

Corporate Carbon Footprint Report 2023

Global Sustainability Office
Lohmann GmbH & CO. KG
Headquarters Neuwied
External Version 1.0

Issued November 2025

Document Information

Document Name:	Corporate Carbon Footprint (CCF)-Report RY 2023
Document Owner:	Lohmann Group Global Sustainability Office
Company Name:	Lohmann GmbH & Co. KG
Adress:	Irlicher Straße 55, 56567 Neuwied
Reporting Period:	01/01/2023-12/31/2023
Issued:	11/2025
Classification:	External

Table of Contents

1	Introduction	4
1.1	The CCF: The basis for effective climate protection	4
1.2	Background	4
1.3	About this Report	4
2	Framework and Methodology	5
2.1	Corporate Carbon Footprint Definition	5
2.2	Accounting and Reporting Standard	5
2.3	Reporting Principles	5
2.4	Technical Support	6
3	Inventory and Boundary Descriptions	7
3.1	GHG Coverage	7
3.2	Organizational Boundary	7
3.3	Basic Figures: Company Locations	7
3.4	Temporal Boundaries	9
3.5	Operational Boundaries	9
3.6	Gross and Net Electricity Emissions: Market-Based and Location-Based	13
4	Data Management	13
4.1	Data Collection	14
4.2	Data Evaluation	14
4.3	Data Quality Assessment	15
5	Results of the Corporate Carbon Footprint 2023	16
5.1	Lohmann Group	16
5.1.1	Lohmann Group: CCF Results Table	18
5.2	Business Unit Technical Products (BU TP)	19
5.2.1	BU TP: CCF Results Table	20
5.3	Business Unit Hygiene (BU Hygiene)	21
5.3.1	BU Hygiene: CCF Results Table	22

1 Introduction

1.1 The CCF: The basis for effective climate protection

Measure, reduce and offset. These three steps are central to climate protection in line with the Paris Agreement, a global climate treaty aiming to combat climate change with set benchmarks for reducing emissions across all sectors. The starting point for action is determining the corporate carbon footprint (CCF). The CCF measures the total amount of greenhouse gas (GHG) emissions generated directly and indirectly by a company's activities. The CCF focuses heavily on carbon dioxide (CO₂) emissions. CO₂ is a greenhouse gas that contributes significantly to global warming and climate change.

By understanding the CO₂ emissions associated with our business, reflected in the CCF report, we can better understand emissions sources: where, how, and to what extent are they being generated across the value chain. The CCF creates transparency, providing a strong basis for strategic decision-making and making reduction opportunities visible. Thus, the CCF forms the basis for formulating realistic reduction targets, planning and implementing actions to achieve these targets, and, through annual CCF-reporting, measuring performance and progress towards sustainability goals.

1.2 Background

In 2021, Lohmann GmbH & Co. KG ("Lohmann") established its own corporate sustainability strategy and contracted DFGE – Institute for Energy, Ecology and Economy to support CCF calculations for the financial year 2021. With the support of DFGE, Lohmann was able to calculate GHG emissions inventory for the first time, understand relevant GHG emissions sources, and identify emissions hot spots as a starting point for reductions targets and mitigation activity. Additionally, a basic methodological framework for calculating Lohmann's carbon footprint was established. Since then, a new questionnaire and data collection process have been implemented to further enhance data quality, align with updated reporting requirements, and better reflect Lohmann's organizational reality.

Since Lohmann's initial CCF report in 2021, adaptations have been made to the CCF calculation methodology to better reflect the Lohmann global structure and to provide greater efficiency and accuracy to provide increased strategic value. In 2023, Lohmann has partnered with osapiens HUB GmbH, applying a certified CCF calculation methodology. This has resulted in adaptations to the CCF calculations method, which are outlined in greater detail throughout this report.

The evolution of Lohmann's CCF reporting methodology requires a fine balance between consistency of reporting procedures (allowing better comparability of results over time) as well as striving for continual improvements, such as adapting CCF reporting methodology to improve data quality, reflect improved data availability over time as well as stay current with best practices in the industry (ensuring more accurate results of higher strategic value). To maintain this balance, this report highlights areas where CCF emissions reporting has changed and identifies where CCF results over time may be attributed to changes in methodology.

1.3 About this Report

Lohmann GmbH & Co. KG and associated legal entities worldwide (together referred to here as "Lohmann Group"), attach great importance to transparent CO₂ accounting as a critical part of its sustainability strategy. This CCF report breaks down the GHG emissions of the Lohmann Group in detail. The aim of this report is to analyze the company's GHG emissions for the financial year 2023 to identify potential reductions and initiate

measures to improve the carbon footprint. It also contains a comparative analysis based on the previous year's data from 2022 and the base year 2021.

The report was prepared after reviewing internal and external documentation and analyzing raw data and data collection systems. The reporting data compiled and analyzed is based on the principles of relevance, completeness, consistency, transparency and accuracy set out in the Greenhouse Gas Protocol (GHG Protocol) of the World Resources Institute (WRI).¹

For analysis purposes, Lohmann divides its CCF calculations into the two main business units: Business Unit Hygiene (BU Hygiene) and Business Unit Technical Products (BU TP).

2 Framework and Methodology

2.1 Corporate Carbon Footprint Definition

The CCF is comprised of the total amount of CO₂ and other GHG emissions associated with a company's overall activities. The carbon footprint is therefore a balance of the emissions of a company and its supply chain over a certain period, usually one year. Non-CO₂ GHGs are compared to CO₂ and converted into units of carbon dioxide equivalent (CO₂e) using global warming potential (GWP).

The calculation is based on the internationally recognized standard of the GHG Protocol and typically comprises three emission scopes: Scope 1 (direct emissions), Scope 2 (indirect emissions from purchased energy) and Scope 3 (other indirect emissions along the value chain).²

The CCF forms the basis for strategic climate management, as it creates transparency, identifies reduction potential and provides a reliable basis for climate targets and compensation measures.

2.2 Accounting and Reporting Standard

The calculation of CO₂ and GHG emissions is based on the internationally recognized accounting and reporting framework, the GHG Protocol, specifically the "Corporate Accounting and Reporting Standard"³ and the "Corporate Value Chain (Scope 3) Accounting and Reporting Standard".⁴ The GHG Protocol is the result of a partnership between the WRI and the World Business Council for Sustainable Development (WBCSD). It is a set of voluntary standards for the accounting, reporting and management of GHG emissions and the Corporate Carbon Footprint and is the most widely used framework for these purposes.⁵

2.3 Reporting Principles

Lohmann's GHG emissions calculations adhere to the requirements and principles of the GHG Protocol in terms of:⁶

¹ <https://ghgprotocol.org/standards-guidance>

² <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>, p. 26

³ <https://ghgprotocol.org/corporate-standard>

⁴ <https://ghgprotocol.org/corporate-value-chain-scope-3-standard>

⁵ <https://ghgprotocol.org/standards-guidance>

⁶ <http://www.ghgprotocol.org/standards/>

- **Relevance**, to ensure that the inventory reflects the GHG emissions of the company and serves the decision-making needs of users.
- **Completeness**, to account for and report on all GHG emission sources and activities within the chosen boundaries, transparently disclosing and justifying all exceptions.
- **Consistency**, using consistent methodologies that enable meaningful comparisons over time. Any changes to the data, inventory boundary, methods or other factors must be transparently documented.
- **Transparency**, to address all relevant issues in a factual and coherent manner, based on a clear audit trail, disclosing any relevant assumptions and making appropriate references to accounting and calculation methodologies and data sources used.
- **Accuracy**, to ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as possible, and that uncertainties are reduced as far as practicable, achieving accuracy to enable users to make decisions with reasonable assurance as to the integrity of the information reported.

2.4 Technical Support

The calculation of Lohmann's CCF was supported by osapiens HUB GmbH ("osapiens"),⁷ the provider of a digital tool to manage emissions calculations. The osapiens HUB Corporate Carbon Footprint methodology has been officially certified by TÜV Rheinland following a comprehensive assessment based on the requirements of the GHG Protocol. TÜV Rheinland has confirmed that osapiens' calculation method meets the latest industry standards and is scientifically validated.⁸ The TÜV Rheinland certification covers key areas including the quality and credibility of emission factor sources, the structure and logic of data collection and presentation of results, and the transparency and reproducibility of the entire calculation process.⁹

⁷ <https://osapiens.com/solutions/ccf/>

⁸ https://www.certipedia.com/quality_marks/0000088056?locale=en&qm_locale=de

⁹ https://www.certipedia.com/quality_marks/0000088056?locale=en&qm_locale=de

3 Inventory and Boundary Descriptions

The GHG Protocol requires transparent inventory boundaries. The **GHG coverage** refers to which greenhouse gases other than CO₂ were included in the CCF calculation. The **organizational boundary** refers to the business activities and structure of the organization selected for consolidated reporting of GHG emissions. The **operational boundary** defines which emission sources and activities are included in the carbon footprint, specifying the emissions across scopes 1,2 and 3 according to the GHG Protocol.

3.1 GHG Coverage

The GHG coverage of this CCF is aligned with the requirements set out by the United Nations Framework Convention on Climate Change (UNFCCC)/Kyoto Protocol and adopted by the GHG Protocol. This includes emissions of CO₂ as well as six other GHGs, including CH₄, N₂O, HFCs, PFCs, SF₆, NF₃.¹⁰ These are converted into CO₂ equivalents (CO₂e) by means of their respective GWP values.

The inventory boundary of this report does not include biogenic CO₂ emissions. Exceptions are emissions from mandatory biofuel shares in regular fuel, and from the bioenergy share within the grid-based electricity mix. Unless otherwise stated, these emissions are included in the respective scope 1-3 categories.

3.2 Organizational Boundary

Business operations vary in their legal and operational structures. For the purposes of financial accounting, there are established rules for consolidated reporting depending on the structure of the organization. Likewise, for consolidated GHG emissions, organizational boundaries must be set to define which businesses and operations constitute Lohmann Group for the purposes of reporting GHG emissions.

The GHG Protocol proposes two approaches: the **control approach** and the **equity share approach**.¹¹ Under the equity share approach, a company accounts for GHG emissions according to its share of equity in the operation, reflecting economic interests. Under the control approach, a company accounts for the GHG emissions from operations over which it has control (i.e. **operational control**). It does not account for GHG emissions from operations in which it owns an interest but has no control.¹²

The organizational boundary of this CCF has been defined using the control approach. Thus, all emissions from operations over which Lohmann exerts operational control are included in the consolidated GHG emission inventory. Specifically, the application of the control approach means that the equity share of GHG emissions from proportionally consolidated joint ventures where Lohmann does not have operational control have not been reported.¹³

3.3 Basic Figures: Company Locations

¹⁰ GHG Protocol 2013, Accounting and Reporting Standard Amendment, p. 2

¹¹ <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>, p. 17

¹² <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>, p. 6

¹³ <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf> p. 16-19

Lohmann operates from several locations worldwide and the company's headquarters is in Neuwied, Germany.

For the calculation of this CCF, the following locations have been included:

- Koblenz, Germany
- Neuwied, Germany
- Remscheid, Germany
- Altendorf, Germany (Lohmann-koester)
- Guadalajara, Mexico (Lohmann-koester)
- Samutkarn, Thailand
- Tianjin, China
- Tamil Nadu, India
- Gyeonggi-do, Korea
- Orange, USA (1)
- Orange, USA (2)
- Hebron, USA
- Louviers, France
- Ponzano, Italy
- Stockerau, Austria
- Kungälv, Sweden
- Gdynia, Poland
- Molins de Rei, Spain
- Milton Keynes, United Kingdom
- Gebze, Turkey

For the calculation of this report, the following locations have not been included:

- St. Petersburg, Russia: As a result of the ongoing geopolitical conflict, emissions data from the Lohmann-affiliated legal entity located in Russia was not collected. It is anticipated that the emissions from this site are relevant; however, emissions data was neither collected nor evaluated.
- Tianjin, China (Lohmann-koester): The Lohmann-koester location in Tianjin, China is supported by a group of less than five employees and shares its site with Lohmann BU Tapes location. For CCF calculation purposes, this site was integrated into the Lohmann BU Tapes site. Thus, Scope 1 and Scope 2 emissions data has been gathered but has not been individually calculated or reported. Furthermore, Scope 3 emissions information for this site has not been collected. It is anticipated that emissions at this site are negligible, presumably less than 1% of total emissions in all scopes.
- Horsholm, Denmark: The Lohmann location in Denmark has a small administrative team and no operations. It is anticipated that emissions at this site are negligible, presumably less than 1% of total emissions in all scopes. Thus, emissions from this site have not been considered relevant.
- Heemskerk, Netherlands: The Lohmann location in the Netherlands is a small office with a small administrative team with no operations. It is anticipated that the emissions at this site are negligible, presumably less than 1% of total emissions in all scopes. Thus, emissions from this site have not been considered relevant.

3.4 Temporal Boundaries

The present carbon footprint includes emissions from company activities in the financial year 2023. Therefore, the period covers January 1 to December 31, 2023.

3.5 Operational Boundaries

The term operational boundary refers to the scope of direct and indirect emissions that fall within a company's organizational boundary.¹⁴ For the purposes of this CCF, all relevant and applicable direct and indirect emissions sources within the inventory boundary related to Lohmann operations have been identified and categorized into different **source categories**, which are allocated to different **scopes**, following the guidelines of the GHG Protocol:¹⁵

- **Scope 1:** Direct emissions from company-owned or controlled sources.
- **Scope 2:** Indirect emissions from purchased energy, primarily electricity and heat.
- **Scope 3:** Other indirect emissions along the value chain – downstream and upstream emissions

Lohmann's process for identifying and classifying direct and indirect emissions is outlined in *Figure 3-1*. Furthermore, the GHG Protocol provides detailed guidance on the classification of emissions scopes and categories, with a detailed description of these classifications as well as the data input used to measure these emissions. *Table 3-1* provides an overview of the scopes and categories according to the GHG Protocol and shows the data sources that have been used in the present case.

FIGURE 3-1: Overview of Calculated Emissions in a Corporate Carbon Footprint

¹⁴ <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>, p. 26

¹⁵ <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>, p. 41

Overview of Calculated Emissions in a Corporate Carbon Footprint

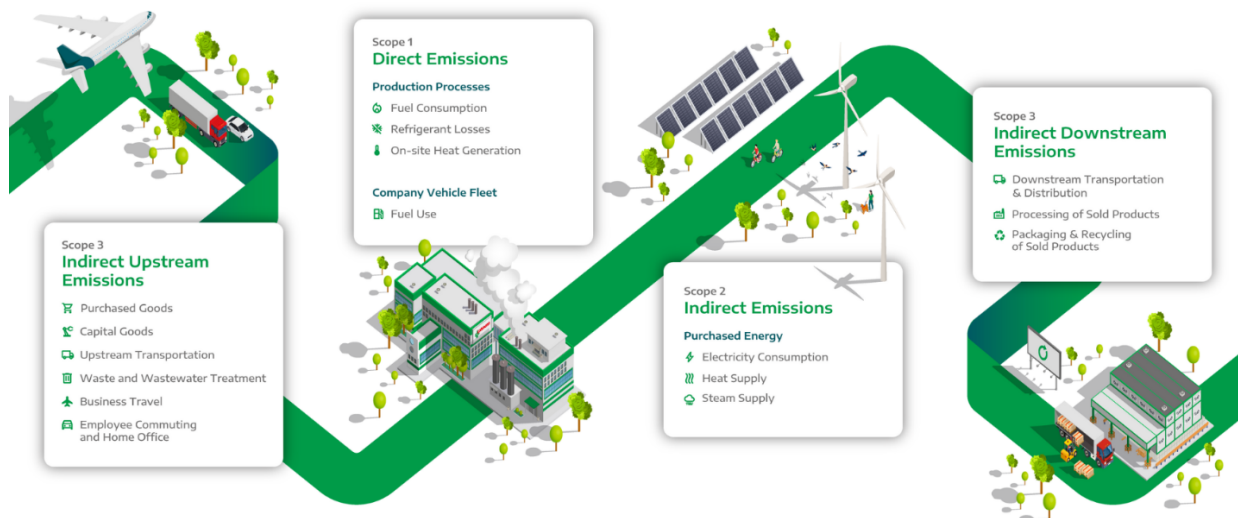


TABLE 3-1: GHG Protocol CCF Scope and Category Overview
Scope and Category overview

Scope	Category	Description	Input Data
1	Energy consumption of combustion for vehicles (owned or controlled)	Emissions from fuel used by vehicles owned or controlled by the reporting company (e.g. leased vehicles).	Total fuel consumption for most locations Total driven kilometers for some locations
1	Energy consumption of combustion within Facilities (owned or controlled)	Emissions from fuel combustion (for example, for heating, cooling, power generation or other applications) in facilities owned or controlled (e.g. leased) by the reporting company.	Measured heat consumption
1	Fugitive Emissions	These emissions result from intentional or unintentional releases, e.g., equipment leaks from joints, seals, packing, and gaskets.	Not applicable: No fugitive emissions recorded
1	Process Emissions	Most of these emissions result from manufacture or processing of chemicals and materials.	Not applicable: No process emissions recorded
2	Purchased Electricity	Emissions associated with the production of electricity the reporting company purchased or acquired from an external supplier.	Measured consumption Supplier-specific emission factor for some locations Country specific grid-wide emission factor for other locations
2	Purchased Steam	Emissions associated with the production of steam the reporting company purchased or acquired from an external supplier.	Measured consumption
2	Purchased Heat	Emissions associated with the production of heat the reporting company purchased or acquired form an external supplier.	Measured consumption
2	Purchased Cooling	Emissions associated with the production of cooling the reporting company purchased or acquired form an external supplier.	Not applicable: No purchased cooling recorded
3 Upstream	Purchased Good & Services	Extraction, production, and transportation of goods and services purchased, not otherwise included in Categories 2 – 8.	Exact amounts and types of materials used in production and operations Material-specific emission factors
3 Upstream	Capital Goods	Extraction, production, and transportation of capital goods purchased or acquired by the reporting company.	Cars, machinery and floor area of offices, warehouses and production buildings Reference emission factors for buildings and equipment
3 Upstream	Fuel and Energy related Activities (not covered in Scope 1 or 2)	Extraction, production and transportation of fuels and energy not already accounted for in scope 1 or scope 2.	Reference emission factors per country

3 Upstream	Upstream Transportation & Distribution	Transportation and distribution (T&D) of purchased products between tier 1 suppliers and the reporting company, T&D services purchased by the reporting company, (e.g., of sold products), and T&D between own facilities (always in vehicles and facilities not owned or controlled by the company).	Total weight of shipments and mailings Transported distance provided Reference emission factor for weight categories of shipments and mailings
3 Upstream	Waste Generation in Operations	Disposal and treatment of waste generated in company's operations (in facilities not owned or controlled by the company)	Exact weight; annual waste report Reference emission factor per waste treatment
3 Upstream	Business Travel	Transportation of employees for business-related activities (in vehicles not owned or operated by the reporting company)	Amount and types of business travel Average emissions per km for transport modes
3 Upstream	Employee Commuting	Transportation of employees between their homes and their worksites (in vehicles not owned or operated by the company)	Number of employees commuting by different modes, estimated average distances Average emissions per km for transport modes
3 Upstream	Upstream Leased assets	Operation of assets leased by the reporting company (leases) and not included in Scopes 1 or 2	Not applicable: No Upstream Leased assets or in included in Scopes 1 or 2
3 Downstream	Downstream Transportation & Distribution	Transportation and distribution of products sold by the reporting company between company and end consumer (if not paid by the company), including retail and storage (in vehicles and facilities not owned or controlled by the reporting company)	Total weight of shipments and mailings Transported distance provided Reference emission factor for weight categories of shipments and mailings
3 Downstream	Processing of sold products	Processing of intermediate products sold by downstream companies (e.g. manufacturers)	Not applicable: No influence or scenario developed
3 Downstream	Use of sold products	End use of goods and services sold by the reporting company in the reporting year	Not applicable: No emissions in use phase
3 Downstream	End-of-life treatment of sold products	Waste disposal and treatment of products sold by the reporting company (in the reporting year) at the end of their life	Not applicable: No emissions in use phase
3 Downstream	Downstream leased assets	Operation of assets owned by the reporting company (lessor) and leased to other entities, not included in scope 1/2.	Not applicable: No downstream leased assets
3 Downstream	Franchises	Operation of franchises in the reporting year, not included in scope 1/2 – reported by franchisor	Not applicable: No franchises
3 Downstream	Investments	Operation of investments (including equity and debt investments and project finance) in the reporting year, not included in scope 1/2	Not applicable: No investments

3.6 Gross and Net Electricity Emissions: Market-Based and Location-Based

There are two distinct methods for scope 2 emissions accounting. Both are useful for different purposes and together these methods can provide better understanding of risks, opportunities and changes to electricity supply over time:¹⁶

A **location-based method** reflects the average emissions intensity of grids where energy consumption occurs (using grid-average emission factor data).¹⁷ The benefit of this approach is that it enables direct comparisons of GHG performance with local averages, allowing for better understanding of local risks and opportunities.¹⁸

A **market-based method** reflects emissions from electricity that companies have chosen. In this case, emissions factors result from contractual information for energy calculation (e.g. direct contracts or energy certificates), if known.¹⁹ The benefit of this approach is that it showcases risks and opportunities conveyed by contractual relationships, including electricity suppliers.²⁰ Where contractual information does not cover all consumption, a residual mix emissions factor (e.g. regional or national) can be used, where available.²¹ This is how emissions for leftover electricity, not covered by renewable energy purchases, are calculated.

For this CCF, emissions for electricity were calculated using both the market-based and the location-based methods. This corresponds to the GHG Protocol Scope 2 Guidance for dual reporting.²² When applying the market-based method, the specific emissions factors of purchased electricity were used, based on stated emissions factors provided by energy suppliers. Where the specific emissions factors were unknown, a residual emissions mixed factor was used where available. Residual mix emissions factors are available through osapiens, where the most appropriate factor was selected (e.g. based on location). Where no residual emissions factor was available, the average emissions factor for electricity generation in the specific country was used. When applying the location-based method, the national average emissions factors were used for the respective energy mix of each country. This enables direct comparison of the local emissions values with country-specific averages.

4 Data Management

Lohmann constantly strives to improve data quality to ensure the accuracy of CCF reporting. Improving data quality for CCF reporting is essential to enable meaningful climate action aligned with the Paris Agreement. The CCF serves as the foundation for identifying, understanding, and managing Lohmann's GHG emissions, particularly CO₂, the primary contributor to global warming. High-quality data ensures transparency and accuracy in identifying emission sources across the value chain, which is critical for setting realistic reduction

¹⁶ <https://ghgprotocol.org/sites/default/files/2023-03/Scope%20%20Guidance.pdf>, p. 25-31.

¹⁷ <https://ghgprotocol.org/sites/default/files/2023-03/Scope%20%20Guidance.pdf>, p. 26.

¹⁸ <https://ghgprotocol.org/sites/default/files/2023-03/Scope%20%20Guidance.pdf>, p. 27.

¹⁹ <https://ghgprotocol.org/sites/default/files/2023-03/Scope%20%20Guidance.pdf>, p. 26.

²⁰ <https://ghgprotocol.org/sites/default/files/2023-03/Scope%20%20Guidance.pdf>, p. 26.

²¹ https://ghgprotocol.org/sites/default/files/2022-12/Scope2_ExecSum_Final.pdf, p. 4.

²² https://ghgprotocol.org/sites/default/files/2022-12/Scope2_ExecSum_Final.pdf, p. 4.

targets and implementing effective mitigation strategies. Without reliable data, Lohmann risks misallocating resources or overlooking key areas for improvement.

Consistent and precise CCF reporting not only supports strategic decision-making but also allows Lohmann to track progress over time, demonstrate accountability, and ultimately focus less on calculation efforts and more on strategic emissions reduction impacts. This section outlines the data management plan applied for this CCF report.

4.1 Data Collection

The data collection process for Lohmann's 2023 CCF reporting was based on a structured and globally coordinated approach. A tailored questionnaire, originally developed by DFGE and later optimized to reflect Lohmann's specific reporting categories, served as the foundation for gathering emissions-related data. Categories not relevant to Lohmann's CCF boundaries such as upstream and downstream leased assets were removed to streamline the process and improve efficiency.

On July 26, 2024, the questionnaire was distributed to all managing directors and general managers (MDs) across Lohmann's global operations. Due to the complexity of the organizational structure and limited cross-functional familiarity, MDs were asked to delegate responsibility for data collection to appropriate individuals or departments within their countries. This delegation was critical to ensure that data was sourced from those with the necessary expertise and access. In some cases, MDs completed the questionnaire themselves, but more commonly, responses were provided by delegated employees. The MDs played a key role in prioritizing the task and allocating resources, especially in the early stages of the process.

The original deadline for submission was set for the end of August 2024. However, responses continued to arrive through December, with final submissions received in January 2025. Throughout this period, the Global Sustainability Office maintained ongoing communication with respondents to clarify requirements, address missing data, and support corrections. While cooperation was generally high, it was clear that the task required significant time and effort and often competed with other operational priorities.

Several challenges emerged during the data collection process. A common issue was a lack of clarity regarding what was being asked; many respondents struggled to interpret the categories and to determine what kind of data was required. Questions about the exact processing of the requested data points arose, reflecting participants' interest in ensuring their submissions were as accurate and useful as possible. Additionally, identifying the correct data owners at each location proved difficult, and even when identified, those individuals often faced constraints in terms of time and resources.

To support the process, the Global Sustainability Office aided through email guidance, consultations, and one-on-one meetings.

Overall, while the data collection process remained consistent with previous years, the experience in 2023 highlighted the importance of clear communication, dedicated resources, and ongoing support. These insights will inform future improvements to the methodology and help strengthen Lohmann's global sustainability reporting framework.

4.2 Data Evaluation

After the completion of the data collection process, all submitted information was transferred into the osapiens CCF HUB for evaluation. This marked a significant development in Lohmann's carbon footprint

reporting approach. While the method of collecting data, primarily through a structured questionnaire, remained unchanged from previous years, the way in which the data was processed and evaluated underwent a major transformation in 2023.

Previously, emissions data was manually categorized into scopes and emissions categories, and calculations were performed using publicly available emissions factors. This manual approach required significant effort and was subject to inconsistencies due to varying interpretations and data quality across regions. In contrast, the osapiens CCF HUB now automates the categorization of data according to certified carbon accounting methodologies, ensuring consistent allocation across operational boundaries and emissions scopes.

A key advantage of the osapiens platform is its integrated access to a wide range of emission factors. The emission factor is correctly assigned after manually entering the parameters into the tool. The selected emissions factor is then applied, and calculations occur automatically. In cases where emissions factors were not readily available within osapiens, supplementary data was sourced from suppliers, industry associations, academic studies, and publicly accessible databases. Where necessary, assumptions and estimations were made. For example, emissions data from a known paper supplier was used to extrapolate values for similar paper products where direct data was unavailable.

Although the evaluation of data continues to be performed manually, the automation afforded by the osapiens platform plays a vital role in this process. By supporting categorization and calculation tasks, automation not only improves consistency, accuracy, and overall strategic value, but also creates additional capacity for focused manual data evaluation wherever necessary. This approach enables experts to dedicate more attention to complex cases and nuanced decision-making, ensuring the highest standards of data integrity and quality are maintained.

4.3 Data Quality Assessment

The quality of the data submitted for each category and from each data provider was assessed using a subjective qualitative rating system. This assessment considered factors such as completeness, accuracy, understanding of the reporting concept, responsiveness, transparency, and reliability. Ratings were not based on a strict quantitative approach but rather on a holistic evaluation of the data's quality. A concept for future CCFs is currently being developed to further enhance the evaluation of actual data.

Compared to the previous year, improvements were noted in several areas, particularly in electricity reporting and Scope 2 emissions. Locations such as Neuwied and Altendorf performed well in the category of purchased goods. Scope 3 data is gradually improving, although market-based reporting still requires better data preparation and more detailed information from energy suppliers. Electricity data collection showed notable improvement, particularly in locations like Neuwied and Altendorf, where invoices and contracts are more readily available.

5 Results of the Corporate Carbon Footprint 2023

This section presents the 2023 CCF results for the Lohmann Group, including a detailed breakdown by Business Units, regions, and countries.

Note on conventions: Tables and figures use European numbering (comma as decimal separator), while the narrative analysis follows English conventions (period as a decimal separator). Additionally, BU Hygiene is abbreviated as BU Hyg in several tables and figures.

5.1 Lohmann Group

In 2023, the Lohmann Group reported total GHG emissions of **133,626.48 t CO₂e**. This figure reflects emissions calculated using the market-based method for purchased electricity, in line with the revised methodology implemented during the year. When calculated using the location-based method, total emissions amount to 136,485.77 t CO₂e. This is shown in *Figure 5-1*.

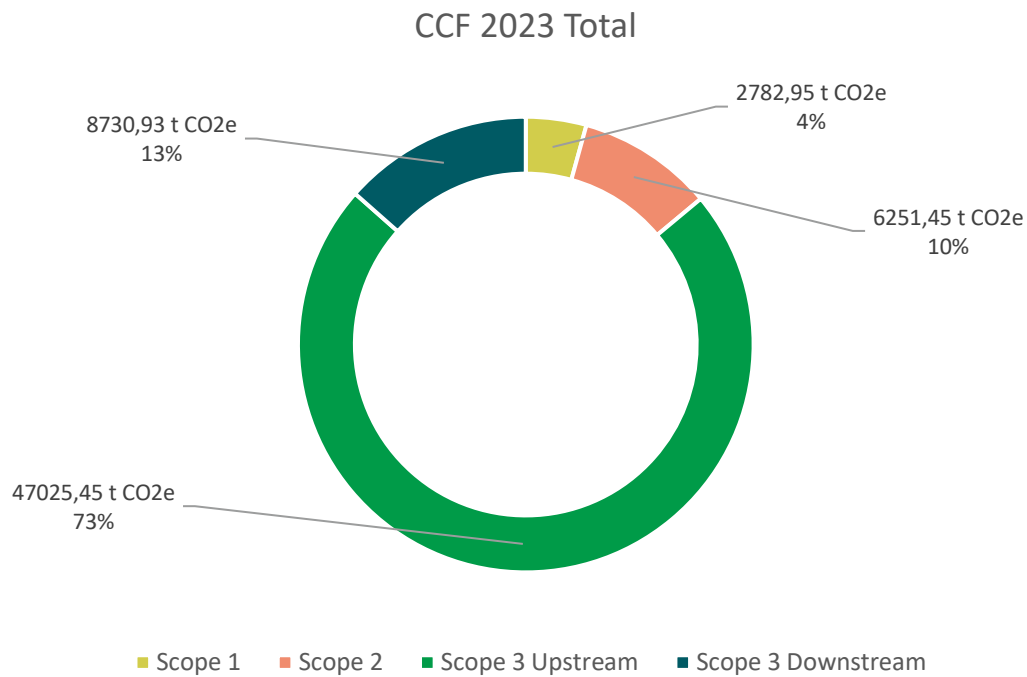
FIGURE 5-1: Total Lohmann Group GHG Emissions 2023

<i>CO₂-Emissions</i>	<i>t CO₂e</i>
Sum	133,626.48
<i>calculated with purchased electricity location-based</i>	<i>136,485.77</i>

A detailed breakdown of emissions by scope is illustrated in *Figure 5-2*. The breakdown by scope reveals that:

- Scope 1: 3,090.86 t CO₂e (2%)
- Scope 2: 8,225.03 t CO₂e (6%)
- Scope 3 Upstream: 110,734.14 t CO₂e (83%)
- Scope 3 Downstream: 11,567.43 t CO₂e (9%)

FIGURE 5-2: Total Lohmann Group GHG Emissions by Scope



Scope 3 emissions, particularly upstream activities, dominate the overall footprint, accounting for over three-quarters of total emissions. This distribution underscores the significant impact of upstream activities on Lohmann's overall carbon footprint. It suggests that the most effective opportunities for emissions reduction lie within Scope 3 upstream processes.

5.1.1 Lohmann Group: CCF Results Table

A detailed breakdown of emission sources and their respective shares for the Lohmann Group is presented in Table 5-2.

TABLE 5-2: Source and Scope of Emissions – Lohmann Group CCF 2023

Source of emission	t CO ₂ e	CCF share [%]
Scope 1	3090,87	2,31
1.1 Fuel Consumption within facilities	2535,17	1,90
1.2 Consumption of combustion for vehicles	555,70	0,42
1.3 Emissions from processing (if applicable)		
1.4 Fugitive emissions (from leakages)		
Scope 2	8225,04	6,16
2.1 Purchased electricity	4999,15	3,74
2.1.1 Purchased electricity market-based	4999,15	3,74
2.1.2 Purchased electricity location-based*	7858,44	5,88
2.2 Other purchased energy	3225,88	2,41
Scope 3	122310,58	91,53
3.1 Purchased goods and services	101066,18	75,63
3.2 Purchased capital goods	3254,32	2,44
3.3 Other fuel and energy activities (if not included in S1 or S2)		
3.4 Upstream transport of goods and materials	5087,35	3,81
3.5 Waste generated during operation	388,11	0,29
3.5.1 Treatment of solid waste	385,55	0,29
3.5.2 Waste water treatment	2,56	0,00
3.6 Business trips (travel and hotel stays)	460,09	0,34
3.6.1 Business trips	422,40	0,32
3.6.2 Hotel stays	37,68	0,03
3.7 Employee commuting	487,10	0,36
3.7.1 Employee commuting	412,40	0,31
3.7.2 Remote work of employees	74,71	0,06
3.8 Operation of leased assets (if not included in S1 or S2)		
3.9 Transport and logistics processes for the products sold	11567,43	8,66
3.10 Processing of products sold		
3.11 Use of products sold		
3.12 Disposal of products sold		
3.13 Operation of leased assets (if not included in S1 or S2)		
3.14 Operation of franchises (if not included in S1 or S2)		
3.15 Emissions from investments (if not included in S1 or S2)		
Sum	133626,48	100,00
* location based	136485,77	

5.2 Business Unit Technical Products (BU TP)

In 2023, BU TP reported total GHG emissions of 64,790.78 t CO₂e, calculated using the market-based method. When using the location-based method for purchased electricity, total emissions amount to 67,080.21 t CO₂e. This is shown in *Figure 5-13*.

FIGURE 5-13: Total GHG Emissions BU TP – 2023

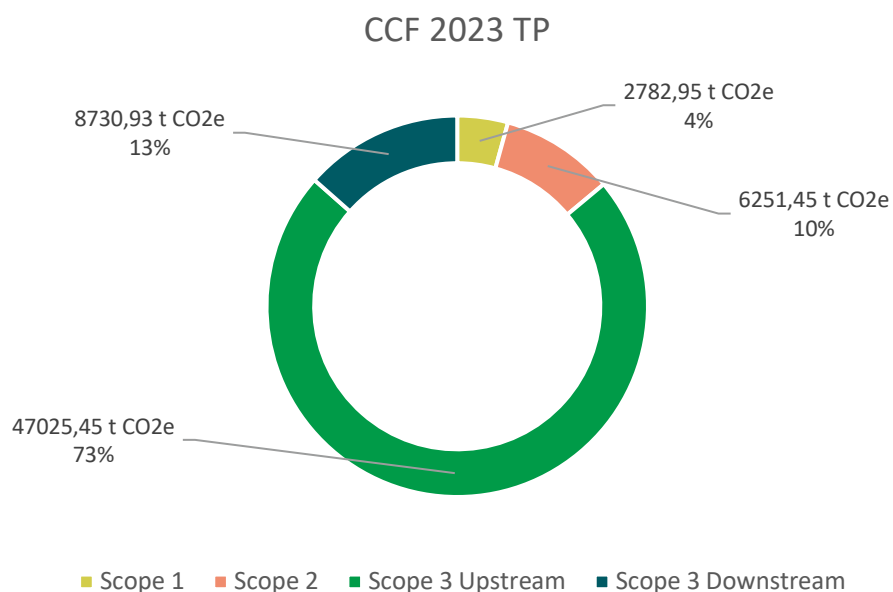
CO ₂ -Emissions	t CO ₂ e
Sum	64790,78
<i>calculated with purchased electricity location-based</i>	<i>67080,21</i>

A detailed breakdown of emissions by scope is illustrated in *Figure 5-14*. The breakdown by scope reveals that:

- Scope 1: 2,782.95 t CO₂e (4%)
- Scope 2: 6,251.45 t CO₂e (9%)
- Scope 3 Upstream: 47,025.45 t CO₂e (18%)
- Scope 3 Downstream: 8,730.93 t CO₂e (77%)

Scope 3 emissions, particularly upstream activities, constitute the majority of BU TP's carbon footprint in 2023.

FIGURE 5-14: Emissions Breakdown by Scope – Business Unit TP CCF 2023



5.2.1 BU TP: CCF Results Table

A detailed breakdown of emission sources and their respective shares is presented in *Table 5-3*.

TABLE 5-3: Source and Scope of Emissions – BU TP CCF 2023

Source of emission	t CO ₂ e	CCF share [%]
Scope 1	2782,95	2,08
1.1 Fuel Consumption within facilities	2398,85	1,80
1.2 Consumption of combustion for vehicles	384,10	0,29
1.3 Emissions from processing (if applicable)		
1.4 Fugitive emissions (from leakages)		
Scope 2	6251,45	4,68
2.1 Purchased electricity	3124,62	2,34
2.1.1 Purchased electricity market-based	3124,62	2,34
2.1.2 Purchased electricity location-based*	5414,06	4,05
2.2 Other purchased energy	3126,83	2,34
Scope 3	55756,38	41,73
3.1 Purchased goods and services	41806,34	31,29
3.2 Purchased capital goods	2284,77	1,71
3.3 Other fuel and energy activities (if not included in S1or S2)		
3.4 Upstream transport of goods and materials	1980,10	1,48
3.5 Waste generated during operation	318,96	0,24
3.5.1 Treatment of solid waste	316,92	0,24
3.5.2 Waste water treatment	2,05	0,00
3.6 Business trips (travel and hotel stays)	340,15	0,25
3.6.1 Business trips	305,14	0,23
3.6.2 Hotel stays	35,01	0,03
3.7 Employee commuting	295,13	0,22
3.7.1 Employee commuting	235,28	0,18
3.7.2 Remote work of employees	59,86	0,04
3.8 Operation of leased assets (if not included in S1or S2)		
3.9 Transport and logistics processes for the products sold	8730,93	6,53
3.10 Processing of products sold		
3.11 Use of products sold		
3.12 Disposal of products sold		
3.13 Operation of leased assets (if not included in S1 or S2)		
3.14 Operation of franchises (if not included in S1 or S2)		
3.15 Emissions from investments (if not included in S1 or S2)		
Sum	64790,78	48,49

5.3 Business Unit Hygiene (BU Hygiene)

In 2023, BU Hygiene reported total GHG emissions of 68,835.702 t CO₂e, calculated using the market-based method. When using the location-based method for purchased electricity, total emissions amounted to 69,405.55 t CO₂e. This is shown in Figure 5-36.

FIGURE 5-36: Total GHG Emissions – BU Hygiene CCF 2023

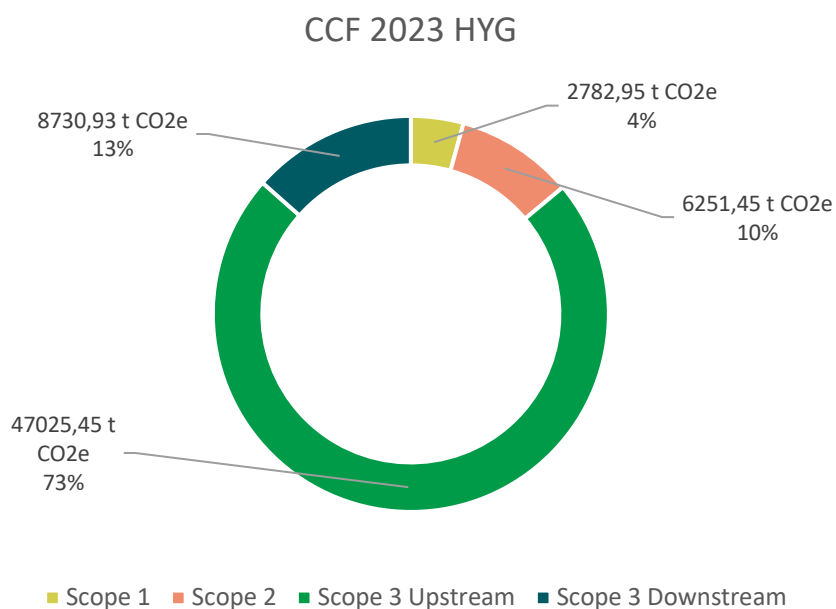
CO ₂ -Emissions	t CO ₂ e
Sum	68835,702
calculated with purchased electricity location-based	69405,55

A detailed breakdown of emissions by scope is illustrated in Figure 5-37. The breakdown by scope reveals that:

- Scope 1: 307.92 t CO₂e (0%)
- Scope 2: 1,973.59 t CO₂e (2%)
- Scope 3 Upstream: 63,717.70 t CO₂e (93%)
- Scope 3 Downstream: 2,836.50 t CO₂e (4%)

Scope 3 emissions, particularly downstream activities, constitute the majority of the carbon footprint, indicating key areas for targeted reduction efforts.

FIGURE 5-37: Emissions Breakdown by Scope – BU Hygiene CCF 2023



5.3.1 BU Hygiene: CCF Results Table

A detailed breakdown of BU Hygiene emission sources and their respective shares is presented in *Table 5-28*.

TABLE 5-28: Source and Scope of Emissions – BU Hygiene CCF 2023

Source of emission	t CO ₂ e HYG Ges	CCF share [%]
Scope 1	307,92	0,23
1.1 Fuel Consumption within facilities	136,32	0,10
1.2 Consumption of combustion for vehicles	171,60	0,13
1.3 Emissions from processing (if applicable)		
1.4 Fugitive emissions (from leakages)		
Scope 2 (market-based)	1973,59	1,48
2.1 Purchased electricity	1874,53	1,40
2.1.1 Purchased electricity market-based	1874,53	1,40
2.1.2 Purchased electricity location-based*	2444,38	1,83
2.2 Other purchased energy	99,06	0,07
Scope 3	66554,20	49,81
3.1 Purchased goods and services	59259,84	44,35
3.2 Purchased capital goods	969,55	0,73
3.3 Other fuel and energy activities (if not included in S1or S2)		
3.4 Upstream transport of goods and materials	3107,25	2,33
3.5 Waste generated during operation	69,15	0,05
3.5.1 Treatment of solid waste	68,63	0,05
3.5.2 Waste water treatment	0,52	0,00
3.6 Business trips (travel and hotel stays)	119,94	0,09
3.6.1 Business trips	117,26	0,09
3.6.2 Hotel stays	2,68	0,00
3.7 Employee commuting	191,97	0,14
3.7.1 Employee commuting	177,12	0,13
3.7.2 Remote work of employees	14,85	0,01
3.8 Operation of leased assets (if not included in S1or S2)		
3.9 Transport and logistics processes for the products sold	2836,50	2,12
3.10 Processing of products sold		
3.11 Use of products sold		
3.12 Disposal of products sold		
3.13 Operation of leased assets (if not included in S1 or S2)		
3.14 Operation of franchises (if not included in S1 or S2)		
3.15 Emissions from investments (if not included in S1 or S2)		
Sum	68835,70	51,51
* location based	69405,55	