Guggenheim Museum Bilbao
Greenhouse Gas (GHG) Inventory 2023 Report

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1. INTRODUCTION AND SCOPE

The Guggenheim Museum Bilbao Foundation is a cultural institution responsible for managing, operating, maintaining, conserving, and promoting the Guggenheim Museum Bilbao.

Since it was founded in October of 1997, the Museum has collected, conserved, and exhibited the art of the 20th century in an iconic work of architecture. Furthermore has consolidated its status as a cultural symbol of the economic revival of the Basque Country and of the international orientation of the Guggenheim Constellation of museums, thus achieving the goals established at the time of its founding.

Furthermore, an integral component of the Guggenheim Museum Bilbao Foundation's goals is contributing to environmental protection. In this sense, its Environmental Policy states that one of the fundamental goals of all activities carried out must be to conserve the environment in a way that is compatible with the nature, magnitude, and environmental impacts of the Museum.

In 2004, the Museum obtained ISO 14001 certification for its environmental management system. Since then, it has implemented measures aiming to reduce its environmental impact, in line with its commitment to environmental conservation and conducting its operations in line with the principles of sustainable development.

The Guggenheim Museum Bilbao created a Strategic Plan 2021–2030 which establishes ten strategic commitments, among which the Museum's environmental purpose is particularly salient. As a part of it, the institution commits to continue to strive to minimize its environmental impact through the development and implementation of sustainable energy solutions and non-polluting processes, encouraging activities seeking eco-efficiency.

The Guggenheim Museum Bilbao Foundation is publishing this report in order to facilitate the verification of its greenhouse gas inventory and to provide transparent information on the Museum's emissions to its interest groups, in line with the commitments that it has made as a part of the Environmental Policy approved by the Executive Committee in the 2017 financial year.

The greenhouse gas (GHG) emissions inventory has been calculated in accordance with the requirements of international standard UNE-EN ISO 14064-1:2019 "Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals." This report, which is the main tool for reporting on said inventory, has the following three goals:

- o To know the scope of the the Guggenheim Museum Bilbao's GHG emissions.

- o To report both internally and externally on the emissions generated by the Guggenheim Museum Bilbao's operations

- o To identify opportunities for improvement in terms of energy efficiency.
- o To continue to be a pioneering organization in the field of sustainable management.
- o To be able to reduce or optimize the Museum's energy consumption, thus achieving a reduction in GHG emissions.

This report uses data from the 2023 GHG inventory.

Creating said inventory and publishing this report is the responsibility of the Museum's **Facilities and Maintenance Department**.

2. ORGANIZATIONAL BOUNDARIES

The GHG inventory presented in this report was created using an "Operational Control" approach, as this is the most representative of the organization's activities.

The Guggenheim Museum Bilbao has considered all GHG emissions and removals generated at the facilities that it controls, as well as the GHG emissions generated during the transportation of artwork for the exhibitions in which it participates.

In accordance with the above definition, the following facilities are included in the GHG inventory:

Organizational Boundaries			
Tag	Tax ID (CIF)	Name	Description
A	G-48832240	GUGGENHEIM MUSEUM BILBAO	Includes the generation of GHG emissions as a result of the Museum's global activities and the sculpture *Arcos Rojos/Red Arches.*
B	G-48832240	EXTERNAL WAREHOUSE	Auxiliary warehouse for artwork crating materials

3. LIMITS OF THIS REPORT

In accordance with the requirements of standard UNE-EN ISO 14064-1:2019, direct and indirect GHG emissions and removals associated with the organization's operations have been identified based on the following defined categories and subcategories:

CATEGORIZATION	TYPE	PROCESS / ACTIVITY	GHGs GENERATED OR REMOVED	FACILITY
Category 1: Direct GHG emissions and removals	Stationary combustion–fossil fuels	Heating: Natural gas	CO_2, CH_4, N_2O	Museum (A)
	Stationary combustion–fossil fuels	Heating: Heating oil (gasóleo C)	CO_2, CH_4, N_2O	Museum (A)
	Stationary combustion–fossil fuels	Generator sets and pressure washer: Automotive diesel (gasóleo A)	CO_2, CH_4, N_2O	Museum (A) and External Warehouse (B)
	Direct fugitive emissions	Air conditioning: Cooling gases	HFCs	Museum (A)
	Direct fugitive emissions	High-voltage cells: sulfur hexafluoride	SF_6	Museum (A)
	Direct fugitive emissions	Fire extinction agents	FE-13, CO_2[1]	Museum (A) and External Warehouse (B)
	Biogenic removals	Existing trees	CO_2	Museum (A)
	Biogenic removals	Ornamental flowers on *Puppy*	CO_2	Museum (A)
Category 2: Energy GHG indirect emissions	Imported electricity	Electricity consumed	CO_2, CH_4, N_2O	Museum (A) and External Warehouse (B)
Category 3: Indirect GHG emissions related to transportation	-	Daily commute of personnel to the workplace	CO_2 e	Museum (A)

[1] The Novec 1230 extinction agent has not been included, as its global warming potential is less than 1.

CATEGORIZATION	TYPE	PROCESS / ACTIVITY	GHGs GENERATED OR REMOVED	FACILITY
	-	Work trips done in the Museum's or employees' vehicles	CO_2 e	Museum (A)
	-	Work trips on public transportation (train, plane, bus, taxi)	CO_2 e	Museum (A)
	-	Transportation of works of art	CO_2 e	Museum (A) and External Warehouse (B)
	-	Personnel accompanying works of art (courier services)	CO_2 e	Museum (A)
	-	Daily commute of Guggenheim services personnel: restaurant and cafeteria	CO_2 e	Museum (A)
	-	Transportation of products purchased by Guggenheim services: restaurant and cafeteria	CO_2 e	Museum (A)
	-	Travel of customers and visitors	CO_2 e	Museum (A)
Category 4: Indirect GHG emissions caused by products used by the organization	Caused by the goods purchased by the Museum	Works of art: creation and conservation	CO_2 e	Museum (A) and External Warehouse (B)
	Caused by the goods purchased by the Museum	Works of art: museographic materials	CO_2 e	Museum (A) and External Warehouse (B)
	Caused by the goods purchased by the Museum	Other goods purchased: crates, etc.	CO_2 e	Museum (A) and External Warehouse (B)
	Caused by the goods purchased by the Museum	Capital goods: manufacture and transportation of equipment and machinery located at the facilities	CO_2 e	Museum (A) and External Warehouse (B)
	Caused by the goods purchased by the Museum	Purchased energy: production and transportation of electricity and gas	CO_2 e	Museum (A) and External Warehouse (B)
	Caused by the goods purchased by the Museum	Water consumption	CO_2 e	Museum (A)

CATEGORIZATION	TYPE	PROCESS / ACTIVITY	GHGs GENERATED OR REMOVED	FACILITY
	Caused by the goods purchased by the organization	Purchase of merchandising	CO2 e	Museum (A)
	Caused by the goods purchased by the organization	Waste transportation	CO2 e	Museum (A)
	Caused by the goods purchased by the organization	Waste management	CO2 e	Museum (A)
	Caused by the goods purchased by the organization	Maintenance and cleaning of facilities: transportation of personnel and products	CO2 e	Museum (A)
	Caused by the goods purchased by the organization	Consulting and advisory services	CO2 e	Museum (A)
	Caused by the goods purchased by the organization	Financial and investment services	CO2 e	Museum (A)
Category 5: Indirect GHG emissions associated with the organization's product use	-	No GHG-generating processes identified in this category	-	-
Category 6: Other indirect GHG emissions	-	No GHG-generating processes identified in this category	-	-

In accordance with standard ISO 14064-1, the following GHGs have been considered for quantification purposes: CO_2, CH_4, N_2O, SF_6, NF_3, PFCs, and HFCs.

Nonetheless, in order to determine the inventory with regards to indirect emissions, they have been evaluated in accordance with the following criteria:

- o **Magnitude/volume**: Indirect emissions or removals assumed to be quantitatively substantial.

- o **Level of influence on sources/sinks**: Extent to which the organization is capable of tracking and reducing emissions and increasing removals (energy efficiency, green design, etc.).

- o **Access to information**: Ability of the organization to access information / activity data in order to calculate the emissions and removals related to activities over which it does not have operational or financial control. This criterion will be given priority considering that it is a limiting factor and that which offers the greatest opportunity for improvement when calculating the carbon footprint more exhaustively.

After applying these criteria, any emissions the significance of which is evaluated as not meeting the established threshold will be excluded.

The emissions sources which have been excluded in accordance with this criterion are the following:

- Direct GHG emissions and removals:
  - o Biogenic removals: ornamental flowers

- Indirect GHG emissions related to transportation:
  - o Indirect emissions caused by the daily commute of Guggenheim services personnel: restaurant and cafeteria.
  - o Indirect emissions caused by the transportation of products purchased by Guggenheim services: restaurant and cafeteria.
  - o Emissions caused by visitor and customer travel.

- Indirect GHG emissions caused by the products used by the organization:
  - o Indirect emissions caused by the goods purchased by the organization: works of art (creation and conservation), other goods purchased, capital goods, energy purchased, water consumption, and purchase of merchandising.
  - o Indirect emissions caused by the services used by the organization: final waste treatment, maintenance and cleaning of facilities, consulting and advisory services, financial and investment services.

- Indirect GHG emissions associated with the organization's product use: no GHG-generating processes have been identified in this category.
- Indirect GHG emissions from other sources: no GHG-generating processes have been identified in this category.

The scope of this report has been expanded, given that the emissions source constituted by the goods purchased by the organization as museography materials has reached the significance threshold established.

Given the limits related to data availability, indirect emissions caused by transportation for work trips done on public transportation, taxis, or buses have not been included. Furthermore, due to a lack of data available on the weight of specific works of art with regards to maritime and air transportation, said indirect emissions have not been included.

4.   BASE YEAR

The base year constitutes a specific time period for the comparing emissions over time.

The base year selected is 2021, given that it is the most recent year that is representative of the Museum's normal operations.

The base year has been recalculated as a result of the expansion of the scope of emissions considered, given that emissions related to the use of museography materials have been included in the inventory. For this reason, it is not appropriate to compare the inventory with the 2019 base year, as the scope of that inventory was more limited.

The emissions during the base year were 2,573.47 t CO_2e, broken down by type of emission below:

2021 GHG Emissions		
Category	**Description**	**GHG Emissions (t CO_2e)**
1	Stationary combustion	1,145.95
	Direct fugitive emissions	0
	Direct removals	2.79
TOTAL Category 1 – Direct GHG emissions:		**1,145.95**
2	Electricity consumed	1,058.64
TOTAL Category 2 – Indirect GHG emissions from imported electricity consumed:		**1,058.64**
3	Daily commute of personnel to the workplace	39.55
	Work trips done in the Museum's or employees' vehicles	2.73
	Work trips of personnel on public transportation (train, plane, bus, taxi)	10.86

2021 GHG Emissions		
Category	Description	GHG Emissions (t CO_2e)
	Transportation of works of art	116.22
TOTAL Category 3 – Indirect GHG emissions related to transportation:		**169.51**
4	Waste transportation	2.03
	Use and transportation of museography materials	157.29
	Use of new crates for works of art	40.20
TOTAL Category 4 – Indirect GHG emissions caused by the products used by the organization		**178.9**
TOTAL GHG Emissions		**2,573.47**

5.   QUANTIFICATION OF EMISSIONS

Emissions have been quantified for the calculation period, specifically the year 2023.

5.1   CATEGORY 1: DIRECT EMISSIONS AND REMOVALS

Below is the breakdown of the direct GHG emissions and removals for the year 2023:

		Direct GHG Emissions					
Tag	Site	Description		Partial Emissions of CO_2 (t CO_2)	Partial Emissions of CH_4 (t CO_2e)	Partial Emissions of N_2O (t CO_2e)	Total Emissions (t CO_2e)
1.1	A	Stationary combustion	Natural gas: Heating	669,32	1,6417	0,0000	670,96
1.2	A		Heating oil (gasóleo C): Heating	331,85	1,2493	0,7368	333,84
1.3	A and B		Automotive diesel (gasóleo A): Generator sets and pressure washer	4,32	0,0175	0,0104	4,35
TOTAL stationary combustion (t CO_2e): 1.009,15							
Tag	Site	Description		Emissions of SF_6 (t CO_2e)	Emissions of HFCs (t CO_2e)	Emissions of FE-13 (t CO_2e)	Total Emissions (t CO_2e)
1.3	A	Direct fugitive emissions	Cooling gases (air conditioning leaks)		0		0
1.4	A		Sulphur hexafluoride: high-voltage cells	0			0
1.5	A and B		Fire extinction agents	FE-13			0	0
1.6	A and B			CO_2				0
TOTAL direct fugitive emissions (t CO_2e): 0							
TOTAL Category 1 – Direct GHG emissions (t CO_2e): 1.009,15							

		Direct GHG Removals		Total Absorbed (t CO_2e)
Tag	Site	Description		Total Absorbed (t CO_2e)
1.6	A	Direct removals by the trees existing at the Museum	Orange trees	2.78
1.6	A		Wild privet	0.01
TOTAL Direct GHG removals (t CO_2e): 2.79				

5.2 CATEGORY 2: INDIRECT EMISSIONS FROM IMPORTED ELECTRICITY CONSUMED

Below is the breakdown of the indirect GHG emissions from imported electricity consumed for the year 2022:

Indirect GHG Emissions from Imported Electricity Consumed			
Tag	Facility	Description	Total Emissions (t CO_2e)
2.1	A and B	Electricity consumed	1,160.26
TOTAL indirect GHG emissions from imported electricity consumed (t CO_2e): 1,160.26			

5.3 CATEGORY 3: INDIRECT GHG EMISSIONS RELATED TO TRANSPORTATION

Below is the breakdown of the indirect GHG emissions related to transportation for the year 2023:

Indirect GHG Emissions Related to Transportation			
Tag	Facility	Description	Total Emissions (t CO_2e)
3.1	A	Daily commute of personnel to the workplace	38,58
3.2	A	Work trips done in employees' personal vehicles	1,05
3.3	A	Work trips of personnel on public transportation (train, plane, bus, taxi, etc.)	29,32
		Courier transportation	57,53
3.4	A and B	Artwork transportation	190,36
TOTAL indirect GHG emissions related to transportation (t CO_2e): 316,84			

5.4   CATEGORY 4: INDIRECT GHG EMISSIONS CAUSED BY THE PRODUCTS USED BY THE ORGANIZATION

Below is the breakdown of the indirect GHG emissions caused by the products used by the organization for the year 2023:

Tag	Facility	Description	Total Emissions (t CO_2e)
		Indirect GHG Emissions Caused by the Products Used by the Organization	
4.1	A	Waste transportation	0,08
4.2	A	Transportation of museography materials	0,65
4.3	A	Use of museography materials	71,89
4.4	A	Transportation of museography waste	0,29
4.5	A	Use of new artwork crates	15,42
TOTAL indirect GHG emissions caused by the products used by the organization (t CO_2e): 88,34			

5.5   TOTAL EMISSIONS

Below are the total GHG emissions for the year 2023, broken down by emission type:

Category	Description	GHG Emissions (t CO_2e)
	GHG Emissions for the Year 2023	
1	Stationary combustion	1.009,15
	Direct fugitive emissions	0,00
	Direct removals	2,79
TOTAL Category 1 – Direct GHG emissions:		**1.009,15**
2	Electricity consumed	1.147,52
TOTAL Category 2 – Indirect GHG emissions from imported electricity consumed:		**1.147,52**
3	Daily commute of personnel to the workplace	38,58
	Work trips done in the Museum's or employees' vehicles	1,05
	Work trips of personnel on public transportation (train, plane, bus, taxi, etc.)	29,32
	Courier transportation	57,53

GHG Emissions for the Year 2023		
Category	**Description**	**GHG Emissions (t CO_2e)**
	Artwork transportation	190,36
TOTAL Category 3 – Indirect GHG emissions related to transportation:		**316,84**
4	Emissions caused by waste transportation	0,08
	Transportation of museography materials	0,65
	Use of museography materials	71,89
	Transportation of museography waste	0,29
	Use of new artwork crates	15,42
TOTAL Category 4 – Indirect GHG emissions caused by the products used by the organization		**88,34**
TOTAL GHG Emissions		**2.561,84**

6. QUANTIFICATION METHODOLOGY

The quantification of obligatory-to-report GHG emissions (direct and indirect GHG emissions from imported electricity consumed), as well as of significant indirect emissions, will be done in accordance with two calculation methodologies depending on the type of emission source:

1. For emissions sources in which a chemical transformation process takes place (stationary or mobile combustion, process-related emissions, or emissions due to the breakdown of organic materials) and indirect emissions related to the generation of electricity consumed,

$$\text{CO2 Emissions (t } CO_2\text{-e)} = \text{Activity Data x Emission Factor}$$

Where:

    a) <u>Activity data</u>: Quantitative measurement of the activity producing a GHG emission.

In the case of stationary combustion sources, it is usually expressed in units of energy (TJ) and is calculated by multiplying fuel consumption (in units of mass or volume) by the fuel's lower calorific value (LCV).

In the case of mobile combustion sources, if fuel consumption is not available, thus making it impossible to conduct calculations using the method for stationary sources, activity data on the distance travelled (km) can be used.

In the case of electricity, the activity data consists of the electricity consumed by the facility (expressed in kWh).

b) <u>Emission factor</u>: Expressed in metric tons of CO_2-e /unit (depending on the units of the activity data), this factor depends on the type and features of the chemical transformation process (and type of fuel) used in each case.

Each fuel produces a specific CO_2-e emission which is closely related to the carbon content of the fuel in question.

Each electricity supplier has its own network emission factor for each kWh of electricity sold.

In all cases, the emission factors used already include the fuel oxidation factor (factor which takes into account the existence of inefficiencies in any combustion process, resulting in non-combusted carbon content or partially oxidized content, such as soot or ashes).

2. For emissions sources for which a chemical transformation process does not takes place (fugitive emissions) or in cases in which emissions data is available in units other than CO_2-e (e.g., metric tons of CH_4),

> **CO2 Emissions (t CO_2-e) = Emissions Data x Global Warming Potential (GWP)**

Where:

a) <u>Emissions data</u>: Quantitative measurement of emissions produced. This data can be available either because the mass of fugitive emissions is known (for example, in the case of refilling refrigerant fluid) or because a measurement is available (for example, because the CH_4 emitted is continuously measured).

b) <u>Global Warming Potential (GWP)</u>: Factor that describes the impact of the radiative

forcing of a unit mass of a given GHG relative to that of CO_2, over a specific time period. It is expressed in metric tons of CO_2-e /t GHG (each type of GHG has its own factor).

Last of all, once the unit calculations of emissions from each source in units of metric tons of CO2-e are available, all emissions in the same category will be added together (direct emissions, indirect energy emissions, and other indirect emissions).

a. Removal Quantification Method

The method for calculating CO2 removals is similar to that used for calculating emissions sources for which a chemical transformation process takes place. This methodology is based on the number of trees (equivalent to the activity data) and their absorption rates (equivalent to the emission factor).

> **CO2 Removals (t CO_2-e) = Number of Trees x Absorption Rate**

Where:

a) <u>Number of trees</u>: Number of trees per species.

b) <u>Absorption rate</u>: Expressed in terms of CO2-e/units per tree and per year. Each species of tree has its own absorption rate.

In cases in which direct emissions data do not exist, the emission factors of known sources have been used. The emission factors used and their sources are explained below:

Type	Item	Column 1	FE CO2	FE Unit	FE CH4	FE CH4 Unit	FE N2O	FE N2O Unit	Source
Electric Utility Distributor	IBERDROLA CLIENTES, S.A.U.	Electric Utility Distributor IBERDROLA CLIENTES, S.A.U.	0,241	kg CO_2e/kWh					Comisión Nacional de los Mercados y la Competencia, 2023
Gas Natural	kWh	Natural gas kWh	0,182	kg CO2/kWh	0,00045	kg CO2/kWh	0,0000000	kg CO2/kWh	Inventario Nacional de Gases de Efecto Invernadero de España 1990-2022 (ed. 2024). IHOBE Carbon Footprint Calculation tool, 2023
Gas Natural	m3	Natural gas m3	0,019	kg CO2/m3	0,000045	kg CO2/m3	0,00000000	kg CO2/m3	Inventario Nacional de Gases de Efecto Invernadero de España 1990-2022 (ed. 2024). PCI kg/kWh (IDAE). Density (m3/kg). IHOBE Carbon Footprint Calculation tool, 2020
Oil (Gasóleo A)	L	Oil (Gasóleo AL)	2,501	kg CO2/l	0,010100	kg CO2/l	0,006006	kg CO2/l	Inventario Nacional de Gases de Efecto Invernadero de España 1990-2022 (ed. 2024)
Oil (Gasóleo C)	L	Heating oil (Gasóleo CL)	2,705	kg CO2/l	0,010184	kg CO2/l	0,006006	kg CO2/l	Inventario Nacional de Gases de Efecto Invernadero de España 1990-2022 (ed. 2024)
Waste transportation	Truck	Waste transportation Truck	0,50679	kg CO2/tkm	0,00011	kg CO2/tkm	0,00538	kg CO2/tkm	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: HGV - Rigid (>3.5 - 7.5 tonnes)
Museographic waste transportation	Truck	Museographic waste transportation Truck	0,50679	kg CO2/tkm	0,00011	kg CO2/tkm	0,00538	kg CO2/tkm	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: HGV - Rigid (>3.5 - 7.5 tonnes)
Commute	Walk	Commute Walk	-	kg CO2/ km					-
Commute	Bus	Commute Bus	0,10141	kg CO2 /VKM (traveler km)	0,00001	kg CO2 /VKM (traveler km)	0,00073	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Bus - Average local bus

Commute	Car	Commute Private car	0,16547	kg CO2/ km	0,00019	kg CO2/ km	0,00098	kg CO2/ km	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Average car - Unknown fuel
Commute	Electric car	Commute Electric car		kg CO2/ km					-
Commute	Hybrid car	Commute Hybrid car	0,09320	kg CO2/ km	0,00037	kg CO2/ km	0,00035	kg CO2/ km	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Average car - Hybrid
Commute	Subway	Commute Subway	0,00094	kg CO2 eq/VKM (traveler km)					Informe de Gases de Efecto Invernadero 2022 Metro Bilbao
Commute	Tram	Commute Tram	0,02832	kg CO2 /VKM (traveler km)	0,00012	kg CO2 /VKM (traveler km)	0,00016	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: rail - light rail and tram
Commute	Train	Commute Train	0,02832	kg CO2 /VKM (traveler km)	0,00012	kg CO2 /VKM (traveler km)	0,00016	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: rail - light rail and tram
Commute	Motorbike	Commute Motorbike	0,11138	kg CO2 /VKM (traveler km)	0,00177	kg CO2 /VKM (traveler km)	0,00052	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: motorbike - avg
Courier transportation	Bus	Courier transportation Bus	0,02669	kg CO2 /VKM (traveler km)	0,00001	kg CO2 /VKM (traveler km)	0,00048	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Bus - Coach
Courier transportation	Car	Courier transportation Private car	0,16547	kg CO2/ km	0,00019	kg CO2/ km	0,00098	kg CO2 / km	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Average car - Unknown fuel
Courier transportation	Taxi	Courier transportation Taxi	0,14742	kg CO2 /VKM (traveler km)	0,00000	kg CO2 /VKM (traveler km)	0,00119	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Taxi - Regular taxi

Courier transportation	Airplane	Courier transportation Airplane	0,17493	kg CO2 /VKM (traveler km)	0,00001	kg CO2 /VKM (traveler km)	0,00086	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- air: Flights - International - average passenger
Courier transportation	Train	Courier transportation Train	0,03510	kg CO2 /VKM (traveler km)	0,00008	kg CO2 /VKM (traveler km)	0,00028	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: rail - national rail
Business travel	Bus	Business travel Bus	0,02669	kg CO2 /VKM (traveler km)	0,00001	kg CO2 /VKM (traveler km)	0,00048	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Bus - Coach
Business travel	Car	Business travel Private car	0,16547	kg CO2/ km	0,00019	kg CO2/ km	0,00098	kg CO2 / km	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Average car - Unknown fuel
Business travel	Taxi	Business travel Taxi	0,14742	kg CO2 /VKM (traveler km)	0,00000	kg CO2 /VKM (traveler km)	0,00119	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: Taxi - Regular taxi
Business travel	Airplane	Business travel Airplane	0,17493	kg CO2 /VKM (traveler km)	0,00001	kg CO2 /VKM (traveler km)	0,00086	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- air: Flights - International - average passenger
Business travel	Train	Business travel Train	0,03510	kg CO2 /VKM (traveler km)	0,00008	kg CO2 /VKM (traveler km)	0,00028	kg CO2 /VKM (traveler km)	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Business Travel- land: rail - national rail
Removals	Orange tree	Removals Orange tree	0,55500	Absorption rate (t CO2/ year)					"Nuevas metodologías para la enseñanza de la biodiversidad y el cambio climático en la Enseñanza Secundaria" Real Jardín Botánico de Madrid-CSIC, Real Jardín Botánico Juan Carlos I Universidad de Alcalá
Removals	Wild privet	Removals Wild privet	0,00130	Absorption rate (t CO2/ year)					"Nuevas metodologías para la enseñanza de la biodiversidad y el cambio climático en la Enseñanza Secundaria" Real Jardín Botánico de Madrid-CSIC, Real Jardín Botánico Juan Carlos I Universidad de Alcalá

Artwork transporation-Weight	Airplane	Artwork transporation-Weight-Airplane	1,09356	kg CO2/ tkm	0,00006	kg CO2/ tkm	0,00542	kg CO2/ tkm	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: Freight flights - International
Artwork transporation-Weight	Ship	Artwork transporation-Weight-Ship	0,05095	kg CO2/ tkm	0,00002	kg CO2/ tkm	0,00062	kg CO2/ tkm	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: Cargo ship - RoRo Ferry - Average
Artwork transporation-Weight	Truck	Artwork transporation-Weight-Truck	0,11199	kg CO2/ tkm	0,00002	kg CO2/ tkm	0,00149	kg CO2/ tkm	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: HGV - All HGVs Average Laden
Artwork transporation-Weight	Furgoneta	Artwork transporation-Weight-Van	0,56645	kg CO2/ tkm	0,00001	kg CO2/tkm	0,00414	kg CO2/ tkm	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: Vans - Average (up to 3.5 tonnes) (Diesel)
Artwork transporation-No weight	Airplane	Artwork transporation-No weight-Airplane	n/a	kg CO2/ km	n/a	kg CO2/ km	n/a	kg CO2/ km	Airplane transportation of artworks with no weight has been excluded from calculation due to lack of data re emission factors
Artwork transporation-No weight	Ship	Artwork transporation-No weight-Ship	n/a	kg CO2/ km	n/a	kg CO2/ km	n/a	kg CO2/ km	Ship transportation of artworks with no weight has been excluded from calculation due to lack of data re emission factors
Artwork transporation-No weight	Truck	Artwork transporation-No weight-Truck	1,00887	kg CO2/ km	0,00016	kg CO2/ km	0,01195	kg CO2/ km	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: HGV - All HGVs Average Laden
Crate transportation	Truck	Crate transportation Truck	1,00187	kg CO2/ km	0,00016	kg CO2/ km	0,01195	kg CO2/ km	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: HGV - All HGVs Average Laden
Transportation of museographic materials	Truck	Transportation of museographic materials Truck	0,50679	kg CO2/tkm	0,00011	kg CO2/tkm	0,00538	kg CO2/tkm	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: HGV - Rigid (>3.5 - 7.5 tonnes)
Transportation of museographic materials	Van	Transportation of museographic materials Van	0,56645	kg CO2/tkm	0,00001	kg CO2/tkm	0,00414	kg CO2/tkm	(DEFRA 2023) UK Government Greenhouse Gas Conversion factors for Company Reporting S3 Freighting goods: Vans - Average (up to 3.5 tonnes) (Diesel)

Use of museographic materials	Steel	Use of museographic materials Steel	2,088	kg CO2eq / kg					Stich carbon calculator
Use of museographic materials	Wood	Use of museographic materials Wood	571,000	kg CO2eq / m3					IHOBE, Environmental Information Sheets - Medium Density Fibreboard (MDF) panel [TABLERO DE FIBRA DE DENSIDAD MEDIA (TABLERO MDF)]
Use of museographic materials	Carpet	Use of museographic materials Carpet	2,08	kg CO2eq / kg					IHOBE, Environmental Information Sheets - PVC
Use of museographic materials	Acrylic paint	Use of museographic materials Acrylic paint	4,556	kg CO2eq / kg					Stich carbon calculator - Acrylic urethane emulsion paint
Use of museographic materials	Lacquer	Use of museographic materials Lacquer	5,312	kg CO2eq / kg					Stich carbon calculator - Paint/Sealer polyglaze clear laquer 100
Use of museographic materials	PVC flooring	Use of museographic materials PVC flooring	2,08	kg CO2eq / kg					IHOBE, Environmental Information Sheets - PVC
Use of museographic materials	Glass	Use of museographic materials Glass	1,031	kg CO2eq / kg					Stich carbon calculator - glass
Use of crating materials	Cardboard	Use of crating materials Cardboard	0,908	kg CO2eq / kg					IHOBE, Environmental Information Sheets - Cardboard
Use of crating materials	Plywood	Use of crating materials Plywood	471,999	kg CO2eq / m3					Stich carbon calculator - plywood

Use of crating materials	Foam	Use of crating materials Foam	2,396	kg CO2eq / kg					Stich carbon calculator - foam

7. IMPACT OF UNCERTAINTY

The statistical uncertainty of the main activity data on tertiary sector activities, such as gas, electricity, and fuel consumption, is subject to legislation on the inspection of measurement devices used in commercial operations. Spanish Royal Decree 889/2006 establishes the maximum error tolerances that these devices are permitted to have, which are listed below:

Minimum Precision Requirements	
Type of Meter	**Maximum Error Percentage**
Gas meter	3%
Electrical energy meter	4%
Fuel meter	2.5%

For the categories "Direct GHG Emissions," "Indirect GHG emissions from imported electricity consumed," and "Indirect GHG emissions related to transportation of waste and works of art," the activity data of which falls under the organization's commercial operations, the organization considers the level of uncertainty to be very low and will only ensure that legislative requirements are met, requiring the supplier of the services in question to provide up-to-date calibration certificates for the applicable devices whenever the emissions from the source are greater than 20%.

For emissions calculated based on activity data that does not fall under the organization's commercial operations, or for activity data for which calculating the uncertainty is not technically viable, a qualitative evaluation of the emission in question is carried out in the following way:

Direct and Indirect Emissions			
GHG Emission / Removal Category	**Level of Uncertainty**	**Description**	**Options for Reducing Uncertainty**
Category 1: Direct emissions	Low	Activity data falls under commercial operations. The main uncertainty is that of the method and scientific uncertainty.	None
Category 2: Electricity consumed	Low	Activity data falls under commercial operations. The main uncertainty is that of the method and scientific uncertainty.	None
Category 3: Transportation	Medium	The main uncertainty is that of the method and scientific uncertainty. Km traveled: Google Maps and surveying of employees.	None

Direct and Indirect Emissions			
GHG Emission / Removal Category	**Level of Uncertainty**	**Description**	**Options for Reducing Uncertainty**
Category 4: Product use	Medium	Weight of wastes transported according to the Record Book, and of museography materials, in accordance with the supplier invoice. Subject to commercial legal operations. Km travelled: Google Maps	None

8. MITIGATION ACTIVITIES

In 2023, a number of GHG reduction activities were carried out enabling the organization to reduce its electricity consumption and therefore its indirect GHG generation due to energy purchased. These initiatives focused on modernizing its lighting, improving pump efficiency, and optimizing the facilities' air conditioning installations. Likewise, 300 solar panels have been installed on the roof of the museum.

9. IMPROVEMENT ACTIONS

Similarly, actions have been planned to reduce greenhouse gas emissions and to improve the performance of the Guggenheim Museum Bilbao during the 2023 financial year.

These actions are part of the Guggenheim Museum Bilbao's Environmental Sustainability Strategic Framework and its different strategic pillars, the first of which is on "Climate Change and Energy Efficiency." In relation to it, the Museum continues to deploy initiatives related to improving the energy efficiency of the Museum's facilities, in particular with respect to lighting and air conditioning.