.10E-04	4.58E-06	3.40E-04	0.00345	7.70E-04	3.61E-08	1.40	1.07	0.0744

Comparison group	Distribution	Country	Product	ODP [kg CFC11-eq.]	AP [Mole of H+ eq.]	EP-fw [kg P eq.]	EP-fm [kg N eq.]	EP-tr [Mole of N eq.]	POCP [kg NMVOC eq.]	ADP-mm [kg Sb-eq.]	ADP-fossil [MJ]	Blue water [kg]	GWP100, Total [kg CO_2-eq.]
			2L PET	5.24E-13	0.00149	1.78E-06	3.23E-04	0.00364	9.71E-04	3.48E-08	6.53	5.66	0.317
			2L HDPE	2.17E-13	0.00216	1.01E-06	2.32E-04	0.00263	7.93E-04	1.97E-08	4.74	3.34	0.179

Annex G Substitution method results

The Total GWP results using the cut-off and substitution methods are provided in Annex G (v2.0).

Annex G Substitution method results

G. Results from substitution method - recycling

Annex Table G-1 Results per pack for GWP100, Total GHG emissions [kg CO_2-eq.]

Comparison group	Distribution	Country	Product	Total (cut-off)	Total (Substitution, recycling)
750ml Milk	**Chilled**	**AU**	TR 750ml OSO34	0.0532	0.0522
			750ml PET	0.232	0.202
			750ml rPET	0.137	0.171
750ml Milk	**Chilled**	**NZ**	TR 750ml OSO34	0.0364	0.0296
			750ml PET	0.154	0.0990
			750ml rPET	0.0498	0.0712
1L Milk	**Ambient**	**AU**	TBA Slim 1L HC23	0.108	0.106
			TBA Edge 1L LC30	0.106	0.105
			TBA Edge 1L LW30 PB	0.106	0.105
			TBA Square 1L HC27	0.128	0.123
1L Milk	**Ambient**	**NZ**	TBA Slim 1L HC23	0.0885	0.0891
			TBA Edge 1L LC30	0.0882	0.0914
			TBA Edge 1L LW30 PB	0.0853	0.0890
			TBA Square 1L HC27	0.107	0.107
1L Milk	**Chilled**	**AU**	TT 1L C38	0.0531	0.0528
			TT 1L C38 PB	0.0440	0.0437
			TR 1L OSO34 PB	0.0463	0.0455
			TB Ultra Edge 900ml WC30	0.0557	0.0492

Comparison group	Distribution	Country	Product	Total (cut-off)	Total (Substitution, recycling)
			TBA Edge 1L LC30	0.0869	0.0808
			1L HDPE	0.208	0.192
			1L PET	0.265	0.230
			1L Glass	0.429	0.448
			1L rPET	0.144	0.178
1L Milk	**Chilled**	**NZ**	TT 1L C38	0.0342	0.0289
			TT 1L C38 PB	0.0255	0.0219
			TR 1L OSO34 PB	0.0288	0.0246
			TB Ultra Edge 900ml WC30	0.0609	0.0570
			TBA Edge 1L LC30	0.0626	0.0590
			1L HDPE	0.117	0.0714
			1L PET	0.179	0.115
			1L Glass	0.321	0.389
			1L rPET	0.0536	0.0745
1.5L Milk	**Chilled**	**AU**	TBA Edge 1.5L WC30	0.0965	0.0906
			1.5L PET	0.325	0.282
			1.5L rPET	0.189	0.239
1.5L Milk	**Chilled**	**NZ**	TBA Edge 1.5L WC30	0.0677	0.0638
			1.5L PET	0.217	0.140
			1.5L rPET	0.0658	0.0999
2L Milk	**Chilled**	**AU**	TR 2L EO	0.0855	0.0830
			2L HDPE	0.242	0.224
2L Milk	**Chilled**	**NZ**	TR 2L EO	0.0566	0.0480

Comparison group	Distribution	Country	Product	Total (cut-off)	Total (Substitution, recycling)
			2L HDPE	0.135	0.0834
250ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 250ml DC26	0.0616	0.0585
			TBA Base 250ml paper	0.0327	0.0331
			237ml Can	0.117	0.110
250ml RTD Coffee and FSN	**Chilled**	**AU**	237ml Can	0.117	0.110
250ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 250ml DC26	0.0503	0.0476
			TBA Base 250ml paper	0.0263	0.0281
			237ml Can	0.114	0.126
250ml RTD Coffee and FSN	**Chilled**	**NZ**	237ml Can	0.115	0.127
300ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 300ml DC26	0.0634	0.0615
			TPA Edge 300ml DC26 PB	0.0657	0.0638
			300ml PET	0.168	0.150
300ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 300ml DC26	0.0525	0.0503
			TPA Edge 300ml DC26 PB	0.0525	0.0503
			300ml PET	0.120	0.0852
330ml RTD Coffee and FSN	**Ambient**	**AU**	TT C38 330ml	0.0471	0.0486
			TPA Square 330ml DC26	0.0722	0.0689
			330ml PET	0.199	0.177
			375ml PET	0.165	0.147

Comparison group	Distribution	Country	Product	Total (cut-off)	Total (Substitution, recycling)
330ml RTD Coffee and FSN	**Ambient**	**NZ**	TT C38 330ml	0.0371	0.0361
			TPA Square 330ml DC26	0.0610	0.0588
			330ml PET	0.141	0.0988
			375ml PET	0.119	0.0843
500ml RTD Coffee and FSN	**Ambient**	**AU**	TPA Edge 500ml DC26	0.0853	0.0826
500ml RTD Coffee and FSN	**Chilled**	**AU**	TPA Edge 500ml DC26	0.0867	0.0840
			TT 500ml C38	0.0588	0.0618
			TT 500ml C38 PB	0.0464	0.0494
			500ml rPET	0.106	0.130
			500ml HDPE	0.166	0.158
			500ml PET	0.229	0.204
500ml RTD Coffee and FSN	**Ambient**	**NZ**	TPA Edge 500ml DC26	0.0759	0.0750
500ml RTD Coffee and FSN	**Chilled**	**NZ**	TPA Edge 500ml DC26	0.0765	0.0756
			TT 500ml C38	0.0500	0.0503
			TT 500ml C38 PB	0.0414	0.0435
			500ml rPET	0.0506	0.0669
			500ml HDPE	0.101	0.0718
			500ml PET	0.160	0.113
250ml Juice	**Ambient**	**AU**	TBA Base Crystal 200ml paper straw	0.0322	0.0340
			TPA Edge 250ml DC26	0.0616	0.0585
			TBA Slim 250ml	0.0421	0.0416
			250ml PET	0.132	0.115

Comparison group	Distribution	Country	Product	Total (cut-off)	Total (Substitution, recycling)
			250ml Glass	0.174	0.181
			200ml Pouch	0.0735	0.0727
250ml Juice	**Ambient**	**NZ**	TBA Base Crystal 200ml	0.0251	0.0267
			TPA Edge 250ml DC26	0.0503	0.0476
			TBA Slim 250ml	0.0352	0.0369
			250ml PET	0.0908	0.0579
			250ml Glass	0.138	0.162
			200ml Pouch	0.0633	0.0579
300ml Juice	**Chilled**	**AU**	TPA Edge 300ml DC26	0.0643	0.0624
			TPA Edge 300ml DC26 PB	0.0666	0.0647
			300ml PET*	0.155	0.139
			300ml Glass*	0.198	0.207
300ml Juice	**Chilled**	**NZ**	TPA Edge 300ml DC26	0.0528	0.0506
			TPA Edge 300ml DC26 PB	0.0528	0.0506
			300ml PET*	0.109	0.0776
			300ml Glass*	0.155	0.182
500ml Juice	**Ambient**	**AU**	TPA Edge 500ml DC26	0.0853	0.0826
			500ml PET	0.207	0.190
500ml Juice	**Ambient**	**NZ**	TPA Edge 500ml DC26	0.0759	0.0750

Comparison group	Distribution	Country	Product	Total (cut-off)	Total (Substitution, recycling)
			500ml PET	0.151	0.116
500ml Juice	**Chilled**	**AU**	TPA Edge 500ml DC26	0.0867	0.0840
			500ml PET	0.198	0.183
500ml Juice	**Chilled**	**NZ**	TPA Edge 500ml DC26	0.0765	0.0756
			500ml PET	0.143	0.111
1L Juice	**Ambient**	**AU**	TSA 1L WC30	0.106	0.106
			TPA Square 1L HC27	0.129	0.124
			1L Glass	0.503	0.533
			1L PET	0.266	0.238
1L Juice	**Ambient**	**NZ**	TSA 1L WC30	0.0884	0.0913
			TPA Square 1L HC27	0.108	0.108
			1L Glass	0.395	0.479
			1L PET	0.190	0.137
1L Juice	**Chilled**	**AU**	TR 1L EO	0.0667	0.0736
			TSA 1L WC30	0.109	0.109
			TPA Square 1L HC27	0.132	0.127
			1L PET	0.265	0.235
1L Juice	**Chilled**	**NZ**	TR 1L EO	0.0569	0.0626
			TSA 1L WC30	0.0892	0.0921
			TPA Square 1L HC27	0.109	0.109
			1L PET	0.185	0.129
1.5L Juice	**Ambient**	**AU**	TBA Edge 1.5L WC30	0.124	0.125
			1.25L PET	0.415	0.368
1.5L Juice	**Ambient**	**NZ**	TBA Edge 1.5L WC30	0.101	0.105

Comparison group	Distribution	Country	Product	Total (cut-off)	Total (Substitution, recycling)
			1.25L PET	0.293	0.206
2L Juice	**Chilled**	**AU**	TR 2L EO	0.119	0.126
			TR 2L PB	0.0914	0.0997
			2L PET	0.454	0.403
			2L HDPE	0.302	0.283
2L Juice	**Chilled**	**NZ**	TR 2L EO	0.0990	0.102
			TR 2L PB	0.0744	0.0800
			2L PET	0.317	0.224
			2L HDPE	0.179	0.120

Annex H Material recovery facility inputs

This annex provides the data used for modelling material recovery facilities (MRF).

Annex Table H-1: Inputs into Metal material recovery facility (MRF)

Process	Inputs	Quantity	Unit {per kg recovered output]	Reference
Sorting of waste tinplate and aluminium	Diesel	0.00142	MJ	(Haupt, et al., 2018a) (Haupt et al., 2018b)
	Electricity	0.174	MJ	
	Metal scrap	1.05	kg	

Annex Table H-2: Inputs into Plastics MRF

Process	Inputs	Quantity	Unit {per kg recovered output]	Reference
Sorting and separating	Diesel	0.00147	kg	(Tonini, et al., 2021)
	LPG	0.0846	MJ	
	Natural Gas	0.000118	MJ	
	Electricity	0.224	MJ	
	Plastic scrap	1.09	kg	
Washing	Water	0.7857	kg	(Sphera, 2025)
	Heat	0.350	MJ	
	Plastic	1.03	kg	

Annex Table H-3: Inputs into Glass MRF

Process	Inputs	Quantity	Unit {per kg recovered output]	Reference
Sorting and separating*	Diesel	0.00147	kg	(Tonini, et al., 2021)
	LPG	0.0846	MJ	
	Natural Gas	0.000118	MJ	
	Electricity	0.224	MJ	
	Glass	1.09	kg	
Crushing, screening, contaminant removal	Electricity	0.132	MJ	(Zulkarnain, et al., 2021)
	Glass	1.03	kg	
Washing to remove small particles, dirt, oil and fat residues etc.	Electricity	0.485	MJ	(Germani, et al., 2019)
	Water	0.206	kg	
	Glass	1.03	kg	

*Same as the sorting process used for mixed plastics

Annex I Critical Review Statement

START2SEE
LIFE CYCLE ASSESSMENTS

START2SEE PTY LTD
UNIT 8 / 2-4 KENSINGTON RD
SOUTH YARRA, VIC 3141
TELEPHONE +61 403 834 470
ROB.ROUWETTE@START2SEE.COM.AU

ACN: 143 127 315
COMMONWEALTH BANK OF AUSTRALIA
MELBOURNE VIC
BSB NO. | 063 019
ACCOUNT NO. | 1056 7769

WWW.START2SEE.COM.AU

thinkstep Ltd
Jeff Vickers
Technical Director

11 Rawhiti Road, Pukerua Bay
Wellington 5026
New Zealand

30 January 2026

Subject: Tetra Pak LCA critical review statement

Dear Jeff,

As the chair of the critical review panel, consisting of Elspeth MacRae, Gordon Robertson and myself, it pleases me to present you with a positive critical review statement concerning the life cycle assessment study "LCA of Beverage Packaging in Australia and New Zealand" that thinkstep-anz completed for Tetra Pak Oceania.

With regard to the final report (version 2.0 of 27 January 2026), the review panel concludes that:

- The methods used to carry out the LCA are consistent with ISO 14040, ISO 14044 and ISO 14067
- The methods used to carry out the LCA are scientifically and technically valid
- The data used are appropriate
- The data sources used were appropriate, well documented, appeared to be generally reliable and reasonable in relation to the goal of the study
- The calculations and assumptions employed were generally clearly and carefully described
- The interpretations reflect the limitations identified and the goal of the study
- The study report is transparent and consistent
- The conclusions drawn from this study are largely consistent with other LCA results for the packaging systems.

The report contains a comprehensive analysis of a large range of beverage packaging formats used in Australia and New Zealand, thereby providing a reasonably good coverage of key packaging systems in these markets.

Following our review of the updated LCA report and thinkstep-anz's responses to the review panel's comments, we would like to bring the following items to your attention:

1. Carton recycling in New Zealand
    - The panel recommends that information is obtained directly from the saveBOARD / Tetra Pak joint venture about carton landfill and recycling rates, as well as the expected trends given the JV's efforts to increase material recovery from cartons.
    - Furthermore, there are numerous council transfer stations and local drop-off points (beyond city kerbside collection) that may contribute to carton recycling in New Zealand. Consulting these stakeholders and/or including data from several of their sites could make the end-of-life scenario more robust.
2. Reporting of statistical and material differences
    - There remains inconsistency in the use of terms such as "negligible", "minor", and "significant".
    - If differences are not statistically significant, state explicitly that "*no statistical difference was found*".
    - Remove terms that imply statistical testing has occurred unless it has been performed.
    - Ensure that the same error margin (5% or 10%) is applied consistently throughout the report, and clarify in the methods section how uncertainty was determined.
3. Verification of bio-based and recycled content
    - In our opinion, the certification (proof) of bio-PET sourcing should be explicitly stated in the report for transparency, noting the new techniques and mass balancing approaches emerging for this.
4. Sampling, replication and representation
    - Product lines from competitors are quite different from each other in a number of areas (depending on the package type). Using an average from a sample size of three packages for a beverage category may mask the underlying details (and spread in results). This point could be subject to scrutiny from competitors or potential customers, so transparent and precise wording is essential.
    - Acknowledge that this approach limits the ability to detect small or statistically meaningful differences, as variation between competing packages can be substantial and may obscure genuine performance differences between company products and alternatives. (The explanation provided in the conclusion section is clearer than in the methods; consider aligning the methods text accordingly.)
5. Biogenic carbon modelling and GHG accounting standards
    - The panel agrees that the treatment of biogenic carbon (i.e. release of biogenic carbon in case of recycling) follows ISO 14067 and EN 16485.
    - The effect of this methodological requirement (recycling leads to greater emissions compared to when a biogenic material is landfilled) may be considered peculiar by stakeholders and could result in criticism from competitors or potential customers. We believe it is important to recognise this risk and communicate clearly how the study's results are affected by this methodological requirement.
6. Microplastics and emerging materials
    - A future update of the LCA should consider whether newly developed plastic materials may degrade to CO_2 rather than microplastics, and how this could influence the LCA's results.

In our opinion, the items listed on the previous page do not infringe on the LCA's compliance with ISO 14040, ISO 14044 and ISO 14067 standards. As such, further revisions are optional or may take place outside the report (i.e. in derivative communication materials).

Please feel free to contact me should you have any further questions regarding our final review statement.

Yours sincerely,

Rob Rouwette
Director, start2see Pty Ltd

Chair of the review panel

elspeth macrae
…………………

Dr. Elspeth MacRae

Co-chair, International Advisory Council on Global Bioeconomy (IACGB)

Former Chief Innovation and Science officer, Scion

Packaging expert for the review panel

Verified by pdfFiller
01/29/2026

Dr. Gordon Robertson

Former Adjunct Professor, University of Queensland

Packaging expert for the review panel

Annex J Review panel comments

Annex J Review panel comments

Annex Table J-1: Review panel comments and responses v1.0

No	Page/ Section	Topic	Reviewer comments	Response
1	General	Structure and Repetition	There is a lot of repetition that could be cut down. The document could be streamlined to be more user-friendly, as it was often repetitive with different sections saying the same thing. The structure could be improved; for example, graphs should always appear at the same point in the text, preferably before the discussion of the data in them.	Thank you for the comment - we have reviewed content and cut down on as much repetition as possible. Some repetition exists to provide context where necessary.
2	General	Writing Style	There are typos and odd phrases that appear to be written by a non-native English speaker. The phrase "this study" is sometimes used confusingly immediately after describing something else. Improve consistency throughout report by using mL instead of ml, and apply either 300mL or 300 mL form throughout.	Spell check completed.

No	Page/ Section	Topic	Reviewer comments	Response
3	General	Data and Sourcing (NZ)	The practitioners should consult the Tetra Pak and Save Board joint venture in New Zealand regarding cartons to landfill. Transfer stations across NZ should be contacted to get actual collection and recycling rates, as this data is available and contradicts statements that NZ recycles everything to landfill (kerbside is only a city issue really).	Content has been updated for end-of-life section 3.8.2: In New Zealand, recycling food and beverage cartons is managed by the Food & Beverage Carton Recycling Scheme (FBCRS). This scheme relies on people dropping off their cartons voluntarily, which is why the recycling rate is so low. Local council kerbside recycling doesn't accept these cartons. Between 1 August 2024 and 31 July 2025, the scheme collected 38 tonnes of cartons. Approximately 4,000 tonnes of food and beverage cartons are placed on the New Zealand market each year, which means the recycling rate is only about 1%. The remaining 99% goes to landfill. Cartons collected by the FBCRS are used to make building products while a small proportion is exported to pulp mills. It is assumed that cartons reach their end of waste state once they are washed and delivered to the collection point.
4	General	Bioplastics Terminology	The blanket statements about "bioplastics" should be changed to specifically reflect the material being discussed (e.g., bio-PET), which is chemically still PET and hence breaks down the same was as PET. It should be noted that other bioplastics, like PHAs and PLA, are new chemical materials and do break down differently.	Added to section 2.1: Tetra Pak produces 'plant-based' versions of cartons where plastics used for closure and laminate coating are made of bioplastics: bio-HDPE and bio-LDPE respectively. Both bio-HDPE and bio-LDPE are made from sugarcane. They are non-biodegradable and have the same properties as fossil-fuel based HDPE and LDPE plastics (see section 3.8.3). Section 3.8.3 has been updated to include more detail on bioplastics.

No	Page/ Section	Topic	Reviewer comments	Response
5	General	Statistical Significance	The report makes claims about differences (e.g. a 0.01 difference) without statistical backing. There needs to be a clear distinction between what is statistically significant and what is not, especially when using language like "significant differences".	The report has been reviewed to remove content that is immaterial (anything with negligible differences are not mentioned, mentioned for completeness or mentioned to explain their insignificance.
6	General	Life Cycle Assessment (LCA) Boundaries	The start and end points for the material/product value chains (and LCA) of different materials are not necessarily clear. While the LCA for aluminium describes the full process from bauxite mining, the equivalent full description for paper (from planting trees), glass, and plastic is not as clear.The aluminium LCA describes including bauxite mining through to ingots and buying ingots from China (from memory) and then manufacturing the flaky barrier or pouches and cans etc. Then I didn't remember seeing the equivalent full description for both paper (is it planting the trees, growing, harvesting, etc to make paper to be used)? Or for other items such as glass and plastic etc.	Detail of the background data upstreams have been added to section 3.9.2. for Raw Materials and Processes.
7	General	Proof of Material Content	It might be worth stating whether it's possible (or not) to provide proof that bio-PET is actually bio-PET, or that recycled content is verified, noting the new techniques and mass balancing approaches emerging for this.	It is possible to provide proof of bio-plastics purchased from Braskem. Both Braskem and Tetra Pak hold Chain of Custody certification (https://bonsucro.com/certified-members/). Certification has not been noted in report.

No	Page/ Section	Topic	Reviewer comments	Response
8	General	Comparison to 2020/2021 Study	It would be beneficial to have a small section comparing the results to the previous 2020/2021 study for the same materials, including noting what materials have changed.	Comparison of results matching the 2021 study was included in the report in section 5.4. A sentence has been added to highlight this.
9	General	Executive Summary	The executive summary needs to be more informative and focus on the key (e.g. top 5) points.	Executive summary has been redone, including other relevant points noted for the summary from other comments.
10	p. 4	Executive Summary / Conclusions	The conclusions should be linked to the data (quality):For example, it is stated that "Consumer end-of-life is significant for cartons, where biogenic carbon sequestration and release result in net sequestration for packaging due to high landfill rates and low degradation rates." Isn't this based on a scenario? That raises the question: How robust are the data and the scenario? Provide a sensitivity analysis if needed.For example, it is stated that "Cartons have the lowest carbon footprint of all beverage packaging options considered in this study in the Australian market." Does this need to be qualified (e.g. A1-A3; whole of life)? Assuming xyz (e.g. methane recovery and use) holds truth, etc.	Have updated the points, taking into account the conditions and statistical significance. The consumer end-of-life impact is dependent on the parameters applied at end of life. Sensitivity analysis is available within report covering these aspects. Claims that there not clearly significant have been removed (or reworded to provide explanations).

No	Page/ Section	Topic	Reviewer comments	Response
11	p. 5	Executive Summary / Conclusions	"Results of one of nine environmental indicators considered in this study (eutrophication of freshwater, "EP-fw") showed no clear preference for one pack format over another across different size classes and has been omitted from these conclusions." It should not be omitted just because the results show no clear preference.	Results of EP-fw reintroduced into conclusions and executive summary.
12	p. 6	Executive Summary / Improve Data Quality	"Obtain third-party-certified LCA data to improve accuracy and reliability in future studies." Add that this may require primary data for plastic (granulate) production, as third-party-certified [verified?] could still be based on generic data.	Added to recommendations section.
13	p. 6	Executive Summary / Design for recycling	The statement "Design for recycling: Manufacture cartons that are fully recyclable to ensure better end of-life material recovery." " is addressed by the fact that the present cartons are already fully recyclable. [see review article Robertson, G.L. Recycling of Aseptic Beverage Cartons: A Review. Recycling 2021, 6, 20. https://doi.org/10.3390/recycling6010020]	Have removed this recommendation. Have added content regarding recyclability into section.
14	p. 6	Executive Summary / Improve recyclability	The goal "Material circularity study to understand the relevance of carton recycling" is unclear. It should be clarified if this means closed-loop recycling and what "relevance" refers to.Also, is this not a near duplicate from Design for recycling?	This recommendation has been removed. It can be argued that the cartons are already designed for recyclability, however, the rates of recycling depend on collection.

No	Page/ Section	Topic	Reviewer comments	Response
15	p. 6	Executive Summary / Biodegradability	Suggestion to add: "Commission a study into the biodegradability of beverage cartons in landfills". This is important due to the significant uncertainty regarding the degradable organic carbon fraction (DOCf) of laminated and coated paperboard.	Have added to recommendations: Commission a desktop bioreactor study into the biodegradability of beverage cartons in landfills to reduce the uncertainty regarding the degradable organic carbon fraction (DOCf) of laminated and coated paperboard, improving accuracy and reliability in future studies.
16	p. 10	Aluminium in paper barrier	Change "using a paper barrier (with only a small amount of aluminium)" to "using a paper barrier (with only a small coating of aluminium)".	Updated to match
17	p. 11	Objectives / Metrics	"These statements will focus on the carbon footprint of products and packaging metrics such as the product-to-packaging ratio and the mass of plastic per litre of product." Be careful with these as they are metrics and not related to environmental impacts. It is also not clear what their objective is, as the metrics are only listed in the LCI section.	Thank you for the comment - we've included these as they are commonly used metrics for packaging considered useful and interesting to readers (measures packaging efficiency for example). Mass of plastic packaging is included (as per previous study) because of public concern regarding plastics in the environment (but cannot give a quantified output on plastics in the environment). Have made a note in the Goal section regarding metrics. The packaging metrics are provided to align with the methodology of the previous study (thinkstep-anz, 2021) and to enable high-level comparison of packaging across the two studies (applicable for juice and white milk). The metrics were used for the nutshell document in the previous study (page 2): https://www.thinkstep-anz.com/assets/Whitepapers-Reports/TetraPak_IN_a_Nutshell_v2.2_Final.pdf. Similar comparisons may be published from this study.

No	Page/ Section	Topic	Reviewer comments	Response
18	p. 12	Scope	Clarify if the study covers 200ml or 250ml packs. Out of 86 packages, specify how many are from NZ and Australia. Clarify what is meant by "3 different packages" and why 3 replicates of each type could not be obtained (surely the latter would be possible?).	Updated the relevant sections. Overall, 74 out of the 86 packs used for this study were purchased within Australia. The beverage brands are available across both markets with the same packaging. By three different packages, we mean three different brands for a beverage category, function and size class). This is not referring to 3 replicates of the same package. It was expected that each pack is mass produced within a reasonably tight tolerance and so it wasn't necessary to buy multiple versions of the same pack.
19	p. 12	Scope	"The average weight of packages was used across both Australia and New Zealand assuming the mass of packages does not vary significantly across the markets." This could be an important choice / limitation. The variation from the average is relevant as well, given some alternatives show rather minor differences.	We are in the same export market and using a large portion of packs from AU to model both AU and NZ packaging. It is assumed that the variation is not significant since packaging across New Zealand and Australia of the same brand are expected to have marginal differences from manufacture.
20	p. 13	Scope	It's surprising there is no non-Tetra Pak carton included for milk. Why is this? For clarity, specify "coffee" instead of "coffee and fsn" to avoid confusion. (Someone who doesn't know the products can read "coffee and fsn" as two product lines.)	Carton milk is not very common in Australia and NZ. Only UHT milk is available.
21	p. 15	Modelling Data	"Limburg (The Netherlands)" Limburg is a province in the Netherlands, as well as a town in Germany. I think Tetra Pak operates out of the latter.	Have updated the report content. Modelling has been updated to use the German grid for manufacture. Transport modelling correctly represented.

No	Page/ Section	Topic	Reviewer comments	Response
22	p. 15	Component Terminology	Change ‘caps’ to ‘closures’ throughout the report.	Replaced all "caps" with "closures".
23	p. 15	Wording of Assumptions	In "It is assumed that plastic alternative packaging," the word ‘alternative’ should be deleted.	Deleted "alternative".
24	p. 15	Recycled PET Bottles	Rewrite "Recycled PET bottles are assumed to be manufactured from plastic granulate that is captured and recycled in-market" as "‘Recycled PET bottles are assumed to be manufactured from plastic granulate that is obtained from recycled PET bottles in-market’".	Text has been replaced.
25	p. 15	Transport for Filling	Rewrite "transported to the country of purchase for filling" as "‘transported to Australia or New Zealand for filling’".	Text has been replaced.
26	p. 15	Glass Container Manufacturin g	Change "Glass containers are assumed to be manufactured in the country of purchase" to "‘Glass containers are assumed to be manufactured locally in either Australia or New Zealand’".	Text has been replaced.
27	p. 15	Glass Recycled Content	The assumption of 30% recycled content for glass is questionable and has a huge impact. Visy reports 70% recycled content in NZ and an average of 64% across ANZ in 2024. APCO reported an average of 54% in 2022-23.	Thank you - The base case for glass has been updated to 70% recycled content. This is a conservative approach because the recycled content available is market average across all glass colours and flint/clear glass typically has the lowest recycled content.

No	Page/ Section	Topic	Reviewer comments	Response
28	p. 15	Aluminium Recycled Content	"Aluminium cans are assumed to be manufactured from virgin aluminium". APCO reported an average of 66% recycled content in 2022-23, and Orora >60%. The rationale for choosing 0% recycled content as the default should be justified. Competitors could potentially use 100% recycled or 100% virgin aluminium, so that may need to be the range for the sensitivity analysis. Also, it is claimed that a conservative approach has been used. The report also states "where there is uncertainty, a choice has been made in a way that is designed to favour alternative packaging formats over cartons." As such, the default scenario should probably start with a high percentage recycled content (e.g. 70%).	Thank you - The base case for aluminium cans has been updated to 70% recycled content. Have also added aluminium with 2 different EFs to the sensitivity analysis (GLO and EU).
29	p. 15	Manufacturing & Sourcing Assumptions	It would be useful to compare the impact of using different Tetra Pak carton conversion locations (e.g., Brazil, Netherlands [or Limburg, Germany?]) versus Beijing.	Added a section to report. Also, for internal/review purposes, included in tab "Hotspots - across sites".
30	p. 15	Manufacturing & Sourcing Assumptions	The assumption that aluminium can manufacturers in ANZ use imported aluminium coils should be inspected, given there is also local aluminium ingot manufacturing. Perhaps check with Orora (https://www.ororabeverage.com/sustainability), Oceania, or other local manufacturers.	Presently, can body stock is imported and not manufactured in Australia and New Zealand. Can manufacture takes place within the countries. There are plans/operations to obtain the primary aluminium content from within Australia in the near future: https://www.visy.com/newsroom/2025/new-australian-market-leading-sustainable-beverage-can-83-recycled-content.

No	Page/ Section	Topic	Reviewer comments	Response
31	p. 16	Product Functionality	"...it is assumed that all packaging options fulfil the equivalent function of protecting the product and that there is no difference in shelf-life." This is a key assumption, and should be listed as such.	Mentioned in section 2.1 Product Function(s) and Functional Unit; and rephrased and included in section 7.2. Assumptions and Limitations.
32	p. 16	Consumer Choice	The reason for consumers choosing a 2L milk size is more likely cost-driven than because they "consume the milk quickly".	Updated text in section 2.1.
33	p. 16	Modelling Choices	"All competitor packages represent an average package of a specific size class per beverage in Australia and New Zealand." This makes sense for an overall comparison. It may also be worth showing the range, or comparing against best available alternative. (This depends on the variation between alternative packagings.)	The study aims at conducting an overall comparison for packaging in the Oceania market. The heat map used for all indicators contain comparison against the best available package per beverage category and size class in Annex F.
34	p. 17-20	"Plant-based" Definition	The term "plant-based" needs to be clearly defined. Does it mean paper without metal, plastic without paper, a specific type of bioplastic, etc.?	Added text to section 2.1 to clarify on plant-based: Tetra Pak produces 'plant-based' versions of cartons where plastics used for closure and laminate coating are made of bio-HDPE or bio-LDPE (see section 3.8.3).
35	p. 21	Excluded Processes	The phrase about retorting not being required is unnecessary and could be deleted. It could be replaced with "processes such as pasteurisation and ultra-heat treatment are not included in the study".	Removed mention of retorting and have added the text to section 2.2.

No	Page/ Section	Topic	Reviewer comments	Response
36	p. 21	Sterilisation	Reword "Sterilisation is included in all packaging options" to "'Sterilisation of the packaging material prior to filling is included where appropriate'" , as not all materials (e.g., HDPE, glass) are sterilised.	Have updated text.
37	p. 21	Modelling Choices	"The impact of producing the beverage is excluded from the assessment. Only the packaging proportion is included for distribution and end-of-life." For distribution, this may need to be challenged, as in practice a difference may not be measurable. i.e. if packaging makes up 3% of the product mass, and differences between packaging options are say 20%, that's a 0.6% difference in overall mass transported (i.e. tkm or transport fuel consumption). If you only look at transport of packaging material, you might conclude that there's a 20% difference in transport fuel use... The latter is only valid if you transport a truck full of packaging material (e.g. pre-shape).	System boundary excludes beverage for each stage of the life cycle, including during transport. The transport emission factors are based on tkm hence takes into account the functional unit. Any additional mass (the beverage) would scale the results of transport accordingly.
38	p. 22	Retail Refrigeration	Excluding retail refrigeration unjustly favors chilled beverages over shelf-stable ones. Retail refrigeration accounts for a significant portion of electricity use in supermarkets. The Franklin report showed home refrigeration was largely irrelevant, but supermarket refrigeration is key. This exclusion should be added to Table 2-4.	Unfortunately we don't have good enough data to model this. The Franklin report focusses on home refrigeration which is out of scope for this study. To minimise uncertainty, we've excluded retail refrigeration from scope and included a recommendation to investigate retail impact in future studies.

No	Page/ Section	Topic	Reviewer comments	Response
39	p. 21-22	System Boundaries	Is transport to recycling or landfill at end-of-life included or excluded? If excluded, this needs to be justified (or included).	Transport to end of life is included - noted in the end-of-life section: Once the beverage has been consumed, the packaging waste is expected to be sent for recycling or to a landfill. End-of-life treatment rates for Australia and New Zealand are given in the following sections. All packaging waste is assumed to be transport over a distance of 50km.
40	p. 22	Terminology	Rewrite "For biological materials which are sent to recycling" as "'For biogenic materials which are recycled'". The phrase "as opposed to adding to the waste issue" is unscientific and should be deleted or rephrased.	Text has been updated as suggested.
41	p. 22	Carbon Release during Recycling	"For biological materials which are sent to recycling (paper, cardboard, bioplastics), the biogenic carbon that is sequestered when the material is produced is modelled as being released artificially as carbon dioxide to the atmosphere during the recycling process. This occurs due to the material leaving the system boundary to become part of another product system,..." This is also relevant for recycled materials entering the product system. Add a sentence to explain whether there are materials entering the product systems with biogenic carbon sequestered in recycled content.	Have added a sentence to clarify that there are no recycled materials entering the system with biogenic carbon. For cartons, it's either recycled or bio-plastic, and not a combination of recycled and bio-plastic.

No	Page/ Section	Topic	Reviewer comments	Response
42	p. 22	Coatings and Inks	The exclusion of coatings and printing inks for competitor packaging seems unfair to Tetra Pak cartons. Clarify what coatings are being referred to (e.g., LDPE).	Apologies, inks were actually excluded. Coatings in this context was related to external coatings (ink) rather than laminate. We've removed mention of "coatings" in this section (as all coatings are included).
43	p. 22	Carbon Release during Recycling	The assumption that CO2 is released when recycling bioplastics is questionable, as the carbon is in the polymer and often reused. This is where the default LCA rules may lead to unintended consequences and a sensitivity analysis would be useful.	Agreed that the LCA rules may lead to unintended consequences. Release of biogenic carbon when recycling leads to greater impact compared to when a biogenic material is landfilled. However, the reason that the artificial biogenic carbon emission is to allow the first life to be carbon negative and consequent life cycled to be an emission (similar to burning fossil). If the biogenic carbon is not released, subsequent material inputs cannot claim the credit according to ISO14067 (guidance in Annex E.3) and EN 16485. Sensitivity analysis has been added to report to show impact of no artificial release vs the artificial release. For this study, the recycling rates are too low to make a material difference with this approach.
44	p. 23	Paper Manufacturin g	What about the impact of using different sources of heat/electricity for paper manufacturing on the LCA?.	Tetra Pak data is used to model the paper emission factor (primary data). The does not consider paper manufacturing from other regions. For cardboard, all packs use the same material. While there will be an effect, they apply to all packaging.

No	Page/ Section	Topic	Reviewer comments	Response
45	p. 24	Biogenic Carbon Release	The assumption that sequestered biogenic carbon is released as CO2 when paper is recycled is questionable. It's unclear where this CO2 release would occur, as most fibers end up in the recycled product. It seems odd to single out biogenic carbon and not all carbon sources.	Treatment of biogenic carbon has been a point of contention in LCA. As per comment response 45 above, this study follows ISO 14067 guidance in Annex E.3 for the treatment of biogenic carbon. This methodological approach is also used for producing EPDs (PCR EN 16485 image below - EN 16485 is for timber products in construction; however, this gives the clearest guidance on carbon accounting for biogenic materials). Have added following text to the Limitations section of the report: → Biogenic carbon at end-of-life was treated in accordance with ISO 14067 (Annex E.3) and EN 16485. This modelling approach has a significant impact on the study results. → When packaging containing biogenic carbon is sent to landfill, the carbon is modelled as an emission. These emissions, and their associated impacts, are calculated based on the fraction of degradable organic carbon (DOCf) and the landfill gas capture rate. Since landfill rates are high in Australia and New Zealand, this aspect of the modelling influences overall results. → When materials containing biogenic carbon are recycled, the carbon is treated as an artificial emission of CO2 to air. This approach complies with ISO 14067 (Annex E.3) and EN 16485. It also ensures that any incineration of bio-based materials in subsequent product life cycles can be treated as carbon neutral (which is common practice in national greenhouse gas inventories). For Australia, where recycling rate for cartons is relatively high, this modelling choice influences overall results and reflects a conservative approach. If this artificial release was not included, the life cycle GHG emissions from cartons would be lower.

No	Page/ Section	Topic	Reviewer comments	Response
46	p. 24	End-of-life allocation	"This study uses the cut-off approach as the primary method, as the authors consider it to be the most appropriate for packaging materials given they are typically of relatively low economic value." We would suggest this is explained differently, as "relatively low economic value" is quite subjective. Generally, the choice for allocation method is explained based on availability and demand for recycled materials. (see comments hereafter)	Text has been updated as suggested.
47	p. 25	Figure 2-3	These diagrams are very high-level, and do not correctly show / describe the intricacies associated with the two methods. As long as the diagrams are not used in publications (outside this report), then it is not a major issue. Note: The credit may also be a debit.	The diagrams are high level and cover only the main processes. They have been kept as is for the report and is not expected to be replicated outside of the report (similar to the previous study from where these diagrams were taken - reference included).
48	p. 25	Recycled Material Terminology	The word ‘scrap’ should be replaced with more meaningful terms. For example, rewrite the sentence to: "‘the recycled material input to the production process is considered to be burden-free and, equally, no credit is received for post-consumer packaging made available for recycling at end-of-life’". This applies to subsequent paragraphs as well.	Replaced with 'waste" and "waste for recycling" where relevant. Some instances of "scrap" are retained matching earlier works.

No	Page/ Section	Topic	Reviewer comments	Response
49	p. 25	Cut-off Approach	"no credit is received for scrap available for recycling at end-of-life. This approach rewards the use of recycled content but does not reward end-of-life recycling." Consider adding: This approach is generally preferred in cases where there is a high supply of recyclable materials and a low demand.	Added to text.
50	p. 25	Cut-off Approach	"Open scrap" should probably be "open-loop scrap"	"Open scrap input" is a modelling description rather than a reference to open/closed loop recycling. This is equivalent to the input of secondary material/ recycled material input into the system.
51	p. 25	Substitution Approach	"substitute for an equivalent amount of virgin material." should be "substitute for a functionally equivalent amount of virgin material."	Added to text.
52	p. 25	Substitution Approach	"the impact of using recycled material is the same as using virgin material. This approach rewards end-of-life recycling but does not reward the use of recycled content." Consider adding: It is generally preferred in situations where there is limited supply of recycled materials and the demand for them is high.	Added to text.
53	p. 26	Substitution Approach	The report talks about net scrap leading to a credit. It would be useful to also briefly explain what happens if there is a shortfall (i.e. the net scrap flow is negative).	Added content regarding burdens that occur if required scrap input is greater than available scrap from end-of-life.

No	Page/ Sectio n	Topic	Reviewer comments	Response
54	p. 29	Microplastics	The commentary on microplastics is ironic given the discussion on CO2 return to the environment. Some bioplastics (though not bio-PET) degrade fully to CO2 without creating microplastics.	This covers plastics in the study that may not biodegrade. Have added note (those that do not biodegrade completely).
55	p. 33	Reviewer Title	Change "Professor Gordon Robertson" to "'Dr Gordon Robertson'". Change "Dr Elspeth MacRae, former Chief Innovation & Science Officer, Scion" to include "currently co-chair IACGB". More details can be provided/added if relevant.	Updated.
56	p. 34	Component Terminology	Change "caps and lids" to "closures".	Updated all instances.
57	p. 34	Typo	Change "Durning internal quality" to "During internal quality".	Updated, thanks. Spellcheck run.

No	Page/ Section	Topic	Reviewer comments	Response
58	p. 34	Replication and Sample Size	The descriptions of replication are very unclear. It's expected to see at least 3-4 replicates for every pack, and it's unclear why this wasn't possible (e.g., buying 4 cans from a supermarket shelf). What does sample size mean for statistic significance?	There are no replicates. As per original study, multiple brands of the same product category, material and size class were sought during purchasing to represent the market. It was expected that each pack is mass produced within a reasonably tight tolerance and so it wasn't necessary to buy multiple versions of the same pack. Updated text to: Packs were selected to represent a given category (e.g., Australian 500 mL juice packed in a PET bottle). The aim was to purchase three packs (different brands) per category, function (chilled or aseptic) and size class; however, there were not enough packs available to meet this aim in many cases.
59	p. 35	Wording and Terminology	Change "did not come in sizes" to "'did not have the internal volumes'". Describe the "cap and ring component" as a "'closure with tamper-evident band that is ruptured during opening'", and refer to the provided nomenclature diagram (to the right) for plastic closures.	Added image and changed description to suit.

No	Page/ Sectio n	Topic	Reviewer comments	Response
60	p. 35	Outliers and Sample Availability	The issue of outliers is confusing when there was a struggle to get 3 replicates. The comment about only 1 pack being available is also unclear, as more should be available on retail shelves. This needs better clarification.	The work is based on collecting three different brands to represent the market for the chosen size class, packaging material and function. The text has been extended with an example and additional text for clarification: Packs were selected to represent a given category (e.g., Australian 250mL juice packed in a PET bottle). The aim was to purchase three different packs (i.e., different brands) per category, function (chilled or aseptic) and size class. For example, for the 250mL juice in a PET bottle, we purchased Berri, V8 and Pop Tops branded packages. In many cases, there were not enough brands available to meet this aim. In cases where there were many different options, the packs that occupied the greatest shelf-frontage were selected, as these were assumed to be the highest-selling products in that category.
61	p. 36	Refrigerated Carton Structure	For "Refrigerated (short shelf life) cartons have a similar structure but there is no aluminium barrier layer," add that there is only one internal plastic (LDPE) layer.	Updated text as suggested.
62	p. 36	Figure Readability and Content	The figure is hard to read and needs a larger font.	Tetra Pak provided updated images and they have been resized for larger font.

No	Page/ Sectio n	Topic	Reviewer comments	Response
63	p. 36	Supply Chain Aspects	A key piece of information is that the carton board comes from Sweden, which means the electricity and supply chain impacts (electricity grid) of Sweden should be compared to those in Australia and NZ, as this is increasingly important. Is it possible to model the extremes of where different components were manufactured and transported to Australia and NZ for final carton manufacture and fill? This would clarify the variation that could be present in Tetra Pak cartons.	Tetra Pak supply chain data for paperboard is primary data and not based on assumption. The emission factor data has been matched to the three-year running average for paperboard. While it is very possible that material manufactured in another region will have different emission factor due to differences in electricity grid and thermal energy for drying, this aspect has not been explored for paperboard as Tetra Pak do not source paperboard for their cartons from Australia/ New Zealand. Hotspot analysis has been included for carton manufacture in other manufacturing locations. While this does not extend to raw material locations, it provides indication that should materials be sourced from different regions, impact would change. We have also modelled Tetra Pak manufacturing where they occur (i.e. not using EU average electricity). The breakdown from this will further provide insight on variation.
64	p. 37	Figure 3-2 Clarity	Figure 3-2 is too skeletal. It should show that after lamination comes printing, and the material is transported in rolls. The term "raw materials" should be clarified to confirm it (presumably) includes all starting materials like trees, oil, chemicals, etc..	The diagram reflects stages that have been modelled. Printing was left out as inks are excluded (but all laminate manufacturing energy is captured for the process as a whole). We've referenced the original report for the diagram and included some updates in text to cater for process and raw material inputs. The datasets used for modelling include the supply chain from forest to paper input, followed by raw material inputs (and their upstreams) required for processing and manufacturing the carton laminate. The background data section contains these details.

No	Page/ Section	Topic	Reviewer comments	Response
65	p. 37	Key Finding	“The paperboard has higher embodied carbon compared to the version used in the original LCA study and is based on Tetra Pak’s global three-year running average for paperboard.” This sounds like an important finding that should be included in the executive summary.	Added to the executive summary, together with a brief section on differences against previous study.

No	Page/ Section	Topic	Reviewer comments	Response
66	p. 37	Aluminium Data	"The aluminium input used for modelling the aluminium barrier layer for Tetra Pak cartons used a European average aluminium dataset from the MLC Database (Sphera, 2024). This choice was made as Tetra Pak's global three-year running average for aluminium carbon emission factor was much lower than the global aluminium emission factor. The European dataset is conservative as the emission factor from this data is higher than Tetra Pak's global average. Non-Tetra Pak cartons were modelled using the global average emission factor for aluminium."If the Global average is higher than the European average, then it requires justification as to why there should be a difference in data sources between Tetra Pak and non-Tetra Pak. There is a real risk that data sources are used that don't reflect what is actually going into Tetra-Pak's and competitor's products. Tetra Pak's global average may not reflect the material used in the products relevant for this study, nor is it clear what the Tetra Pak's global average values are based on. They may not align methodologically for example. If there are differences in the model because one data point is "known" (i.e. Tetra Pak's alu source GHG intensity), and the other data point is unknown (i.e. competitor's alu source GHG intensity), then choosing different datasets is a direct LCA practitioner's choice affecting the comparison. Please review / explain.	Thank you for your feedback. In this case, primary data was used where it exists as per section 6.3.5 of ISO14067. The competitor EF is unknown and so we have used the global average data from IAI. This approach is aligned with ISO14067 when there is no primary data. In this case, the global average EF is lower than the Chinese aluminium EF - we expect the source of raw material to be Asia. It is unlikely that New Zealand/Australia would purchase aluminium from Europe. As a global company, Tetra Pak sources its aluminium through its global supply chain. Most other(competitor) packaging materials are produced through a regional supply chain in the Asia/Pacific region.
67	p. 38	Transport of Preforms	How far away from the filling sites are the preform sites?	Preform transport to filling site is assumed as 50km. Now noted in section 3.3.2.

No	Page/ Section	Topic	Reviewer comments	Response
68	p. 38	Table 3-1 Terminology	In Table 3-1, replace "cap/lid" with "closure". Clarify if the "seal" is the lining in the closure and if the "ring" is the tamper-evident band, and change the terms accordingly.	Seal has been updated to induction seal (not lining in closure). Other terms updated to suggestions.
69	p. 39	Manufacturing Process Descriptions	Describe PET manufacturing as "stretch blow moulding" and HDPE as "extrusion blow moulding". Change "the pull tab is installed" to "'the pull tab is rivetted onto the end'". Change "the cans are filled and capped" to "'the cans are filled and the ends seamed on'". Correct the typo "as opposed cans" to "as opposed to cans".	Have updated as suggested.
70	p. 39	Figure 3-2 Clarity	What is the transport mode from China to the Australian or NZ markets?	Transport mode is container ship with additional road transport to cover site to port. Transport section and Background data section contains details to minimise repetition.
71	p. 39	Tetra Pak Aluminium Sourcing	There is a claim "that Tetra Pak specifically sources low carbon aluminium". Such a claim needs explanation (How do they do this?) and substantiation.	This has been reworded to: Tetra Pak sources aluminium from Aluminium Stewardship Initiative (ASI) certified suppliers. ASI is a global initiative setting standards and certifications addressing GHG emissions, water use, biodiversity, human and labour rights and OHS. Tetra Pak's Climate Team tracks supply of materials per manufacturing site, identifying emission factors of materials used. The EFs are used to calculate three-year running global average which we've used in this study.

No	Page/ Section	Topic	Reviewer comments	Response
72	p. 40	Glass Recycled Content	The rationale for the glass recycled content is not clear. Surely you can get more realistic data for NZ and Australia? If 30% is suitable for a comparison against the previous study then that's OK, but it's a separate item.	Visy glass content is 70% recycled (https://www.visy.com/newsroom/2025/industry-leading-70-recycled-glass-target-smashed-manufacturer-visy-new-zealand-first). However, it is unclear if this is for clear glass - we expect the recycled content for clear glass to be lower. In the interest of following a conservative approach glass recycled content has been updated to 70% for the base case.
73	p. 42	Excluded Processes	"Pallet packaging such as plastic shrink wrap are excluded from the study." Presumably because this is identical for all options? Add the justification.	Added to list of exclusions and noted justification in section 3.3.6.
74	p. 44	Clarity of Report	"For plastic, non-Tetra Pak carton, pouch, aluminium and glass packages, it was assumed that manufacture occurred within Australia or New Zealand. For laminate (cartons and pouch), glass and aluminium, non-laminate based raw materials were assumed to be sourced within the two countries. For plastic and laminate materials, raw material was assumed to be sourced from China."It would be good to present an overview of the materials and GWP factors for each option. There are an awful lot of options and combinations of materials in the report, and it is very difficult to understand what is influencing what.	Emission factors from the model are provided separately. As they are proprietary to Sphera, they will not be made available in the report. Hotspot analysis to a greater degree is provided within the report focussing on one of each material type in the study.
75	p. 45	Use Phase	The "Use Phase" section needs to be expanded to clarify that "use" refers to consumption by the consumer after purchase. As noted earlier, the energy for chilling non-aseptic beverages in retail outlets should be included.	Have added to text: No use phase (where the user stores and consumes the beverage in the packaging after purchase) is modelled for packaging comparisons.

No	Page/ Section	Topic	Reviewer comments	Response
76	p. 46	Carton Recycling	"Tetra Pak's own analysis suggests a recycling rate of 29% for Australia in 2024, and this number is used as a baseline." Please provide the evidence or reference, as this value may	This is from personal communication with client - there are independent audits of MRFs in Australia (APC audited), and the 29% is from these audits based on collected bales.
77	p. 46	Tables 3-3 & 3-4 (Recycling)	SaveBOARD now has plants in NZ and Australia that convert used beverage cartons into MDF, which should be considered. The NZ recycling figure of 2% seems low compared to Australia's 29%. SaveBOARD should be contacted to get their latest processing volumes for cartons in both countries. Note: The Polymer coated paperboard values in Australia don't add up to 100%	Have checked SaveBoard processes (see tab for SaveBoard process) and they align with expectations. The packs are washed at some point and while in NZ this is done by consumers, it is taken as part of end-of-life processes. There are important differences related to collection of cartons between Australia and New Zealand. Australia allows curbside collection of cartons, hence data for Australia is based on MFR audits. The resulting cartons are then used for manufacturers such as SaveBoard (Saveboard is not the only destination). New Zealand does not allow curb-side collection of cartons. Consumers are responsible for taking cartons to collection sites. The % for recycling has been recalculated based on data from the Food & Beverage Carton Recycling Scheme (FBCRS) that keep statistics.

No	Page/ Section	Topic	Reviewer comments	Response
78	p. 46	Transport Distance	The assumption of 15 km for transport of filled packages to a retailer is very low and unlikely for both countries, even within major cities. Then need to compare likely longer distance delivery depending on populations….; The APCO study does not provide data for laminated products such as cartons and pouches. This study carries forward the previous – as in several other instances this is "our study" not APCO study carries forward….	Updated transport distances as noted in section 3.6.Regarding the pouch and carton packaging, Section 3.8.1 has been updated for clarity.
79	p. 47	Terminology and Data	See earlier comments on the questionable assumptions about biogenic carbon sequestration. Change "landfill processing" to "'landfilling'". For waste recycling, better data should be sourced beyond just city data, potentially from reports like "Rethinking Plastic" from the NZ PM's Chief Science Advisor (https://www.pmcsa.ac.nz/topics/rethinking-plastics/).	Have replaced landfill processing with landfilling. Regarding recycling - specific to cartons, Tetra Pak tracks data from the Food & Beverage Carton Recycling Scheme (FBCRS), those who manage recycling food and beverage cartons. Their data shows that the % of cartons officially recycled is 1%. There is no curbside collection for cartons across NZ.
80	p. 47	Biogenic Carbon at End-of-life	It is not necessarily clear to the unitiated reader why carbon is released at end-of-life (recycling), but partially sequestered when sent to landfill. You are following specific LCA rules, but the report would benefit from explaining this or referencing where the explanation can be found, why/what assumptions are made, and how the methodology affects the comparison between bio-based materials, bioplastics and fossil plastics.	Content has been added to note the rules follows and how they impact results - after analysis, it looks like the end-of-life approach does not impact result in this study due to low recycling rates.

No	Page/ Section	Topic	Reviewer comments	Response
81	p. 47	Biogenic Carbon at End-of-life	"Where the material is sent for incineration or recycling, the sequestered biogenic carbon is released as carbon dioxide to the atmosphere (in addition to emissions from combustion)." As incineration and combustion are not relevant (unless you specify combustion relates to flaring), these are best removed from the text.	Removed text.
82	p. 47-48	Bioplastic s	Clarify if "bioplastics" refers to "bio-based plastics". In this study, this only applies to the closures on some Tetra Pak cartons (bio-HDPE from sugarcane). The assumption that bioplastics do not degrade in landfill is questionable and contradicts recent literature. A helpful figure from European Bioplastics (to the right) could be included.	A brief section has been added with content on bio-based plastics. The report refers to bio-based plastic and mention of bioplastics have been replaced.

No	Page/ Section	Topic	Reviewer comments	Response
83	p. 48	Cited Literature	Some of the literature cited is very old (e.g., from 1998, 2006) and more recent material should be available. The reviewers disagree with the report's assumption that bioplastics (like bio-coats and bio-caps) do not degrade in landfills. This is an inaccurate generalisation in our view, pointing out that unlike conventional fossil-fuel-based plastics, many bioplastics are specifically designed to biodegrade through the action of microbes and enzymes found in waste environments. A growing body of recent scientific literature confirms that various bioplastics can biodegrade under simulated landfill and soil conditions. Examples include papers from:- Sustainable Waste Management & Circular Economy (2024) Evaluation of bioplastics biodegradation under simulated landfill conditions, Published: 04 October 2023 Volume 31, pages 17779–17787- Waste Management (2021) Degradation of bioplastics in organic waste by mesophilic anaerobic digestion, composting and soil incubation, Volume 134, October 2021, Pages 67-77, https://doi.org/10.1016/j.wasman.2021.08.016.- Journal Kimia dan Kemasan (2018) Isroi, Isroi & Supeni, Guntarti & Eris, Deden & Cahyaningtyas, Agustina. (2018). Biodegradability of Cassava Edible Bioplastics in Landfill Soil and Plantation Soil. Journal Kimia dan Kemasan. 40. 129. (https://www.researchgate.net/publication/328641417_Biodegradability_of_Cassava_Edible_Bioplastics_in_Landfill_Soil_and_Plantation_Soil). - Renewable and Sustainable Energy Reviews (2017) Renewable and Sustainable Energy Reviews Volume 71, May 2017, Pages 555-562 Sustainable bio-plastic production through landfill methane recycling (https://www.sciencedirect.com/science/article/abs/pii/S1364032116311376) The science in this area is constantly evolving, with new discoveries such as microbes that can now degrade conventional plastics like PET. While challenging the report's broad assumption about bioplastics, the statement made in the report regarding PET degradation ("some bioplastics such as bio-PET and bio-PE, which are chemically identical to their fossil fuel counterparts, do not readily biodegrade") is okay.	Thank you for your feedback. We have now clarified the distinction between bio-based plastics and biodegradable plastics in the report. The term bioplastics is often used to describe both bio-based and biodegradable plastics, which contributes to confusion in terminology. We have reviewed the report to use the term bio-based plastic only. The literature you suggested is indeed relevant for bio-based and biodegradable plastics, such as PLA and starch-based. However, it does not apply to the material considered in this LCA study. This study has bio-HDPE/bio-LDPE, which is made from biomass but is not biodegradable. We have included this discussion in the report (section for Plastic production -> bio-based plastic).

No	Page/ Section	Topic	Reviewer comments	Response
84	p. 49	System Boundaries	"The methane that is capture is flared or used to generate electricity."Explain what was modelled and where the system boundary ends, because if you give a credit for electricity generated from methane captured in a landfill site, doesn't that violate the double-counting principle in (5.12 of) ISO 14067?	This text notes what generally happens at landfills, not what's included in this study. Have made a note so it is clear. There are no credits for electricity generation for this study.
85	p. 50	Carton Recycling Process	The assumption that carton recycling requires similar processing to metals and plastics needs to be verified by contacting recyclers in Australia and NZ, such as SaveBOARD, where little washing occurs. Also, the processes for metals and plastics differ, so be precise about what is modelled. Note: Cartons are missing from table 3-6.	SaveBoard processing has been examined. There is no washing at SaveBoard - waste is shredded, blended, squashed and melted (hot-pressed) - see SaveBoard process tab. However, they expect cartons to be washed and flattened before they are dropped off. As a conservative measure, the washing and processing is included for cartons in the model at end-of-life.
86	p. 52	Table 3-7 (Grouping of regions)	The table shows that RER and TH have been used as proxies for multiple countries. The electricity mixes in these countries can vary quite a bit. If electricity is important, then use more specific national mixes.	Emission factors for electricity grids per country were compared (see tab Hotspots and additional section in report). Due to variability, we've now remodelled the packaging for country-specific electricity.

No	Page/ Section	Topic	Reviewer comments	Response
87	p. 54	Table 3-8 (Data Sourcing)	Clarify if HDPE and LDPE are sourced from Asia. Using a European database for the paperboard dataset seems inappropriate for this study.	HDPE and LDPE for cartons are sourced regionally - i.e. close to where the cartons are manufactured. For sites in Asia, CN background datasets were used while for sites in Europe, EU datasets were used. Have noted source of data for HDPE and LDPE in the report (background data section). The paperboard is made in Sweden (primary data)- the EU dataset has emission factor that closely matches the Tetra Pak paper EF.
88	p. 55	Table 3-9 (Data Sourcing)	The location can have significant effect on emissions (e.g. for aluminium and plastics processing), so arguably using a global average is a proxy. Did you adjust the Global datasets by using AU/NZ electricity mixes to better represent local conditions?	It is not possible to adjust MLC datasets to this extent, hence selection of background data generally involves research to identify expected EFs and then comparison of dataset results to fit. Aluminium used for can manufacture are not sourced from AU/NZ. Therefore, raw material has not been modified to use local electricity. Only the can manufacture electricity has been adapted to local grids. Plastic processing used country-specific grids, however, plastic raw materials are modelled based on existing aggregated datasets from Sphera's database (process is the same as the 2021 study).
89	p. 57	Table 3-11	Elsewhere it says plastic wrap is excluded. What is correct? Pallets have a visible effect on the results (bringing down all carbon footprints(!?)), but are not included in this table.	Plastic wrap that is included is secondary packaging. Shrink/plastic wrap used to wrap around pallet, tertiary packaging is excluded. Added packaging level to table for additional clarification
90	p. 58	Table 3-12	Is incineration relevant?	Not relevant - removed

No	Page/ Section	Topic	Reviewer comments	Response
91			"Distribution assumptions are given in section 3.3.6.3." The referenced section discusses distribution of secondary/tertiary packaging only. Please add other relevant details.	Replaced cross-reference
92	p. 60	Results Interpretati on	The statement "LCIA results are therefore relative expressions only…" should be included in the document's summary. The scope of the "Consumer Pack" category needs clarification regarding what beverage distribution is included or excluded.	Added to exec summary. Added a clarification to "Consumer Pack" that beverage transportation is excluded.
93	p. 61-92	Results Section (Chapter 5)	This chapter has uneven text and structure, making it hard to follow. There is no indication of the statistical significance of differences, which undermines the credibility of the data. Comments on results need to be structured consistently (e.g., always Aus first, then NZ). Figure 5.3 and key points are often buried in the text.	The results chapter has been restructured - includes packaging characteristics, results graph, key outcomes. Since patter of results for AU vs NZ is consistent across all comparisons, this is mentioned in interpretation.
94	p. 62	Unit Consistenc y	Ensure consistency in units. The report uses both "ml" and "mL". Choose one form and use it throughout.	Standardised to mL

No	Page/ Section	Topic	Reviewer comments	Response
95	p. 63-64	Statistical Significance of Claims	Statements like "rPET package has lowest carbon footprint for New Zealand" or "Cartons with 30% recycled content have slightly lower carbon footprint" or "Carbon footprint for the glass packaging distribution stage is higher due to the greater mass of packaging being transported. The end-of-life of the glass bottles is also more significant than it is for cartons." should be removed if the differences are not statistically significant. (or else show evidence of significance)	Statistically insignificant content has been removed.
96	p. 65	NZ vs. Australia Electricity Grid	The statement about the lower carbon-intensive electricity grid in NZ being the reason for lower footprints for PET/rPET is a key point and should have been raised earlier.	Mentioned in the Executive summary and in the interpretation section.

No	Page/ Section	Topic	Reviewer comments	Response
97	p. 60-83	Improve Clarity and Consistency of Results	It is hard to keep track of information when reading the results chapter. For improved clarity and consistency throughout the chapter, a standardised structure should be used for presenting results and summaries: - Consistent comparison order: When comparing the carbon footprints of different packages, the report should be consistent in its presentation, for example, by always discussing the lower-impact package before the higher-impact one. - Structured summaries: Each product category section should conclude with a summary that focuses exclusively on significant differences. - Specific summary format: These summaries should follow a recurring format for each product category, such as milk: 1) A comparison of the beverage carton against the other packaging types. 2) An analysis of the differences between the New Zealand and Australian scenarios. 3) A highlight of the key positive or negative feature for the carton within that specific category. Keep it simple throughout whole document: say it only once unless summing up major section and perspective.	The results section has been restructured. The interpretation sections have been cut down to focus on content that is significant.

98	p. 60-83	Presentation of Results	"End-of-life: This category includes the end-of-life disposal of the consumer packs, including transportation of the package to landfill or recycling. Biogenic carbon sequestered by paper and cardboard is included in this category to show the net carbon sequestered or released and to avoid having negative numbers within the Consumer Pack category above."This approach is not in line with ISO 14067, which dictates that removals and releases should be included in the life cycle stage where they occur:"In the case of products from biomass, carbon storage is calculated as carbon removal during plant growth and subsequent emission if the biogenic carbon is released in the use or end-of-life stages. If carbon removal from the atmosphere is included within the system boundary, the flows of biogenic carbon into and out of biomass-derived materials that are combusted as the end-of-life scenario will result in zero net contribution to the CFP, except for any portion of biogenic carbon converted to CH_4. If the product is reused or recycled as the end-of-life scenario, this can also result in zero net contribution to the CFP, when biogenic carbon flows are transferred to subsequent product systems."If done correctly, it will not matter for the overall comparison, but it is currently quite difficult to check the results and understand whether this has been modelled correctly.	The removals and emissions have been presented separately for the total carbon footprint and the breakdown in the Annex. The modelling is based on datasets (emissions and removals occurring in the datasets based on LCI needed), and an adjustment to release the necessary biogenic carbon amount based on scenario.

No	Page/ Section	Topic	Reviewer comments	Response
99	p. 67	Key Finding	"Of these cartons, TBA Base has the lowest carbon footprint." is a good example of a key comment that is buried in text. Make these stand out more for readability.	This was found to be statistically insignificant as other cartons had similar carbon footprints. No change to report.
100	p. 67-68	Relevance	"Chilled versions of TPA Edge have slightly higher impact due to the refrigerated truck" is not significant so should not be raised (or should be qualified).	Thank you - removed content.
101	p. 71	Statistical Significanc e	The statement "Carton with 30% recycled content has the lowest carbon footprint of the Tetra Pak cartons" is unlikely to be statistically significant and should be removed.	Yes, it is statistically insignificant. The statement and content have been removed.
102	p. 72	Statistical Significanc e of Claims	Claims of "slightly higher impact" or "slightly lower carbon footprint" for different carton versions are unlikely to be significant and should not be mentioned	Yes, it is statistically insignificant. These types of statement/wording have been removed.
103	p. 73	Recycled Content Description	The "Carton with 30% recycled content" was not clearly described earlier. It should be specified as "'Carton with 30% recycled LDPE content in laminate layer and closure'". It would also be useful to express this as a percentage of total carton weight.	The three types of Tetra Pak cartons in this study have been noted in section 2.1 Product Function(s) and Functional Unit. The cartons with 30% recycled content is described as: Cartons made with fossil-based plastics made of 30% recycled content (30% recycled content in HDPE closures and LDPE laminate coating) on page 18.
104	p. 73	Statistical Significanc e of Claims	The figure 5-9 indicates there often is no significant difference between TT and rPET variants. The conclusions drawn from this figure are questionable if differences are very minor.	Yes, thank you. This is not statistically significant and has been removed.

No	Page/ Section	Topic	Reviewer comments	Response
105	p. 74-75	Structure and Data Presentation	This section is a good example of where the figure should come before the commentary for consistency. The visual difference between TBA Base Crystal and TPA Edge appears significant and should be analyzed. Are the differences between AU and NZ significant?	The results section has been restructured to have key packaging characteristics to assist with interpretation, then the comparison figure, followed by brief conclusions per comparison. The Interpretation section contains more detail.
106	p. 78	Transport Details	A diesel truck is mentioned for the first time here; this should have been defined in the methods section earlier.	Added detail to 3.6 "Distribution".
107	p. 78-79	Statistical Significance of Claims	The claim of being "primarily due to significantly fewer" appears not backed by statistics. Statements about differences in carbon footprints between packages are mostly not believable without statistical proof	Removed wording such as "significantly fewer" from report. Also updated section so only important aspects are included.
108	p. 84	Interpretation	A hotspot analysis is missing. It is therefore very difficult to check how data and assumptions impact on the results. Please add hotspot analyses for the cradle-to-gate production of key packaging options / materials.	A cradle to grave hotspot analysis per packaging material is included in a new hotspot section of the report. For cartons, cradle to gate analysis included where different electricity grids have been used reflecting manufacturing sites for this study.

No	Page/ Section	Topic	Reviewer comments	Response
109	p. 84	Interpretation	The claim that New Zealand has higher landfill rates than Australia is not clear from the graphs and should be questioned. The statement that the "carbon footprint from pallet life cycle is negligible, however, net sequestration of biogenic carbon occurs across all packaging options" is not necessarily backed up by the graphs. The pallets lower the footprint in most scenarios, which in itself is questionable.The statement that the transport carbon footprint is negligible is confusing, especially regarding distance differences between Australia and New Zealand. The use of "tend to" is too vague; be more specific if possible (e.g., "in 5 out of 8 cases").	Despite the differences in landfill rate, the combination of modelling approach and the end-of-life rates lead to similar end-of-life impact across both Australia and New Zealand.Re "carbon footprint from pallet life cycle is negligible, however, net sequestration of biogenic carbon occurs across all packaging options" - have updated to a very small net sequestration. This can be seen for the pallet bar for all the graphs below the 0 x-axis. The modelling for pallet = landfill at end of life, with the given DOCf, only a proportion of biogenic carbon released at end of life. This coupled with the upstream sequestration in raw material, the net sequestration for pallet is observed. This is consistent with the previous study too, although that study combined Shipper and pallet results hence this impact is not very obvious. It's concluded that end-of-life impact is not significant.
110	p. 85	Regional Differences	The reason why NZ scenarios have lower carbon footprints (i.e., electricity carbon intensity) should be included. The statement that rPET outperforms cartons in NZ scenarios is a key finding and should be highlighted, assuming it's statistically true.	With the update to rPET modelling, rPET carbon footprint is now similar to cartons. There is one package that looks marginally better than cartons (1.5L Milk Chilled). Interpretation has been updated.

No	Page/ Section	Topic	Reviewer comments	Response
111	p. 85	Analysis and Recommendations	It would be more helpful to analyse the impact of different Tetra Pak conversion locations to see the range of impacts and guide future sourcing decisions. Statements about the performance of plant-based or recycled content versions need to be statistically verified. The claim that rPET bottles vary significantly by manufacturing location should be substantiated with examples.	One carton is analysed as manufactured across all the Tetra Pak manufacturing sites. This, combined with the update to use specific country grids (as opposed to the EU average grid) reveals the significance of raw material and electricity. Comparison of impact for conventional and plant-based cartons, and for rPET packages that have been produced in Australia and New Zealand has been included (%) with this claim.
112	p. 86	Unclear or Questionable Statements	The statement "While the pouch is lightweight, it has higher consumer packaging mass compared with the cartons" is confusing. The claim that "most cartons have a net negative carbon footprint" is questionable. The statement about biogenic carbon being released when material is recycled and landfilled should be queried.	The statement regarding biogenic carbon being released when recycling is discussed in other comments and noted in the report.
113	p. 86	Wording of Comparisons	Rewrite "It is also seen that cartons with caps have higher impact compared to formats with no caps" to "'As expected, cartons with closures have higher impact compared to formats with no closures'" for consistency.	Updated text as suggested.
114	p. 86	Key Finding	The statement "Overall, cartons without caps, with bioplastic caps, and without aluminium layers have the lowest carbon footprint" is a key finding that should be highlighted if statistically true.	Agreed and have included a modified version highlighting versions without caps and without aluminium layer. Further analysis shows that bio-based materials may not lead to statically significant difference between fossil-based and bio-based versions for aseptic cartons.

No	Page/ Section	Topic	Reviewer comments	Response
115	p. 86	Wording	"Plastics, glass, and aluminium are all inert materials which do not break down in a landfill and so have a low carbon footprint impact at end-of-life. However, the impacts of processing these materials are included to reach end-of-waste-state." This sounds as if there is processing to make these materials suitable for landfill, which I don't think is what was intended.	There is no processing to ready materials for landfilling. The impact for end of life from landfill is from landfill datasets. We have reworded.
116	p. 86	Interpretation	"The landfill rates are high for Australia and New Zealand, hence most cartons have a net negative carbon footprint over their life cycles, meaning that net sequestration is observed." This begs the question: Will increasing the recycling rates lead to an increase in emissions? As the EOL assumptions are probably key to the answer, care should be taken with this conclusion and potential flow-on conclusions.	Yes, recycling would mean emissions increase for materials with sequestered biogenic carbon. Added note of caution for this.
117	p. 86	Wording	"Both New Zealand and Australia use the same landfill gas capture rate." Consider rewording to "The model assumes the same landfill gas capture rate in New Zealand and Australia."	Updated.

No	Page/ Section	Topic	Reviewer comments	Response
118	p. 87	Statistical Significance of Claims	The claim that impacts from material recycling facilities are "slightly higher" for Australia than New Zealand needs to be checked for statistical significance. Be more specific about "bioplastics," as the study only concerns bio-PET.	Content with 'slightly' have been removed as not statistically significant. Updated bioplastics to bio-LDPE and bio-HDPE. We still refer to bioplastics in some places and there is a small new section in the Manufacture of plastics section on bioplastics.
119	p. 87	Key Finding	The statement about the 68% landfill gas capture rate being the base case for all cartons is a key point that should be in the summary, together with other EOL parameters and an evaluation of their importance.	The Summary has been updated to mention landfill parameters and outcome.
120	p. 87	Interpretation	The claim that "Cartons are the most space-efficient packaging type" is potentially an important aspect for transport scenarios, although its effect has not been studied. Therefore, the statement should be qualified.	Opted to removed this statement as we cannot qualify it at present (and is out of scope).
121	p. 88	Statistical Significance of Claims	The claim that the 200ml Australian juice pouch is "lowest-equal" with a carton needs statistical verification. The wording in the sentence "this finding is more pronounced in New Zealand with its more renewable electricity mix" should be checked for correctness	Have removed as statistically not relevant.
122	p. 89	Modelling Choices	The use of a 1997 reference for the base case DOCf seems very old; there should be more current literature available.	Recent literature use the same value, likely from the same source - have added another citation.

No	Page/ Section	Topic	Reviewer comments	Response
123	p. 90	Results Interpretati on	Table 5-1 and Figure 5-18 indicate the baseline scenario assumes 0% landfill and 0% gas capture. That doesn't sound right. In section 5.2.2. it was stated capture rate is 68%?!	The sensitivity analysis was updated to include 68% landfill gas capture rate. 0% and 100% are also included to show a possible range.
124	p. 91	Results Interpretati on	These last two columns in Figure 5-18 show how sensitive the model is to landfill gas capture rates. This may make it difficult to draw robust conclusions.	While results show sensitivity to landfill gas capture rates, the study uses 68% which is an official rate supplied by the Ministry for the Environment, New Zealand. Since % to landfill for NZ is 99%, the value provides an accurate basis for modelling. For Australia, landfill gas capture rate from literature
125	p. 92	Clarity of Report	The reasoning behind the statement "this scenario is physically impossible" needs to be explained.	Have updated the text to provide better explanation: The scenario with the lowest carbon footprint has 0% DOCf (i.e. no degradation) with a 100% landfill rate (landfill gas capture rate is irrelevant as there is no degradation). This low carbon footprint is due to sequestration of carbon in paper in landfill. However, this scenario is considered unlikely because even though the paper in the carton is coated in plastic (which will decrease biodegradation), it is likely that some of the plastic barrier layer would be damaged in the landfill, exposing at least some of the paper to degradation.
126	p. 92	Recommen dations	The recommendation for a desktop bioreactor study on cartons is a key point that should stand out and be included in the summary.	Included in the summary.

No	Page/ Section	Topic	Reviewer comments	Response
127	p. 92	System Expansion (Substitution)	The model applies the 0:100 allocation approach in the substitution method. This aligns with the methodology used in EPDs. It is also possible to apply a 50:50 allocation approach, which may reduce bias and assumptions associated with recycled content and recycling flows.	Kept to 0:100 approach for this study and included a recommendation to include scenario for 50:50 in subsequent studies.
128	p. 92	Allocation / Modelling Choices	There are multiple underlying mechanisms leading to negative results from "consumer pack end-of-life" in the result graphs. i.e. net flow of recycled material replacing virgin material, carbon sequestration (as it is explained earlier that this is included at end-of-life rather than the start of the life cycle where you would expect this), or even from exported electricity (although this probably has not been accounted for in the default approach). A more detailed analysis that focuses on the drivers of the impacts and benefits is required to really understand the LCA.	The negative results from for consumer packaging end of life is driven by sequestration and emission. The sequestration is based on the biogenic carbon content of materials while the emissions are due to end-of-life approach. The end-of-life approach relies on the recycling/landfilling rates. For recycling, biogenic carbon is modelled as released while for landfilling emissions are due to DOCf and landfill gas capture rate. Since landfilling rate is higher, only a proportion of biogenic carbon that is sequestered is emitted, thus leading to net sequestration. The amount is quite low and has been deemed insignificant for the overall study. The above and other drivers of impact have been discussed in the Interpretation section.
129	p. 93	Recommendations	The report should clarify if there is a recommendation for a methodology regarding claims related to cartons.	This has been included as a recommendation for future work - to develop a rigorous methodology for comparative packaging claims.

No	Page/ Section	Topic	Reviewer comments	Response
130	p. 93	Key Finding	The concluding paragraph on the substitution method is a key statement and should be in the summary if statistically backed.	Have added to conclusions and summary: The outcome of sensitivity analysis shows that cartons have the lowest or one of the lowest carbon footprints of all packaging systems considered by this study, irrespective of which end-of-life allocation method is applied.
131	p. 97	TERI Study Data	The TERI study assumed 54% recycling and 45% incineration for cans.	Included as a bullet point.
132	p. 98	Literature Review	A comparison of only 7 studies seems low for 2024/2025; more literature is likely available. The comment that plastic granulate from China has a higher footprint needs evidence or explanation what this is based on.	Thank you for the comment - indeed there is a lot of literature, however, we have focussed on studies that are available via desktop searches, with reports readily available online. The literature available gives sufficient indication of outliers where they exist, and explanations. China has higher carbon footprint compared to other regions - see tab Plastic granulate comparison for PET. Granulate from India has the highest carbon footprint. However, it is more likely that granulates are sourced from China for this region.
133	p. 99	TERI Study Context	It should be noted that the TERI study, which shows significantly lower results for cans, was commissioned by Ball, a manufacturer of aluminium cans in India.	Noted and mentioned the reasons for the lower impact - use of substitution method at end-of-life. Some text updates done to provide context.

No	Page/ Section	Topic	Reviewer comments	Response
134	p. 100	Wording	"In general, the results from this study align with results from the other studies considered." (this study = the current study) Rather than alignment, it may be more correct to talk about the studies showing similar trends (with the exception of rPET?).	Have reworded statement.
135	p. 102-103	Methodolog y Limitations	If precision is considered high, the error rate should be stated. There is no mention of replication or any issues with it, and this needs to be clarified	There are no replicates in the study. The issue with the average mass of pack components being made up of one or two packs (of different brands) is not an issue related to precision, but is a potential issue related to representation. The aim of taking mass measurements across different brands per size class and material was to capture the packaging available in the market. The lack of a three-pack average means market did not have three packs at the time of data collection. With respect to precision, there is the potential issues with scaling packs so as to match the required size class. This has been noted with reference to the section on scaling and the packs that were scaled to fit the required size class.

No	Page/ Section	Topic	Reviewer comments	Response
136	p. 104	Conclusion Claims	The claims in the conclusion about the range of carbon footprint differences (e.g., "between 12% and 329%") need to be checked for statistical significance. The claim about packaging with lower carbon footprints (2% to 22% lower) also needs statistical checks. The statement that cartons with bio-caps perform better is noted, but the end-of-life impact is still that of PET.	The percentages have been updated. These are statistics pertaining to each comparison depicting the difference in carbon footprint between Tetra Pak cartons results relative to the second lowest in each comparison. This is to indicate the overall range. For some comparisons (i.e. the lower end), this indicates that the difference is quite minor.
137	p. 105	Conclusion Claims	The statement that carton versions with recycled content have a "slightly lower" carbon footprint is not statistically substantiated. The claim that the consumer pack manufacturing stage has "by far" the largest contribution is emotive; quantify it. Claims about the significance of secondary packaging and end-of-life impacts need an evidence basis.	Reworded and removed words such as 'slightly lower, slightly higher, by far. Significance of secondary packaging and end-of-life are covered in the hotspot analysis section.
138	p. 107	Key Finding	The claim that "Cartons maintain their position as a lower-carbon option under most scenarios, particularly in Australia" needs to stand out and be in the summary. A reason should be provided for why increasing the recycled content of glass reduces the carbon footprint.	Have included claim in summary. Explanation of glass (applicable to aluminium as well) impact reduction has been added: Recycled materials offer significant improvements by reducing impacts due to extracting and processing raw materials. Additionally, the recycling process requires less thermal energy, e.g. for melting glass.

No	Page/ Section	Topic	Reviewer comments	Response
139	p. 108	Conclusions and Wording	There are English language issues in section 7.4.1. The statement that the data can be used for comparative claims is only true if statistically backed up. The conclusion on chilled vs. ambient should be positioned higher up. The final point needs to cover the impact of different bioplastic polymer types.	The wording has been updated to remove insignificant comparative notes. The study does not endorse chilled vs. ambient comparisons and as such this has been removed - The only reason that a chilled and ambient comparison are found in a single graph is for illustrative purposes. In these cases, the same package is delivered via chilled and ambient trucks.
140	p. 109	Recommendations	The limitations section is good. Recommendations for future analyses should include the potential of non-PET plastics.	There aren't a lot of other packaging materials in the market for the beverage categories in this study. However, have included a recommendation to investigate and include non-PET plastic packaging in comparison.
141	p. 123	Annex B.6 (Pallets)	I don't understand how to read these data, given the results associated with pallets appear (almost) always equal in the graphs in section 5. It is risky to introduce benefits that are almost entirely based on the modelling assumptions (e.g. number of reuses of a pallet + disposal scenario), rather than solid data.	Annex B.6 provides the mass of the (standard) pallet used for the palletisation of the beverage products. Since the dimensions and masses of the beverage products in secondary packaging are different across the comparisons, the number of secondary packages per pallet is provided, together with the use cycles of the pallet, so that the mass allocation of the pallet to a single primary packaging can be calculated.
142	p. 125	Annex D-1	The carbon content number for a wooden pallet is missing from the table.	Included in table now.

Annex Table J-2: Review panel comments and responses v2.0

No.	Reviewer comments	Response
1	P3 refrigeration .... Products at consumer is also..... – the phrasing products at consumer is a bit odd – implies when at home in persons fridge? And at consumer maybe refrigeration after leaving the sales store is a better phrasing?	Updated: Refrigeration impact for chilled products at retail outlets and after leaving the outlets are also excluded.
2	P36: experts as well as the practitioner's responses is available in Annex J. maybe "are" not "is" is better phrasing?	Updated: The Critical Review comments by the independent experts as well as the practitioner's responses are available in Annex J.
3	P50: For plastic and pouch materials, raw material was assumed to be sourced from China. – maybe better as "the raw materials"	Updated: Glass, aluminium and non-laminate based raw materials were assumed to be sourced within the two countries. The raw materials for plastic and pouch packaging were assumed to be sourced from China. Thus, distances were calculated based on transport from Shanghai.
4	P86: PET package has higher carbon footprint compared to the carton should say has "a" higher footprint....	Updated: PET package has a higher carbon footprint compared to the carton
5	P87: PET package has the higher carbon footprint compared to cartons ....→ Carbon footprint of PET packaging in Australia ; should say pet package... has "a" not "the" higher footprint, and also state with "the" carbon footprint for next arrow.	Updated: PET package has a higher carbon footprint compared to cartons
6	P88: The TSA carton (lower aluminium mass compared to TPA) has lowest carbon footprint – has "the" lowest carbon...	Updated: The TSA carton (lower aluminium mass compared to TPA) has the lowest carbon footprint
7	P89: PET package has the highest carbon footprint really should read "PET packages have" the highest...	Updated: PET package have the highest carbon footprint, significantly higher than other packaging
8	P89: PET package in New Zealand has lower carbon footprint compared to Australia – should read has "a" lower carbon...	Updated: PET package in New Zealand has a lower carbon footprint compared to Australia (by 31%)

No.	Reviewer comments	Response
9	P90: Carton has lower carbon footprint compared to PET packaging- should read "Cartons have" the lower carbon ….	Updated: Cartons have the lower carbon footprint compared to PET packaging
10	P91: Plant-based versions of cartons have lower carbon footprint – should read have "a" lower carbon….or else lower carbon "footprints"	Updated: Plant-based versions of cartons have a lower carbon footprint

No.	Reviewer comments	Response
11	P98: hotspot biobased materials – some sentences don't really make sense: This further indicates significance of aluminium towards carbon footprint of cartons. For.....perhaps if I am reading it correctly – "further indicates the significance of aluminium in contributing to the carbon footprint".....	In comparisons that include closures, several Tetra Pak cartons with a bio-based plastic layer (bio-LDPE) and a bio-based plastic closure (bio-HDPE) show a lower carbon footprint than versions without bio-based plastics. However, this reduction is only significant for non-aseptic cartons (e.g., Tetra Top and Tetra Rex). The percentage differences in carbon footprint for the plant-based versions, relative to their fossil-based counterparts, are presented below. A positive percentage indicates a reduction in carbon footprint for cartons with bio-based plastics, while a negative percentage indicates an increase compared with cartons containing fossil-based layers and closures In chilled beverage comparisons, cartons without an aluminium barrier layer consistently perform better than those with aluminium layers, showing notable differences in carbon footprint. This further highlights the influence of aluminium on the carbon footprint of cartons. For Australian cases, aseptic cartons with bio-based materials have higher carbon footprints due to a combination of manufacturing location, higher recycling rates in Australia compared to New Zealand, and the end-of-life modelling approach that releases biogenic carbon during recycling. However, the differences in carbon footprint among these aseptic cartons are insignificant. Overall, variation in carton results (i.e., consumer packaging impacts) is driven by differences in the carbon emission factors of electricity grids in the regions where the cartons are manufactured.

No.	Reviewer comments	Response
12	p98: hotspot biobased materials - The variation in results for cartons (i.e., the consumer packaging impact) is due to differences in the carbon emission factors of electricity grids in the regions where the cartons are manufactured. – the whole sentence is repetitive of the previous statements and you could remove it.	Updated: For Australian cases, aseptic cartons with bio-based materials have higher carbon footprints due to a combination of manufacturing location (carbon emission factors of electricity grids), higher recycling rates in Australia compared to New Zealand, and the end-of-life modelling approach that releases biogenic carbon during recycling. However, the differences in carbon footprint among these aseptic cartons are insignificant.
13	P98: has a closure and the closure composition, the manufacturing location – doesn't make sense – maybe just "the closure competition, and the manufacturing location"…	Update: The overall carbon footprint depends on several factors, including the package function (aseptic or chilled) and associated carton composition, the presence and composition of closures, and the electricity carbon emission factor at the manufacturing locations.
14	P101: All packages are filled using data from – the packages aren't filled with data! – "packaging filling information uses data from"…. Which is what I assume you mean. Or maybe "Data for filling packaging is sourced from"….	Updated: Data for filling packaging is sourced from the Tetra Pak Oceania study (thinkstep-anz, 2021).
15	P125: Tetra Pak packaging are compared against alternative packaging options within those classes. In some – Tetra Pak packaging "is" compared against….	Updated: Tetra Pak packaging is compared against alternative packaging options within those classes.
16	P125: Zealand. In the 1.5L chilled milk comparison, the packaging with lower carbon footprint compared to cartons had 3% lower carbon footprint (thus comparable to cartons) – doesn't make sense to read – I think you mean? – "In the 1.5L chilled milk comparison, alternative packaging options (to cartons or to tetrapak cartons?) had one exemplar that was similar to the tetrapak (or all???) cartons with a carbon footprint comparable to cartons" – id really cut down this sentence to the specific you want to say….	Updated: In the 1.5L chilled milk comparison, the rPET packaging is only 3% lower in carbon footprint, thus comparable to the carbon footprint of the Tetra Pak carton.

No.	Reviewer comments	Response
17	P125: also have strong environmental performance – have “a” strong.....	Updated: Beverage cartons also have a strong environmental performance relative to other beverage package formats across a range of environmental indicators.
18	p. 3: ‘refrigeration for chilled products at consumer is also excluded’. This is confusing; suggest ‘refrigeration for chilled products at retail outlets is also excluded’	Updated to: Refrigeration impact for chilled products at retail outlets and after leaving the outlets are also excluded.
19	p. 6 & 7: same figure on both pages	Cannot see duplicate figures (unless it is the tracked version of report). The clean version only has a figure in page 6
20	p. 10: suggest change customer to consumer as in Tetra Pak the customer in the company that buys the packaging material and fills it, to be purchased and consumed by the consumer.	Updated: This choice is typically made by the packaging consumer.
21	p. 39: when will we have an opportunity to review the critical review comments?	Critical review comments sent in email
22	p. 42: Figure 3-1: Cross-section of a plastic closure with temper-evident band -Change to tamper-evident!	Thanks! Updated to tamper
23	p. 42: (for beverages that are short-life or fresh) cartons have a similar structure but have only one internal plastic (LDPE) layer. There is no aluminium barrier layer. Suggest change to: (for beverages that are short shelf life or fresh) cartons have a similar structure but have only one internal and one external plastic (LDPE) layer. There is no aluminium barrier layer.	Updated to: Refrigerated non-aseptic (for beverages that are short shelf life or fresh) cartons have a similar structure but have only one internal and one external plastic (LDPE) layer. There is no aluminium barrier layer.
24	p. 42: Change to CTMP (Chemi-Thermomechanical Pulping)	Updated to: Chemi-Thermomechanical Pulping
25	p. 53: Laminate and closures for Tetra Pak cartons - Suggest change to ‘Laminated paperboard and closures for Tetra Pak cartons’	Updated to: Laminated paperboard and closures for Tetra Pak cartons are manufactured overseas and transported to Australia and New Zealand for filling.

No.	Reviewer comments	Response
26	p. 54: cartons which can be in sheets. Suggest change to 'cartons which can be in rolls'	Updated to rolls
27	p. 72 & 73: Figure 5-1 appears twice	The clean version shows one figure
28	p. 113: non-aseptic (short-life or fresh) versions - Suggest change to 'non-aseptic (short shelf life or fresh) versions'	Updated to include shelf
29	p. 114: the closure composition, the manufacturing location. Suggest change to 'the closure composition, and the manufacturing location'	Section updated: The overall carbon footprint depends on several factors, including the package function (aseptic or chilled) and associated carton composition, the presence and composition of closures, and the electricity carbon emission factor at the manufacturing locations.
30	p. 116: are typically landfilled and recycled. Suggest change to 'are typically landfilled or recycled'	Updated to: are typically landfilled or recycled
31	p. 122: close of bracket missing: (with holes pierced in the laminate layer to simulate municipal comingled waste.	Added bracket
32	p. 141: this doesn't read right: the increase in carbon emission factor for carton paperboard the 1L carton in this study	Updated: A combination of higher carton mass and the increase in carbon emission factor for carton paperboard in this study.
33	p. 152: References: to be consistent the full name of all journals should be given. Barlaz et al., 2009 Controls on landfill gas collection efficiency: instantaneous and lifetime performance. Journal of the Air & Waste Management Association	Barlaz, M., Chanton, J., & Green, R. (2009). Controls on landfill gas collection efficiency: instantaneous and lifetime performance. Journal of the Air & Waste Management Association, 59, 1399–1404.
34	Eleazer et al., Environmental Science & Technology	Eleazer, W., Odle Ill, W., Wang, Y.-S, & Barlaz, M. (1997). Biodegradability of municipal solid waste components in laboratory-scale landfills. Environmental Science & Technology, 31(3), 911-917.

No.	Reviewer comments	Response
35	Robertson, G.L. (2013). Closures and sealing systems. In: Food Packaging Principles & Practice, third ed. CRC Press, Boca Raton, FL, p. 274.	Robertson, G. L. (2013). Closures and sealing systems. In Food packaging principles and practice, third ed. (p 274). Boca Raton, FL: CRC Press.
36	Sphera 2000. Life cycle assessment of beverage packaging: Pathways to a circular, low-carbon future.	Sphera. (2020). Life cycle assessment of beverage packaging: Pathways to a circular, low-carbon future.
37	Struijs et al., 2009. Published by the Dutch Ministry of Infrastructure and the Environment, RIVM, Bilthoven, Netherlands	Struijs, J. B. (2009). Aquatic Eutrophication. Chapter 6. In M. H. Goedkoop, ReCiPe 2008 A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level. Report I: Characterisation factors, first edition. Bilthoven, Netherlands: Dutch Ministry of Infrastructure and the Environment, RIVM.
38	The Aluminium Association. (2024). Amid Recycling Rate Decline, Aluminum Beverage Can Remains Most Recycled Drinks Package. Retrieved from https://www.aluminum.org/news/Amid Recycling Rate Decline, Aluminum Beverage Can Remains Most Recycled Drinks Package | The Aluminum Association	The Aluminium Association. (2024). Amid Recycling Rate Decline, Aluminum Beverage Can Remains Most Recycled Drinks Package. Retrieved from The Aluminium Association: https://www.aluminum.org/news/amid-recycling-rate-decline-aluminum-beverage-can-remains-most-recycled-drinks-package
39	Ülger-Vatansever et al., 2024. Environmental Science and Pollution Research	Ülger-Vatansever, B., Onay, T., & Demirel, B. (2024). Evaluation of bioplastics biodegradation under simulated landfill conditions. Environmental Science and Pollution Research , 31(12), 17779-17787.
40	Zulkarnain et al, 2021 IOP Conference Series: Earth and Environmental Science	Zulkarnain, I., Lai, L., Syakir, M., Rahman, A., Yusuff, S., & Hanafiah, M. (2021). Life cycle assessment of crushed glass abrasive manufacturing. IOP Conference Series: Earth and Environmental Science, 880, 012054.

No.	Reviewer comments	Response
41	This can be read to contradict the previous sentence. I think this sentence relates to the IAI global average, and therefore it should be moved after "...global average data from the International Aluminium Institute (IAI) was used." I suggest to change it to: The IAI global average GHG emission factor is 2-3 times greater than the European emission factor or Tetra Pak global average factor.	Updated paragraph to: The European dataset is conservative compared to Tetra Pak's global average emission factor, as Tetra Pak's global average is lower than the European value. For Tetra Pak cartons, the European dataset was used because its carbon emission factor is similar to the available primary data. According to ISO 14067, primary data should be used where available. However, since Tetra Pak's emission factor is proprietary, a conservative approach was applied by using the European dataset.
42	Check sentence: Plant-based TBA 1L Edge LW30: bio-HDPE closure (1.3g) and bio-LDPE	Updated to: 29.6g carton with plant-based (PB) content in its LDPE layer and a 1.3g bio-HDPE closure
43	→ *Heavier packages such as TBA Square have higher carbon footprints. The difference in carbon footprint is significant (17% greater than the next highest result)* Another interesting conclusion - in my opinion - that is not covered: TBA Slim HC23 is a product designed to optimise the number of units per shipper carton and reduce transport emissions, Compared against the TBA Edge LC30 packaging, the benefits are clearly visible through lower shipper impacts per unit, but the benefits are entirely negated by the increased impacts of the heavier carton (consumer pack).	Yes, if we look at the TBA Slim and Edge cartons, TBA Slim leads to lower shipper impact, but has higher carton mass. Since shipper option is not under Tetra Pak's control, we've not discussed this aspect in the report. The conclusion that heavier packages lead to higher impact is maintained.

No.	Reviewer comments	Response
44	→ *Heavier packages such as TBA Square have higher carbon footprints. The difference in carbon footprint is significant (17% greater than the next highest result)* ...when considering the potential benefits from material recycling in the next life cycle. When considering only the current life cycle, the footprint results of the TBA Square and TBA Edge LW30 PB are identical in NZ and TBA Square is marginally worse in AU.	TBA Square and TBA Edge LW30 PB are not identical in NZ - did you mean the TBA slim and TBA Edge 1L LC30? If so, yes, they turn out identical for NZ. The differences are so subtle that mention of this does not add more to the work. We had to cut down quite a bit from the first round of verification to maintain statistical significance. Have expanded on the nuances of parameters at play in the Interpretation instead of including content in the results section.
45	→ The carton has the lowest carbon footprint for Australia, due to the lower mass of carton when compared against bottles, as well as the lower emissions intensity of carton compared against PET/rPET → Producing rPET packaging in New Zealand leads to lower carbon footprint compared to Australia when average grid electricity is used. This is due to the fact New Zealand's electricity is mainly generated with renewable sources and thus has a lower electricity carbon emission factor → PET package has the highest carbon footprint, due to the relatively high emissions intensity of PET compared against rPET and carton, as well as the higher mass of PET bottles when compared against cartons Carbon footprints of packaging in Australia are higher than in New Zealand, which is mainly a reflection of the difference in electricity emissions intensity between these countries and the amount of electricity required for manufacturing each packaging type (With the benefit of looking at it again after some time, so I understand this is not within the scope) The conclusions are correct, but it would be helpful to expand on the underlying drivers for each conclusion.	We have kept the explanations for the differences in impact out of the Results section overall so as to avoid repetition and maintain statistical significance of conclusions. The results section outlines the most obvious conclusions in bullet points, focussing on the outcomes of the comparison. Explanation is provided in the interpretation section. Include a statement to that effect at the start of the results section and then elaborated a bit more in the Interpretation section. Added to 5.1: The results section presents a summary of the comparison outcomes. The interpretation and discussion of the results are provided in Section 7.

No.	Reviewer comments	Response
46	In *comparisons* that include closures, several Tetra Pak cartons with a bio-based plastic layer (bio-LDPE) and a bio-based plastic closure (bio-HDPE) show a lower carbon footprint than versions without bio-based plastics. However, this reduction is only significant for non-aseptic cartons (e.g., Tetra Top and Tetra Rex). The percentage differences in carbon footprint for the plant-based versions, relative to their fossil-based counterparts, are presented below. A positive percentage indicates a reduction in carbon footprint for cartons with bio-based plastics, while a negative percentage indicates an increase compared with cartons containing fossil-based layers and closures This sounds like a section that may be lifted from the report, so it may be good to repeat the life cycle stages that are covered (A-C). I suggest you also reflect on how robust the end-of-life assumptions are. (as per section 5.4.1)	Added: The assessment results are based on several factors including the system boundary, material carbon emission factors, composition of packaging, and the end-of-life modelling approach applied in this study. The life cycle stages considered include raw material extraction and processing, packaging manufacture, filling, distribution, and end-of-life. The end-of-life approach for materials containing biogenic content results in the release of biogenic carbon from the portion of bio-based plastics that is recycled, and either the release or sequestration of biogenic carbon from the portion of bio-based plastics that are landfilled. This release or sequestration depends on the degradable organic carbon fraction (DOCf) of the material.

No.	Reviewer comments	Response
47	In comparisons that include closures, several Tetra Pak cartons with a bio-based plastic layer (bio-LDPE) and a bio-based plastic closure (bio-HDPE) *show a lower carbon footprint than versions without bio-based plastics*. However, this reduction is only significant for non-aseptic cartons (e.g., Tetra Top and Tetra Rex). The percentage differences in carbon footprint for the plant-based versions, relative to their fossil-based counterparts, are presented below. A positive percentage indicates a reduction in carbon footprint for cartons with bio-based plastics, while a negative percentage indicates an increase compared with cartons containing fossil-based layers and closures If you don't provide further explanation, then it is insinuated that the difference is (primarily) caused by the difference between bio-based and non-bio-based plastics. However, the fact that there is no difference for aseptic cartons means there are other factors at play. It would be good to tease this out.	Have added more explanation (two paragraphs). Overall, non-aseptic packs have differences in the bio-plastic layers (difference in mass) and thus also mass of the cartons - in these instances, there is a noticeable difference as seen for the non-aseptic cartons. Meanwhile, for the aseptic cartons, the aluminium barrier layer dominates impact to an extent that the difference in laminate layer and closure material becomes insignificant. In some cases, the mass of closure is also different between the two versions. These, together with the end of life approach applied, leads to subtle differences that have led to these results patterns.

thinkstep anz

About thinkstep-anz

We're an independent and award winning sustainability firm with offices in Australia and Aotearoa New Zealand - and a global reach.

Our team works with you to put sustainability at the heart of your business, to set you up to succeed and inspire you to keep achieving more.

We focus on what matters and use data to understand organisations and their impact. We provide practical resources and ideas that move you ahead.

We create value for organisations like yours, bringing our technical expertise and business know-how to help you tell your story. It's what we've been doing since 2006.

Our services cover:

Product sustainability and circular economy

- Life Cycle Assessment (LCA)
- Environmental Product Declarations (EPD)
- Circular Economy (CE)
- Cradle to Cradle (C2C)
- Material Circularity
- Water footprint
- Packaging

Carbon emissions and climate resilience

- Carbon Footprint
- Scope 3 emissions
- Reduction strategy
- Carbon targets
- Science-based targets (SBT)
- Emission factors

Sustainability strategy

- Materiality assessment
- Green building
- Sustainable Development Goals (SDGs)
- Regenerative futures
- 3 Horizons
- Roadmaps
- Responsible procurement
- Benchmarking
- Workshops
- Business circularity

Reporting

- Climate-related disclosures
- Global Reporting Initiative (GRI) & Integrated reporting (<IR>)
- B Corp
- CDP

Communications

- Sustainability reports
- Case studies
- Board presentations
- Training
- Copywriting
- Infographics
- Media support

Software and data

- LCA for experts (GaBi)
- LCA calculator
- Material Circularity Indicator (MCI)
- Corporate sustainability (SoFi)
- MCI tool
- Excel carbon calculator

thinkstep anz

Succeed sustainably

www.thinkstep-anz.com

We don't just talk about sustainability – we practise it too

Certified B Corporation | SCIENCE BASED TARGETS – DRIVING AMBITIOUS CORPORATE CLIMATE ACTION | UN GLOBAL COMPACT | CLIMATE LEADERS COALITION – ON A MISSION TO REDUCE EMISSIONS IN NEW ZEALAND

thinkstep ltd (NZ)

11 Rawhiti Road,
Pukerua Bay 5026
+64 4 889 2520

Wellington | Auckland | Hamilton | Christchurch

thinkstep pty ltd (AU)

25 Jubilee Street,
South Perth WA 6151,
+61 2 8007 3330

Sydney | Perth | Canberra | Adelaide | Melbourne

meet@thinkstep-anz.com

thinkstep-anz

thinkstep-anz