Product Carbon Footprint Report

Technically Specified Rubber (TSR)

Corrie MacColl Limited

product carbon footprint CO_2

Technically Specified Rubber

Future Proof powered by Nature

Version: 1
Date: 24 July 2026
Project: PCF Rubber & Latex
Author: Kai Verheul

CORRIE MACCOLL

EST 1780

Ankersmidplein 2
1506 CK, Zaandam

Based on the route from production to customer:
Hevecam – Kribi – Antwerp

Summary

This report presents the Product Carbon Footprint (PCF) analysis of one metric tonne of technically specified rubber (TSR) supplied by Corrie MacColl. The analysis was carried out to quantify the greenhouse gas emissions associated with the production and distribution of TSR and to provide transparent climate information to customers and other stakeholders.

The Product Carbon Footprint has been determined in accordance with ISO 14067:2018, following the principles for life cycle assessment as described in ISO 14040 and ISO 14044. The greenhouse gas emissions have been characterised using the EN 15804+A2 GWP100 methodology. The study applies a 'cradle-to-port' system boundary, which encompasses the establishment and maintenance of plantations, latex harvesting, transport to the processing facility, production, packaging and distribution to the customer's nearest seaport.

The functional unit is defined as:
One metric tonne (1,000 kg) of technically specified rubber (TSR), delivered to the customer's nearest seaport.

The calculated product carbon footprint is:
295.13 kg CO_2-eq per metric tonne of technically specified rubber (TSR)

This total comprises 482.34 kg CO_2-eq from fossil greenhouse gas emissions, –187.78 kg CO_2-eq from net biogenic carbon fluxes and 0.57 kg CO_2-eq from land use and land-use change.

The production and packaging stage makes the largest contribution to the PCF (252.63 kg CO_2-eq), mainly due to the fuel consumption for drying the rubber and the electricity required during processing. Distribution accounts for 95.83 kg CO_2-eq, followed by transport to the processing facility (20.50 kg CO_2-eq). The extraction of natural resources and raw materials contributes –73.83 kg CO_2-eq, reflecting the significant uptake of carbon from the atmosphere by the growing rubber trees.

This study provides Corrie MacColl with a transparent and scientifically sound assessment of the climate impact of technically specified rubber (TSR). It identifies the main sources of emissions and forms a solid basis for communication with customers, sustainability reporting and future CO_2 reduction initiatives.

CONTENTS

1. Introduction

This chapter describes the background, objective and context of the Product Carbon Footprint (PCF) study. It provides the reader with an overview of the purpose of the analysis and the context in which it was carried out.

1.1 Background and Purpose

Corrie MacColl is one of the world's leading suppliers of natural rubber and produces technically specified rubber (TSR) from responsibly sourced natural latex. As sustainability and climate transparency become increasingly important in global supply chains, understanding the greenhouse gas emissions associated with products is essential for customers, regulators and other stakeholders.

To provide transparent and scientifically robust information on the climate impact of its TSR products, Corrie MacColl commissioned Firm of the Future to carry out a Product Carbon Footprint (PCF) analysis. The analysis quantifies the greenhouse gas emissions associated with the product's entire life cycle within the defined system boundaries, expressed in kilograms of carbon dioxide equivalents (kg CO_2-eq).

1.2 Intended Application

This report has been prepared in accordance with ISO 14067:2018, which sets out the principles, requirements and guidelines for quantifying and reporting the carbon footprint of products. The study is based on the principles of life cycle assessment as defined in ISO 14040 and ISO 14044, with the focus exclusively on climate change impacts.

The intended purpose of this study is to quantify and communicate the PCF of Corrie MacColl's technically specified rubber (TSR). The results are intended to support internal sustainability management, communication with customers and initiatives to reduce greenhouse gas emissions throughout the supply chain.

The intended target audience comprises Corrie MacColl, its customers, supply chain partners and other stakeholders interested in the product's climate impact.

The results of this study are not intended to be directly compared with Product Carbon Footprints prepared using a different methodology, with differing system boundaries, assumptions or data sources.

1.3 Reading Guide

This report presents the methodology and results of the Product Carbon Footprint (PCF) analysis for technically specified rubber (TSR).

Following this introduction, Chapter 2 describes the methodological framework, including the functional unit, system boundaries, data quality, key assumptions and sensitivity analysis.

Chapter 3 presents the life cycle inventory (LCI) and describes the primary and background data used to model the product system. The inventory is structured according to the successive life cycle stages, from plantation management and raw material extraction through production, packaging and distribution to the customer's nearest seaport.

Chapter 4 presents the results of the PCF, including total greenhouse gas emissions, the contribution of the various life-cycle stages (with the biogenic carbon balance shown separately), and the contribution analysis.

The report concludes with the references in Chapter 5.

2. Methodology

This chapter describes the methodological framework applied for the analysis of the Product Carbon Footprint (PCF). It explains the standards, calculation methods, functional unit, system boundaries and key assumptions that form the basis of the study.

2.1 Methodological Approach

The Product Carbon Footprint (PCF) analysis was carried out in accordance with the principles and requirements of ISO 14067:2018, which sets out the methodology for quantifying and reporting the PCF. The analysis follows the life cycle assessment framework as described in ISO 14040 and ISO 14044, with the focus exclusively on greenhouse gas emissions.

Greenhouse gas emissions have been quantified over a 100-year time horizon (GWP100) using the climate change characterisation factors as set out in EN 15804+A2 and are reported in kilograms of carbon dioxide equivalent (kg CO_2-eq). The analysis covers all greenhouse gases covered by the Kyoto Protocol, insofar as these are included in the life-cycle inventory datasets.

The primary data are derived from operational records collected at the Hevecam plantation and processing facility in Cameroon for the production year 2025. Where site-specific data were unavailable, technical calculations, representative assumptions and literature sources were used to complete the inventory.

The background data for the life-cycle inventory are sourced from the ecoinvent database (version 3.10.1). The effects of climate change were characterised using the EF v3.1 EN 15804 method. For most background processes, datasets for ‘Global’ (GLO) and ‘Rest-of-World’ (RoW) were deliberately selected in order to develop a generic Product Carbon Footprint model applicable to multiple TSR production sites. Country-specific datasets were used only where site-specific modelling was deemed essential, such as for electricity consumption.

2.2 Scope and functional unit

The functional unit of this Product Carbon Footprint analysis is defined as:

One metric tonne (1,000 kg) of technically specified rubber (TSR), delivered to the customer’s nearest seaport.

The analysis follows a ‘cradle-to-port’ system boundary and includes all relevant greenhouse gas emissions associated with the production and delivery of the rubber product.

The reference flow comprises all significant inputs in terms of materials, energy, water, packaging, transport and auxiliary processes required to produce and deliver one metric tonne of TSR within the defined system boundaries. Insignificant inputs with a negligible contribution to the total Product Carbon Footprint have been excluded in accordance with the cut-off criteria described in section 2.2.5.

2.2.1 Product description

The product assessed in this study is technically specified rubber (TSR), produced from natural rubber latex obtained from mature *Hevea* brasiliensis trees. TSR is supplied as a semi-finished product for the manufacture of tyres and various industrial rubber products.

2.2.2 Scalability

The results of the Product Carbon Footprint are reported per functional unit of one metric tonne of Technically Specified Rubber. The reported carbon footprint can be scaled proportionally for different production volumes, provided that the production technology, material composition, energy sources and transport scenarios remain unchanged.

2.2.3 System boundaries

The analysis follows a 'cradle-to-port' system boundary. Table 1 shows the life-cycle stages that have been included.

Life-cycle stage	**Included**
Raw material supply	✓
Transport to the factory	✓
Production	✓
Transport to the customer's port	✓
Production of processed products	Not included
Usage phase	Not included
End of life	Not included
Benefits outside the system boundaries	Not included

Table 1. *System boundaries of the Product Carbon Footprint analysis.*

2.2.4 Process description

Figure 1 shows the product system and the system boundary taken into account in this PCF analysis.

The product system begins with the establishment and maintenance of a rubber plantation, followed by the harvesting of natural latex and its transport to the processing facility.

At the processing facility, the latex is converted into technically specified rubber through shredding, washing, drying, pressing, sorting and packaging. During these processes, electricity, fuel, water, processing chemicals and auxiliary materials are consumed.

The packaged TSR is then transported to the customer's nearest seaport, where the product leaves the defined system boundary.

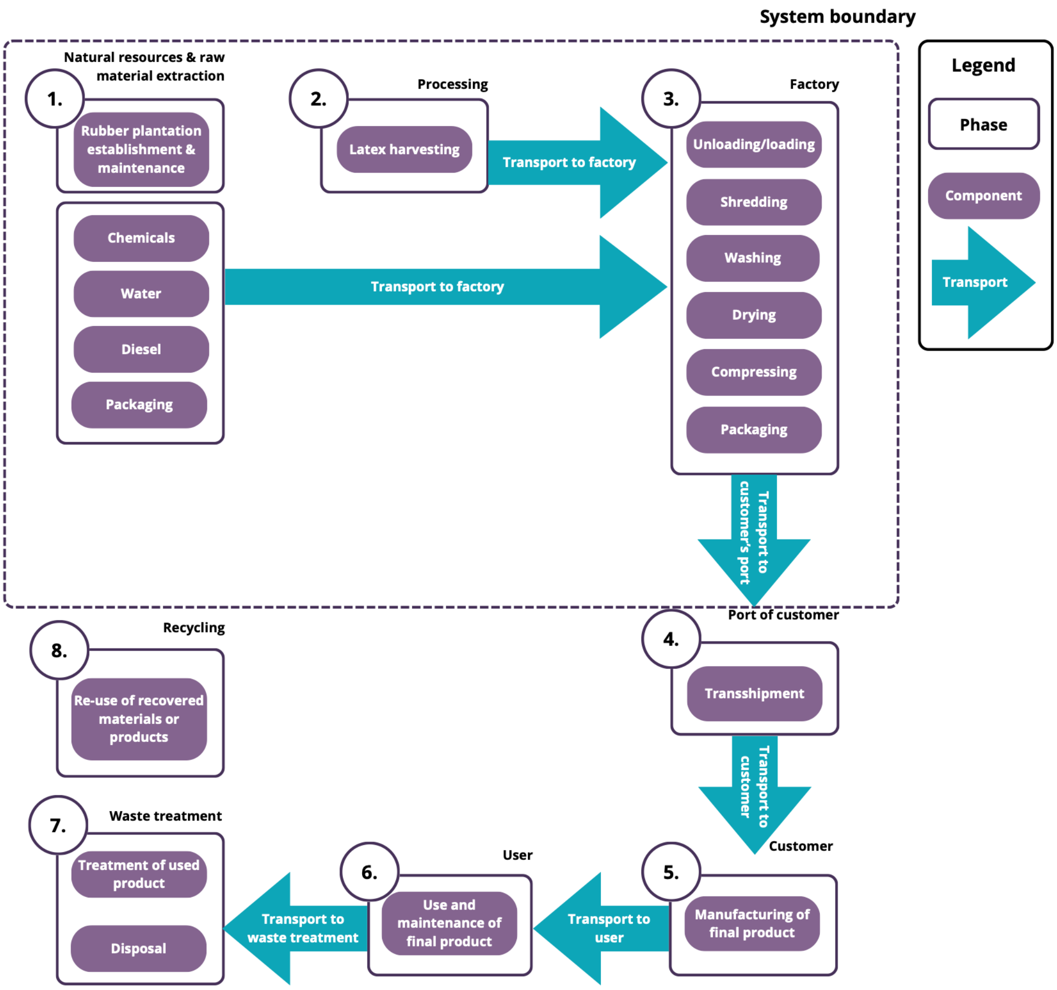

Figure 1. *Diagram of the system boundaries for the PCF analysis*

2.2.5 Cut-off criteria

All significant material and energy flows that contribute to the Product Carbon Footprint have been included in the analysis.
Input streams that make only a negligible contribution to total greenhouse gas emissions have been excluded, provided that this does not have a material impact on the results or conclusions of the study.

2.2.6 Consistency

Consistency has been ensured through the uniform application of system boundaries, calculation methods, characterisation factors, assumptions and allocation procedures throughout the analysis.

Where available, site-specific data from the Hevecam plantation and processing facility has been used. Where site-specific data was not available, representative assumptions and technical calculations have been consistently applied to comparable processes to ensure a transparent and reproducible analysis.

2.2.7 Sensitivity analysis

This Product Carbon Footprint analysis is primarily based on site-specific operational data collected at the Hevecam plantation and processing facility. Where primary data were not available, technical calculations and representative assumptions were applied to complete the inventory. The remaining assumptions are considered to have only a limited impact on the reported Product Carbon Footprint and on the overall conclusions of the analysis.

3. Life Cycle Inventory (LCI)

This chapter describes the life cycle inventory (LCI) of Corrie MacColl's technically specified rubber (TSR). The LCI forms the quantitative basis of the PCF analysis and encompasses all significant material, energy and transport flows within the defined 'cradle-to-port' system boundary. All inventory data presented in this chapter relate to the functional unit of one metric tonne of TSR, delivered to the customer's nearest seaport.

3.1 Data collection

The primary data have been quantified using operational records collected at the Hevecam plantation and at the processing facility in Cameroon. These records reflect operational activities for the 2025 production year and include production volumes, as well as the consumption of energy, water, chemicals and packaging materials.

Background data for materials, energy, transport and supporting processes have been obtained from the ecoinvent database (version 3.10.1). This database is widely used in European life-cycle assessments and Product Carbon Footprint studies and provides internationally recognised life-cycle inventory data. For most background processes, a conscious decision was made to use global-level (GLO) or 'rest of the world' (RoW) datasets, in order to obtain a generic Product Carbon Footprint model that can be applied across multiple TSR production sites. Where a site-specific dataset was required, such as for electricity consumption, country-specific datasets were used.

The inventory data used in this study are drawn from three different data categories:

- **Measured** – Values derived directly from operational data. For most production inputs, the quantities allocated to the functional unit were determined by relating the total annual consumption and production data for 2025 to one metric tonne of latex concentrate.
- **Calculated** – Values derived from primary operational data in combination with technical calculations, allocation procedures or assumptions, such as transport requirements, production ratios or material requirements.
- **Estimated** – Values determined on the basis of technical judgement, available process information or literature sources where no actual operational data was available.

The quality of the inventory data have been assessed in accordance with the data quality principles as described in ISO 14044. The assessment considered the temporal, geographical and technological representativeness of the data, as well as the completeness, consistency and accuracy of the inventory.

Data quality aspect	Assessment	Justification
Temporal representativeness	High	The operational data relate to operational activities during the production year 2025. The background data are sourced from ecoinvent version 3.10.1, one of the most widely used databases of life-cycle inventories for European LCA and Product Carbon Footprint studies.
Geographical representativeness	Average–High	The operational data is sourced from the Hevecam plantation and processing facility in Cameroon. The background datasets have been deliberately selected on the basis of Global (GLO) and Rest-of-World (RoW) datasets, where applicable, in order to develop a generic Product Carbon Footprint model that can be applied to all of Corrie MacColl's international TSR production sites.
Technological representativeness	High	The selected datasets represent technologies considered to be representative of the cultivation, processing, transport and energy systems included in this assessment. Where no exact process-specific datasets were available, the most representative available datasets were selected based on the technology used.
Completeness	High	All material and energy flows expected to make a material contribution to the Product Carbon Footprint have been included. Minor flows with a negligible impact have been excluded in accordance with the cut-off criteria described in section 2.2.5.
Consistency	High	Throughout the assessment, the same methodological framework, system boundaries, characterisation factors, modelling assumptions and version of the ecoinvent database were consistently applied.
Accuracy	Medium-High	Most of the inventory data is derived from measured operational data. Where primary data was unavailable, technical calculations, literature sources and expert judgement were used.

Table 2. *Assessment of the inventory's data quality*

Overall, the inventory is considered to be a reliable representation of the Product Carbon Footprint of technically specified rubber (TSR).

3.2 Natural Resources & Raw Material Extraction

The first stage of the product system comprises the extraction and production of the raw materials required for the manufacture of technically specified rubber (TSR). This includes the cultivation of *Hevea* brasiliensis trees for the production of natural latex, as well as the upstream production of auxiliary materials and fuel used during the production process.

Natural latex is produced from mature *Hevea* brasiliensis trees grown on rainwater-fed plantations, thereby eliminating the need for additional irrigation. The baseline data on plantation activities are sourced from the Hevecam plantation in Cameroon. The inventory covers the planting of rubber trees, plantation maintenance and the management of pruning waste.
The number of rubber trees allocated to the functional unit has been determined using site-specific production data in combination with expert information on the average lifetime latex yield per rubber tree in the field. The calculation is based on the quantity of field latex required to produce one metric tonne of TSR and the corresponding average lifetime yield per tree. The quantity of pruning waste has been estimated based on the resulting number of trees.

Upstream production of auxiliary materials, including processing chemicals, fuels, electricity, packaging materials and other means of production, is represented using appropriate life-cycle inventory datasets from the ecoinvent database (version 3.10.1). The quantities of these materials were determined using operational data from the Hevecam processing facility and are reported in the production phase, where they are consumed.

Material/process	Quantity	Unit	Source: ecoinvent 3.10.1	Data quality
Production of rubber tree seedlings	10.15	trees	Seedling production (based on: tree seedling production, in an unheated greenhouse (RoW) I EN15804)	Calculated
Establishment and maintenance of a rubber tree plantation	10.15	trees	Establishing an orchard (based on establishing an orchard (RoW) I EN15804)	Calculated
Pruning waste	100	kg	Treatment of garden bio-waste, home composting in heaps (RoW) I EN15804	Estimated
Water	4.34	m^3	water (based on the market for tap water (RoW) I EN15804)	Measured
Sulphuric acid	0.17	kg	market for sulphuric acid (RoW) I EN15804	Measured
Lime	0.45	kg	market for lime (RoW) I EN15804	Measured
Sulphate Hydroxylamine	0.41	kg	market for hydroxylamine (RoW) I EN15804	Measured
Phosphoric acid	1.02	kg	market for phosphoric acid, fertiliser grade, anhydrous, in 70% solution (RoW) I EN15804	Measured

Table 3. *Breakdown of raw material extraction for the production of 1 metric tonne of TSR*

3.3 Latex harvesting and transport to the processing facility

Natural latex is harvested by hand from mature *Hevea* brasiliensis trees by tapping the bark. Harvesting is carried out using simple, reusable tools and collection buckets, which are assumed to make a negligible contribution to the total Product Carbon Footprint due to their long service life.

After harvesting, the collected latex is coagulated and transported from the plantation to the TSR processing facility. The data reflecting this transport phase has been obtained from the Hevecam production system. As no site-specific transport distances from individual plantations to the processing facility were available, an average transport distance of 50 km was used as an appropriate value for local transport.

The gross mass of solidified rubber required to produce one metric tonne of TSR was calculated using the primary production data. This value was then used to determine the transport requirements associated with delivering the solidified rubber to the processing facility.

Material/process	**Quantity**	**Unit**	**Source: ecoinvent 3.10.1**	**Data quality**
Transport by tractor and trailer	54.11	Metric tonnes*km	market for transport, tractor and trailer, agricultural (RoW) I EN15804	Calculated

Table 4. *Breakdown of transport to the processing facility*

3.4 TSR production and packaging

During the production phase, vulcanised natural rubber is processed into technically specified rubber (TSR). The operational data reflecting this process are sourced from the Hevecam processing facility in Cameroon.
The production process consists of several successive processing steps, including:

- shredding;
- washing;
- drying;
- pressing;
- packaging.

The inventory for this phase covers the consumption of electricity, thermal energy, water, processing chemicals, packaging materials and internal material transport. No site-specific consumption data were available for individual processing steps or machines. Instead, the quantities allocated to the functional unit were determined by attributing the total annual consumption of each production input to the total annual TSR production at the Hevecam processing facility for the year 2025. This approach yields representative average consumption values per metric tonne of TSR.

In order to determine a PCF for Corrie MacColl's total TSR portfolio, electricity consumption has been modelled using a weighted electricity mix that reflects the geographical origin of the processed rubber. The electricity mix consists of 50% Cameroon, 25% Thailand and 25% Malaysia, which corresponds to the relative contribution of these production sites to the total TSR supply. Other background processes were modelled using 'Global' or 'Rest-of-World' datasets from ecoinvent, which were considered sufficiently representative for this generic PCF model.

Diesel consumption for the operation of forklift trucks used in internal material handling was estimated, as no site-specific data on fuel consumption was available. Furthermore, the average mass of the production equipment was estimated due to the lack of detailed equipment specifications. The greenhouse gas emissions from the production equipment were allocated to the functional unit based on an assumed average machine mass, an annual operating time of 1,920 hours and an assumed service life of 25 years, in line with the service life of the selected background dataset. Both assumptions contribute only marginally to the total Product Carbon Footprint and therefore have a negligible impact on the calculated results.

Material/process	Quantity	Unit	Source: ecoinvent 3.10.1	Data quality
Use of forklift truck	0.30	L Diesel	market for diesel, burned in construction machinery (GLO) I EN15804	Estimated
Use of machinery	6.2	hours	use of TSR machinery (calculated on an hourly basis based on the market for heavy industrial machinery, unspecified (RoW) I EN15804)	Estimated
Electricity consumption of machinery	186.42	kWh	energy mix (based on 50% of the market for low-voltage electricity (CM) I EN15804; 25% of the market for low-voltage electricity (TH) I EN15804; 25% of the market for low-voltage electricity (MY) I EN15804)	Measured
Fuel for drying	45.2	L fuel	heat production, light fuel oil, at industrial furnace 1MW (RoW) I EN15804	Measured
Wastewater treatment	4.34	m^3	treatment of wastewater, average, wastewater treatment (RoW) I EN15804	Calculated
Packaging on wooden pallets	22	kg	wood pallet (based on the market for EUR flat pallets (RoW) I EN15804; treatment of waste wood, untreated, municipal incineration (GLO) I EN15804)	Estimated

Table 5. *Breakdown of TSR production and packaging*

3.5 Distribution

Following production and packaging, the TSR is prepared for distribution. This phase involves road transport from the processing facility to the export port and sea freight to the customer's nearest seaport.

To provide a representative transport scenario for the Product Carbon Footprint analysis, a reference distribution route has been defined. The route consists of road transport from the Hevecam production facility to the port of Kribi (Cameroon), followed by sea freight from the port of Kribi to the port of Antwerp (Belgium).

This reference route has been chosen to reflect a realistic export scenario for TSR. Although the actual transport routes may vary depending on the production location and final destination, the chosen route provides a transparent and reproducible basis for the Product Carbon Footprint model. Alternative production facilities or customer locations can be assessed by adjusting the transport distances, whilst maintaining the same methodological approach.

Material/ process	**Quantity**	**Unit**	**Source: ecoinvent 3.10.1**	**Data quality**
Transport by lorry	60	tonne-kilometres	market group for transport, freight, lorry, unspecified (GLO) I EN15804	Calculated
Transport by container ship	8,500	tonne-km	market for transport, freight, sea, container ship (GLO) I EN15804	Calculated

Table 6. *Breakdown of the distribution of one tonne of TSR*

For this Product Carbon Footprint (PCF) analysis, the system boundary has been defined as extending up to and including the arrival of the packaged rubber at the customer's nearest seaport, with unloading from the ship falling outside the system boundary.

The inventory data presented in this chapter form the basis for the greenhouse gas calculations presented in the following chapter.

4. Results

This chapter presents the results of the Product Carbon Footprint (PCF) analysis for technically specified rubber (TSR). The calculated greenhouse gas emissions are expressed in kilograms of carbon dioxide equivalent (kg CO_2-eq) and are based on the life cycle inventory described in Chapter 3.

4.1 Calculation of the Product Carbon Footprint

The Product Carbon Footprint has been calculated in accordance with the principles and requirements of ISO 14067:2018, using the life cycle assessment framework as defined in ISO 14040 and ISO 14044.

The assessment:

- quantifies greenhouse gas emissions using the EN 15804+A2 GWP100 characterisation factors;
- applies allocation procedures where necessary for processes with multiple inputs and outputs, recycling and reuse, in accordance with the principles of ISO 14044;
- uses background data from the life cycle inventory in the ecoinvent database (version 3.10.1).

4.2 Results of the Product Carbon Footprint

The product's carbon footprint is 295.13 kg CO_2-eq per metric tonne of TSR within the defined 'cradle-to-port' system boundary.

Table 7 provides an overview of the contribution of each life-cycle stage, together with the associated greenhouse gas emissions from fossil fuels, biogenic sources and land use.

Greenhouse gas category	**Total**	**Extraction of raw materials**	**Transport to the processing facility**	**Production and packaging**	**Distribution**
kg CO_2-eq – total	**295.13**	**-73.83**	**20.50**	**252.63**	**95.83**
kg CO_2-eq – fossil	**482.34**	111.81	21.05	253.72	95.76
kg CO_2-eq – biogenic	**-187.78**	-185.76	-0.58	-1.43	-0.01
kg CO_2-eq – land use	**0.57**	0.12	0.03	0.34	0.08

Table 7. *Weighted results of the CO_2 footprint for one metric tonne of TSR delivered to the customer's nearest seaport.*

4.3 Biogenic carbon sequestration and emissions

During the growth of the rubber trees, approximately 185.77 kg of CO_2 is removed from the atmosphere and sequestered for every metric tonne of technically specified rubber produced. This carbon is sequestered in the biomass of the rubber trees and the harvested latex.

A significant proportion of this biogenic carbon remains stored outside the 'cradle-to-port' system boundary. The carbon sequestered in the standing rubber trees is expected to remain stored for an average of approximately 15 years, based on a productive lifespan of the plantation of 30 years. The remaining carbon is contained in the produced latex concentrate and remains stored until the downstream latex products reach the end of their useful life.

The uptake by the rubber trees accounts for the vast majority of the biogenic carbon flows included in this analysis. Other biogenic material inputs contribute approximately 2 kg CO_2-eq and are therefore negligible by comparison.

4.4 Contribution analysis

The contribution analysis provides additional insight into the processes and inventory flows that contribute most to the total Product Carbon Footprint of technically specified rubber. By identifying the key factors, the analysis maps out the stages of the production system that have the greatest influence on the reported greenhouse gas emissions.

Activity	**Stage**	**kg CO_2-eq – total**	**kg CO_2-eq – fossil**	**kg CO_2-eq – biogenic**	**kg CO_2-eq – land use**
	Total	**295.13**	**482.34**	**-187.78**	**0.57**
Fuel for drying	Production and packaging	154.80	154.77	0.02	0.01
Transport by container ship	Distribution	86.72	86.70	-0.02	0.05
Electricity for machinery	Production and packaging	85.83	85.18	0.35	0.30
Transport to the factory	Transport to processing facility	20.50	21.05	-0.58	0.03

Transport by lorry	Distribution	9.10	9.06	0.01	0.03
Sulphate Hydroxylamine	Natural resources and extraction of raw materials	7.79	7.77	0.02	0.01
Wooden pallet packaging	Production and packaging	5.51	9.07	-3.58	0.03
Water	Natural resources and the extraction of raw materials	5.48	5.47	0.00	0.01
Wastewater treatment	Production and packaging	3.54	1.76	1.78	0.00
Use of machinery	Production and packaging	1.88	1.88	0.00	0.00
Loading/unloading with a forklift truck	Production and packaging	1.08	1.08	0.00	0.00
Phosphoric acid	Natural resources and extraction of raw materials	0.87	0.87	-0.01	0.01
Sulphuric acid	Natural resources and extraction of raw materials	0.03	0.03	0.00	0.00
Lime	Natural resources and extraction of raw materials	0.02	0.02	0.00	0.00

Growing tree seedlings	Natural resources and raw material extraction	0.00	0.00	0.00	0.00
Establishment and maintenance of orchards	Natural resources and extraction of raw materials	-88.02	97.66	-185.77	0.10

Table 8. *Contribution analysis for the production of one metric tonne of TSR*

Table 8 ranks the individual inventory streams based on their contribution to the total climate impact, whilst Figure 2 groups these contributions by life-cycle stage and distinguishes between fossil, biogenic and land-use-induced greenhouse gas emissions.

The production and packaging phase makes the largest contribution to the Product Carbon Footprint, at 252.63 kg CO_2-eq, which accounts for approximately 86% of the total PCF. Within this phase, the fuel used for drying the rubber is the main source of greenhouse gas emissions (154.80 kg CO_2-eq), followed by the electricity consumption of the processing equipment (85.83 kg CO_2-eq). By contrast, emissions associated with the production equipment itself are relatively small (1.88 kg CO_2-eq), reflecting the high production volume over its lifetime.

Natural resources and raw material extraction contribute –73.83 kg CO_2-eq. Although this stage includes fossil greenhouse gas emissions associated with the establishment of plantations, auxiliary materials and processing chemicals, these emissions are more than offset by the uptake of carbon dioxide from the atmosphere during the growth of the rubber tree.

The distribution phase contributes 95.83 kg CO_2-eq and is dominated by maritime transport (86.72 kg CO_2-eq), whilst road transport accounts for a relatively small proportion (9.10 kg CO_2-eq). Transport to the processing facility contributes 20.50 kg CO_2-eq, making this the phase with the lowest emissions of fossil greenhouse gases in the life cycle.

Figure 2 shows that fossil greenhouse gas emissions dominate the climate change impact across the entire product system. The only substantial biogenic contribution occurs during raw material extraction, where carbon uptake by the rubber trees exceeds the emissions associated with the decomposition of pruning waste, resulting in a net negative biogenic contribution. Emissions related to land use remain low across all life-cycle stages.

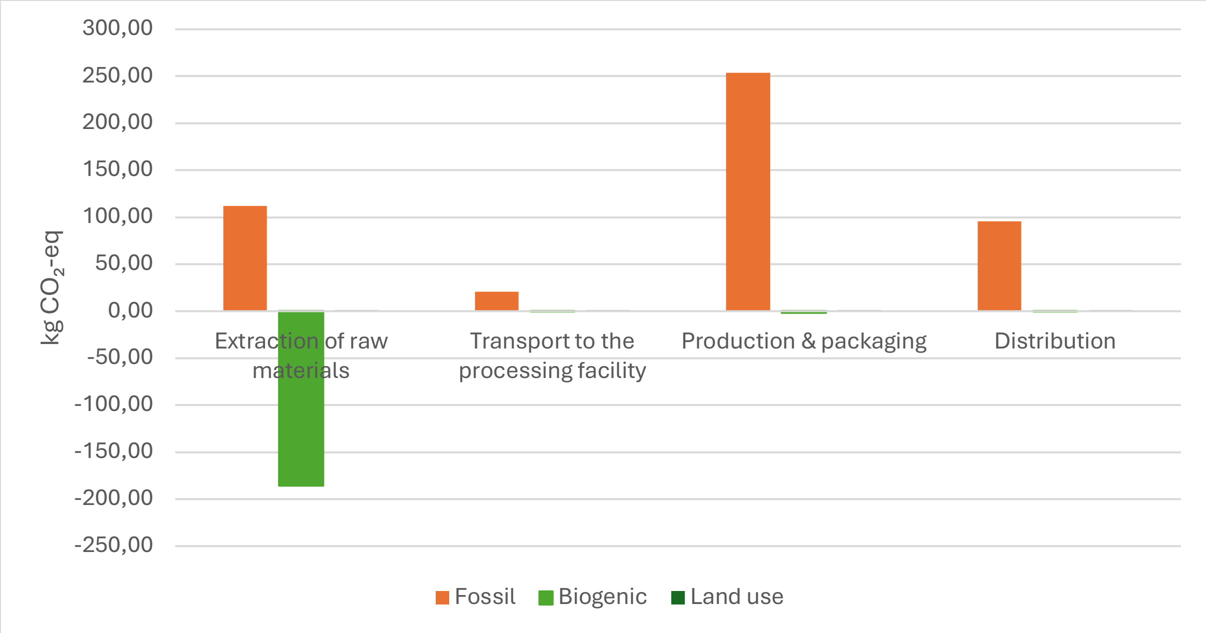

Figure 2. *Contributions to climate change by life-cycle stage for one metric tonne of technical-grade rubber.*

The reported Product Carbon Footprint is based on site-specific operational data collected at the Hevecam plantation and at the processing facility, supplemented by representative background data from the ecoinvent database. Although technical estimates were required for a limited number of inventory parameters, the analysis is considered to be a robust and consistent quantification of the greenhouse gas emissions associated with the production and distribution of technically specified rubber within the defined ‘cradle-to-port’ system boundaries.

5. References

- Corrie MacColl PLC. (2025). *Internal production data, energy consumption data, material inventories, transport data and plantation management data.* Unpublished.
- Ecoinvent. (2024). *ecoinvent database*, version 3.10.1. Available at: https://www.ecoinvent.org
- International Organisation for Standardisation (ISO). (2018). *ISO 14067:2018 – Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification.*
- International Organisation for Standardisation (ISO). (2006). *ISO 14040:2006 – Environmental management — Life cycle assessment — Principles and framework.*
- International Organisation for Standardisation (ISO). (2006). *ISO 14044:2006 – Environmental management — Life cycle assessment — Requirements and guidelines.*
- European Committee for Standardisation (CEN). (2019). *EN 15804:2012+A2:2019 – Sustainability of construction works — Environmental product declarations — Product category rules for construction products.*