



GHG EMISSIONS REPORT

20
23

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01

GLOSSARY and ABBREVIATIONS

CO₂e

Carbon dioxide equivalent

The universal measurement unit to indicate each of the six main Greenhouse Gases' global warming potential (GWP), relative to a carbon dioxide unit. It assesses the release (or avoidance) of different greenhouse gases on a common basis.

GHG

Greenhouse gases

For the purposes of the standard used, GHGs are the six gases listed in the Kyoto Protocol: carbon dioxide (CO₂); methane (CH₄); nitrous oxide (N₂O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulfur hexafluoride (SF₆).

GHG emissions

GHGs release to the atmosphere.

Direct GHG emissions

Self-reported emissions from company-owned or controlled sources.

Indirect GHG emissions

Emissions resulting from companies' operations, occurring at sources owned or controlled by another. The most common example is electricity consumption.

GWP

Global Warming Potential. A factor describing the radiative impact force (degree of damage to the atmosphere) of a GHG given unit relative to a CO₂ unit.

Life Cycle Assessment (LCA)

A product's assessment relative to GHG emissions. It considers each step of its life cycle, including resource extraction, production, use and waste disposal.

Organizational boundaries

Company operations considered within the scope of GHG emissions accounting and reporting.

Equity approach

Under this approach, a company measures GHG emissions from operations following its equity interest in the operation. The equity interest reflects the economic interest, the extent to which a company has rights to the risks and benefits from an operation.

Financial control

When the company controls the financial and operative policies that govern it, as part of its economic activities.

Control approach

Under it, a company fully accounts GHG emissions from operations it controls. Does not consider GHG emissions from operations where it has interest but does not control. Control is defined in financial or operational terms. When using it to consolidate GHG emissions, companies should choose between **operational or financial control approach**.

Global Climate Action Agenda (GCAA)

Initially named Lima Paris Action Agenda, the GCAA was launched to spur rapid climate action, boost cooperation between governments, local authorities, the business community, investors, and civil society supporting adoption and implementation of the Paris Agreement.¹

Operational control

When a company or one of its subsidiaries have full authority to introduce and implement policies to the operation. This criteria follows many companies' current accounting and reporting practices, reporting emissions from the facilities they administer (i.e., for which they hold the operating license). It is expected that (in most cases), if the company or one of its subsidiaries is the operator of a facility, it will have full authority to introduce and implement its operating policies, therefore holding operational control. Under it, a company accounts for 100% of the emissions from operations over which it controls.

Scope

Defines operational boundaries for direct and indirect GHG emissions. To differentiate direct and indirect sources, improve transparency, and provide usefulness for different types of organizations, climate policy types, and business objectives, three "scopes" (Scope 1, 2 and 3) are defined for GHG accounting and reporting. Scopes 1 and 2 are defined to ensure that two or more companies will not account for emissions in the same scope. This befits scopes to be used in GHG programs where double counting is important. Companies should account and report separately on Scopes 1 and 2 as a minimum.

Scope 1 inventory

Direct GHG emissions are from sources owned or controlled by the company, i.e., emissions from combustion in furnaces, vehicles, etc., owned or controlled by itself; emissions from chemical production in owned or controlled equipment. Direct CO₂ emissions from biomass combustion shall not be included in Scope 1, rather reported separately. GHG emissions not covered under the Kyoto Protocol, e.g. CFCs, NO_x, etc. shall not be included in scope 1, but can be separately reported.

¹ UNFCCC (2015). Global Climate Action Agenda. Lima/Paris: United Nations Framework Convention on Climate Change. Available at:

https://sustainabledevelopment.un.org/content/documents/16533Concept_note_GCAA_and_SDG_side_event_07182017_final_14_juillet_2.pdf

Scope 2 Inventory

Scope 2 accounts for GHG emissions from purchased electricity generation consumed by the company. Purchased electricity is defined as purchased or otherwise brought within the company's organizational boundaries. Scope 2 emissions occur physically at the facility where the electricity is generated.

Scope 3 Inventory

Scope 3 is an optional reporting category (for SMEs) that measures all other indirect emissions. They result from the company's activities but occur at sources not owned or controlled by it. Examples include extraction and production of purchased materials; transportation of purchased fuels; and use of products and services sold.

Base year

Companies should choose and report a base year where verifiable emissions data are available and explain reasons for that year's perusal. The inventory base year can also be used to establish and track progress towards a GHG target, calling it as a target base year.

Value chain

GHG emissions from upstream and downstream activities associated with the company's operations.

Emission Factor (EF)

A representative value that attempts to measure the pollution emitted to the atmosphere as a result from a company's activity within organizational boundaries.

WBCSD

World Business Council for Sustainable Development.

WRI

World Resource Institute.

ton.km - Ton.kilometer

A freight unit of measurement representing the transport of one ton (1,000 kilograms) of goods over one kilometer.

tCO₂e

Metric Tons (equal to 1,00 kilograms) of Carbon dioxide's GWP equivalent units (please see CO₂e definition).

CO₂

Carbon dioxide.

CH₄

Methane.

N₂O

Nitrogen dioxide.

HFC

Hydrofluorocarbons.

CBP

Perfluorocarbons.

SF₆

Sulfur Hexafluoride.

02 INTRODUCTION

Global warming and climate change hold a foremost position within sustainable development. They are defined as the persistent climate variations directly or indirectly caused by human activity, resulting from the increase of Greenhouse Gases' (GHG) atmospheric concentration over natural threshold levels.

Several governments are taking action to reduce their GHG emissions, through national policies that include the introduction of emission trading systems (ETS), voluntary programs, carbon and energy taxes, as well as laws and regulations on energy efficiency and emissions.

Therefore, enterprises must be capable of understanding and managing their GHG emissions to ensure long-term success within a competitive business environment, also befitting them to comply with future national or regional climate policies. Consequently, carbon footprints are widely used as an international and accurate tool to measure and quantify a product's impact on the environment.

Sistema.bio's GHG Inventory was measured and calculated following the GHG Protocol, developed by WRI and WBCSD. The tool establishes comprehensive standardized global frameworks to measure and manage GHG emissions from public and private sector operations, value chains and mitigation actions.

As part of Sistema.bio's commitment to sustainability, the company started measuring its corporate carbon footprint in 2022 (thusly using this as its base year). It has now established a process to yearly measure its carbon footprint, and is strengthening partnerships with suppliers and renowned environmental actors to increase its own environmental ambition.

Sistema.bio is a [proud](#) *Certified B Corp*, member of the *SME Climate Hub*, supporter of the United Nations Global Compact (UNGC) also certified under its *Climate ambition accelerator*. By measuring its carbon footprint and decarbonizing its operations with the help of its partners, **Sistema.bio reaffirms its mission to create a better, greener, and fairer world, alongside its commitment to the Global Climate Action Agenda (GCAA).**



03 MEASUREMENT METHODOLOGY

The GHG Protocol Corporate Accounting and Reporting Standard provides requirements and guidance for companies and other organizations preparing a GHG emissions inventory. It was designed considering the below objectives:

- Assist companies to prepare a GHG inventory that represents a true and fair account of their emissions using standardized approaches and principles.
- Simplifying and reducing the costs of compiling a GHG inventory.
- Provide information to build an effective strategy to manage and reduce GHG emissions.
- Increase consistency and transparency in GHG accounting and reporting among companies and programs.

GHG Protocol establishes 3 scopes to include in organizations' carbon footprint analysis. **Scope 1** includes all direct emissions generated, such as from mobile combustion, stationary combustion, and fugitive gas emissions during the operation or production of its activity. **Scope 2** includes emissions associated with the generation of electricity, heating/cooling or purchased steam for the company's own consumption. Finally, **Scope 3** includes emissions from upstream and downstream activities associated with its operations.

Organizational boundaries

The organizational boundary chosen for this analysis is the operational control approach.

Operating limits

The operational limits of this measurement are summarized in **Table 1** below. It shows included and excluded categories, not applying to this organization. It also details the status of the information requested, in terms of quality and quantity, as well as relevant assumptions or comments.

Table 1. Operational limits

Scope	Required information	Status	Assumptions, comments and/or exclusions of sources/facilities and/or operations
1	Stationary combustions	Received	100% of the information was received.
1	Fugitive emissions	N/A	No refrigerant gases were consumed.
1	Mobile combustion	Received	100% of the information was received.
2	Electricity	Received	100% of the information was received.
3	Goods and services purchased	Partially received	Only emissions from the geomembrane and clothing used were included. The emission factor was used for LLDPE production, not for the production of the geomembrane itself.
3	Capital assets	N/A	No capital goods were purchased during the year under study.
3	Other energy consumption	Included	Including electricity transmission losses.
3	Upstream transportation	Received	100% of the information was received.
3	Waste	Excluded	Excluded from the analysis due to materiality.
3	Employees' transportation	Currently calculating	33% of the information was received. Results were extrapolated to obtain an estimate figure.
3	Corporate travel	Received	100% of the information was received.
3	Downstream transportation	Received	100% of the information was received.
3	End-of-life treatment	Excluded	This category was excluded from the analysis due to lack of information. The products sold are still in their use life.

3	Processing of products sold	N/A	Not applicable.
3	Leased assets	N/A	No leased assets.
3	Use of products sold	Excluded	This category was not included due to lack of information at the product use stage - a system for collecting such information is currently being developed for future reporting.
3	Investments	N/A	No investments.
3	Franchises	N/A	No information was collected for this category.

Reporting period

The period analyzed in this report is from January 1, 2023, to December 31, 2023.

Base year

The base year was 2022, the first year in which Sistema.bio measured its emissions.

04 RESULTS



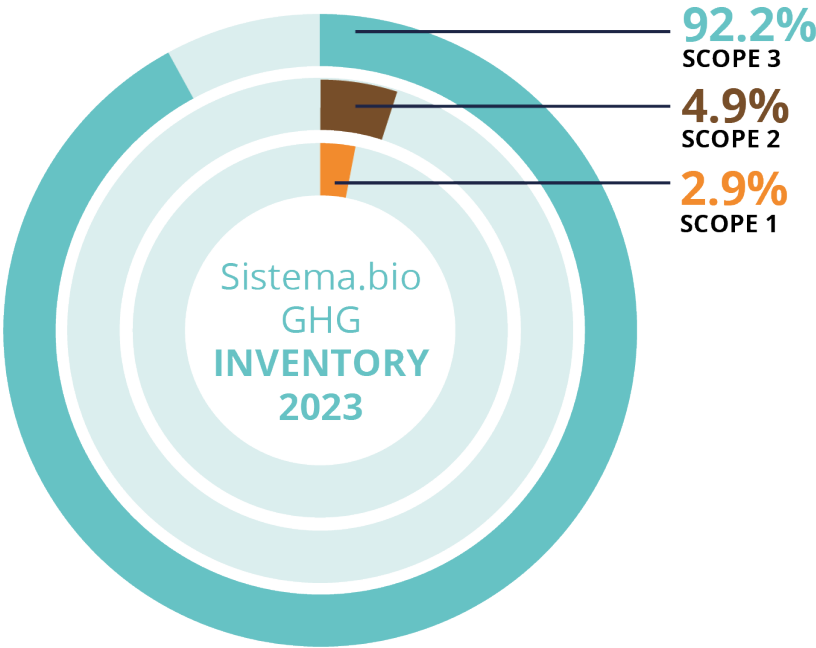
4.1 Emissions by scope

This section includes overall results of the GHG inventory analysis for the January to December 2023 period. **Sistema.bio's total carbon footprint is 5,484.32 tCO₂e.** The overall results by scope are shown in Table 2.

Annex I contains the factors used for footprint calculations.

Table 2. Overall results by scope in tons of CO₂ equivalent

Emission source	tCO ₂ e
Scope 1	157.1
Scope 2	271.43
Scope 3	5055.79
TOTAL (tCO₂e)	5,484.32





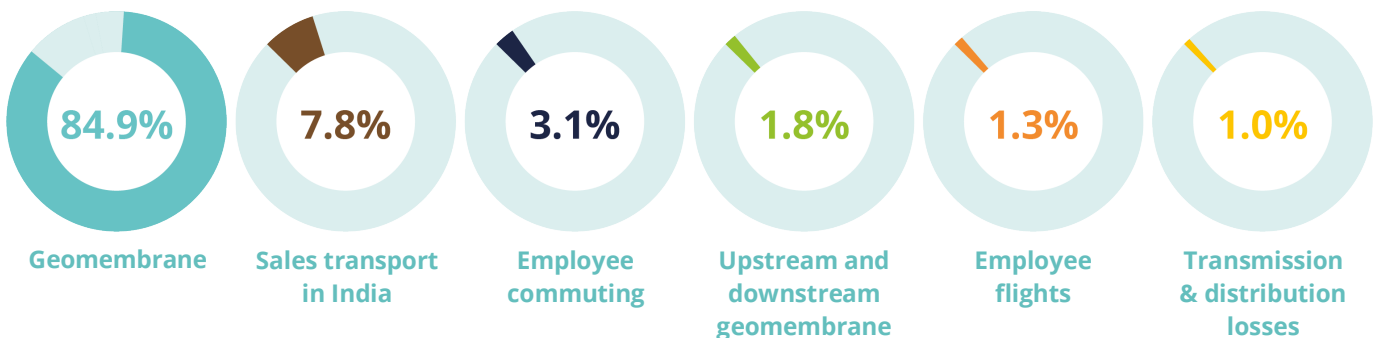
4.2 Emissions by category

The below table shows GHG emissions under each GHG Protocol category.

Annex II details used activity indicators to calculate emissions.

Table 3. Overall results by scope and category in tons of CO₂ equivalent

Emission source	tCOe ₂
Scope 1	157.1
Stationary combustion	.69
Mobile combustion	156.41
Scope 2	271.43
Electricity consumption	271.43
Scope 3	5,055.79
Geomembrane	4,215.16
Upstream and downstream transportation	89.66
Corporate travel	545.64
T&D losses	51.48
Employees commuting	153.85
TOTAL	5,484.32





4.3 Annual historical emissions

Table 4. Emissions year on year

Emission source	2022 tCO ₂ e	2023 tCO ₂ e
Scope 1	156.49	157.1
Stationary combustion	1.35	.6896
Mobile Combustion	155.14	156.41
Scope 2	97.22	271.43
Electricity consumption	97.22	271.43
Scope 3	2,631.24	5,055.79
Geomembrane	2,349.83	4,215.16
Upstream and downstream transportation	53.57	89.66
Corporate travel	209.7	545.64
T&D losses	18.14	51.48
Employees commuting	-	153.85
TOTAL	2,902.8	5,484.32



4.4 Performance indicators

Intensity is a key indicator to assess efficiency and emissions generated in multiple perspectives. Calculated indicators are presented in Table 5.

Table 5. Performance indicators

Indicator	Unit	2023 Intensity
Employee intensity	tCO ₂ e/collaborator	15.4
Intensity per product	kgCO ₂ e/biodigester	.577
Billing intensity	gCO ₂ e/U\$S	460.1



4.5 Base year emissions recalculation

2022 was the first year that Sistema.bio's carbon footprint was measured. No recalculations were performed on the base year.



4.6 Biogenic emissions

No biogenic emissions were estimated in the reporting period due to lack of information at the use stage – please see justification in Table 1, *End-of-life treatment*.



4.7 Compensation

No compensation actions were taken at this time.



4.8 Reduction

No mitigation actions were taken at this time. Sistema.bio will analyze this year's results, assess mitigation pathways, determine its capacity to implement some of them, and report taken actions in next year's measurement.

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Annex I: EMISSION FACTORS

Scope	Source	Detail	EF Unit (gas/detail)	Emission Factors	Source
				CO2e	
1	Stationary combustion	LP Gas	Kg/L	1.60	INECC (2014). <i>Emission factors for different types of fossil and alternative fuels consumed in Mexico.</i> Emission factors for LPG. Metropolitan area of the Mexican Valley. 1. kg CO2/l LPG liquid phase
					Mobile combustion
	Gasoline	Kg/km	0.101	IPCC 2006 <i>Guidelines for National Greenhouse Gas Inventories.</i> Passenger vehicles. Motorcycle. Medium	
2	Electricity	Mexico	Kg/MWh	0.423	SEMARNAT (2021) <i>Emission factor of the national electricity system 2021.</i> Estimated
	Electricity	Kenya	Kg/KWh	0.1617	IEA (2020) <i>Emission Factors.</i> Kenya. Total. 2019 Estimated
	Electricity	India	Kg/KWh	0.715	Government of India (2022). <i>CO2 baseline database for the Indian power sector.</i> Weighted average emission factor (considering renewable energy generation of Indian grid)
3	Purchased goods and services	Geomembrane	Kg/kg	2.95	Ecoinvent. Granular LLDPE
		Textile	Kg/t	0.17	UK DEFRA 2021

	Other electrical consumption	T&D Losses	Kg/kWh.72	0.01879	UK DEFRA 2021
	Upstream transportation	Maritime	Kg/ton.km	0.013232	UK, DEFRA, 2021. Freighting goods. Cargo ship, general cargo, average
	Corporate Travel	Aerial	Kg/kg fuel	-	ICAO calculator
	Downstream Transportation	Medium car, petrol	Kg/ton.km	0.19	UK, DEFRA, 2021. Freighting goods. Cars. Medium car. Petrol
		Van < 1.74 t	Kg/ton.km	0.72	UK, DEFRA, 2021. Freighting goods. Vans. Class II (1.305 to 1.74 tonnes). Petrol
		Van < 3.5	Kg/ton.km	0.78	UK, DEFRA, 2021. Freighting goods. Vans. Class II (1.74 to 3.5 tonnes). Petrol
		HGV	Kg/ton.km	0.21	UK, DEFRA, 2021. Freighting goods. HGV (all diesel). All rigids. Average laden
	Employees commuting	Car (gasoline)	Km	.19	UK, DEFRA, 2021. Employee commuting. Medium car (petrol)
				.142	
				.1852	India, GHG Program, 2015. India <u>specific</u> road transport emission factors GIZ, Road transport GHG <u>emission factors</u> for Kenya, 2015. Passenger vehicle
Car (EV)	Km	.05	UK, DEFRA, 2021. Employee commuting. Medium car (Battery electric vehicle)		

		Motorcycle	Km	.1	<p>UK, DEFRA, 2021. Employee commuting. Motorbike</p> <p>India, GHG Program, 2015. India <u>specific</u> road transport emission factors</p>
		Bus	Passenger.km	.1	<p>UK, DEFRA, 2021. Employee commuting. Average local bus</p>
		Low emissions bus	Passenger.km	.00153	<p>INECC, 2020. Methodology for the identification and measurement of mitigation actions due to the implementation of public transport systems. <u>Metrobus Insurgentes</u> (CDMX). Emission factor per passenger</p>
		Metro	Passenger.km	.04	<p>UK, DEFRA, 2021. Employee commuting. Metro</p> <p>India. GHG Program, 2015. India <u>specific</u> rail transport emission factors for passenger travel and material transport</p> <p><i>Internal calculation</i> with data from Distrito federal, México, Ministry of environment, 2012. GHG <u>registry</u> from the Federal district</p>

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Annex II: ACTIVITY INDICATORS

Scope	Category	Detail	Unit	Mexico	India	Kenya
1	1.1 Fixed combustion	LPG	L	866.4	N/A	N/A
	1.3 Mobile combustion	Auto	km	318,858	704,263.58	489,069
	1.3 Mobile combustion	Motorcycle	km	314	N/A	33,056
2	Electricity consumption	Offices	kwh	9,131	126,704	10,241
3	3.1 Acquired assets	Geomembrane	Ha	4.47	54.54	N/A
	3.1 Acquired assets	Textiles	t	.107	.22	.423
	Upstream transportation by sea	Maritime	ton.km	7/3,500	719/3,500	230/3,500
	Downstream transportation	Van < 1.74 t	km	246	704,263.59	N/A
	Downstream transportation	Van < 3.5	km	176	57,640	N/A
	Downstream transportation	HGV	ton.km	35/572	N/A	N/A
	Employee commuting	Car (gasoline)	km	.19	.142	.0185
		Car (EV)		.05	.095	.05
		Motorcycle		.1	.0290	.068
		Bus		.1	.1	.0846
Low emissions bus		.00153				
Metro		.04		.00795	.03	



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