CARBON FOOTPRINT

GHG Standards Compliance

Industrie Generali spa

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SUMMARY

Introduction

Carbon footprint is an indicator used to estimate the quantity of greenhouse gas emissions, specifically those with an impact on climate change, generated directly or indirectly by an individual, a company, an event, a product, or a nation.

The measurement used for the carbon footprint is expressed in terms of tons of CO2, or CO2 equivalent if the estimation includes not only carbon dioxide (CO2) emissions but also other greenhouse gases, such as methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), or sulfur hexafluoride (SF6), as defined by the Kyoto Protocol, an international agreement signed in 1997 to combat climate change. CO2 equivalent is used to indicate the global warming impact of a certain quantity of greenhouse gases compared to the impact of the same quantity of CO2.

There are two main methodologies commonly used to calculate the carbon footprint of companies. On one hand, there's the GHG Protocol produced by the World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). On the other hand, there's the standard produced by the International Organization for Standardization (ISO), with specific reference to ISO 14064.

The standards and guidelines of the GHG Protocol are a system designed to allow companies to measure, manage, and report greenhouse gas emissions from their operations and value chains. Through sector-specific tables with standards and emissions data for different sectors and hydrocarbons, these protocols enable companies, as well as cities or nations, to prepare reliable reporting of their emissions, covering all six greenhouse gases included in the Kyoto Protocol.

Scope definition and Carbon Intensity

In the calculation of carbon footprint, it's important to choose the measurement scope, which means deciding whether to include only direct emissions (Scope 1), or also those arising from electricity consumption (Scope 2), and finally, whether to examine indirect emissions emitted along the entire supply chain (Scope 3).

When calculating the carbon footprint of a product or service, emissions from all greenhouse gases (GHGs) must be considered. These emissions are converted into CO2 equivalent using parameters established globally by the Intergovernmental Panel on Climate Change (IPCC), an organization operating under the auspices of the United Nations.

The calculation of the carbon footprint of a product or service should take into account all stages of the supply chain, starting from raw material extraction to waste disposal, following the Life Cycle Assessment (LCA) approach. Specifically, as seen in Figure 1, the scopes include:

1. Scope 1: t All direct emissions produced by companies. This index includes emissions from agriculture and livestock, internal industrial processes, internal transportation, and waste disposal generated within the company.
2. Scope 2: All indirect emissions produced by companies. In this category, all emissions related to electricity consumption in any form, whether primary, secondary, photovoltaic, more or less renewable, are calculated.
3. Scope 3: All emissions produced by processes external to the company, including the transportation of raw materials and the transportation of the finished product, as well as emissions from employee business travel and waste disposal outside the company's boundaries.

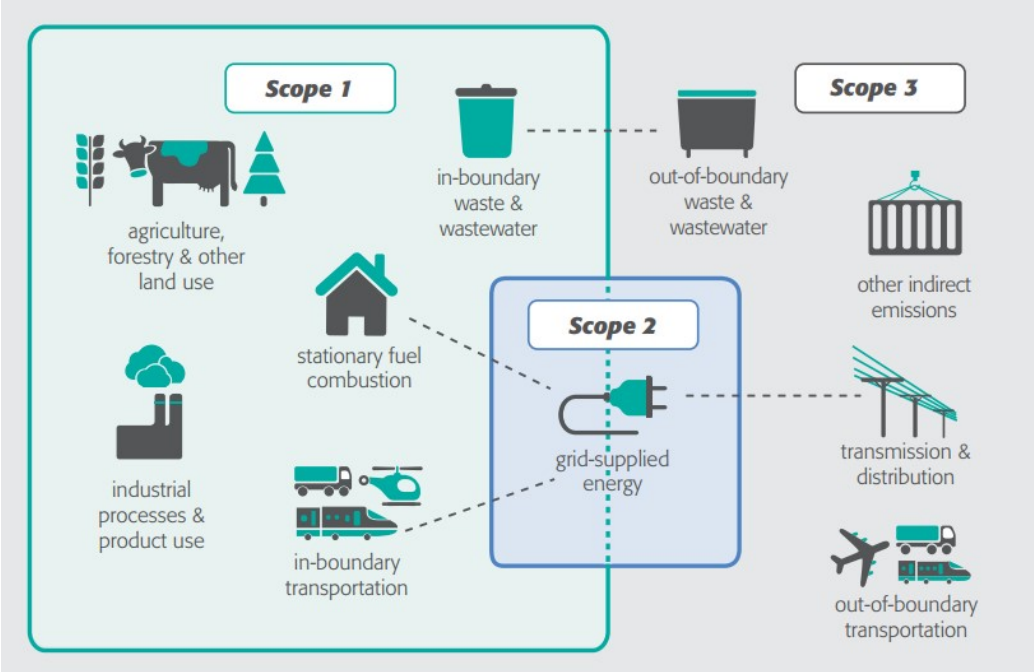


Figure 1 - Scope definition

These scopes provide a comprehensive view of the environmental impact of a product or service, considering both direct and indirect emissions throughout its life cycle.

Included in the inventory are greenhouse gas emissions from Scope 1, Scope 2, and also certain categories of GHGs from Scope 3 that, for example:

- Are quantitatively significant relative to the total,
- Contribute to the company's risk profile (e.g., climate risks),
- Are considered material by stakeholders regarding the corporate profile and its activities,
- Can be reduced through direct and indirect actions by the company.

To understand the impact of emissions on their own company, metrics are used. The recommended carbon metric by GHG Standards used in the analysis of corporate actions and obligations is as follows:

- Carbon intensity: the total intensity of greenhouse gas emissions from Scope 1 and Scope 2 of the portfolio (based on emitter revenues), directly attributable to the investor through their share of ownership in the total market value of companies. It is measured in tCO2e per million euros of revenue.

Metodology

The calculation of the Carbon Footprint is an important analysis for Italian companies. Like any measurement related to standard protocols, it involves mandatory steps. Every good analysis should include:

1. Planning: The Carbon Footprint, also known as the "organization's carbon footprint," is crucial in planning decarbonization measures. It provides the emissions baseline and a precise indication of which company activities generate the most greenhouse gas emissions. This allows for the prioritization of decarbonization efforts in terms of technical, planning, and cost-benefit considerations.

2. Monitoring: Regular updates, typically conducted annually or at intervals of a few years, enable the monitoring of the effectiveness of the actions taken and progress toward achieving objectives.

3. Communication: Creating a Carbon Footprint is also essential for corporate communication. It demonstrates a quantitative and structured approach to addressing the climate impact, while also meeting the requirements of major sustainability reporting standards (such as the Global Reporting Initiative Standard, GRI).

The procedure followed in a company to prepare the report typically includes the following steps:

- Identification of Sources: Identifying the sources of greenhouse gas emissions within the organization, which may include Scope 1 (direct emissions), Scope 2 (indirect emissions from energy consumption), and relevant Scope 3 emissions.
- Quantification Methodology: Developing a methodology for quantifying emissions, including choosing appropriate emission factors and conversion factors for different greenhouse gases.
- Data Collection: Gathering data related to emissions sources, energy consumption, production processes, transportation, and other relevant activities.
- Calculation of Greenhouse Gas Emissions: Using the data and quantification methodology to calculate the emissions of greenhouse gases, typically expressed in terms of CO2 equivalent.

By following these steps and conducting a comprehensive Carbon Footprint analysis, companies can gain insights into their emissions profile, prioritize decarbonization efforts, track progress, and communicate their sustainability efforts effectively.

Sources identification

Although responsible sources of CO2 equivalent emissions in the atmosphere are numerous, sources in an industrial company like the one under consideration can be grouped into macro areas:

- Electrical energy drawn from the grid or generated by photovoltaic systems
- Thermal energy used for processes, such as natural gas, LPG, and other fossil fuels, liquid or gaseous
- Refrigerants used in heat pumps, chillers, and air conditioners
- Analysis of company vehicle transport and employee transportation
- Analysis of chemical reactions under the hood

- Analysis of insulating gas leaks in electrical panels
- Analysis of dust generated during company processes
- Waste disposal
- Analysis of transportation related to raw material purchases

Quantification Methodology

Each process mentioned in the sources produces a different amount of the 6 identified greenhouse gases. To calculate their impact, the GHG Protocol Corporate Standard conversion factors are used, allowing the identification of the quantity of greenhouse gas produced for each identified source. As an example, the following are reported:

- For electrical energy, the quantity of renewable energy purchased is considered.
- For thermal energy, the calorific value of fossil fuels, liquid or gaseous, is considered.
- For the quantity of refrigerant, the average lost during the year is considered, or it is based on maintenance reports of the machinery in question.
- For transportation analysis, emissions due to different vehicle engines are calculated, considering the length of the journeys made.
- For electrical panels, it is based on maintenance reports of the same.

Data Collection

The company has provided the following data:

- Electric and thermal energy bills
- Any production through photovoltaic systems
- List of machinery with technical specifications
- List of produced and disposed of waste
- Information on employee transportation and company vehicles
- Origin of raw materials and destination of finished products
- Maintenance reports of electrical panels, heat pumps, refrigerants, and air conditioners.

Calculation of Greenhouse Gas Emissions

The calculation has been carried out using the aforementioned standards, and each greenhouse gas has been converted into CO2 equivalent using Table 3 - GWP for greenhouse gases in Annex B, which identifies the conversion factor to indicate the hazardousness of each greenhouse gas compared to carbon dioxide.

Company description

To carry out the calculation, it is necessary to first define the physical and temporal boundaries within which the organization operates, taking care to include all possible connected and associated units.
Once the boundaries have been established, the identification of greenhouse gas emission sources can proceed, and data related to the activity can be collected. We choose to present only the data related to Scope 1 and Scope 2 emissions.
The facility of Industrie Generali S.p.A. is located in an industrial area on the outskirts of the municipality of Vanzaghello and consists of two buildings:

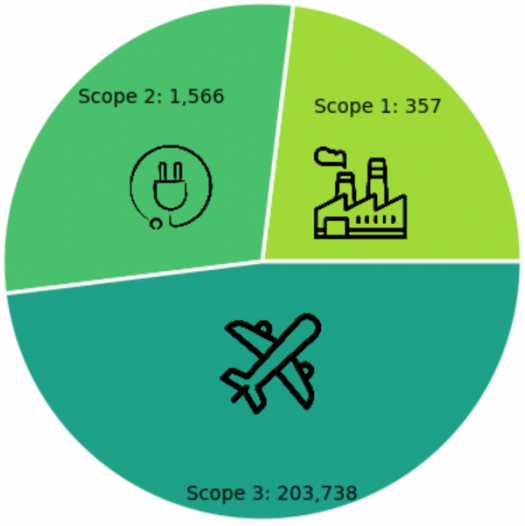
- Production: single-story warehouse of 1,300 square meters, housing the main production cycle consisting of two Turbo lines for the production of plastic materials, covering 700 square meters, a warehouse of 300 square meters, a laboratory of 80 square meters, and offices/services of 220 square meters.
- Warehouse: single-story warehouse of 3,325 square meters, housing an office area of 152 square meters, while the remaining space is dedicated to the warehouse.

The company's primary activity is the production of plastic materials. The main part of the production cycle to obtain the finished product consists of:

- Turbo mixers, coolers, and accessories for preparing the dry-blend of PVC to feed the extrusion plants.
- Granulation lines for the transformation of plasticized and crystal PVC; in addition to twin-screw extruders, there are all the accessories to complete the PVC transformation process.

Results

Here are the results derived from the analysis of the company's processes. The figure shows the aggregated data by scope, converted into CO_2 equivalent. The company produced 357 tons of CO_2 for Scope 1, 1,596 tons of CO_2 for Scope 2, and 203,738 tons of CO_2 for Scope 3 in 2023. The total emissions expressed in CO_2 equivalent amount to 205,661 tons. Continuing with a more in-depth analysis, it is possible to identify different areas for each Scope. For each area, the incidence in tons for each individual greenhouse gas is calculated for 2023. Table 1 analyzes the greenhouse gases for the sources included in Scope 1, Table 2 analyzes the greenhouse gases for the sources included in Scope 2, and subsequently, the emissions for Scope 3 are analyzed.



Moving forward with a more detailed analysis, it is possible to identify distinct categories within each Scope. For each category, the impact in tonnes of each individual greenhouse gas is calculated for the calendar year 2023. Table 1 examines the greenhouse gases for the sources included within Scope 1, while Table 2 delves into the greenhouse gases for the sources included within Scope 2.

Scope 1	CO_2	N2O	CH4	HFC	PCF	SF6
Thermic Energy (CH4)						
Thermic Energy (Gasoline)	10,196	4,414E-04	8,828E-05			
Thermic Energy (fuel)	11,523	1,192E-04	1,192E-05			
GPL	20,584	3,669E-04	3,669E-05			
Refrigerants				315,200		
Electric Panels						

Table 1 - Scope 1, year 2023

Scope 2	CO_2	N2O	CH4	HFC	PCF	SF6
Electric energy (primary)	1.565					
Electric energy (FV)						

Table 2 - Scope 2, year 2023

Scope 3	CO_2	N2O	CH4	HFC	PCF	SF6
Transport MP	43.062	1,864	0,373			
Business trip						
Distribution	160.676	2,866578	2,867E-01			

Table 3 - Scope 3, year 2023

Regarding Scope 1 and 2, which are the company's direct contributions, the largest impact for the company is due to the use of electricity, which produces the majority of CO_2 tons for Scope 2. There were no SF6 losses due to maintenance of electrical switchgear. Including Scope 3 as well, the predominance of the latter is evident. The distribution of finished products produces by far the highest tons of CO_2.

It is possible to provide a final analysis by studying the percentage composition over the years. This allows for an immediate temporal comparison. Figure 2 analyzes the percentage for each scope for each year on the left axis. On the secondary axis, the total CO_2 equivalent emitted in that year, expressed in tons, is shown.

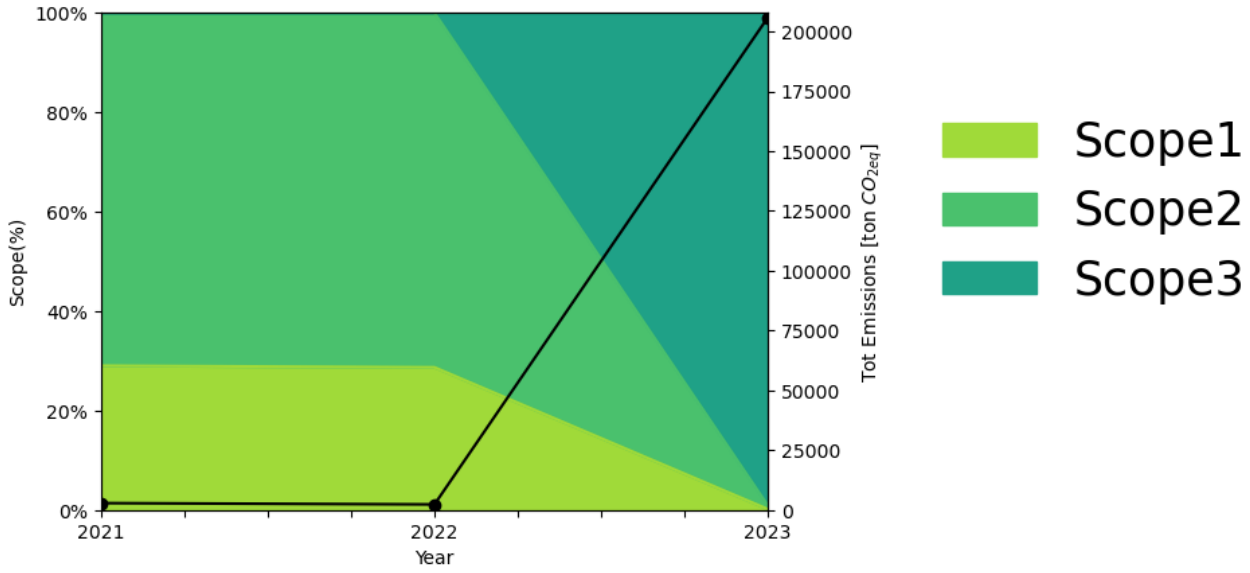


Figura 2 - Scope percentage

In Figure 4, the percentage of greenhouse gases emitted relative to the total is analyzed over the years. The dashed black line always represents the total emissions expressed in CO_2 equivalents. In Figure 5, the percentage of greenhouse gases emitted for each usage within the company's processes is examined.

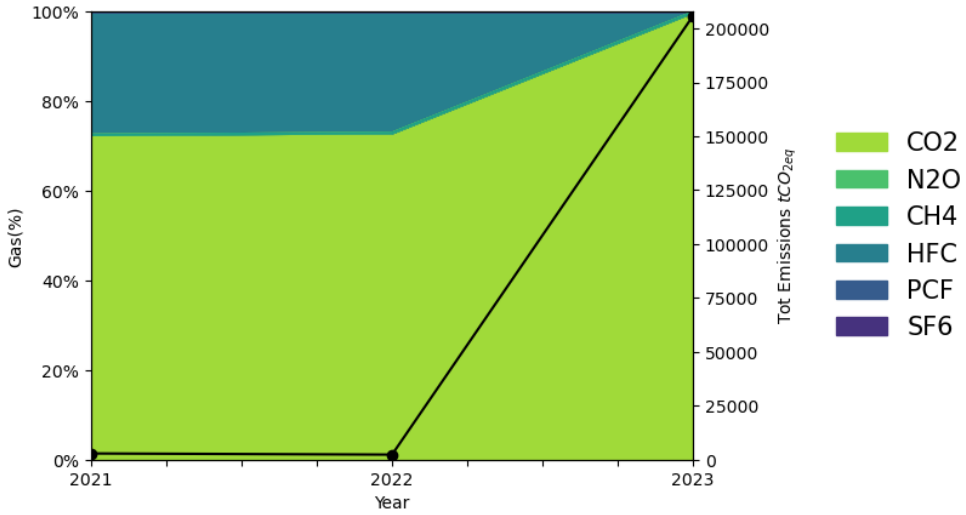


Figura 3 - Percentage of GHG

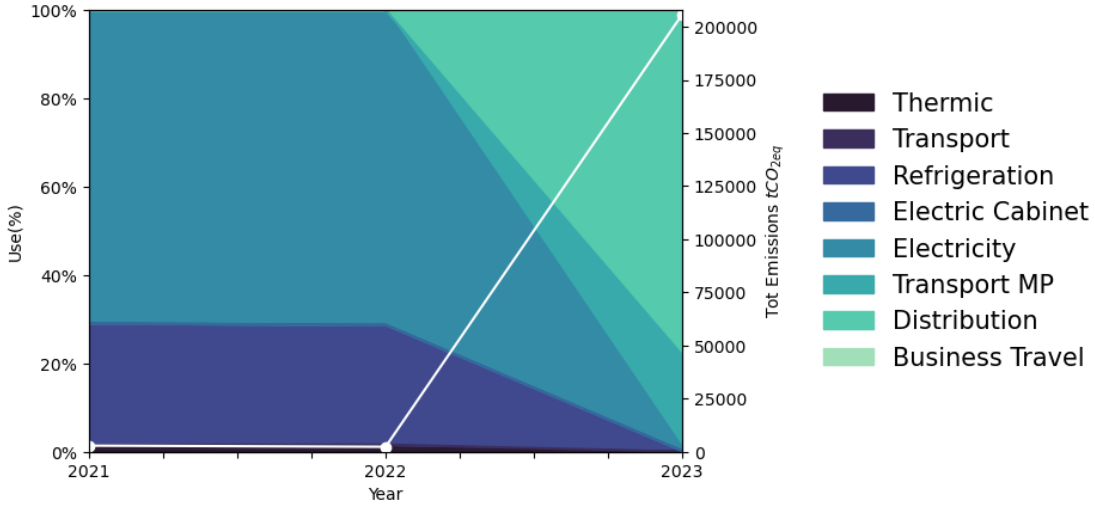


Figura 4 - Use percentage

Carbon dioxide stands out as the predominant greenhouse gas emitted in all the years analyzed. Greenhouse gases from refrigerants represent the second-highest percentage of emissions. The overall trend of emissions over the years shows a minimum point in 2022. Since 2023 is the first year in which Scope 3 is analyzed, it is not meaningful to compare the results with previous years.

Scope 3, by considering factors beyond the company's geographical boundaries, tends to partially alter the view of the company's carbon footprint being examined. In absolute terms, the tons of CO_2 emitted due to the distribution of finished products and the sourcing of raw materials overshadow any other result. It is worth noting that the sum of the emissions directly attributed to the company, that is, the sum of Scope 1 and Scope 2, has decreased over the years.

	2021	2022	2023
Scope 1 (ton CO_2)	831	667	357
Scope 2 (ton CO_2)	2.033	1.658	1.566
Scope 3 (ton CO_2)	-	-	203.738

Carbon Intensity

Lastly, the chart below presents an analysis of revenues, total emissions, and carbon intensity calculated as the ratio of the first two quantities. Where possible, values for previous years have also been included. Revenue has declined, and the decision was also made to analyze Scope 3. Considering these values, the carbon intensity is around 6.58 kg CO_2 per euro.

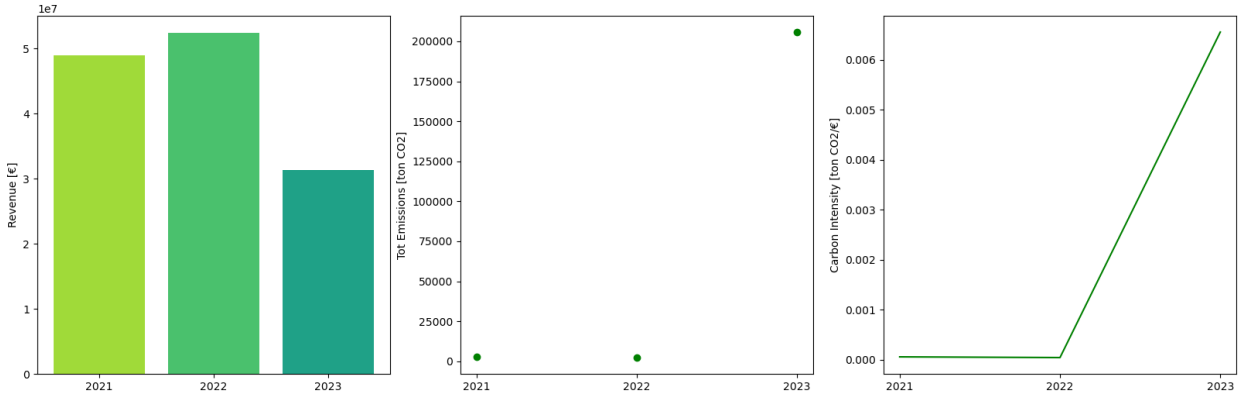


Figure 5 - Carbon Intensity

For completeness, here are the tables for the years analyzed:

2022	Amount of fuel	Units	CO_2	CH_4	N_2O	HFC	PCF	SF6
CH4								
Gasoline	2184	litres (l)	5,845459	0,000237	4,73316E-05			
Fuel	4605	litres (l)	10,4616	0,000453	9,05767E-05			
GPL	13303	Kg	21,000	3,328E-04	3,328E-05			
Refrigerants	0,4	Kg				630,400		
Electric Panels								
Elettricity	5366525	kWh	1658,256					

2021	Amount of fuel	Units	CO_2	CH_4	N_2O	HFC	PCF	SF6
CH4								
Gasoline	2402,4	litres (l)	6,43044	0,002603	5,20648E-05			
Fuel	5065,5	litres (l)	11,507765	0,0004982	9,96343E-05			
GPL	15744	litres (l)	25,375	4,021E-04	4,021E-05			
Refrigerants	0,5	Kg	0,000	0,000	0,000	788,000	0,000	0,000
Electric Panels								
Elettricity	6580262	kWh	2033,301					

Annex A

The analysis and reports according to GHG standards should be based on the following principles:

- Relevance: Ensure that the GHG inventory adequately reflects the company's emissions and meets the decision-making needs of both internal and external stakeholders.
- Completeness: Account for and report on all sources and activities of greenhouse gas emissions within the chosen inventory boundary. Disclose and justify any specific exclusions.
- Consistency: Use consistent methodologies to enable meaningful comparisons of emissions over time. Transparently document any changes to data, inventory boundary, methods, or any other relevant factors in the time series.
- Transparency: Address all relevant issues factually and consistently, based on a clear audit trail. Disclose any significant assumptions and make appropriate references to accounting and calculation methodologies and data sources used.
- Accuracy: Ensure that the quantification of greenhouse gas emissions is neither systematically overestimated nor underestimated relative to actual emissions, to the best of your judgment. Aim for reduced uncertainties where possible. Achieve sufficient precision to enable stakeholders to make decisions with reasonable confidence in the accuracy of the reported information.

Annex B

GHG STANDARD	GAS GWP
CO_2	1
CH_4 fossile	30
CH_4 biogenico	28
N_2O	265
HFCs	4 -12400
PFCs	6630-11100
SF_6	23500
NF_3	16100

Table 4 - GWP for each gas

	u.m.	PCL	u.m.	CO2
Natural Gas	tep/Smc	0,000825	tCO2/Smc	0,001968
Gasoline	tep/l	0,000848	tCO2/l	0,002641523
Fuel	tep/l	0,000781	tCO2/l	0,002347898
Oil	tep/t	0,98	tCO2/t	3,14
GPL	tep/t	1,102	tCO2/t	3,024
Carbon	tep/t	0,6	tCO2/t	2,351
Wood	tep/t	0,25	tCO2/t	0
Cooling energy	tep/MWh		tCO2/t	0,337
Thermic energy	tep/MWh	0,095556	tCO2/t	0,001968
Electric energy	tep/MWh	0,187	tCO2/MWh	0,337

Table 5 - Conversion factors

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