Wherever gas is used, we are there

Report on Greenhouse Gas Emissions Cavagna Group

Year 2021

According to UNI EN ISO 14064-1:2019 standard and GHG Protocol Corporate

Calcinato, 02 February 2023

INDEX

1 FOREWORD

1.1 PRESENTATION OF THE GROUP

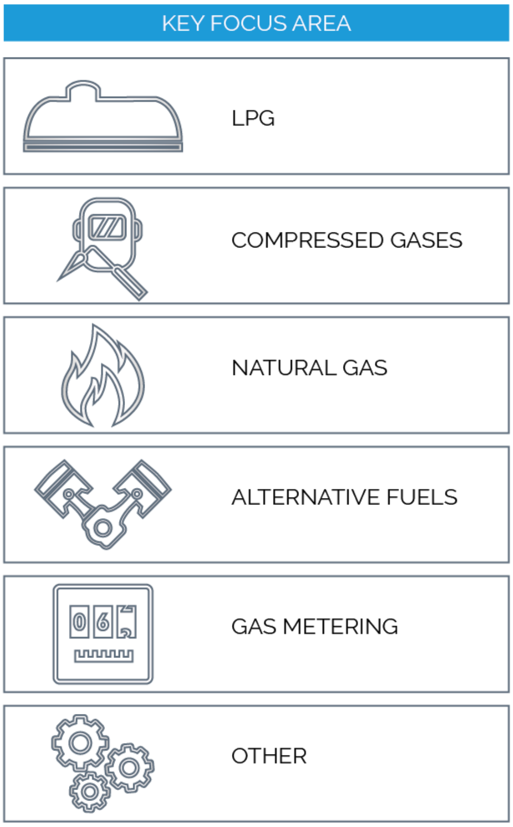
For over 70 years, the Cavagna Group has been a global leader providing advanced, integrated solutions for the control, regulation, metering and storage of compressed gases (gas for energy, alternative fuel gases, medical gases, industrial gases, cryogenic gases and specialty gases). It was founded in 1949 in northern Italy, near Brescia, an area long renowned for its metalworking industry. Today, the Group is made up of 9 vertically integrated production units in Italy and 7 other companies spread out across 5 continents and sells its products in more than 150 countries.

The Group now flanks it consolidated design and production business with an increasing commitment to the sustainable energy transition and digital transformation of the sectors it operates in, with a focus on developing IoT solutions and digitally controlled technologies. It thus remains true to its original mission — wherever gas fuels progress and life, Cavagna is there — and brings innovative solutions to the twin transition.

The current market positioning and supply organization of Cavagna Group is structured into six fundamental production and market paths, which testify the Group's operational breadth and its wide-ranging commitment to the "glocal" logic: thinking globally and intervening with actions aimed at overseeing individual markets.

New investments have been progressively added to the original production sectors (gas regulation and control systems) which have led to an expansion of the organizational structure and of the scenario of interest. The Group also moved through targeted acquisitions, implementing a configuration in various areas, synergistic for know-how and commercial potential.

An identity that today allows to cover all the technological needs connected to the use of gas.



1.2 CLIMATE CHANGE: A CHALLENGE AND AN OPPORTUNITY

Climate changes have been identified as one of the major challenges that nations, governments, economic systems and citizens will face in the coming decades. Climate changes have significant implications for both natural and human systems and can lead to a significant change in resource use, production processes and economic activities.

The main greenhouse gases (GHG: Greenhouse Gas) from anthropic activities as indicated in the Kyoto Protocol, are carbon dioxide (CO_2), methane(CH_4), nitrous oxide (N_2O) and many fluorinated gases.

In this context with an environment oriented market, Cavagna Group has identified the GHG report as an opportunity to improve the knowledge about its emissions and related risks. Also, it is important to identify environmental impact areas in order to develop eco-solutions. This can lead to improved materials and energy efficiency, as well as the development of new products that can reduce greenhouse gas emissions.

1.3 OUR COMMITMENT TO THE ENVIRONMENT

Cavagna Group has always considered environmental commitment as one of the main principles of society.

Therefore, in order to implement effective and active action focused on the protection of the environment, in addition to carrying out activities in compliance with Italian and Community environmental legislation, Cavagna Group has launched a series of actions to prevent, manage and reduce environmental impact.

The main plant of the Cavagna Group, located in Calcinato, has implemented a certified environmental management system according to ISO 14001.

<u>Use renewable energy sources</u>

Cavagna Group employs renewable energy sources in some plants to minimize greenhouse gas emissions in order to prevent climate change, unanimously considering the most important global environmental challenges.

A photovoltaic generator was installed in the main plant. It covers the surface of the industrial structure roof of 3.080 m2 with 2.468 high efficiency monocrystalline silicon modules.

The annual energy generated by the plant is little more than 12% of the average annual consumption of the structure.

Moreover, a cogeneration plant for the production of biomass energy (crude vegetable oil) has been installed, with a rated power of 420 kW (electric) and 380 kW (thermal), which produces about 3.15 GWh of electricity per year.

Heat is recovered from the cogeneration engine and used as a heat source to warm up the plant and cool it in summer thanks to an absorption group.

<u>Reduction of energy consumption</u>

The energy consumption of the Calcinato plant is constantly monitored to identify areas of improvement. To this end, some compressors have recently been replaced with other more efficient ones.

Furthermore, the lighting systems of the structure are equipped with energy saving dimmer and in some areas LED lamps have been installed.

2 PRINCIPLES

The study of greenhouse gas (GHG) emissions has been conducted in accordance with the principles of GHG Protocol Corporate - Specifications and guidance at the organization level for the quantification and reporting of greenhouse gas emissions and their removal.

A) Relevance

The boundaries of the study reflect the economic reality of the Cavagna Group. The sources of greenhouse gas emissions from its companies have been identified and the relevant data for quantifying emissions has been collected.

B) Completeness

All greenhouse gas emissions from group companies have been identified, including all greenhouse gases listed in Annex C to ISO 14064-1.

C) Consistency

Data collection and calculation were based on the principle of consistency, so that information can be compared over the years.

Any changes to boundaries, methods or calculation factors will be justified and documented.

D) Accuracy

The Cavagna Group has reduced data collection and calculation errors through internal controls and a specific procedure within its quality system. Audits were carried out on the collected data, with a positive result.

E) Transparency

In the report, the inventory and all the information used for the calculation are transparently reported.

3 GHG INVENTORY DESIGN AND DEVELOPMENT

3.1 ORGANIZATIONAL BOUNDARIES

The organizational boundaries of the study include the following companies, based in various countries, belonging to the Cavagna Group:

- Bigas
- CGE
- CGA
- CG Brazil
- CGT
- CGUK
- CG Vietnam
- Cemco Kosangas
- CNA
- Congrif
- Cori
- Kosan
- KPAL
- Mesura
- Nirmal
- NP
- Omeca
- Reca
- Zhongshan
- Mesura Metering

The study was carried out according to the "control approach": the organization has accounted for all GHG emissions over which it has financial and operational control.

It is important to note that as of 2020, the company called GGI (Greengear Global) has been closed and for this reason does not fall within the organisation's confines.

All activities in the facilities within the organizational boundaries have been included in the analysis and accounting.

In some companies of Cavagna Group, data wasn't collected for the following reasons:

- Arusem: company without headquarters and staff;
- Cavagna Group South Africa because it was acquired on 1 December 2021 and the results are not significant for the entire year under review
- Gazprom Gas Engine Systems Ltd (RU) because the control is less than 50%
- Repco because the control is less than 50%
- Pergola because to be absorbed by Omeca at the end of 2019

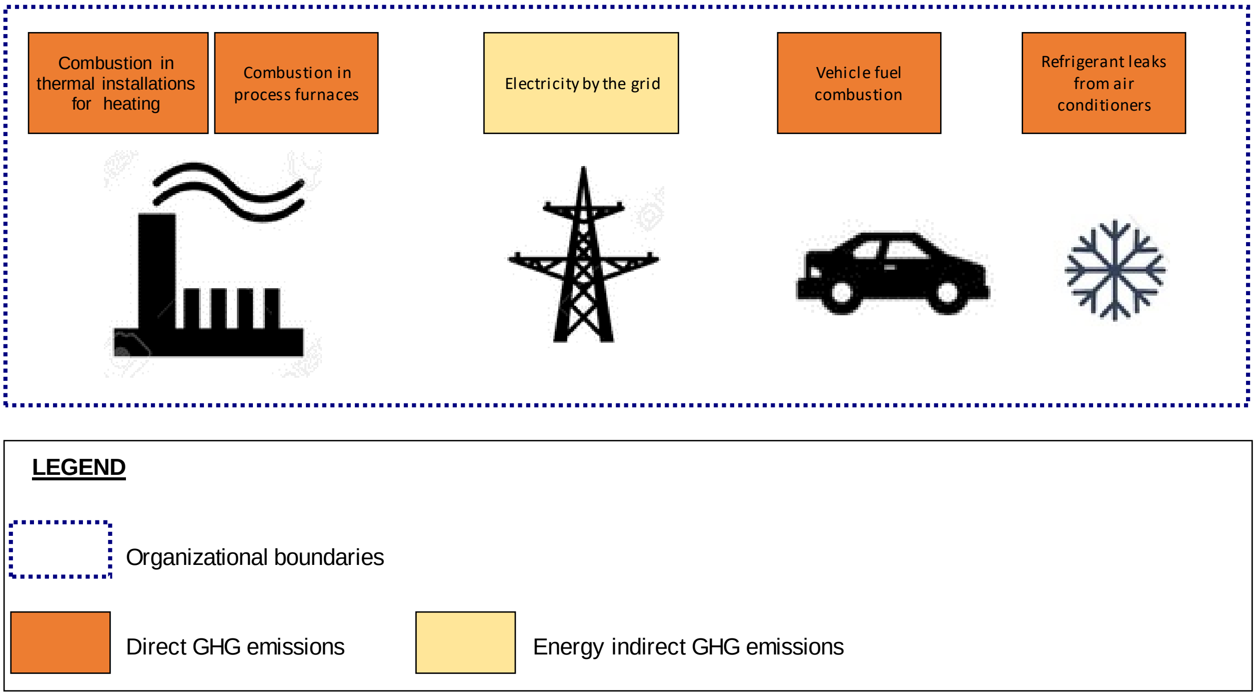
3.2 OPERATIONAL BOUNDARIES

The categories of GHG emissions provided by the protocol GHG are:

- Scope 1→ Direct GHG emissions: GHG emissions from sources within the organizational boundaries;
- Scope 2→ Energy indirect GHG emissions: GHG emissions from the generation of imported electricity, heat and steam;
- Scope 3→ Other indirect GHG emissions: GHG emissions from the products and services used by the organization, such as emissions from raw materials used, workers' mobility, etc.

The emissions considered in the present study are: Direct Emissions and Energy Indirect Emissions as defined in the following diagram (Scope 1 emissions and Scope 2 emissions).

Other indirect emissions are excluded from this study (Scope 3 emissions).



4 QUANTIFICATION OF GHG EMISSIONS

4.1 BASE-YEAR

The quantification of GHG emissions is related to the activities of the organization, according to the above-mentioned boundaries, from 01/01/2021 to 31/12/2021.

Being the third year of data collection and quantification, the previous quantification for the year 2019 is taken as the reference year.

4.2 EXCLUSION

All sources within the organizational boundaries are included in the collection and quantification and therefore there are no exclusions.

4.3 QUANTIFICATION METHODOLOGY

The calculation methodology is the following:

*GHG emissions = Activity data * EF*

where:

GHG Emissions is the quantification of GHG emissions from activity, expressed in terms of tons of CO2 equivalent (tCO2e)

Activity data is the quantity, generated or used, that describes activity, expressed in terms of energy (J o MWh), mass (kg) or volume (m^3 o l)

EF Is the emission factor that can convert activity data into the resulting GHG emission, expressed in CO2e emitted per activity unit

The result of the calculation is expressed in tonnes of CO2 equivalent (tCO2 e).

All the greenhouse gases listed in Annex C of ISO 14064-1 are considered in the calculation.

As the first report is concerned, no changes to the quantification method are relevant.

4.4 EMISSION FACTORS

The emission factors used in the calculation and the related sources are listed in the Annex 1.

4.5 GWP

The calculation is done using the "IPCC 2013 GWP 100 years" evaluation method that uses the following characterization factors:

Chemical name	Formula	GWP 100 years
Carbon dioxide	CO2	1
Fossil methane	CH4	30
Biogenic methane	CH4	28
Nitrogen dioxide	N2O	265

The results of the study are expressed in kg of CO2 equivalents per unit of product.

5 GHG SOURCES

5.1 GHG SOURCES AND INVENTORY

The sources of GHG emissions of the Cavagna Group identified are as follows:

Source	Source of Data	Emission Category
Combustion of fuels in thermal power stations for heating working environments Combustion in process furnaces	Fuel purchase invoices	Direct
Vehicle fuel combustion	Estimates from the average annual cost of purchasing fuels and purchase invoices	
Refrigerant leaks from air conditioners	Handbooks Plant or estimates	
Use of acetylene for welding	Estimates	
Imported electricity	Electricity purchase invoices	Indirect energy
Combustion of rapeseed oil in a cogenerator for the production of electricity.	Fuel purchase invoices	Other indirect

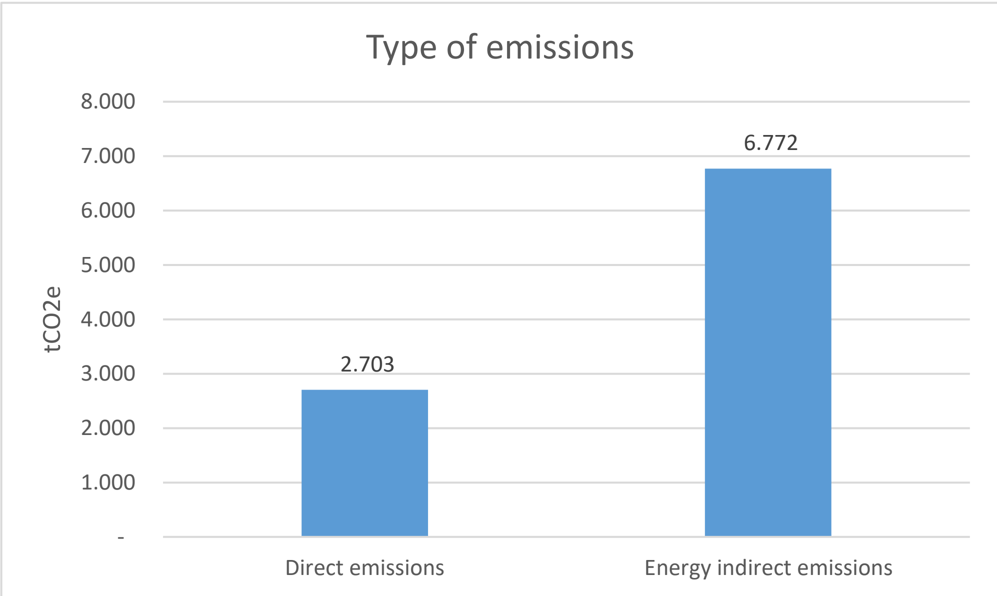
Pellet combustion for heating.		

Emission sources consist of central heating, used for heating the buildings, process furnaces, vehicles, welds, fluorinated gas conditioning systems.

Indirect emissions are related to the electricity from the grid used in offices and in various production processes.
Within the organizational boundaries there are no GHG absorbers.

6 GHG EMISSIONS

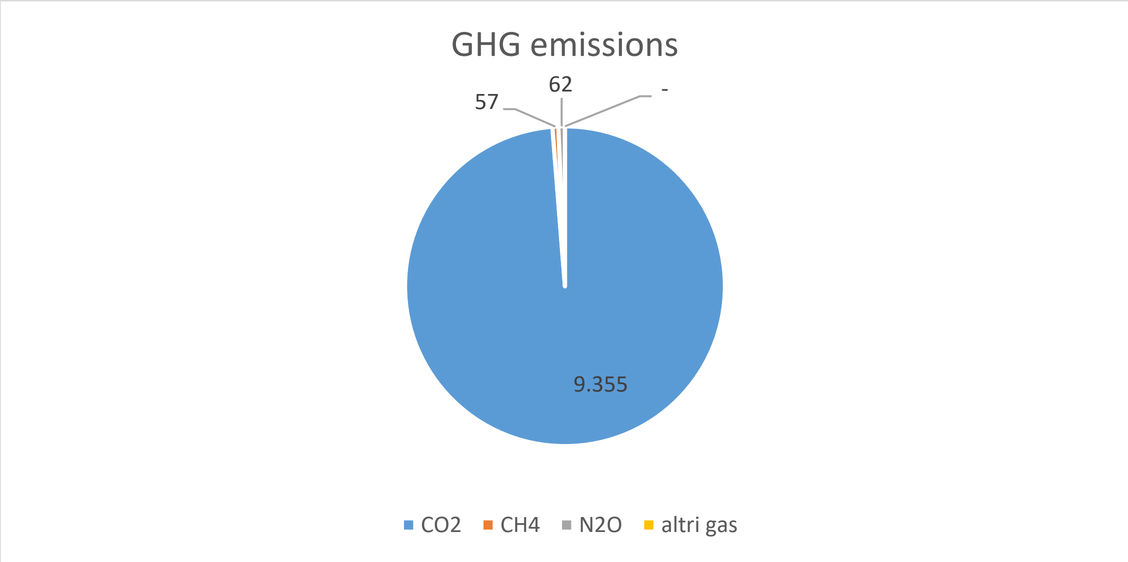
The Cavagna Group's GHG emissions are as follows:



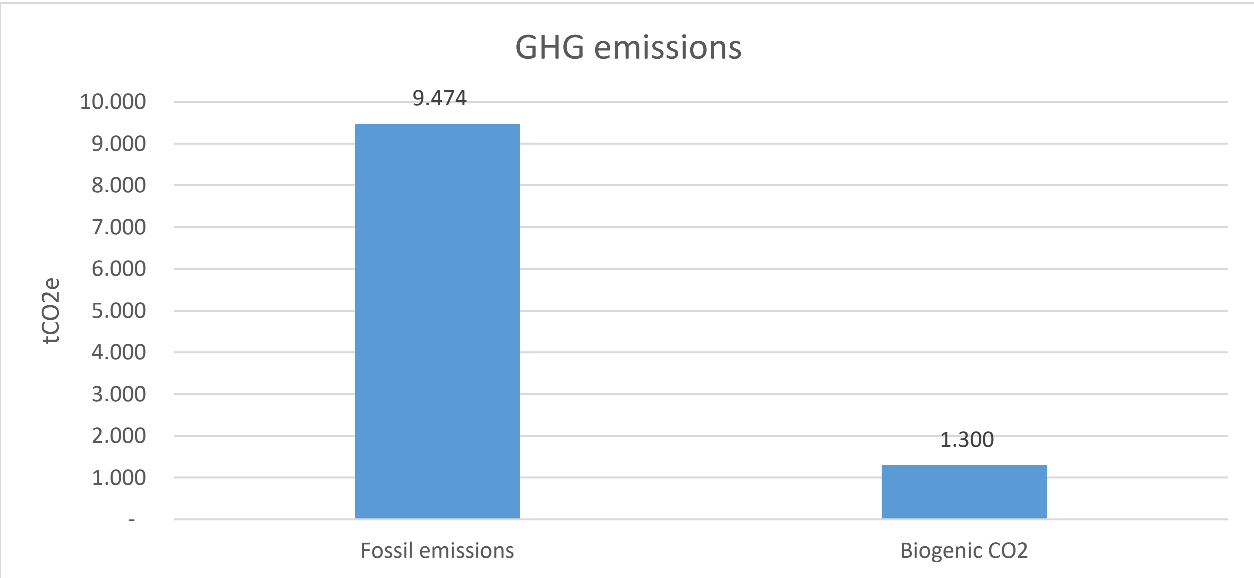
The emissions associated with the production of consumed electricity are predominant.

Compared to 2019, direct emissions increased slightly while indirect emissions from energy consumption decreased.

Among the various GHG, carbon dioxide prevails, as shown in the following graph (direct + energy indirect GHG emissions):

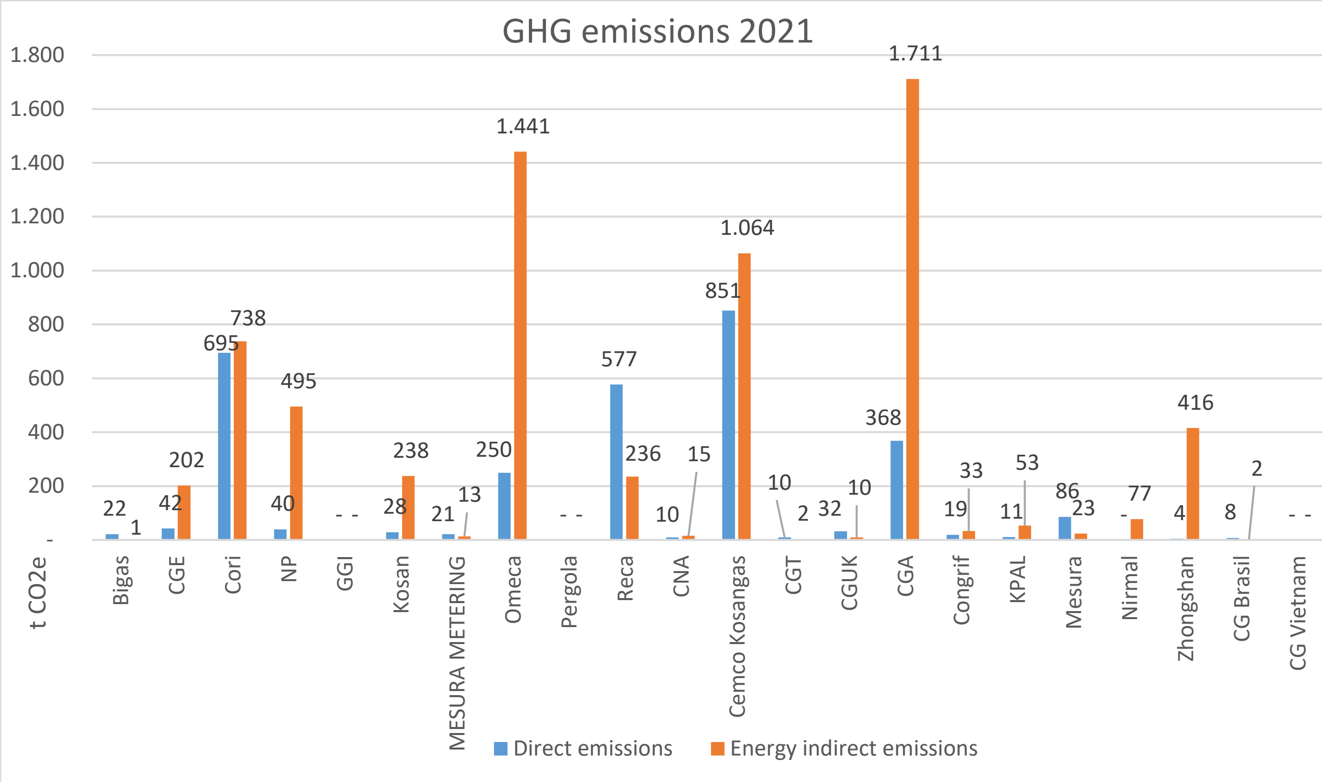


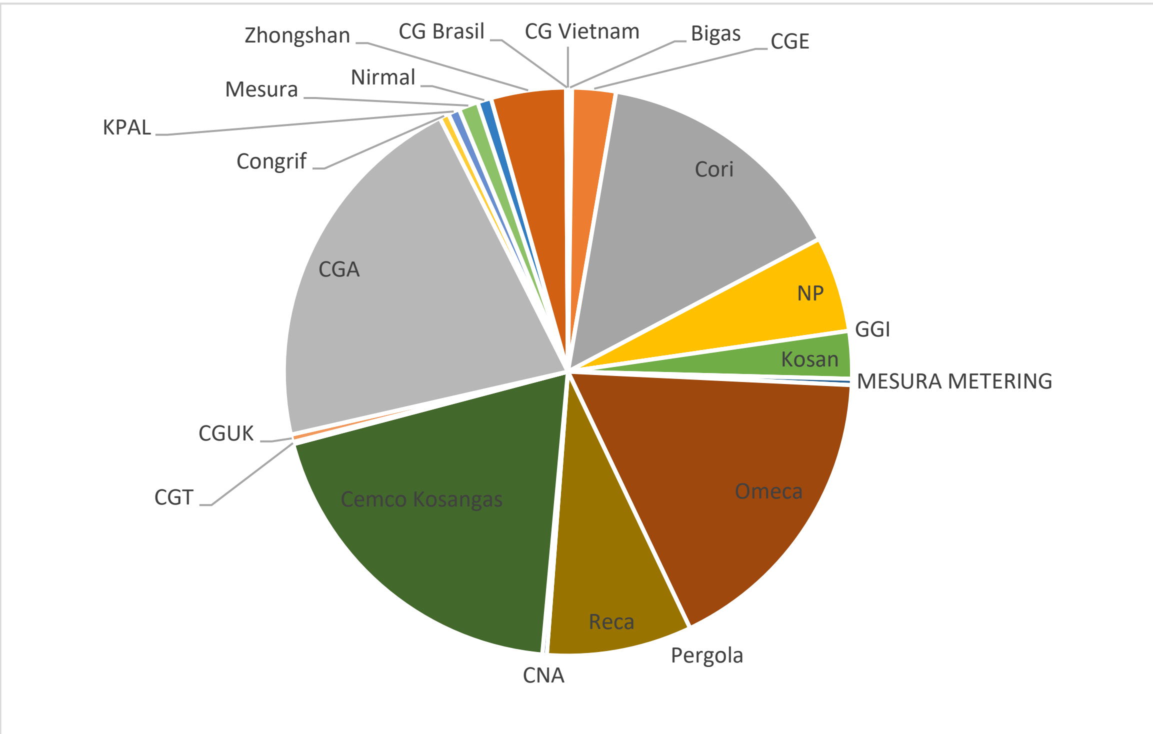
Biogenic CO2 emissions (combustion of rapeseed oil and pellets), which are not considered in the previous values since the same amount of carbon dioxide is absorbed during biomass growth, are about 1/5 of fossil emissions:



Among the various companies in the group, the plants with higher GHG emissions are

- Cori 1433 tCO2e
- Omeca 1691 tCO2e
- Cemco Kosangas 1915 tCO2e
- CGA 2079 tCO2e
- Reca 813 tCO2e



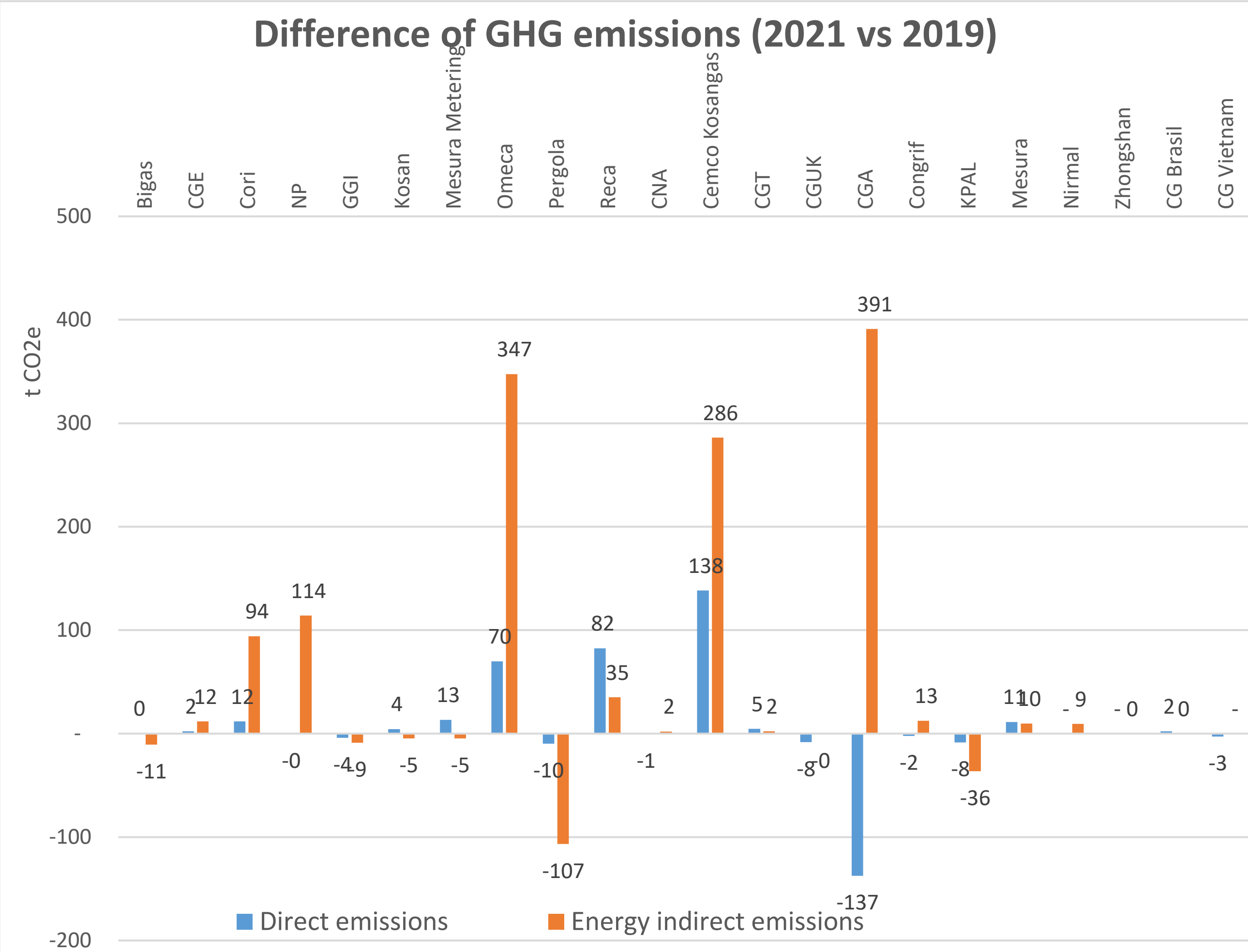


In the calculation of emissions from Omeca, it is not considered the environmental benefit deriving from the electricity produced in the rapeseed oil cogenerator, as this is sold to the national grid and does not go into self-consumption. The environmental advantage deriving from the self-consumption of electricity produced by photovoltaic panels has been considered.

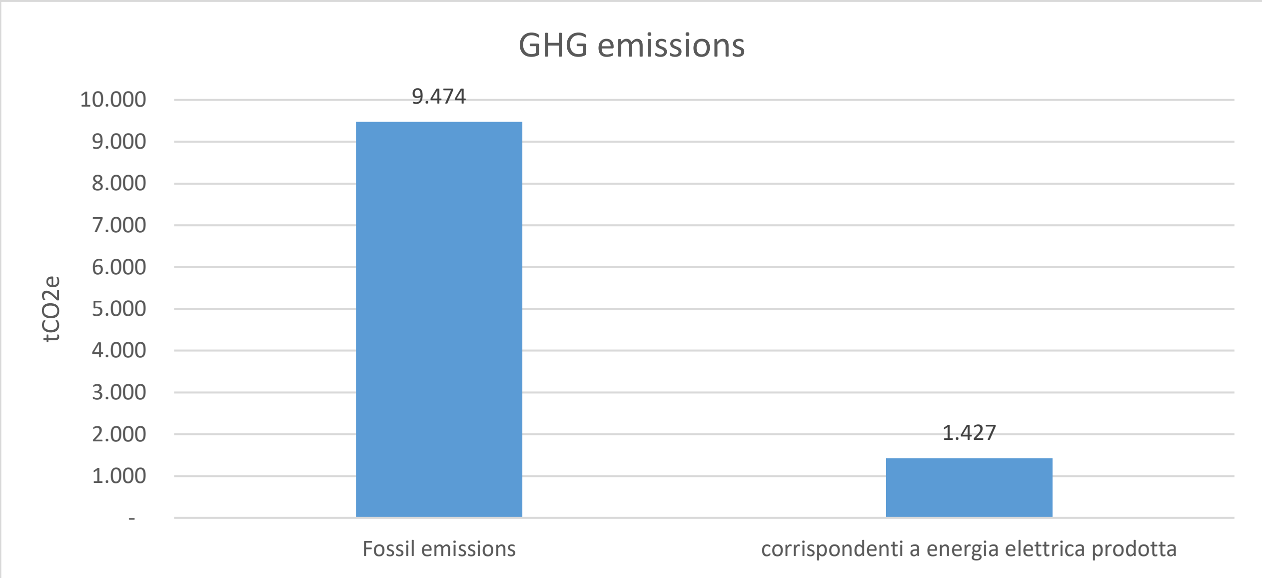
The loss of GGI from organisational boundaries can therefore be considered irrelevant given the very low level of the associated emissions.

Significant changes emerge from the comparison with the previous quantification of emissions, in particular:

- *Cori* *increase in emissions related to electricity consumption attributable to an overall increase in production;*
- *EnnePi* *increase in emissions related to electricity consumption attributable to an overall increase in production;*
- *Omeca* *increase in emissionsa related to electricity consumption attributable to an overall increase in production. The 2021 data also include data from the former Pergola.*
- *Cemco Kosangas* *increased direct emissions due to a considerable increase in LPG during the production process and indirect emissions from energy consumption as a result of increased production.*
- *CGA* *increase in indirect emissions from electricity consumption as a result of an increase in production, but at the same time a decrease in the car fleet, which reduced direct emissions considerably.*



The total GHG emissions are compared with those "avoided" thanks to the electricity production systems in the group companies (vegetable oil cogenerators and photovoltaic panels). Calculation is made by multiplying the electricity produced by the national electricity emission factor.



NOTE: at the moment no indicators for greenhouse gas emissions were introduced; it will be evaluated whether to introduce them during the next updates of the study.

6.1 ASSESSMENT OF UNCERTAINTY

The results of a greenhouse gas emissions study are always affected by a margin of uncertainty.
Each source of data was associated the following uncertainty in order to assess the overall uncertainty

Source	Data sources	Uncertainty
Combustion of fuels	Fuel purchase invoices	2% for natural gas 5% For other fuels where consumption is calculated by estimating stocks at the beginning and at the end of the year
Combustion of fuel for road transport vehicles	Estimates from the average annual cost of purchasing fuels and purchase invoices	20%
Losses of greenhouse gas coolers from air conditioning systems	Plant Handbooks or estimates	20%
Use of acetylene for welding	Estimates	20%
Greenhouse gas emissions from the produced electricity bought by the net	Electricity purchase invoices	2% because there are tax measuring instruments

The overall uncertainty of the study is 3%, less than 10%.

7 CONTACTS

Omeca's Environmental Management Function (FGA) is responsible for collecting data and editing this report. It uses the collaboration of quality (or environment) companies representatives involved in the analysis whose contacts are available in the organization charts.

8 ACRONYMS

CO_2	Carbon dioxide
CH_4	Methane
N_2O	Nitrogen dioxide
CO_2e	CO_2 equivalent
EF	Emission factor
GHG	Greenhouse Gas

ANNEX 1 – EMISSION FACTORS

The emission factors used in the calculation and the related sources are shown in the following tables.

Stationary combustion			
Fuels	**CO2**	**CH4**	**N2O**
Natural gas (Italy)	1,995 kg CO2/mc [1]	0,24 kg CH4/t [2]	0,0048 kg N2O/t [2]
Natural gas (worldwide data)	2692,8 kg CO2/t Density: 0,7 kg/mc at 0°C [2]		
LPG (Italy)	3024 kg CO2/t [1]	0,2365 kg CH4/t [2]	0,00473 kg N2O/t [2]
LPG (worldwide data)	2984,63 kg CO2/t [2]		
diesel – worldwide data	3186,3 kg CO2/t [2]	0,43 kg CH4/t [2]	0,0258 kg N2O/t [2]
Crude oil – worldwide data	3100,59 kg CO2/t [2]	0,423 kg CH4/t [2]	0,02538 kg N2O/t [2]
Pellet	1747,2 kg CO2/t [2] Biogenic CO2	4,68 kg CH4/t [2]	0,0624 kg N2O/t [2]
Rapeseed oil	2181,04 kg CO2/t [2] Biogenic CO2	0,274 kg CH4/t [2]	0,01644 kg N2O/t [2]

[1] ISPRA - Inventario nazionale italiano UNFCCC anno 2015

[2] GHG protocol - Emission Factors from Cross Sector Tools April 2014 – Stationary Combustion

Transport fuel use			
Fuel	**CO2**	**CH4**	**N2O**
Petrol	2,27 kg CO2/l [3]	0,0001 kg CH4/l [3]	0,0000 kg N2O/l [3]
Diesel	2,68 kg CO2/l [3]	0,0000 kg CH4/l [3]	0,0000 kg N2O/l [3]
LPG	1,61 kg CO2/l [3]	0,0002 kg CH4/l [3]	0,0003 kg N2O/l [3]
Natural gas	2,67 kg CO2/kg [3]	0,5970 kg CH4/kg [4]	0,0405 kg N2O/kg [4]

[3] GHG protocol - Emission Factors from Cross Sector Tools April 2014 – Transport fuel – other region

[4] UK government - Greenhouse gas reporting - Conversion factors 2016 - https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2016

Refrigerant gas	
HFC 410 A	50% R32 and 50% R125 [5]

[5] Gas stoichiometric composition

Welding	
Acetylene	3,38 kg CO2/kg [5]
CO2	1 kg CO2/kg

[5] Gas stoichiometric composition

Electricity emission factors			
Country	**CO2**	**CH4**	**N2O**
Italy	325,2 g CO2/kWh [6]	0,21% CO2 emissions [6]	0,50% CO2 emissions [6]
UK	348,9 g CO2/kWh [7]	0,18% CO2 emissions [7]	0,60% CO2 emissions [7]
Francia	34,8 g CO2/kWh [8]	0,18% CO2 emissions [13]	0,60% CO2 emissions [13]
Portogallo	359,5 g CO2/kWh [8]	0,18% CO2 emissions [13]	0,60% CO2 emissions [13]
Brasile	158,1 g CO2/kWh [9]	0,18% CO2 emissions [13]	0,60% CO2 emissions [13]
Cile	614 g CO2/kWh [9]	0,18% CO2 emissions [13]	0,60% CO2 emissions [13]
Cina	895,5 g CO2/kWh [9]	0,18% CO2 emissions [13]	0,60% CO2 emissions [13]
India	903 g CO2/kWh [9]	0,18% CO2 emissions [13]	0,60% CO2 emissions [13]
Tailandia	569 g CO2/kWh [9]	0,18% CO2 emissions [13]	0,60% CO2 emissions [13]
Turchia	472 g CO2/kWh [10]	0,18% CO2 emissions [13]	0,60% CO2 emissions [13]
USA	343,9 g CO2/kWh [12]	0,01% CO2 emissions [12]	0,31% CO2 emissions [12]

[6] ISPRA- Fattori di emissione atmosferica di CO2 e altri gas a effetto serra nel settore elettrico 257/2017 - Tabella 2.4 Dato produzione – dati anno 2017; tabella 2.12 altri gas anno 2016

[7] UK Government - GHG Conversion Factors for Company Reporting -2017

[8] UE- http://www.eea.europa.eu/data-and-maps/indicators/overview-of-the-electricity-production-2/assessment

[9] List of Grid Emission Factors - https://pub.iges.or.jp/pub/list-grid-emission-factor

[10] DEFRA - 8th October 2014 Guidelines for DEFRA/DECC's GHG - Conversion Factors for Company Reporting.

[11] ECOMETRICA - Technical Paper | Electricity-specific emission factors for grid electricity - August 2011 https://ecometrica.com/assets/Electricity-specific-emission-factors-for-grid-electricity.pdf

[12] EPA - https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub

[13] In the absence of data on CH4 and N2O emissions from electricity generation in other countries, the same percentage of UK

The specified emission factors refer only to emissions related to electricity generation and do not include distribution and transformation losses, classified as "other indirect emissions".