GHG EMISSIONS REPORT

2024

SISTEMA.bio®

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01 GLOSSARY and ABBREVIATIONS

CO_2e
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 (CO_2); 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 CO_2 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 if 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, NOx, 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.

WBCSD

World Business Council for Sustainable Development.

Emission Factor (EF)

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

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.

$tCOe_2$

Metric Tons (equal to 1,00 kilograms) of Carbon dioxide's GWP equivalent units (please see CO_2e definition).

CO_2

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 (thus using this as its base year). It has now established a process to yearly measure its carbon footprint, and is developing a decarbonization roadmap with the support of its suppliers.

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, 2024, to December 31, 2024.

Base year

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

04 RESULTS

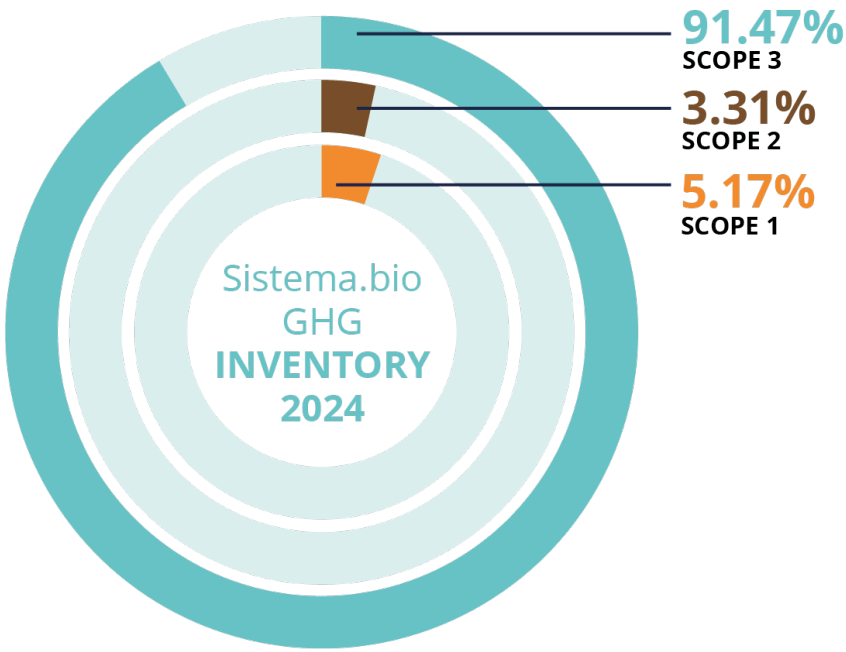
4.1 Emissions by scope

This section includes overall results of the GHG inventory analysis for the January to December 2024 period. **Sistema.bio's total carbon footprint is 4,887.06 tCO_2e.** 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 CO_2 equivalent

Sistema.bio GHG inventory 2024	
Emission source	tCO_2e
Scope 1	252.67
Scope 2	164.25
Scope 3	4,470.28
TOTAL (tCO_2e)	**4,887.06**



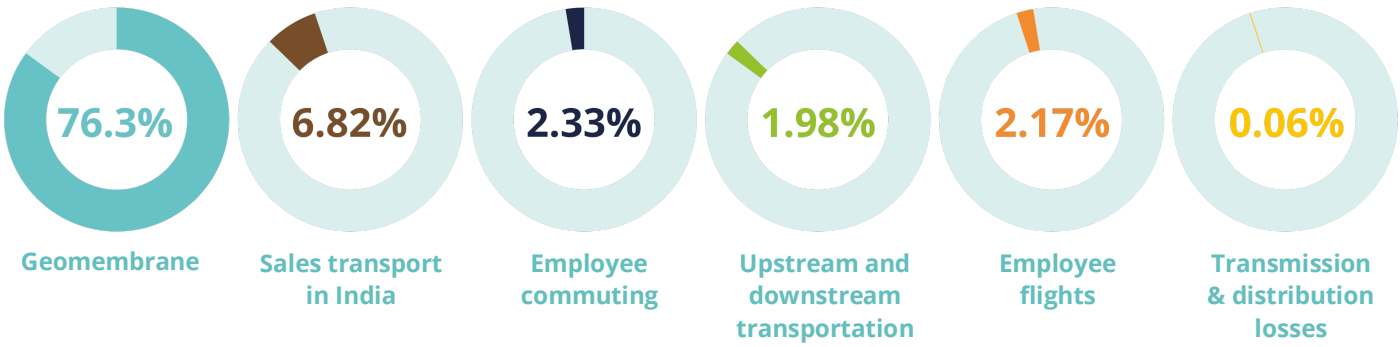
4.2 Emissions by category

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 CO_2 equivalent

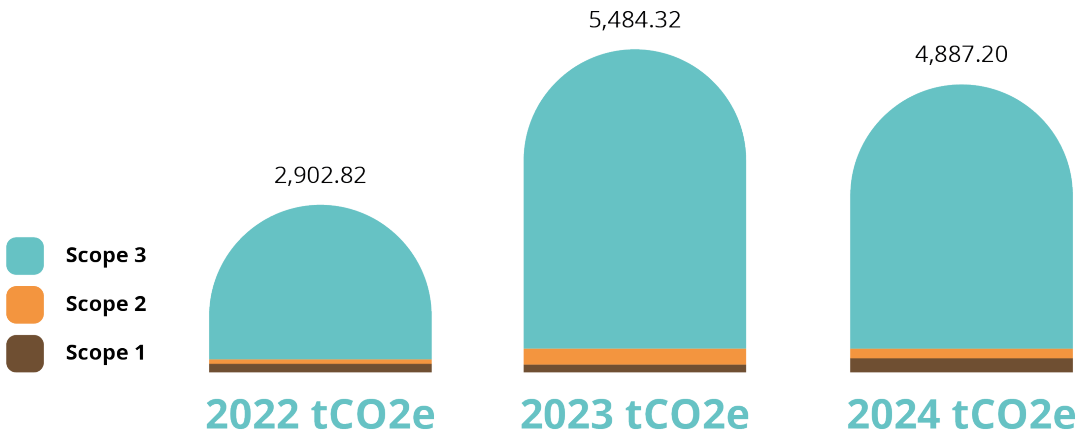
Sistema.bio GHG inventory 2024	
Emission source	$tCOe_2$
Scope 1	252.67
Stationary combustion	1.15
Mobile combustion	251.52
Scope 2	164.25
Electricity consumption	164.25
Scope 3	4,470.28
Geomembrane	3,728.00
Upstream and downstream transportation	96.94
Corporate travel	501.40
T&D losses	31
Employees commuting	114.26
TOTAL	**4,887.2**



4.3 Annual historical emissions

Table 4. Emissions year on year

Emission source	2022 tCO_2e	2023 tCO_2e	2024 tCO2e
Scope 1	156.49	157.10	252.67
Stationary combustion	1.35	.69	1.15
Mobile Combustion	155.14	156.41	251.52
Scope 2	97.22	271.43	164.25
Electricity consumption	97.22	271.43	164.25
Scope 3	2,631.24	5,055.79	4,470.28
Geomembrane	2,349.83	4,215.16	3,728.00
Upstream and downstream transportation	53.57	89.66	96.94
Corporate travel	209.42	545.64	501.40
T&D losses	18.14	51.48	31.00
Employees commuting	-	153.85	114.26
TOTAL	**2,902.82**	**5,484.32**	**4,887.20**



Sistema.bio experienced different levels of demand during the three years its carbon footprint has been measured, with a clear increase of its sales during 2023, hence the higher footprint for that year. Further, for 2024 measurement, the company changed the EF corresponding to the geomembrane. It has previously used a generic 2.95 LLDPE value from the *EcoInvent* database.

Upon establishing communication with Solmax, the manufacturer of the geomembrane, transitioned to 2.83 and 2.891 values (for the product supplied to India and Mexico, respectively), as these are the specific product factors including the LCA. This permitting to also stop measuring part of the geomembrane's upstream transport, as it was already included in Solmax' assessment. Consequently, using the product's specific factors permitted to reduce the emissions allocated to it by 5-10%

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	2024 intensity
Employee intensity	tCO_2e/collaborator	15.40	12.03
Intensity per product	$kgCO_2e$/biodigester	.57	.53
Billing intensity	gCO_2e/U$S	460.12	474.91

4.5 Base year emissions recalculation

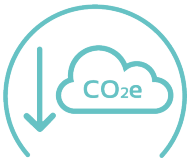
2022 was the first year that Sistema.bio's carbon footprint was measured. No recalculations were performed on the base year.

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

Sistema.bio hired a carbon consultancy and is working with its geomembrane supplier to analyze its footprint and produce three mitigation pathways, including a lower-carbon intensive geomembrane. The company is currently assessing results and will begin its decarbonization process next year.

05 CONCLUSION

Sistema.bio has established and is perfecting a procedure to yearly measure its emissions. The company has a clear goal of achieving net-zero emissions by 2050, and began exploring its decarbonization roadmap in 2024 through a consultancy with IDOM, a Spanish carbon consultancy. The project produced decarbonization pathways, determining their mitigation potential and financial implications. Among these are switching to a lower-carbon geomembrane (pathway with the greatest potential, currently working on a prototype with Solmax), transitioning to a lower-carbon automotive fleet, and powering its operations with renewable energy. The company's Carbon & Impact department is now assessing these pathways' feasibility and will suggest to the company's leadership the implementation of a plan for 2026 onwards.

06 Annex I: **EMISSION FACTORS**

Scope	Source	Detail	EF Unit (gas/detail)	Emission Factors CO2e	Source
1	Stationary combustion	LP Gas	Kg/L	1.60	INECC (2014). *Emission factors for different types of fossil and alternative fuels consumed in Mexico*. Emission factors for LPG. Metropolitan area of the Mexican Valley.1. kg CO2/l LPG liquid phase
	Mobile combustion	Gasoline	Kg/km	0.188	IPCC 2006 *Guidelines for National Greenhouse Gas Inventories*. Passenger vehicles. Cars. Medium car. Petrol
		Gasoline	Kg/km	0.101	IPCC 2006 *Guidelines for National Greenhouse Gas Inventories.* Passenger vehicles. Motorcycle. Medium
2	Electricity	Mexico	Kg/MWh	0.423	SEMARNAT (2021) *Emission factor of the national electricity system 2021*. Estimated
	Electricity	Kenya	Kg/KWh	0.1617	IEA (2020) Emission Factors. Kenya. Total. 2019 Estimated
	Electricity	India	Kg/KWh	0.715	Government of India (2022). *CO2 baseline database for the Indian power sector*. Weighted average emission factor (considering renewable energy generation of Indian grid)
3	Purchased goods and services	Geomembrane	Kg/kg	2.83/2.819	Solmax LCA of Sistema.bio custom-made geomembrane (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) India, GHG Program, 2015. India specific road transport emission factors GIZ, Road transport GHG emission factors for Kenya, 2015. Passenger vehicle
				.142	
				.1852	
		Car (EV)	Km	.05	UK, DEFRA, 2021. Employee commuting.

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

07 Annex II: **ACTIVITY INDICATORS**

Scope	Category	Detail	Unit	Mexico	India	Kenya
1	1.1 Fixed combustion	LPG	L	431	N/A	N/A
	1.3 Mobile combustion	Auto	km	254,179	NA	969,255
	1.3 Mobile combustion	Motorcycle	km	5,181	N/A	207,881
2	Electricity consumption	Offices	kwh	15,980	216,636	16,062
3	3.1 Acquired assets	Geomembrane	Ha	8.40	89.06	N/A
	3.1 Acquired assets	Textiles	t	.39	.663	.48
	Upstream transportation by sea	Maritime	ton.km	2.32/3,500	1,356/3,500	120/3,500
	Downstream transportation	Auto	km	0	2,917,326	N/A
	Downstream transportation	HGV	ton.km	3,746/70	N/A	262.6/315.1
	Downstream transportation	Car (gasoline)	km	.19	.142	.0185
	Employee commuting	Car (EV)	km	.05	.095	.05
		Motorcycle		.1	.0290	.068
		Bus		.1	.1	.0846
		Low emissions bus		.00153	.1 .00795	.0846 .03
		Metro		.04		

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Created by the **Carbon & Impact Team** in June 2025

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