



# Corporate Carbon Footprint

Reporting of Category 1, Category 2, and indirect emissions not included  
in Category 1 and 2 (Category 6) emissions

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## 1. Introduction

The objective of this study is the quantification of greenhouse gas emissions through the calculation of the Carbon Footprint of the company Arkimedia Srl, referred to the year 2020.

The Carbon Footprint (CF) is an environmental indicator aimed at quantifying the climate-altering gas emissions produced directly or indirectly by a company, an organization, an individual, a product or an event, with the purpose of measuring the impact that anthropogenic activities cause towards climate change. Climate change has implications for both human and natural systems and could lead to significant changes in resource use, production and economic activities [1]. Therefore, companies must be able to understand and manage the risks due to GHGs if they are to ensure long-term success in competitive business. An accurate and well-designed corporate inventory of GHG emissions enables the achievement of several goals, including public reporting of GHG emissions, participation in GHG markets, and recognition of early voluntary action [2].

This Carbon Footprint study is carried out in line with ISO 14064-1:2019 [1], which details its execution and reporting.

The reference methodology used in this study is the Life Cycle Assessment (LCA) (ISO14040/14044) [3][4]. According to ISO 14040/14044, the structure of LCA can be summarized in four main phases (Figure 1):

- Aim and scope: preliminary phase in which the purpose of the study, the functional unit, the boundaries of the system studied, the data requirements and the assumptions are defined;
- Inventory analysis: i.e. the quantification of input and output flows for all processes in the LCA;
- Impact assessment: a step that aggregates the results of the inventory, using scientific models, into a number of potential environmental impacts;
- Interpretation: the phase in which the LCA results are interpreted in order to derive conclusions and recommendations.

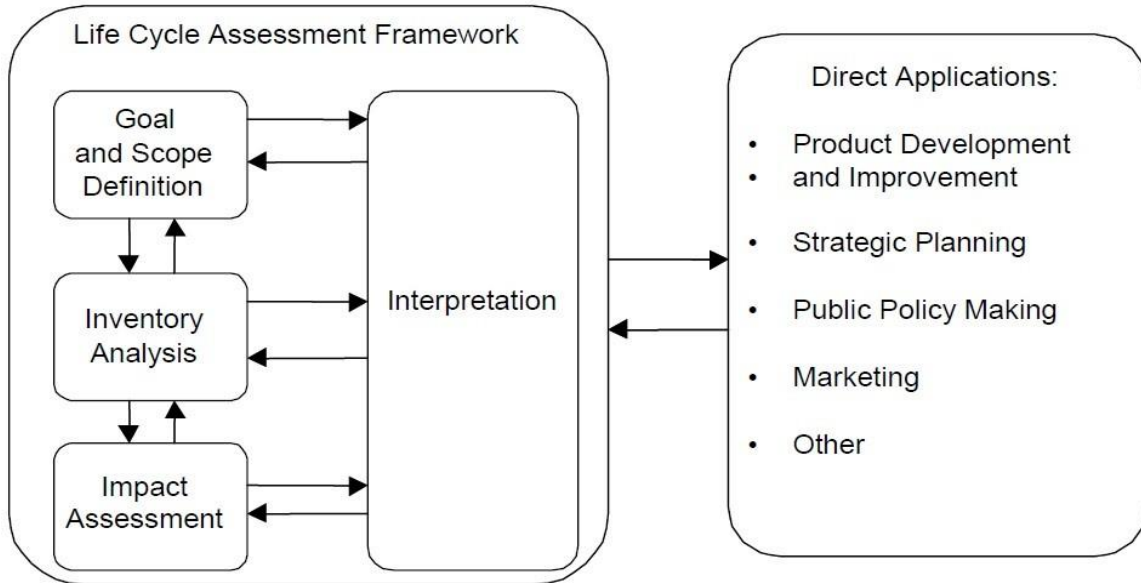


Figure 1 Stages of LCA according to ISO 14040/14044 standards [3] [4].

### 1.1 The company: Arkimedia srl

Arkimedia is a company located in Camposampiero (PD) that has been making high quality watch straps since 1993. Arkimedia is engaged in the production of watch straps for important luxury brands.

The company works following the principles of sustainable ethics, bringing respect for the raw material, the leather, which is used by limiting waste, and for the environment, through the use of solar energy. Arkimedia has ISO 14001, ISO 45001 and TF-Treaceability and Fashion certifications. Arkimedia products are also covered by 2 patents: App Strap and Diamond Strap [5].

## 2. Objective and scope

The objective of this study is the quantification of greenhouse gas emissions due to the activities carried out by Arkimedia Srl, in the year 2020.

The study was carried out using SimaPro software v. 9.1.1 [6], in line with ISO 14064-1:2019 [1] and the ISO 14040/14044 series of standards [3][4].

According to ISO 14064-1:2019, the emissions reported within a corporate Carbon Footprint are divided into the following categories:

- Category 1 - Direct emissions from a source owned or controlled by the organisation;
- Category 2 - Indirect greenhouse gas emissions related to the production and consumption of energy imported by the organisation;
- Category 3 - Indirect greenhouse gas emissions from transport;
- Category 4 - Indirect greenhouse gas emissions from products used by the organisation;
- Category 5 - Indirect greenhouse gas emissions associated with the use of products from the organisation;
- Category 6 - Indirect greenhouse gas emissions from other sources.

This analysis is presented as a partial corporate Carbon Footprint and includes the categories of direct emissions (Category 1), indirect emissions from imported energy (Category 2) and indirect emissions related to natural gas, electricity and company vehicles not included in Categories 1 and 2 (Category 6). The company applies the calculation to the above categories as a first assessment of its carbon footprint, with the aim of acquiring greater awareness and control of its environmental performance.

A critical review is not planned due to the internal nature of the study.

### 2.1 LCA Approach

The approach used to conduct this LCA is attributive. The attributive LCA model represents the evaluation of the actual, average or estimated supply chain of a product or process. The existing or estimated system is placed in a static technological context.

The attributive approach is a type of modelling whereby environmentally relevant inputs and outputs for each process involved in the product life cycle are attributed to the functional unit.

### 2.2 Functional unit

The functional unit examined is the activity of an entire year of the company Arkimedia Srl. The reporting year is 2020.

### 2.3 Organizational boundaries

For the definition of corporate organizational boundaries, the control approach was applied in this study. According to this approach, the organization accounts for 100% of greenhouse gas emissions and/or removals related to operations and facilities/installations over which it has financial or operational control.

The organizational boundaries of Arkimedia Srl concern the headquarters located in Camposampiero, in the province of Padua.

### 2.4 Reporting Boundaries

In order to perform the corporate Carbon Footprint of Arkimedia Srl, reporting boundaries were defined according to the guidance provided by ISO 14064-1:2019. In this study, direct emissions (Category 1), indirect emissions from imported energy (Category 2) of greenhouse gases due to Arkimedia Srl's activity have been considered. Indirect emissions referring to natural gas, electricity and company vehicles not included in Categories 1 and 2 (Category 6) were also reported.

Activities included within "Category 1 - Direct Emissions" include direct GHG emissions from sources owned or controlled by the organization. Specifically, the emission areas included according to ISO 14064-1:2019 in this category are:

- direct emissions from combustion of fuels in stationary sources (e.g. boilers, turbines, furnaces);
- direct emissions from fuel combustion in mobile sources (e.g. company fleet);
- direct emissions from physical or chemical processing (production or processing of chemicals and materials, processing of waste);
- direct fugitive emissions resulting from the release of greenhouse gases in anthropogenic systems (e.g., leaks of refrigerant gases from air conditioning systems, etc.);
- direct emissions from land use, land use change and forestry.

In this study, emissions due to fuels used to produce heat in boilers and fuels used for company vehicles were considered.

Indirect emissions from imported energy (Category 2) include emissions from the production of purchased electricity, heat, steam or cooling. In this study, emissions due to the consumption of purchased electricity in the relevant organizational boundary were considered.

Indirect emissions related to natural gas, electric power and farm equipment (i.e., contributions related to fuel purchases, losses due to electric power transmission and distribution (T&D), infrastructure, road production) do not include the following

included in Categories 1 and 2 have been calculated and reported in Category 6, "indirect emissions from other sources".

Indirect emissions related to Categories 3, 4 and 5 are not included in the analysis.

Figure 2 shows the reporting boundaries considered in this Carbon Footprint study.




REPORTING BOUNDARIES		
Category 1 - Direct emissions (Scope 1)	Category 2 - Emissions indirect from imported energy (Scope 2)	Category 6 - Indirect emissions from other sources (Scope 3)
<p><i>direct greenhouse gas emissions from sources owned or controlled by the organisation</i></p>  <ul style="list-style-type: none"> <li>▪ Natural gas used in the boiler</li> <li>▪ Fuels used for company vehicles</li> </ul>	<p><i>indirect emissions of ad greenhouse effect from energy consumption</i></p>  <ul style="list-style-type: none"> <li>▪ Electricity from the grid</li> </ul>	<p><i>indirect emissions of greenhouse gases greenhouse gas emissions from transport</i></p>  <ul style="list-style-type: none"> <li>▪ Emissions related to company vehicles not included in Category 1</li> <li>▪ Natural gas emissions not included in Category 1</li> <li>▪ Emissions related to grid electricity not included in Category 1</li> <li>▪ Emissions related to the photovoltaic system</li> </ul>

Figure 2 Reporting boundaries of the company Carbon Footprint study of Arkimedia Srl

## 2.4 Data Quality

Primary data referring to natural gas and grid electricity consumption, electricity production through the photovoltaic system, and fuel consumption for corporate travel were used in the study.

Secondary data were used for the other processes, using, in particular, the ecoinvent v3.6 LCA database [7].

### Temporal representativeness of data

The primary data used refer to the entire year 2020. The year 2020 becomes the reference year as it is the first time period for which the Carbon Footprint is calculated.



The secondary data used in the study came from the ecoinvent v3.6 database [7] published in 2019.

### Geographical representativeness of the data

The primary data were collected at the headquarters of Arkimedia, located in Camposampiero in the province of Padua.

### Recruitment and simplifications

- In order to facilitate the calculations of the company Carbon Footprint and the presentation of the results it has been used the LCA software SimaPro 9.1.1 [6] that contains some LCA databases among which ecoinvent v3.6 [7].
- ISPRA factors [8][9][10] relating to the last year available were used to quantify direct emissions due to the use of fuels from sources owned or controlled by the company (Category 1) and indirect emissions due to the production of electricity purchased by the company (Category 2). The ISPRA factors used are contained in the 341/2021 report for natural gas [8] and on the ISPRA website in the sections on electricity [9] and transport [10].
- Emission factors for natural gas and electricity are for the year 2019. Emission factors for transportation are for 2018.
- In the document "ARKIMEDIA\_emissions 2020". [11] concerning the stack emissions of the company Arkimedia, no greenhouse gas emissions are indicated. There are also no fugitive emissions of refrigerant gases for the reference year.
- Indirect emissions referring to natural gas, electric energy and company vehicles not included in Categories 1 and 2 have been reported by subtracting the emissions calculated with the entire ecoinvent v3.6 processes from the emissions calculated with the ISPRA emission factors. These indirect emissions have been attributed to Category 6 - indirect emissions from other sources.
- Indirect emissions related to the natural gas used in the boiler (Category 6) have been calculated using the ecoinvent 3.6 process referred to the technology (condensing boiler < 100 kW) and to the type of fuel (natural gas) indicated, considering the reference geographical reality (RER). Since the selected process uses MJ consumed as a unit of measure, to relate it to the data provided (Sm<sup>3</sup> of natural gas consumed), the process has been converted into m<sup>3</sup>. The m<sup>3</sup> consumed per MJ produced was deducted from the process in the ecoinvent database (0.025 m<sup>3</sup>/MJ).
- The emission factors used for company vehicles (Category 6) are derived from the ecoinvent database processes "Transport, passenger car, medium size, diesel, EURO 5 {RER}| Cut-off, S" for diesel powered cars and "Transport, passenger car, medium size, petrol, EURO 5 {RER}| Cut-off, S" for the Mild-Hybrid car (petrol fuel). The EURO 5 class process was used in



lack of a specific process in the database for the EURO 6 class. For the Mild-Hybrid car the emission factor related to the gasoline car was considered as representative, with reference to the liters of gasoline consumed in the year 2020.

In order to relate the selected datasets to litres of diesel/petrol consumed, the processes, having kilometres driven as units, were converted to litres of fuel consumed. The consumption per kilometre was deduced from the process of the ecoinvent database (0.056 kg/km for the car powered by diesel; 0.063 kg/km for the car powered by petrol). To relate the kg of fuel to the primary data provided in litres, a density of 0.833 kg/l was considered for diesel (average value referred to the density of diesel indicated by the UNI EN 590 standard [12]) and 0.748 kg/l for petrol (average value referred to the density of petrol indicated by the UNI EN 220 standard [13]).

- The indirect emissions relating to the consumption of energy from the electricity grid were calculated by creating the specific electricity mix from the bills of Arkimedia Srl's supplier from the Italian electricity mix in the ecoinvent v3.6 database.
- Indirect emissions related to the heat pump used for heating have not been included in the analysis due to the lack of data on the amount of heat energy produced.
- The data relative to the production of electric energy for 2020 of the photovoltaic plant (10,000 kWh) has been obtained from primary data. Emissions related to the entire annual production of the photovoltaic plant have been considered in the model.

## 2.6 Environmental impact assessment method

The Carbon Footprint (CF) is an environmental indicator that quantifies the greenhouse gas emissions produced directly or indirectly by a company, an organization, an individual, a product or an event, in order to measure the impact of human activities on climate change. In particular, the impact is expressed in the form of kilograms of CO<sub>2</sub> equivalent emitted. Kilograms of CO<sub>2</sub> equivalent are calculated by multiplying the emissions of each greenhouse gas by its equivalence factor (EF). Greenhouse gas equivalence factors, developed by the Intergovernmental Panel on Climate Change (IPCC), express the contribution of a given greenhouse gas to global warming compared to carbon dioxide, whose equivalence factor by definition is 1.

The calculation of the company Carbon Footprint for Arkimedia Srl was performed by applying the IPCC 2013 GWP 100a v 1.03 method present in the software SimaPro 9.1.1 [6]. The IPCC method used for the calculation of the Carbon Footprint counts all the greenhouse gases foreseen by the ISO 14064-1:2019 standard and in the IPCC AR 5 report [14].

In addition, CO<sub>2</sub> emissions of biogenic origin from anthropogenic activities were quantified and reported separately according to the guidance in the reference standard. CO<sub>2</sub> sequestration was not assessed in the study.

Environmental impacts related to other environmental impact categories were not considered in this study.

### 3. Inventory Analysis

Inventory analysis involves procedures for collecting and calculating data to quantify the inputs and outputs affecting the produced system. The term *input* data refers to energy consumption and the use of materials entering the production system (e.g. chemical compounds, construction materials, water), while *output* data refers to the set of emissions, wastes, co-products leaving the system.

The data collection was carried out by filling in a questionnaire to collect data on Arkimedia's corporate Carbon Footprint. In addition, some data and clarifications were provided by means of documents, data sheets and an exchange of e-mails.

The primary and secondary data were implemented in the LCA model.

To facilitate the LCA calculations and the presentation of the results, the LCA software SimaPro 9.1.1 [6] was used, which contains some LCA databases including ecoinvent v.3.6.

The primary data concerning emission categories 1 and 2 are presented in Table 1. Table 2 shows the data relative to the production of electrical energy from photovoltaic systems relative to the year 2020.

Inventory data		Consumption	Unit of measurement
Category 1 (Scope 1)	Natural gas	3929	Sm <sup>3</sup>
	Fuel for company vehicles	Diesel	3204
		Petrol	1096
Category 2 (Scope 2)	Electricity from the grid	31101	kWh

*Table 1 Inventory data for Category 1 - emissions sayand Category 2 - indirect emissions from imported energy*

Inventory data		Production	Unit of measurement
Category 6 (Scope 3)	Electricity from photovoltaics	10000	kWh

*Table 2 Inventory data on electricity production from photovoltaic systems for the year 2020*

Table 3 shows the ISPRA emission factors related to natural gas, electric energy from the network and fuels for company vehicles used to calculate the company Carbon Footprint. The processes and ecoinvent v3.6 emission factors used in the software modelling for the reporting of indirect emissions not included in Categories 1 and 2 are also presented.

Factors and processes for LCA calculation			
GHG sources	ISPRA emission factor	Ecoinvent process	Emission factor ecoinvent v3.6
Natural gas	1.976 kg <sub>CO2/Sm</sub> <sup>3</sup> [8]	Heat, central or small-scale, natural gas {Europe without Switzerland}  heat production, natural gas, at boiler condensing modulating <100kW   Cut-off, S	2.804 kg <sub>CO2eq/Sm</sub> <sup>3</sup> [7]
Electricity grid	0.2686 kg <sub>CO2/kWh</sub> [9] - consumption factor	Electricity, medium voltage {Mix Arkimedia}  market for   Cut-off, S	0.4050 kg <sub>CO2eq/kWh</sub> [7]
Diesel car	0.154 kg <sub>CO2/km</sub> [10] (equal to 2.314 kg CO2/l)	Transport, passenger car, medium size, diesel, EURO 5 {RER}  transport, passenger car, medium size, diesel, EURO 5   Cut-off, S	0.303 kg CO2eq/km [7] (equivalent to 4.531 kg CO2eq/l)
Petrol car	0.195 kg <sub>CO2/km</sub> [10] (equal to 2.352 kg CO2/l)	Transport, passenger car, medium size, petrol, EURO 5 {RER}  transport, passenger car, medium size, petrol, EURO 5  Cut-off, S	0.335 kg CO2eq/km [7] (equivalent to 4.033 kg CO2eq/l)

Table 3 Emission factors and processes used for LCA calculation

### 3.1 Inventory results

Figure 3 shows the flow chart of the most significant processes involved in calculating Arkimedia's corporate Carbon Footprint, for the areas of emission considered and the impact category analysed. The thickness of the arrows is proportional to the contribution of each process.

The flow chart shows that direct emissions account for 40.96% of the total GWP impact of the emission sources considered, indirect emissions from imported energy account for 19.27%, and indirect emissions from natural gas, electric power, and company vehicles account for 39.77%.

The largest contributions related to the GWP impact category are due to direct emissions related to the combustion of gasoline and diesel in company vehicles (23.05%), followed by indirect emissions related to company vehicles (20.63%), indirect emissions from imported energy (19.27%) and direct emissions of natural gas (17.91%).

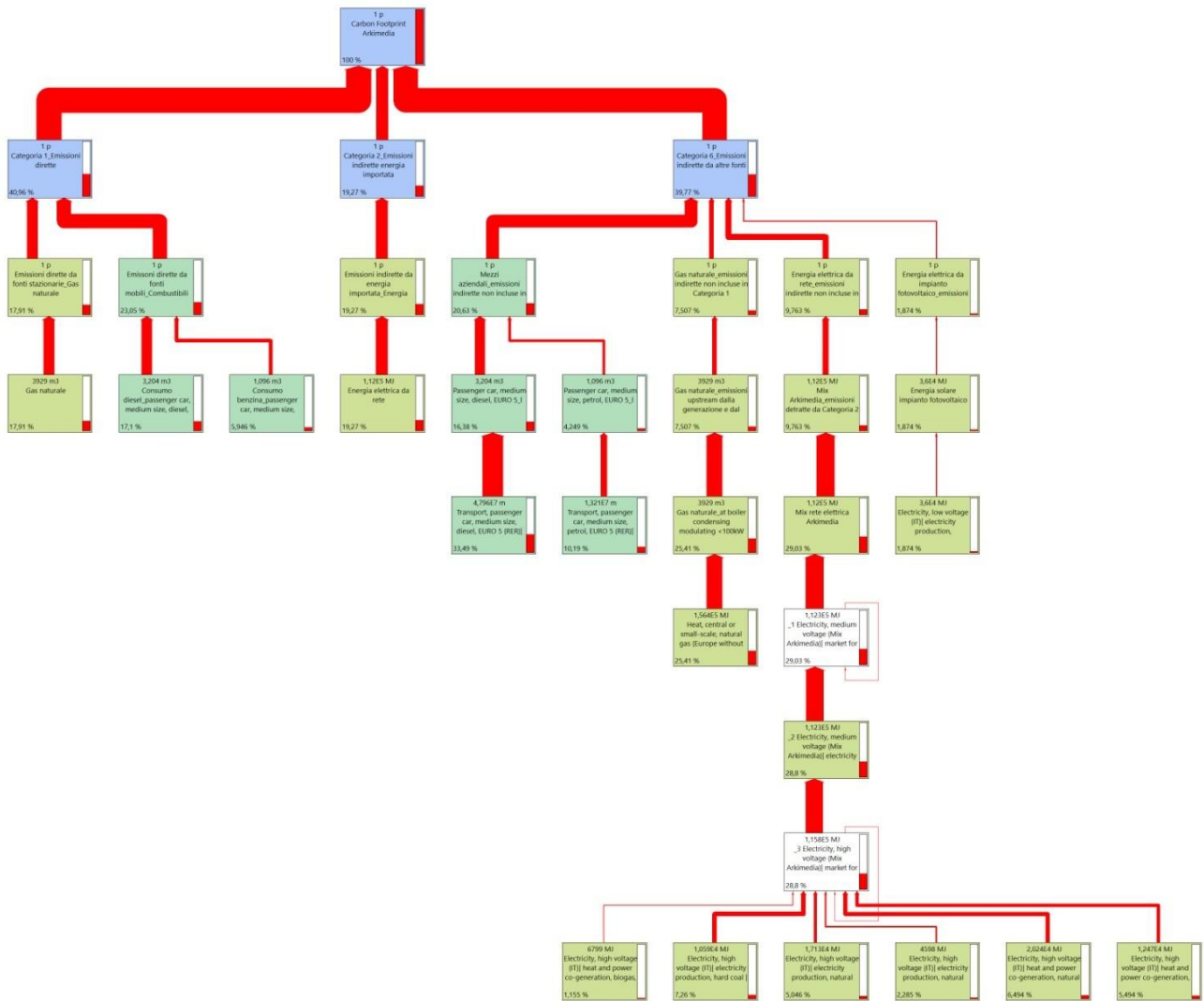


Figure 3 Flow chart of the Carbon Footprint of Arkimedia Srl for the year 2020 for the emission categories considered

Table 4 shows the inventory inherent in the quantification of greenhouse gases for this company Carbon Footprint study. The table highlights the inventory results for carbon dioxide, methane, nitrous oxide, sulfur hexafluoride and other greenhouse gases.

Greenhouse gas inventory							
Gas	Quantity [kg]				Factor	GWP [kg CO <sub>2</sub> eq].	%
	Category 1	Category 2	Category 6	TOTAL		TOTAL	TOTAL
CO2 fossil	17757	8354	13272	39383	1	39383	90,84%
CH4 fossil	0	0	103	103	30,5	3144	7,25%
N2O	0	0	1,52	1,52	265	404	0,93%
CH4 biogenic	0	0	9,49	9,49	27,75	263	0,61%
SF6	0	0	0,00446	0,00446	23500	105	0,24%
CO2 land transformation	0	0	13,2	13,2	1	13,2	0,03%
CO2 to soil or bionass stock	0	0	0,61	0,61	-1	-0,61	0,00%
NF3	0	0	2,12E-12	2,12E-12	16100	3,42E-08	0,00%
Other greenhouse gases	0	0	0,0155	0,0155	-	42,4	0,10%
<b>TOTAL</b>	<b>17757</b>	<b>8354</b>	<b>13400</b>	<b>39511</b>	<b>-</b>	<b>43354</b>	<b>100%</b>

Gas	kg <sub>2</sub> Biogenic CO
Biogenic CO2	2461

Table 4 Greenhouse gas inventory

#### 4. Impact assessment

The purpose of the impact assessment phase is to aggregate and convert the inventory results into their potential environmental impacts. This phase allows the data in the inventory table to be associated with environmental issues such as global warming through the use of impact indicators and equivalence factors.

For the environmental impact assessment, the IPCC 2013 GWP 100a method was selected [14], which evaluates the contributions of all greenhouse gases specified in ISO 14064, including carbon dioxide, methane gas, nitrous oxide, sulfur hexafluoride, nitrogen trifluoride, and expresses them in a single result expressed in kg of CO<sub>2</sub> equivalent.

Table 5 and Figure 4 present the results obtained through the calculation of Arkimedia's Carbon Footprint for the year 2020, divided by category considered.

IPCC 2013 GWP 100a		IPCC	
		kg CO <sub>2</sub> eq	%
Category 1 (Scope 1)	Natural gas - direct emissions from stationary sources	7764	17,91%
	Fuel Company vehicles - direct emissions from mobile sources	9993	23,05%
	<b>TOTAL</b>	<b>17757</b>	<b>40,96%</b>
Category 2 (Scope 2)	Grid electricity - indirect emissions from imported energy	8354	19,27%
	<b>TOTAL</b>	<b>8354</b>	<b>19,27%</b>
Category 6 (Scope 3)	Company vehicles - indirect emissions not included in Category 1	8944	20,63%
	Natural gas - indirect emissions not included in Category 1	3254	7,51%
	Grid electricity - indirect emissions not included in Category 2	4233	9,76%
	Electricity from photovoltaic system - indirect emissions	812	1,87%
	<b>TOTAL</b>	<b>17243</b>	<b>39,77%</b>
<b>TOTAL</b>		<b>43354</b>	<b>100%</b>
<b>Biogenic CO emissions</b>		<b>2461 kg of CO<sub>2</sub> biogenic</b>	

Table 5 Impact results relative to the corporate Carbon Footprint of Arkimedia Srl for the year 2020



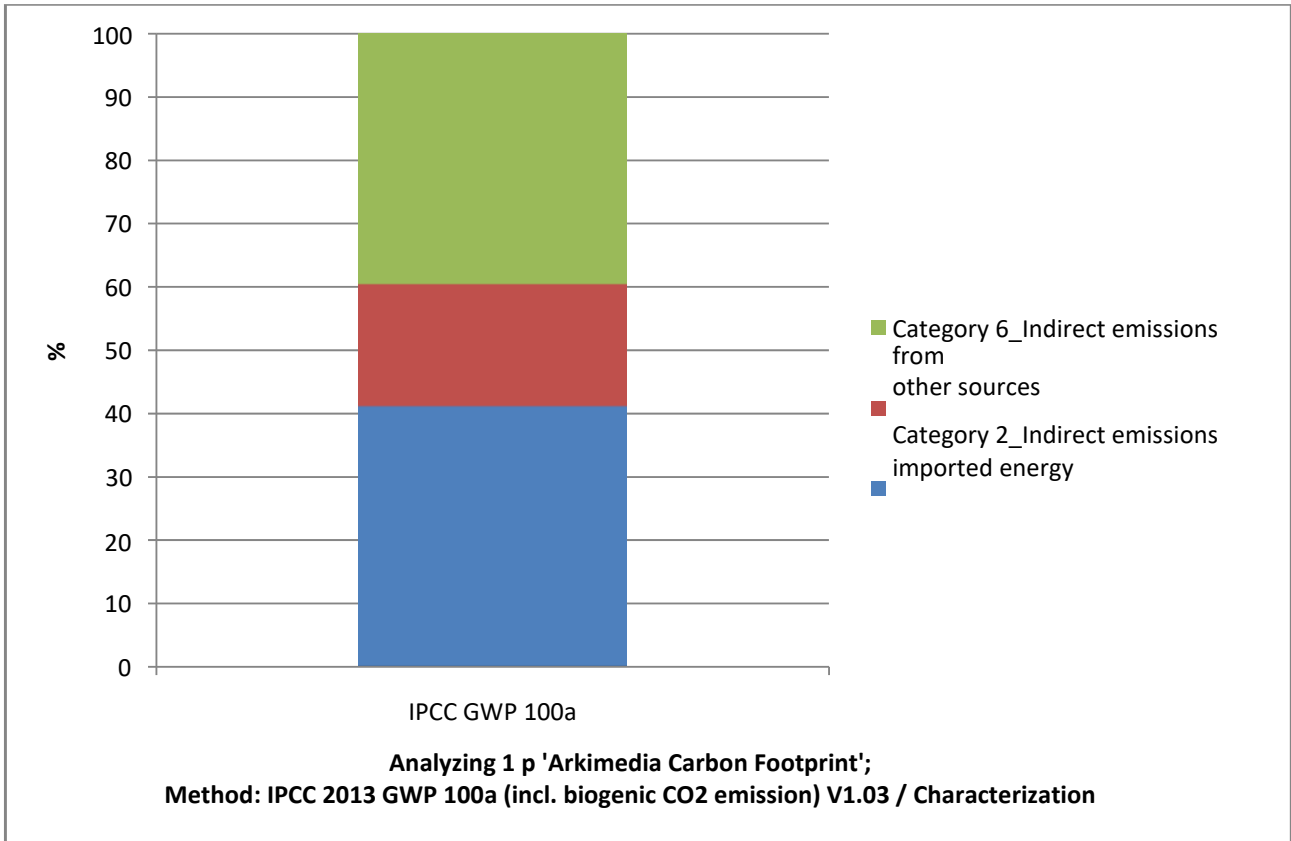


Figure 4 Breakdown of impacts by category of emission relative to the corporate Carbon Footprint of Arkimedia Srl for the year 2020

The calculation of the Carbon Footprint of Arkimedia Srl showed an impact of 44354 kg CO2 eq for the categories of emissions analyzed related to the activities of the company for the year 2020. On the basis of the analysis carried out, direct emissions (Category 1) contribute significantly to the GWP impact (17757 kg CO2 eq), where the consumption of natural gas and the consumption of fuel for company vehicles have an impact of 7764 kg CO2 eq and 9993 kg CO2 eq respectively. Indirect emissions relating to Category 6 are also significant, with an impact of 17243 kg of CO2 eq, in particular due to indirect emissions relating to company vehicles (8944 kg of CO2 eq). Indirect emissions relating to imported electricity (Category 2) are instead equal to 8354 kg of CO2 eq.

## 5. Interpretation

An analysis of the uncertainty relative to the calculation of the Carbon Footprint of Arkimedia Srl was carried out, with reference to the single categories considered and to the total result. The uncertainty was calculated using Montecarlo analysis and is relative to a 95% confidence interval. In order to calculate the uncertainty, a lognormal probability distribution (in line with the ecoinvent database entries) was assigned to the data entered in the model, through the compilation of the Pedegree Matrix [15]. The uncertainty value considered refers to the average between the upper uncertainty interval and lower uncertainty interval, obtained as a result of the Monte Carlo analysis. The Monte Carlo analysis was conducted for 1000 iterations.

The results of the analysis (Figure 5) show an uncertainty of +/- 5% for Category 1, +/- 8% for Category 2 and +/- 27% for Category 6. The overall uncertainty of the company's Carbon Footprint calculation is +/- 11%.

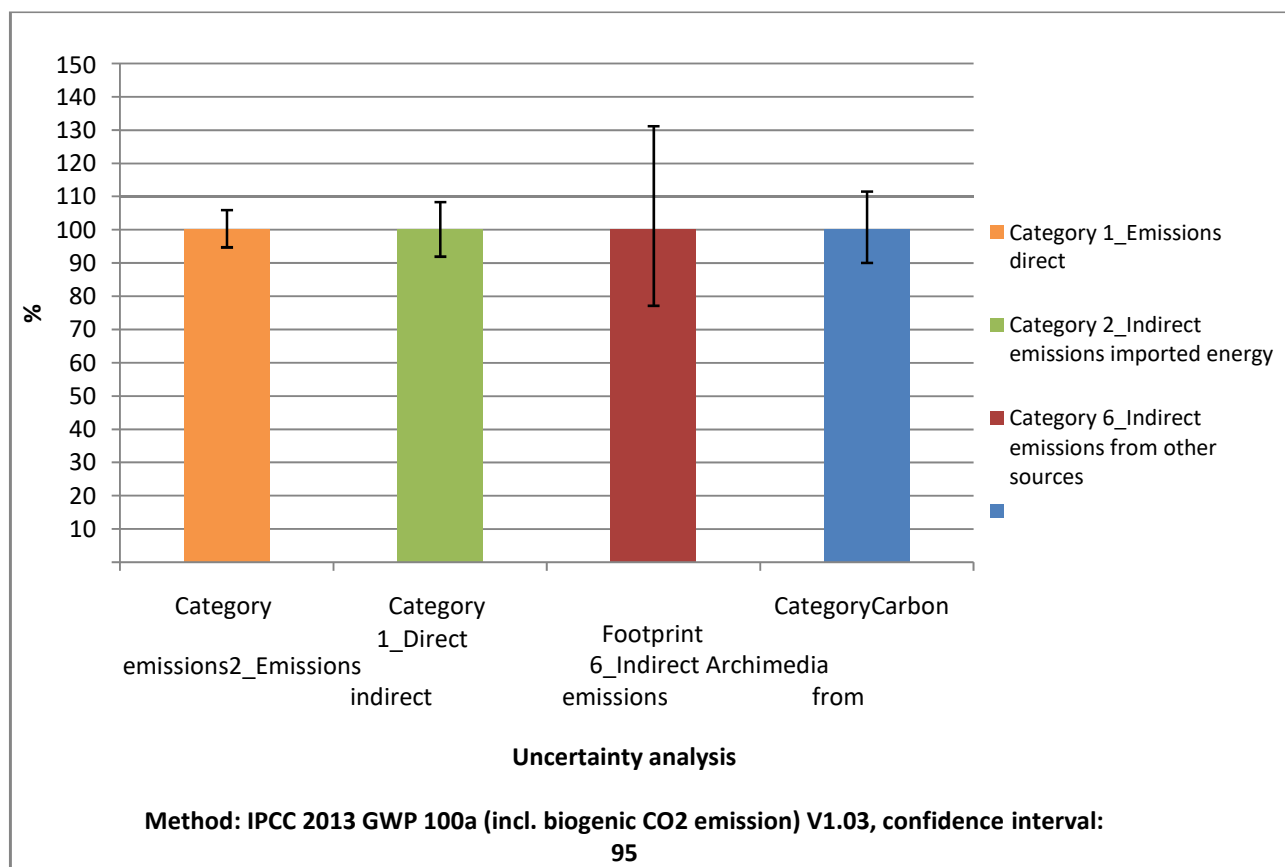


Figure 5 Uncertainty analysis

## 6. Conclusions

The objective of this study is to quantify the greenhouse gas emissions due to the activities carried out by Arkimedia Srl, in the year 2020.

This analysis is presented as a partial corporate Carbon Footprint (CF). The company applies the calculation of corporate CF as a first assessment of its carbon footprint, with the aim of gaining greater awareness and control of its environmental performance.

Direct emissions (Category 1) and indirect emissions from imported energy (Category 2) of greenhouse gases are considered. Indirect emissions relating to natural gas, electricity and company vehicles not included in Categories 1 and 2 (Category 6) have also been reported.

The GWP impact results for Category 1 are 17757 kg CO<sub>2</sub> eq (40.96%), while they are 8354 kg CO<sub>2</sub> eq (19.27%) for Category 2 and 17243 kg CO<sub>2</sub> eq (39.77%) for Category 6.

The total emissions reported are 43354 kg of CO<sub>2</sub> eq.

The largest contributions to the GWP impact are due to direct emissions related to the combustion of gasoline and diesel in company vehicles (23.05%), followed by indirect emissions related to company vehicles (20.63%), indirect emissions from imported energy (19.27%) and direct emissions of natural gas (17.91%).

CO<sub>2</sub> emissions of biogenic origin have been calculated separately and amount to 2461 kg biogenic CO<sub>2</sub>.

The analysis of the categories analysed could be refined by including indirect impacts related to the heat pump, through the retrieval of the specific data related to the consumption of the pump.

The uncertainty analysis carried out considers a 95% confidence interval, and is equal to +/- 5% for Category 1, +/- 8% for Category 2 and +/- 27% for Category 6. The overall uncertainty of the company Carbon Footprint calculation is +/- 11%.

In order to achieve a decrease in the emission of greenhouse gases, the company can act on electricity through the increased use of electricity from renewable sources. This choice could be a solution to lower the amount of CO<sub>2</sub> equivalent emitted.

A more complete assessment of the Carbon Footprint could be made by including in the primary data all the contributions that have not been assessed (Categories 3, 4 and 5), such as, for example, contributions linked to the purchase and transport of raw materials, to employees' home-work journeys, to products sold by the company (use and end of life), to company waste, etc.



The inclusion of these contributions would allow for more complete and comprehensive reporting, as well as increase awareness of the company's carbon footprint in relation to its business.

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