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OIL DYNAMICS GROUP

Carbon Footprint Assessment Report 2023

Scope 1 - 3

Issued: Stratos Management SRL

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1. INTRODUCTION

Oil Dynamics, is a group of companies, active in the oil industry. The group of companies Oil Dynamics GmbH, a company founded in Germany in 2015, owns 100% of the Romanian company OIL DYNAMICS SERVICES SRL.

GERMANY

The business of Oil Dynamics GmbH - Germany is focused on the design, manufacture, packaging, packaging, testing, supply and service of premium products for the upstream, onshore and offshore oil industry as well as for geothermal applications. The headquarters of Oil Dynamics GmbH is in Heilderberg and the manufacturing plant is located in Hockenheim, Germany.

Oil Dynamics GmbH provides numerous services, such as:

- Design and production of pumping systems;
- Testing pumping systems;
- Testing probes;
- Installing equipment in the field;
- Field project management;
- Optimization and real-time monitoring of systems;
- Consulting;
- Equipment and systems maintenance services;
- Training for operators.

Website: https://www.oildynamics.com
Registered office address: Rudolf-Diesel-Straße 11 - 69115 Heidelberg - Germany
Email: info@oildynamics.de
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ROMANIA

In Romania, Oil Dynamics Services SRL operates in a single location in Ilfov county, within an industrial park. The location comprises office space, as well as a warehouse. Oil Dynamics Services provides oil well services for Oil Dynamics GmbH.

Oil Dynamics Services SRL, offers the following services:

- Supply of ESP, HPS (submersible equipment);
- Consulting;
- Sizing and selecting complete ESP systems for most applications;
- Equipment inspection & complete quality control;
- Delivery and transportation of equipment (outsourced) to and from the well site;
- Assembly / disassembly of ESP drilling and surface equipment;
- Starting up and commissioning ESP;

- ESP troubleshooting during operation;
- Current repairs of ESP equipment;
- Equipment testing;
- Disassembly, inspection, defect analysis of ESP and surface equipment (DIFA);
- Analysis of functional results with recommendations to increase lifespan;
- Production optimization.

Related services include monitoring and troubleshooting. Monitoring is done using SCADA (short for Supervisory Control and Data Acquisition) software or visually through field inspections by FS personnel (field service).

Website: https://www.oildynamics.com
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Information contained in the Report

The information contained in this report is confidential and is the result of an independent assessment carried out by Stratos Management S.R.L. in accordance with the Technical Guidelines published by the GHG Protocol. It includes information on:

- input data used
- the framing of activities within the SCOPE
- selected emission factors
- carbon emissions from the assessment
- data accuracy assessment

With regard to the results of the carbon emission calculations, in order to avoid duplication of the information contained in this Report, they are presented as follows:

- **Overall**: Total emission result and then the result according to SCOPE, not including input data and emission factors (Chapter 2);
- **Partial**: Results broken down by activity with input data and without emission factors (Chapter 5);
- **Full**: Results broken down by activity, together with input data and emission factors (Chapters 6 and 8.3).

The Beneficiary of the report will use the information provided in the report for informational and consultative purposes, and the decisions made on the basis of the information contained in the report are entirely at the Beneficiary's own risk.

2. EXECUTIVE SUMMARY

In the global context of climate change and corporate social responsibility, Oil Dynamics takes a proactive and responsible approach to its environmental impact. In 2024, we launched a project to assess our carbon footprint for 2023, marking a firm commitment to sustainability.

This initiative is a significant step in Oil Dynamics' efforts to understand and quantify the impact of its activities on climate change.

The present report provides an in-depth look at the methodologies used, the data collected and the results obtained from the carbon footprint analysis for the year 2023, on all three SCOPE domains.

Below is a percentage distribution of emissions by area in order to highlight the activities with the highest impact. We can observe that the activities included in SCOPE 1, represent 53% of the total emissions generated.

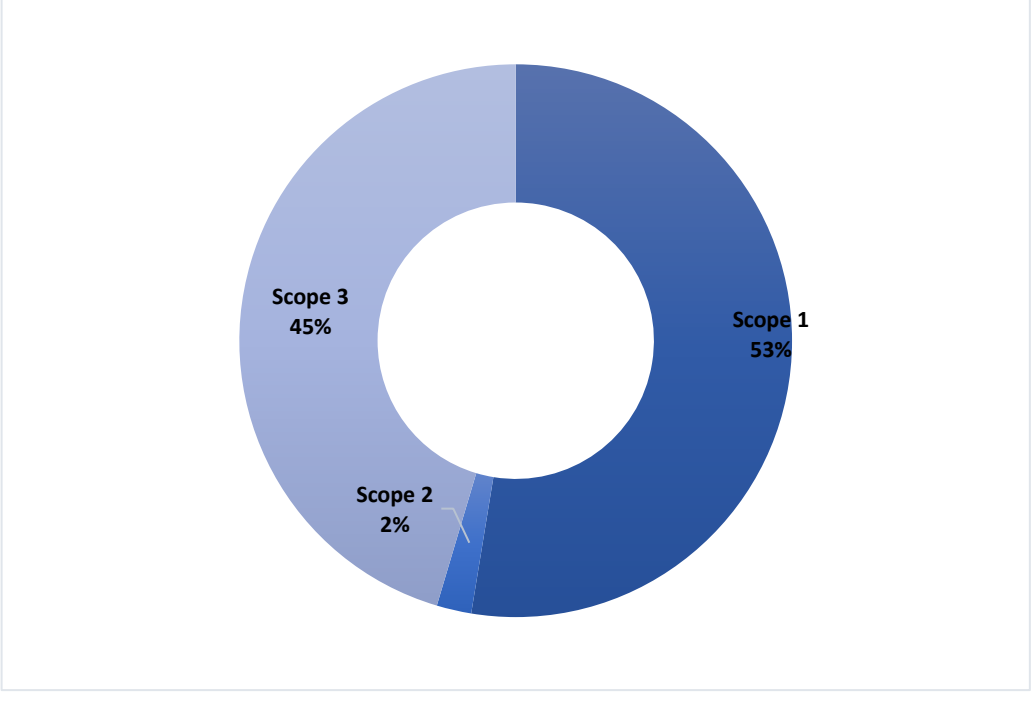

Figure 1 Carbon footprint 2023

Table 1 Evaluation results

SCOPE 1, tCO e_2	SCOPE 2, tCO e_2	SCOPE 3, tCO e_2	TOTAL, tCO e_2
439.81	**16.99**	**379.69**	**836.49**

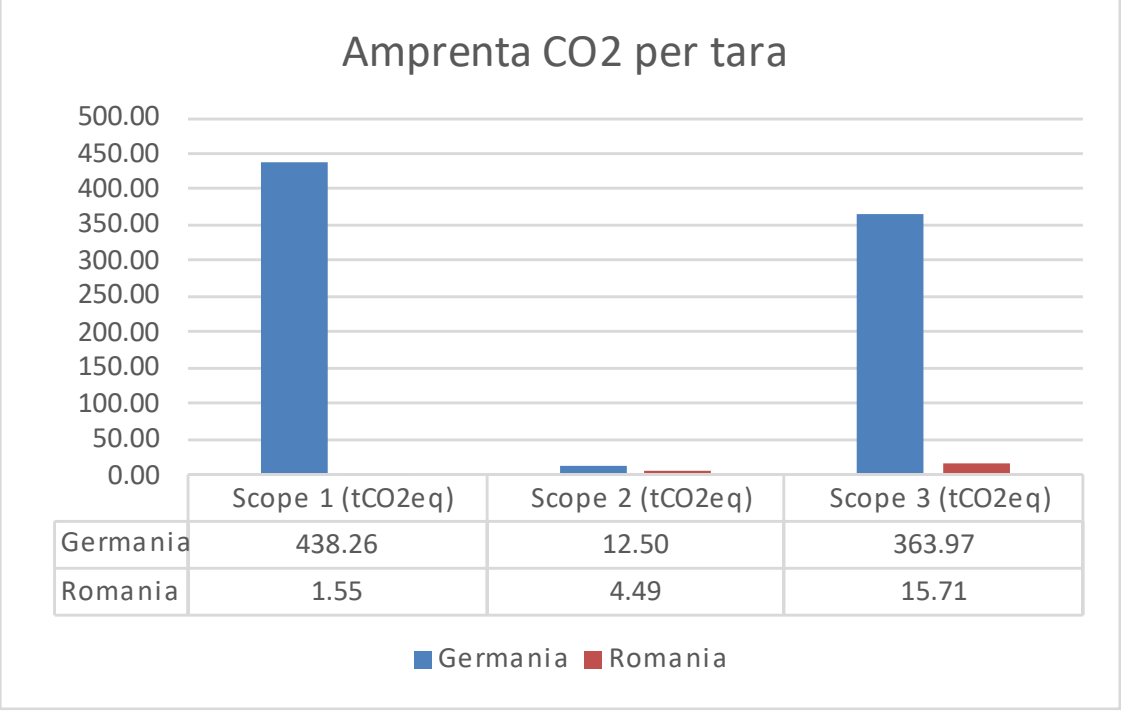

Figure 2 Distribution of carbon emissions by country

Within the group, it can be seen that the activity in Germany has an impact of 99.6% in SCOPE 1, 73.5% in SCOPE 2 and 95.8% in SCOPE 3. Overall, this activity contributes 97.4% of the total emissions of the whole organization.

The company's activities and their categorization into SCOPE categories were carried out according to the Technical Guidelines provided by the GHG Protocol, their final mapping is presented below.

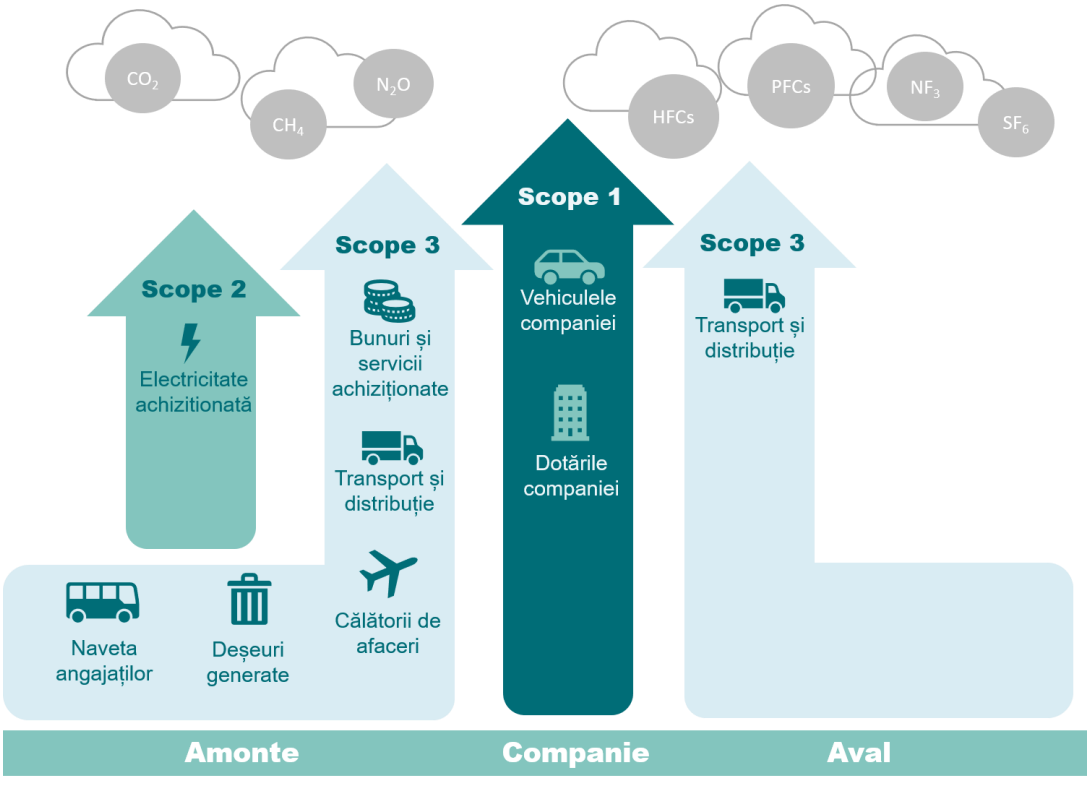

Figure 1 Oil Dynamics activities considered in the CO2 calculation

The largest source for total emissions is direct emissions from the SCOPE 1 category **(439.81 tCO2 e)**, more specifically, company vehicles and company equipment (natural gas).

The next category of emissions is represented by those generated by the activities assigned to SCOPE 3 **(379.69 tCO2 e)**, coming from the purchase of goods and services, waste generated, business travel, employee commuting, transportation and distribution. The SCOPE 3 domain is segmented into downstream activities, which have emissions amounting to **29.27 tCO2 e**, and upstream activities amounting to **350.43 tCO2 e**.

Table 2 SCOPE 3 evaluation results

SCOPE 3, tCO e_2		TOTAL
Upstream	**Down**	
350.43	**29.27**	**379.69**

The smallest share in total emissions comes from SCOPE 2 activities (**16.99 tCO2 e)** - i.e. the consumption of electricity purchased for the purpose of current activities.

3. OBJECTIVE AND PURPOSE OF THE ANALYSIS

3.1. Introduction and definition of objectives

Arguments for the study

This analysis was performed for:

- identifying the company activities that generate the highest greenhouse gas emissions (CO equivalent$_2$);
- a better understanding of how resources are used internally;
- developing a best practice model for employees, clients and beneficiaries;
- to respond to requests from Oil Dynamics' beneficiaries.

Target group

The report is addressed primarily to the company's management to facilitate the decision-making process and to employees to increase internal awareness of carbon emissions.

Secondly, the report is intended to inform the interested public, including partners, beneficiaries and other stakeholders.

3.2. Purpose

Delimiting the system according to operations

The company has in its structure 3 locations, namely 1 located in Romania (office space and warehouse) and 2 locations located in Germany (headquarters and factory). The company deals with manufacturing, packaging, testing and commercialization of products for the oil industry.

In this carbon footprint calculation, direct emissions, generated by the company by burning fuels in directly owned equipment, as well as indirect emissions generated by energy consumption were taken into account. As a method, operational control was selected.

Delimitation criteria

All activities relevant to the analyzed system have been included in the flowchart, except for the qualitatively insignificant ones, i.e. those representing less than 5% of the carbon footprint. Thus, the system boundaries should cover at least 95% of climate change impacts. The effort that would have been needed to collect the omitted data could thus be redirected to obtain more accurate data for elementary processes and activities.

Temporal and geographical scope

This analysis includes the company's operations that took place in Romania and Germany in calendar year 2023.

Limitations of the study

This report assesses the company's carbon footprint, in other words its scope is limited to the category of environmental impact, i.e. global warming potential (GWP). Emissions data are reported as average level indicators (in tCO_2 equivalent), as it was not possible to collect and estimate certain data on direct and indirect emissions of other greenhouse gases.

4. GENERAL INFORMATION

4.1. Terms and definitions

Greenhouse gases (GHG)

Greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide, sulphur hexafluoride, hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). In the process of calculating a carbon footprint, the amounts of greenhouse gases emitted as a side-effect of the activity under analysis must also be taken into account.

Unit of measurement for carbon footprint calculation (tCO_2 e)

Due to its large volume of emissions, CO_2 is considered to be the most representative of the greenhouse gases mentioned above. The carbon footprint size is expressed in tons of CO_2 equivalent (tCO_2 e). In assessing the size of a carbon footprint, other types of greenhouse gases are converted to CO_2 equivalent. In order to determine the true carbon footprint size, the tCO_2 e values have to be summed up to obtain the total carbon footprint value.

GHG Protocol

The point of reference in our calculation is the GHG Protocol[1] (or GHG). This is a three-tiered system, divided into SCOPE (en: scope).

SCOPE 1	SCOPE 2	SCOPE 3
direct combustion of energy sources (fossil fuels, or other fuels)	indirect energy use (e.g. electricity)	other activities that indirectly generate emissions

4.2. Emission factors

In order to centralize the database we used the most important national and international databases, such as:

- Database UK Government GHG Conversion Factors for Company Reporting, 2023;
- ANRE Annual Report, 2022.

The factors for each activity will be presented below, depending on the type of activity.

[1] www.ghgprotocol.org

Table 3 Factors used and sources

Source factors	Related data type	UM factors	Emission factor value
ANRE Annual Report, 2022+ GHG UK	Electricity purchased	kg CO2/kWh	0.23
GHG UK		kg CO2/kWh	0.21
GHG UK	Natural gas	kg CO2/mc	2.04
GHG UK	Motor vehicle fuel - Diesel	kg CO /liter$_{2eq}$	2.512063884563760
GHG UK	Motor vehicle fuel - Petrol	kg CO /liter$_{2eq}$	2.09747312751678
GHG UK	Water purchased	kg CO2/mc	0.176684546579014
GHG UK	Waste water evacuated	kg CO2/mc	0.201318291710656
GHG UK	Business travel - airplane	kgCO2e/passenger.km	0.175803783892617
GHG UK	Business travel - car	kgCO2e/km	0.166638587919463
GHG UK	Business travel - hotel Germany	kgCOe/room per night	13.2
GHG UK	Business travel - hotel Romania	kgCOe/room per night	0.0203
GHG UK	Business travel - hotel France	kgCOe/room per night	6.7
GHG UK	Business travel - hotel China	kgCOe/room per night	0.0693
GHG UK	Municipal waste disposed of	kg CO2e/tonne	497.044706528032
GHG UK	Waste generated - recovered	kg CO2e/tonne	21.2808072368763
GHG UK	Train transportation	kg CO2/tonne.km	0.0277880711409396
GHG UK	Truck transportation	kg CO2/km	0.642578477852349
GHG UK	Steam transport	kg CO2/tonne.km	0.013212768590604
GHG UK	Employee commute - car	kgCO2e/passenger.km	0.169826448880537
GHG UK	Employee commute - train	kgCO2e/passenger.km	0.0354629637583893

4.3. Data Quality Assessment

One element of GHG emissions data quality management involves quantitative and qualitative uncertainty analysis. In the case of Oil Dynamisc, this analysis was carried out using the GHG Protocol instructions on uncertainty assessment in GHG inventories and the calculation of the statistical parameter[2] together with the associated calculation tool.

The Guidelines are based on the IPCC Guidelines for National GHG Inventories and can be considered as a complement to the calculation tools provided by the GHG Protocol.

When documenting the quantitative uncertainty assessment results, they were ranked using a summary scale (Table 3). These ordinal values are based on the quantitative confidence intervals, as a percentage of the estimated or measured value, within which the true value is likely to exist.

[2] https://ghgprotocol.org/sites/default/files/2023-03/ghg-uncertainty.pdf

Table 4 Assessment of data accuracy and appropriate intervals used in the GHG Protocol

Data accuracy	**Range as percentage of mean value**
Very good	+/- 5%
High	+/- 15%
Reasonable	+/- 30%
Low	>30%

The results of the Oil Dynamics data quality assessment are presented in chapter 8.3.

5. INVENT

5.1. SCOPE 1: Direct emissions

Company vehicles

- **General information**
  The company has in operational control two types of vehicles:
  - Cars that use gasoline;
  - Cars using diesel;
- **The method of obtaining the information**
  The fuel consumption of the company's vehicles is calculated based on the average fuel consumption specific to each vehicle type for the year 2023.
- **Range of variation**
  Data are calculated with a statistical margin of error of 50%.
- **Emission factors**
  The source of emission factors is the UK Government GHG Conversion Factors for Company Reporting database . [3]
- **Data:**

Table 5 Vehicle input data

Source	Activity	Quantity, [liters]
Administrative	Internal fuel (diesel)	4260.00
	Internal fuel (gasoline)	500.00

Company facilities

- **General information**
  This data category includes natural gas consumption for heating and production. The activity is carried out in three locations and involves the manufacture of petroleum products as well as office activities.
- **Temporal context**
  Natural gas consumption differs throughout the year due to temperature changes.
- **Geographical location**
  Only locations in Germany were considered in this calculation.
- **The method of obtaining the information**
  The data was extracted from the invoices issued by the company's supplier, which in turn recorded consumption based on the metered consumption by the company's meters.
- **Range of variation**
  Data are calculated with a statistical probability of less than 25%.

[3] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022

- **Data:**

Table 6 Input data, direct emissions

Source	Activity	Quantity, [mc]
Administrative	Natural gas consumption	210000

5.2. SCOPE 2: Indirect emissions from energy consumption

Electricity consumption

- **General information**
  The company uses electricity for its current activities, with electricity meters installed and operated by representatives of the local electricity distributor.
  For offices, electricity is needed for office equipment (printers, computers, cell phones and servers), for air conditioning during the summer, for central heating (where applicable), for cleaning and maintenance, for kitchen appliances and lighting.
  In the case of the factory, electricity is additionally used to operate the production and auxiliary production facilities.
- **Temporal context**
  The energy consumption may vary throughout the year, depending on the production, lighting and air conditioning needs determined by the number of orders and the changing seasons.
- **The method of obtaining the information**
  Company specific consumption is calculated directly, based on data extracted from the beneficiary's records.
- **Data provider**
  Verified information from the beneficiary.
- **Range of variation**
  Data are calculated with a margin of error of less than 2% statistical probability.
- **Data:**

Table 7 Input data, energy consumption emissions

Source	Activity	Quantity, [kWh]
Administrative	Electricity purchased	80256.60

5.3. SCOPE 3: Indirect emissions

Goods and services purchased

- **General information**
  Drinking water is purchased from external sources and is used for hygienic-sanitary purposes, for production and ancillary production activities.

- **Geographical location**

  Two categories of locations were considered in this calculation as follows:

  Location in Romania

  Location in Germany

- **The method of obtaining the information**

  Specific consumption is calculated directly, based on data extracted from the beneficiary's records.

- **Range of variation**

  The range of consumption is 25%.

- **Data:**

Table 8 Input data, Goods purchased

Source	Activity	Quantity
Romania	Water purchased	178.00 mc
Germany	Water purchased	107.00 mc
China	ESP, Power Cable	211,203.00 kg
China	ESP, Power Cable	143,110.00 kg
China	EN	52,724.00 kg

Business travel - transportation

- **General information**

  Company employees frequently travel abroad to participate in project work. Travel is usually to the continents of Europe but occasionally to Asia, and in 2023, 20 airplane tickets were purchased and included in this calculation.

- **The method of obtaining the information**

  The evaluator was provided with airfare information, specifically:

  – Travel period
  – Number of persons/trip
  – Starting point
  – Destination, in the form of the city name or sometimes the country name

  Based on this information, using the airport distance calculator, https://www.airportdistancecalculator.com/, the distance traveled per flight was determined.

  The number of kilometers thus traveled were then multiplied by the number of persons per airplane ticket, the process being repeated for each airplane ticket. This yielded the actual number of kilometers traveled by these trips for emissions calculations.

- **Range of variation**

  In the case of air tickets, the range of estimates is: 10%.

- **Data:**

Table 9 Input data, Business travel - transportation

Starting point	Destination point	Distance Starting point - Destination/km	Nr persons	Total actual km traveled (km*nr pers)
Bucharest	Frankfurt	1452	1	1452
Frankfrurt	Bucharest	1452	13	18876
Frankfurt	Paris	447	1	447
Frankfurt	Beijing	7828	5	39140

Business travel - Hotel

- **General information**

  Company employees frequently travel abroad to participate in projects. Travel is usually to Europe, but occasionally to Asia. During these trips a total of 216 nights of hotel accommodation were purchased and included in this calculation.

- **The method of obtaining the information**

  The evaluator was provided with airfare information, specifically:
  - Travel period
  - Number of persons/trip
  - Starting point
  - Destination, in the form of the city name or sometimes the country name

  Based on this information, the number of nights spent at the hotel was calculated.

- **Assumptions**

  It was not possible to accurately determine the number of rooms according to the number of persons, using the hypothesis 1 travel period = 1 room.

  We have excluded returns of employees from third countries outside Romania, considering that in the city of residence of the employees it is not necessary to purchase hotel nights.

- **Range of variation**

  For nights spent in hotels, the range of estimates is 10%.

- **Data**

Table 10 Entry data, Business trips - hotel

Tara hotel	Number of nights
Germany	**25**
Romania	**153**
France	**3**
China	**35**

Waste generated

- **General information**

  The company has implemented a selective waste collection system for the reporting year. The data related to the waste generated by the company were entered for the analysis.

- **Geographical location**

  Three categories of locations were considered in this calculation as follows:

  Location in Romania

  Location in Germany

- **The method of obtaining the information**

  The information is based on reports to local environmental authorities, in the case of the two factories, and on data from invoices issued by collection service providers, in the case of the other locations.

- **Variation ranges**

  Calculations have been based on statistical data with an uncertainty of 5%.

- **Data:**

Table 11 Input data, waste generated

Location/Entity	Waste Type	UM	Quantity
Romania	Mixed municipal waste	**t**	2.283
Romania	Paper and cardboard packaging waste	**t**	0.378
Romania	Plastic packaging waste	**t**	0.066
Germany	Mixed municipal waste	**t**	5.9
Germany	Wood waste	**t**	1.26
Germany	Paper	**t**	0.285
Germany	Plastic packaging	**t**	3.852
Germany	Oils	**t**	0.409

Employee commute

- **General information**

  The company has implemented a selective waste collection system for the reporting year. The data related to the waste generated by the company were entered for the analysis.
- **Geographical location**

  Three categories of locations were considered in this calculation as follows:

  Location in Romania

  Location in Germany
- **The method of obtaining the information**

  The information is based on reports to local environmental authorities, in the case of the two factories, and on data from invoices issued by collection service providers, in the case of the other locations.
- **Variation ranges**

  Calculations were based on statistical data, with an uncertainty of 2%.
- **Data:**

Upstream transportation and distribution

- **General information**

  The company has implemented a selective waste collection system for the reporting year. The data related to the waste generated by the company were entered for the analysis.
- **Geographical location**

  Three categories of locations were considered in this calculation as follows:

  Location in Romania

  Location in Germany
- **The method of obtaining the information**

  The information is based on reports to local environmental authorities, in the case of the two factories, and on data from invoices issued by collection service providers, in the case of the other locations.
- **Variation ranges**

  Calculations have been based on statistical data with an uncertainty of 5%.
- **Data:**

Downstream transportation and distribution

- **General information**

  The company has implemented a selective waste collection system for the reporting year. The data related to the waste generated by the company were entered for the analysis.
- **Geographical location**

  Three categories of locations were considered in this calculation as follows:

Location in Romania

Location in Germany

- **The method of obtaining the information**

  The information is based on reports to local environmental authorities, in the case of the two factories, and on data from invoices issued by collection service providers, in the case of the other locations.

- **Variation ranges**

  Calculations have been based on statistical data with an uncertainty of 5%.

- **Data:**

6. DETAILED ANALYSIS OF RESULTS

Of the activities carried out by Oil Dynamics, the biggest impact on its own emissions is the company's equipment (natural gas - **428.06 t CO2eq**) used for heating the company's work and production spaces. This category of emissions represents 51.17% of total emissions.

The next significant impact of 32.88% is the emissions associated with the transportation of raw materials from China, in particular train transportation (**249.81.99 t CO_2 eq**) required for current production activities.

All other activities carried out are insignificant compared to the first 2 sources, accounting for 15.95% of total emissions. However, the commuting of employees with their own vehicles stands out, this category of activity having **61.77 t CO_2 eq** emitted in 2023, as well as the transportation of their own products, carried out by trucks, the amount of carbon being much lower, namely **29.27 tCO2eq**.

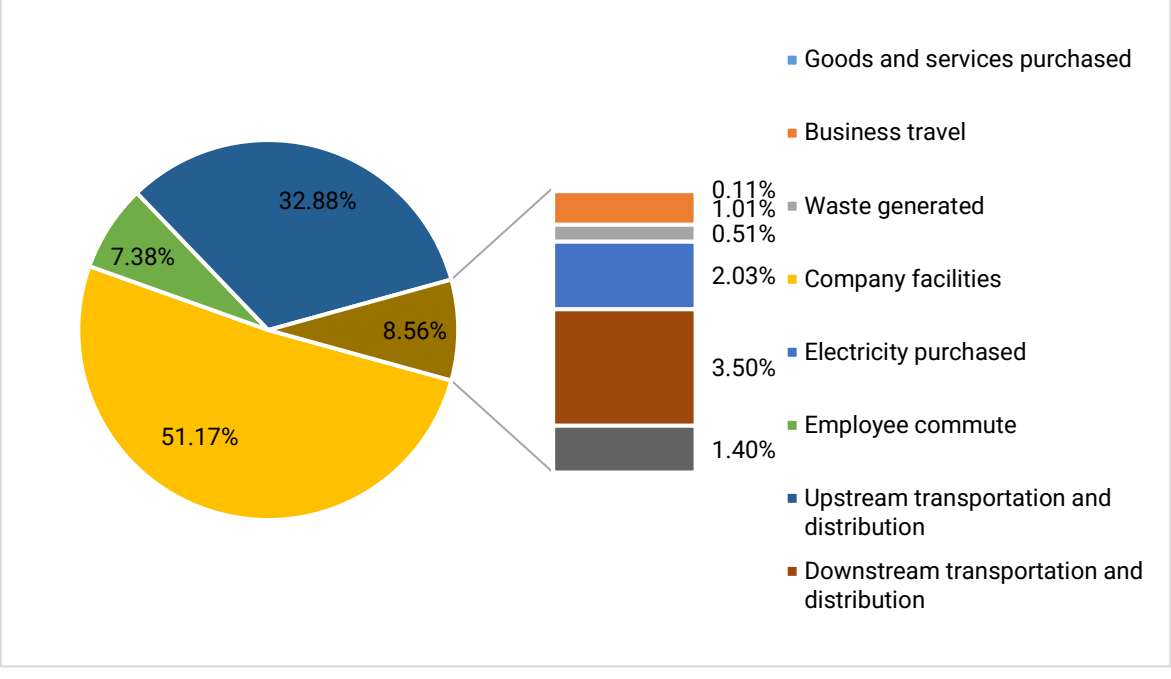

Figure 3 Distribution of the impact of Oil Dynamics activities on its own carbon footprint

Table 12 Evaluation results for each activity

Activity category	Germany	Romania
Goods and services purchased	0.88	0.03
Business travel	7.56	0.88
Waste generated	3.08	1.18
Company facilities	428.06	0.00
Electricity purchased	12.50	4.49
Employee commute	48.15	13.62
Upstream transportation and distribution	275.04	0.00
Downstream transportation and distribution	29.27	0.00
Company vehicles	10.20	1.55
Total	**814.73**	**21.76**

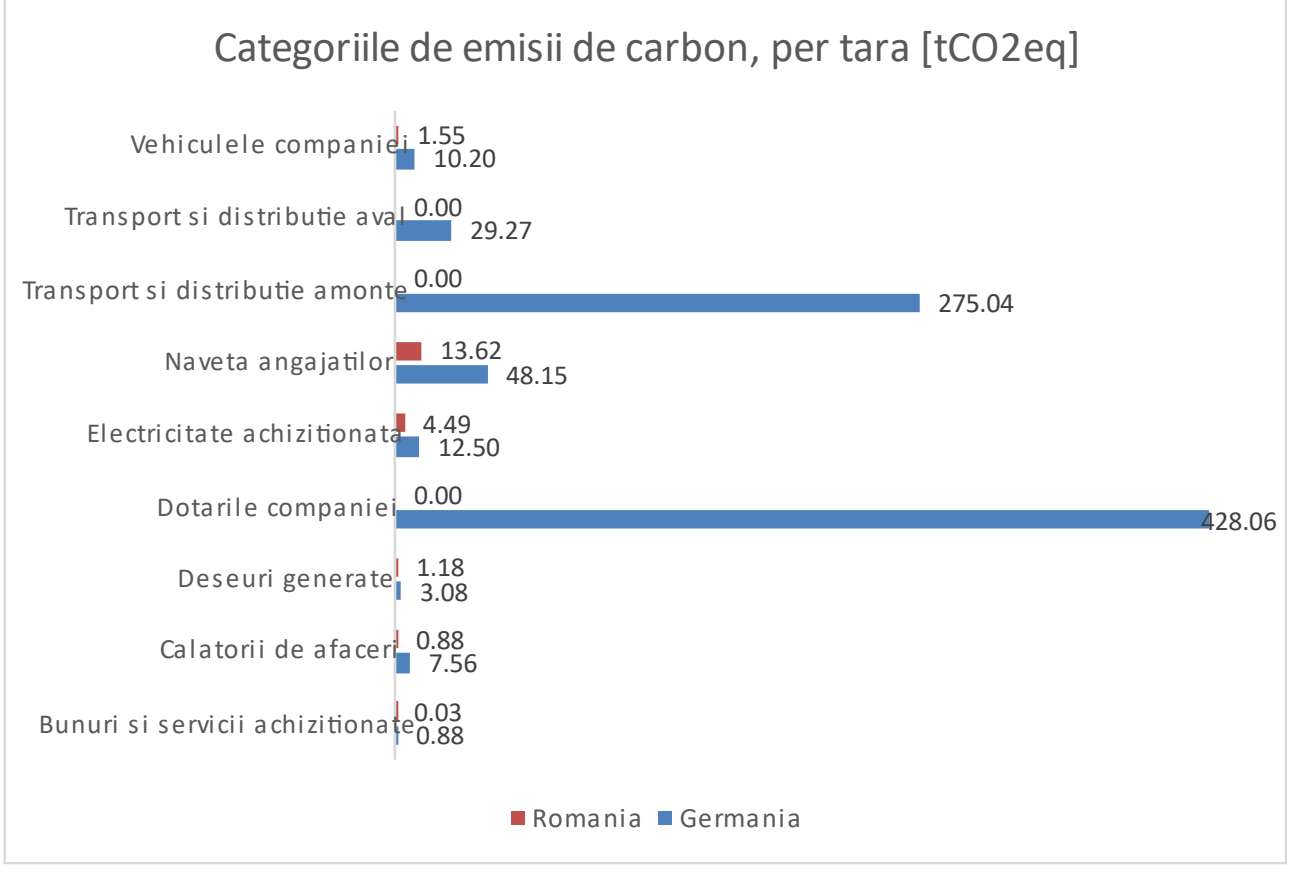

Figure 4 Map of Oil Dynamics emissions in Romania and Germany

7. RECOMMENDATIONS FOR FUTURE ACTIONS

7.1. Climate change risk analysis

Climate change will affect different regions of the world differently: while some regions will suffer from extreme heat and drought, others will face extreme weather events, and analysis predicts that these will intensify over the coming decades . [4]

According to the European Commission's climate change analysis, Europe will face frequent heat waves, forest fires and droughts, which will lead to high costs for society and the economy due to depletion of natural resources, damage to real estate and infrastructure, damage to human health and negative impacts on economic sectors.

In addition, the legislative context created by the European Green Pact[5] and the new directives and regulations adopted or to be adopted will have an important impact on large organizations, which will translate into a significant increase in the demands coming from the value chain of each company on sustainability. It is important to mention that the EU Directive 2022/2464 which aims at reporting sustainability information and applies from January 1, 2024 requires, through the related reporting standards, mandatory carbon footprint reporting for SCOPE 1 and 2 for the first reporting year and then SCOPE 3 starting with the second reporting year. Although in the first year of application organizations will focus on their own activities, starting with the second year they will also request information on the carbon footprint of their business partners.

Industry-specific risks:

- increasing the price for carbon emissions;
- reducing oil resources
- rising costs of raw materials, electricity or natural gas;
- Stricter compliance requirements will increase the pressure of environmental regulation. Companies will face certain costs to reduce emissions from their own operations in order to decarbonize and limit industrial pollution;
- lack of investment in activities directly related to the extraction of oil;
- unfavorable lending conditions, at a higher interest rate compared to loans granted to green activities;
- new or more frequent requests from business partners regarding the data collected, which address sustainability issues;
- Advances in low-carbon technologies will lead to a shift from conventional industrial products to low-emission and more energy-efficient alternatives;
- Emerging legal risks: numerous lawsuits have been filed against industrial companies that have failed to comply with environmental regulations;
- One of the main market risks stems from the possible shift in consumer preferences that may arise during the transition to a low-carbon economy for

[4] https://ec.europa.eu/clima/climate-change/climate-change-consequences_ro
[5] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_ro

sustainable green products. The transition to renewable energy sources (solar, wind) may lead to lower demand for oil and gas infrastructure;
- Climate change such as intense storms can increase the risk of damage to production facilities and disruption to supply chains;
- rising temperatures can lead to decreased employee productivity, health and safety risks;
- Heat waves can overload cooling systems, causing higher energy costs and possible equipment failure.

Thus, it is recommended that the organization continues to assess its carbon footprint annually, using internationally recognized methods. It is also useful to include specific actions that can be implemented by similar companies to reduce their impact in order to demonstrate their commitment to environmental protection to their stakeholders.

7.2. Actions to reduce carbon footprint

As part of the company's carbon footprint reduction strategy, a set of improvement measures is recommended. These fall into two categories: actions that can be implemented immediately and medium-term actions. These measures can also be categorized into "soft measures" (training, notifications, new internal policies or regulations) and "hard measures" (investments, changes in equipment, production flows or other). With this in mind, the company may pay more attention to sets of best practices that have an impact on its carbon footprint.

1. Company vehicles (11.75 tCO2eq - Scope 1)

- **Soft immediate measures:**
  - **Green driving training:** It is recommended to train employees in fuel-efficient driving techniques.
  - **Strategic partnerships:** The use of a single fuel purchasing system with consumption limits per vehicle or fleet is envisaged.
  - **Optimizing transport routes:** Using logistics management software to identify routes with the lowest emissions.
- **Hard immediate action:**
  - **Fleet maintenance:** Regular maintenance of company vehicles is suggested to maintain fuel efficiency.
- **Soft medium-term measures:**
  - **Telecommuting and carpooling policies:** It is recommended to develop policies that encourage telecommuting (for applicable functions) or carpooling, thereby reducing the need for vehicle use.
- **Hard medium-term measures:**

- **Transition to electric or hybrid vehicles:** It is recommended to gradually replace internal combustion vehicles with electric or hybrid vehicles to reduce direct emissions, where feasible.

2. **Company facilities (428.06 tCO2eq - Scope 1)**

- **Soft immediate measures:**
  - **Energy saving policies:** It is recommended to implement strict energy saving protocols, such as turning off unused equipment and optimizing HVAC settings.
- **Hard immediate action:**
  - **Modernization of buildings:** Investments in modernization of buildings are recommended, such as better thermal insulation, energy efficient windows and modernization of heating and cooling systems.
- **Soft medium-term measures:**
  - **Energy management systems:** It is recommended to introduce intelligent energy management systems to monitor and optimize energy consumption in the company's units.
- **Hard medium-term measures:**
  - **Sustainable building design:** For future expansions, we suggest adopting sustainable building practices, including LEED or similar certifications that prioritize energy efficiency.

3. **Energy purchased (16.99 tCO2eq - Scope 2)**

- **Soft immediate measures:**
  - **Energy consumption awareness campaigns:** It is recommended to inform employees about the impact of their energy consumption and to train them on how to use energy efficiently and reduce it.
- **Hard immediate action:**
  - **Investment in IoT systems:** It is recommended to support the human factor through intelligent systems to optimize the operation of equipment that uses electricity, involving sensors, smart plugs controlled and automated through a master application. This system also facilitates the collection of data on individual consumption in order to identify the equipment with the highest consumption, allowing a cost-benefit analysis for their possible replacement.
  - **Replace lighting and HVAC systems with energy-efficient models:** It is suggested to replace traditional lighting with LED and modernize heating, ventilation and air conditioning systems with energy-efficient models in all units.
- **Soft medium-term measures:**

- **Energy supplier audits:** It is recommended to work with energy suppliers to conduct energy efficiency assessments, identifying opportunities to reduce their footprint.

- **Hard medium-term measures:**
  - **Long-term contracts for green energy:** Investment in long-term contracts with renewable energy suppliers is recommended to ensure a stable supply of green energy.
  - **Transition to renewable energy sources:** it is recommended to invest in own renewable energy sources (e.g. photovoltaic panels) in order to increase energy independence and to capitalize on natural sources of energy generation.

4. **Other:**

- Partnerships with organizations for recycling: Working with specialized companies for recycling non-hazardous and hazardous materials.
- Material reuse program: Introduce internal procedures for reuse of equipment, auxiliary materials or packaging.
- Installation of rainwater harvesting systems for use in irrigation or other ancillary purposes.
- Engage employees in sustainability initiatives through training programs and involvement in the company's sustainability goals;
- Continuous monitoring of emissions and annual recurrence of the carbon footprint calculation, including the improvement of the system for recording the targeted indicators;
- Taking into account sustainability and sustainability measures such as resource efficiency and supply chain optimization (working with suppliers that address low-carbon solutions);
- The realization of plans for the assessment and improvement of the environmental impact of the projects;
- Adopt circular economy principles by designing products that are easier to recycle or reuse, which could minimize environmental impact;
- Regular reporting and setting emission reduction targets.

8. DATA QUALITY ASSESSMENT

8.1. Degree of completion

Although certain activities are excluded from the operational limits - maintenance of office equipment, catering and website administration for example - none of these excluded processes significantly influence the reported emissions, as they represent less than 1% of the emission sources .

8.2. Uncertainty

The Data Quality Assestment matrix, constructed to assess the quality of the data used in the calculation and the related emission factors , was used to evaluate the uncertainty parameter of the study.

Activity intensity information

Input data were scored with percentages from 1% to 100%, with 1% representing high data accuracy and 100% representing very high data uncertainty. The scoring matrix is presented below.

Table 13 Input data quality assessment criteria

Aspect	Scoring criteria	Score
Quality of data collection	Well documented and accurate data collection method	1% - 24%
	Moderately documented, with minor uncertainties	25% - 49%
	Acceptable documentation with some uncertainty	50% - 74%
	Poorly documented, with significant uncertainty	75% - 90%
	Undocumented or unreliable data collection method	91% - 100%
Consistency	Data are consistent across all time periods and sources	1% - 24%
	Largely consistent with minor discrepancies	25% - 49%
	Some inconsistencies that can affect reliability	50% - 74%
	Major inconsistencies in data sources	75% - 90%
	Very inconsistent or contradictory data	91% - 100%
Completeness	Data cover all relevant sources/processes	1% - 24%
	Mostly complete with minor gaps	25% - 49%
	Some significant data gaps	50% - 74%
	Large gaps in data coverage	75% - 90%

Aspect	Scoring criteria	Score
	Data is very incomplete	91% - 100%

The uncertainty of the input data is the average of the scores, the result of which is then entered into the Uncertainty Calculation Matrix (see Chapter 8.3).

Emission factor uncertainty

The emission factors were scored with percentages from 1% to 100%, with 1% representing high data accuracy and 100% representing very high data uncertainty. The scoring matrix is presented below.

Table 14 Evaluation criteria for emission factors

Aspect	Scoring criteria	Score
Emission factor source	Literature reviewed industry/government data	1% - 24%
	Industry data with some validation	25% - 49%
	Secondary sources with known limitations	50% - 74%
	Assumptions with significant uncertainty	75% - 90%
	Unverified or assumed data	91% - 100%
Applicability	Very applicable to the specific activity/process	1% - 24%
	Most applicable with minor deviations	25% - 49%
	Moderate applicable with some known deviations	50% - 74%
	Low enforceability due to significant deviations	75% - 90%
	Poor applicability to the specific activity/process	91% - 100%

The uncertainty of the emission factors is the average of all notes, the result is then entered into the Uncertainty Calculation Matrix (see Section 8.3).

Matericei Quality Assessment results

Table 15 Input data evaluation results

Input data	Quality of data collection	Consistency	Completeness	Result uncertainty of input data
Electricity purchased	5%	1%	1%	**2%**
Natural gas	25%	25%	25%	**25%**
Motor vehicle fuel	75%	50%	25%	**50%**
Goods and services purchased	25%	25%	25%	**25%**

Input data	Quality of data collection	Consistency	Completeness	Result uncertainty of input data
Business travel	5%	1%	25%	**10%**
Waste generated	5%	5%	5%	**5%**
Transportation and distribution	5%	5%	5%	**5%**
Employee commute	5%	1%	1%	**2%**

Table 16 Results of emission factor assessment

Emission factors	Emission factor source	Applicability	Result uncertainty emission factors
Electricity purchased	1%	1%	**1%**
Natural gas	1%	1%	**1%**
Motor vehicle fuel	1%	1%	**1%**
Goods and services purchased	1%	1%	**1%**
Business travel	1%	5%	**3%**
Waste generated	1%	5%	**3%**
Transportation and distribution	1%	5%	**3%**
Employee commute	1%	5%	**3%**

Total uncertainty

The total carbon footprint can vary within an estimated range of **+/- 12.9%.**

8.3. Uncertainty results

The GHG Protocol Guidance on Uncertainty Assessment in GHG Inventories and Calculation of the Statistical Parameter, as mentioned in chapter 4.3The results are presented in **Table *17* Oil Dynamics data accuracy assessment results, indirect measurement**.

Table 17 Oil Dynamics data accuracy assessment results, indirect measurement

Data source	Consum	Consumption	Consumer uncertainty	Emission factor	U.M. emission factor	Uncertainty emission factors	Calculated emissions, tCO_2 eq	Uncertainty of calculated emissions $I = \sqrt{C^2 + F^2}$	Accuratete
Electricity purchased - Romania	19906.60	kWh	+/- 2.0%	0.23	kg CO2/kWh	+/- 1.0%	4.49	+/- 2.2%	Very good
Electricity purchased - Germany	60350.00	kWh	+/- 2.0%	0.21	kg CO2/kWh	+/- 1.0%	12.50	+/- 2.2%	Very good
Company facilities - Germany	210000.00	mc	+/- 25.0%	2.04	kg CO2/mc	+/- 1.0%	428.06	+/- 25.0%	Reasonable
Company vehicles - Romania	500.00	liters	+/- 50.0%	2.10	kg CO2/liter	+/- 1.0%	1.05	+/- 50.0%	Low
Company vehicles - Germany	4060.00	liters	+/- 50.0%	2.51	kg CO2/liter	+/- 1.0%	10.20	+/- 50.0%	Low
Company vehicles - Romania	200.00	liters	+/- 50.0%	2.51	kg CO2/liter	+/- 1.0%	0.50	+/- 50.0%	Low
Goods and services purchased - Romania	178.00	mc	+/- 25.0%	0.18	kg CO2/mc	+/- 1.0%	0.03	+/- 25.0%	Reasonable
Goods and services purchased - Germany	107.00	mc	+/- 25.0%	0.18	kg CO2/mc	+/- 1.0%	0.02	+/- 25.0%	Reasonable
Waste generated - Romania	178.00	mc	+/- 5.0%	0.20	kg CO2/mc	+/- 3.0%	0.04	+/- 5.8%	High

Data source	Consum	Consumption	Consumer uncertainty	Emission factor	U.M. emission factor	Uncertainty emission factors	Calculated emissions, tCO_2 eq	Uncertainty of calculated emissions $I = \sqrt{C^2 + F^2}$	Accuratete
Waste generated - Germany	107.00	mc	+/- 5.0%	0.20	kg CO2/mc	+/- 3.0%	0.02	+/- 5.8%	High
Business Travel - Romania	1452.00	km	+/- 10.0%	0.18	kgCO2e/passenger.km	+/- 3.0%	0.26	+/- 10.4%	High
Business Travel - Romania	1792.00	km	+/- 10.0%	0.17	kgCO2e/km	+/- 3.0%	0.30	+/- 10.4%	High
Business Travel - Romania	10.00	km	+/- 10.0%	13.20	kgCOe/room per night	+/- 3.0%	0.13	+/- 10.4%	High
Business Travel - Romania	15.00	km	+/- 10.0%	13.20	kgCOe/room per night	+/- 3.0%	0.20	+/- 10.4%	High
Business travel - Germany	1452.00	km	+/- 10.0%	0.18	kgCO2e/passenger.km	+/- 3.0%	0.26	+/- 10.4%	High
Business travel - Germany	1780.00	km	+/- 10.0%	0.17	kgCO2e/passenger.km	+/- 3.0%	0.30	+/- 10.4%	High
Business travel - Germany	447.00	km	+/- 10.0%	0.18	kgCO2e/passenger.km	+/- 3.0%	0.08	+/- 10.4%	High
Business travel - Germany	7828.00	km	+/- 10.0%	0.18	kgCO2e/passenger.km	+/- 3.0%	1.38	+/- 10.4%	High
Business travel - Germany	143.00	km	+/- 10.0%	20.30	$kgCO_2e$/room per night	+/- 3.0%	2.90	+/- 10.4%	High

Data source	Consum	Consumption	Consumer uncertainty	Emission factor	U.M. emission factor	Uncertainty emission factors	Calculated emissions, tCO_2 eq	Uncertainty of calculated emissions $I = \sqrt{C^2 + F^2}$	Accuratete
Business travel - Germany	10.00	km	+/- 10.0%	20.30	$kgCO_2e$/room per night	+/- 3.0%	0.20	+/- 10.4%	High
Business travel - Germany	3.00	km	+/- 10.0%	6.70	kgCOe/room per night	+/- 3.0%	0.02	+/- 10.4%	High
Business travel - Germany	35.00	km	+/- 10.0%	69.30	$kgCO_2e$/room per night	+/- 3.0%	2.43	+/- 10.4%	High
Waste generated - Romania	2.28	tone	+/- 5.0%	497.04	kg CO2e/tonne	+/- 3.0%	1.13	+/- 5.8%	High
Waste generated - Romania	0.38	tone	+/- 5.0%	21.28	kg CO2e/tonne	+/- 3.0%	0.01	+/- 5.8%	High
Waste generated - Romania	0.07	tone	+/- 5.0%	21.28	kg CO2e/tonne	+/- 3.0%	0.00	+/- 5.8%	High
Waste generated - Germany	5.90	tone	+/- 5.0%	497.04	kg CO2e/tonne	+/- 3.0%	2.93	+/- 5.8%	High
Waste generated - Germany	1.26	tone	+/- 5.0%	21.28	kg CO2e/tonne	+/- 3.0%	0.03	+/- 5.8%	High
Waste generated - Germany	0.29	tone	+/- 5.0%	21.28	kg CO2e/tonne	+/- 3.0%	0.01	+/- 5.8%	High
Waste generated - Germany	3.85	tone	+/- 5.0%	21.28	kg CO2e/tonne	+/- 3.0%	0.08	+/- 5.8%	High

Data source	Consum	Consumption	Consumer uncertainty	Emission factor	U.M. emission factor	Uncertainty emission factors	Calculated emissions, tCO_2 eq	Uncertainty of calculated emissions $I = \sqrt{C^2 + F^2}$	Accuratete
Waste generated - Germany	0.41	tone	+/- 5.0%	21.28	kg CO2e/tonne	+/- 3.0%	0.01	+/- 5.8%	High
Upstream transportation and distribution - Germany	6234387.31	km	+/- 5.0%	0.03	kg CO2/tonne.km	+/- 3.0%	173.24	+/- 5.8%	High
Upstream transportation and distribution - Germany	6135.36	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	3.94	+/- 5.8%	High
Upstream transportation and distribution - Germany	2755588.77	km	+/- 5.0%	0.03	kg CO2/tonne.km	+/- 3.0%	76.57	+/- 5.8%	High
Upstream transportation and distribution - Germany	2852.85	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	1.83	+/- 5.8%	High
Upstream transportation and distribution - Germany	1103829.66	km	+/- 5.0%	0.01	kg CO2/tonne.km	+/- 3.0%	14.58	+/- 5.8%	High
Upstream transportation and	1528.03	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.98	+/- 5.8%	High

Data source	Consum	Consumption	Consumer uncertainty	Emission factor	U.M. emission factor	Uncertainty emission factors	Calculated emissions, tCO_2 eq	Uncertainty of calculated emissions $I = \sqrt{C^2 + F^2}$	Accuratete
distribution - Germany									
Upstream transportation and distribution - Germany	2653.02	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	1.70	+/- 5.8%	High
Upstream transportation and distribution - Germany	588.25	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.38	+/- 5.8%	High
Upstream transportation and distribution - Germany	2716.54	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	1.75	+/- 5.8%	High
Upstream transportation and distribution - Germany	25.52	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.02	+/- 5.8%	High
Upstream transportation and distribution - Germany	61.68	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.04	+/- 5.8%	High
Downstream transportation and distribution - Germany	34578.36	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	22.22	+/- 5.8%	High

Data source	Consum	Consumption	Consumer uncertainty	Emission factor	U.M. emission factor	Uncertainty emission factors	Calculated emissions, tCO_2 eq	Uncertainty of calculated emissions $I = \sqrt{C^2 + F^2}$	Accuratete
Downstream transportation and distribution - Germany	5374.82	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	3.45	+/- 5.8%	High
Downstream transportation and distribution - Germany	4255.20	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	2.73	+/- 5.8%	High
Downstream transportation and distribution - Germany	688.80	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.44	+/- 5.8%	High
Downstream transportation and distribution - Germany	21.34	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.01	+/- 5.8%	High
Downstream transportation and distribution - Germany	172.20	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.11	+/- 5.8%	High
Downstream transportation and distribution - Germany	245.81	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.16	+/- 5.8%	High
Downstream transportation	208.68	km	+/- 5.0%	0.64	kg CO2/km	+/- 3.0%	0.13	+/- 5.8%	High

Data source	Consum	Consumption	Consumer uncertainty	Emission factor	U.M. emission factor	Uncertainty emission factors	Calculated emissions, tCO_2 eq	Uncertainty of calculated emissions $I = \sqrt{C^2 + F^2}$	Accuratete
and distribution - Germany									
Employee commute - Germany	263810.00	km	+/- 2.0%	0.17	kgCO2e/passenger.km	+/- 3.0%	44.80	+/- 3.6%	Very good
Employee commute - Germany	8464.00	km	+/- 2.0%	0.17	kgCO2e/passenger.km	+/- 3.0%	1.44	+/- 3.6%	Very good
Employee commute - Germany	53820.00	km	+/- 2.0%	0.04	kgCO2e/passenger.km	+/- 3.0%	1.91	+/- 3.6%	Very good
Employee commute - Romania	80192.00	km	+/- 2.0%	0.17	kgCO2e/passenger.km	+/- 3.0%	13.62	+/- 3.6%	Very good

Considering that CO emissions$_2$ were calculated using consumption data and emission factors, the accuracy was assessed using the indirect measurement method.

The data accuracy for the Oil Dynamics carbon footprint assessment is "**High**".

8.4. Representativeness

The Data Quality Assessment matrix was used to estimate data representativeness.

Technological correlation (relevance)

The technological correlation is very good, in most cases the data are directly related to the analyzed activities or similar processes and materials.

Temporal correlation (constant)

The representativeness of intensity parameters and emission factors is adequate. The activity intensity parameters are relevant in the temporal context of the study, and most emission factors are not older than three years from the study year.

Geographical correlation (accuracy)

All intensity parameters were obtained from the analyzed area, while for emission factors such data were not available, so data from an area with similar conditions were considered.

8.5. Transparent

The methods of derivation (calculation, assumptions on sources) of the data provided have been adequately documented and emission factors have been taken from public sources.

9. REFERENCES

5. Bureau Veritas. (2014). 2013 Social and Environmental Responsibility Report. Neuilly-sur-Seine, France: Bureau Veritas.
6. Carbon Solutions Global (2014). Carbon Solutions Global Carbon Calculator. (Carbon Solutions Global) Retrieved June 20, 2014, from http://www.carbonsolutionsglobal.com/offsetting/certified-carbon-footprint-calculator
7. carbonfootprint.com (2014). Carbon Footprint. http://calculator.carbonfootprint.com/calculator.aspx?tab=6
8. Carlin, D., Maheen, A., & Baker, K. (2023). Climate risks in the industrials sector. UN Environment program.
9. Chester, M. V. (2008). Life-cycle Environmental Inventory of Passenger Transportation in the United States. Berkeley, California, USA: Institute of Transportation Studies, UC Berkeley.
10. Chester, M. V., & Horvath, A. (2009). Environmental Assessment of Passenger Transportation Should Include Infrastructure and Supply Chains. Environmental Research Letters, 4(2).
11. Chester, M. V., & Horvath, A. (2012). High-speed Rail with Emerging Automobiles and Aircraft Can Reduce Environmental Impacts in California's Future. 7(3).
12. Chester, M. V., Pincetl, S., Eisenstein, W., & Matute, J. (2012). Infrastructure and Automobile Shifts: Positioning Transit to Reduce Life-cycle Environmental Impacts for Urban Sustainability Goals.
13. Covenant of Mayors. (2012). SEAP Guidebook - Emission factors. Covenant of Mayors.
14. DEFRA. (2015). How did we calculate the numbers - http://xls.co2list.org/. London, UK: Department for Environment, Food & Rural Affairs, United Kingdom.
15. DELL (2010). Product Carbon Carbon Footprint (PCF) Assessment of a DELL Laptop. Austin, Texas, USA: DELL.
16. Deloitte (2014) Global Report: Environmental Sustainability. Paris, France: Deloitte.
17. energysp.hu (2009). Hungary - Energy efficiency report. ABB.
18. Fourth Assessment Report: Climate Change 2007. Synthesis Report. UN Intragovernmental Panel on Climate Change.
19. Itten, R., Frischknecht, R., & Stucki, M. (2012). Life-cycle Inventories of Electricity Mixes and Grid. Uster, Switzerland: Esu Services Ltd.
20. M. J. Bradley & Associates (2007) Comparison of Energy Use & CO2 Emissions From Different Transportation Modes. Washington DC, USA: American Bus Association.
21. MND (2012). National Energy Strategy 2030 (Nemzeti Energia Stratégia 2030). Budapest: Hungarian Ministry of National Development.
22. SGS. (2014). SUSTAINABLE & productive SUSTAINABILITY HIGHLIGHTS 2013. SGS.
23. UCL (2009) Travel related carbon footprint. London, UK: Environment Institute, University College London.
24. Volkswagen (2010). The Life Cycle of a Car. Volfsburg: Volkswagen AG Group Research.
25. (Cisco, 2015)
26. Chong, H., & Ricaurte, E. (2014). hotel sustainability benchmarking [Electronic article]. Cornell Hospitality Reports, 14(11), 6-27 (Chong H., 2014)
27. Annual Activity Report for 2022 by the National Energy Regulatory Authority - ANRE

28. Assessing embodied carbon emissions of communication user devices by combining approaches, N. Lovehagen, J. Malmodin, P. Bergmark, S. Matinfar, Ericsson Research, Ericsson AB, 164 83 Stockholm, Sweden, 2023

10. TABLES LIST