2019 Organizational GHG Emissions Inventory Report

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GHG Emissions Inventory 2019 Information Sheet

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Reporting period: Calendar year 2019

Base year: Calendar year 2009

Base year recalculation policy: Consistent with WRI/WBCSD GHG Protocol

2019 gross emissions: 40.29 metric tons CO_2-equivalent ($MtCO_2e$)
Scope 1: 0 $MtCO_2e$
Scope 2: 0 $MtCO_2e$
Scope 3: 40.29 $MtCO_2e$

GHG emissions estimated: CO_2, CH_4, and N_2O

GHG emissions not estimated: HFCs, PFCs, and SF_6 as fluorinated emissions are assumed to be negligible.

Table 1: Emissions breakdown per gas (in metric tons)

	CO_2	CH_4	N_2O	HFCs/PFCs/SF_6	CO_2e
Scope 1	NO	NO	NO	NO	NO
Scope 2	NO	NO	NO	NO	NO
Scope 3, categories 1-5	NO	NO	NO	NO	NO
Scope 3, category 6	27.91	0.00014	0.00088	NE	28.16
Scope 3, category 7	7.55	0.0017	0.00009	NE	7.63
Scope 3, categories 8-10	NO	NO	NO	NO	NO
Scope 3, category 11	4.48	NE	NE	NE	4.48
Scope 3, categories 12-15	NO	NO	NO	NO	NO

NO = Not Occurring
NE = Not Estimated

Reporting protocol: GHG Protocol Corporate Accounting and Reporting Standard (2004)

Global warming potential values: IPCC Sixth Assessment Report (AR6) (2021), 100-year time horizon

Verification: Estimates have not undergone a third-party audit or verification; however, internal quality-assurance (QA) and quality-check (QC) procedures were utilized.[1]

Prepared by: Erika Barnett, Senior Program Officer, GHGMI

[1] A list of QC procedures can be found in section VI.

I) Project Introduction

This emissions inventory report presents the greenhouse gas (GHG) emission estimate resulting from the Greenhouse Gas Management Institute (GHGMI) operations in the calendar year 2019. The report includes relevant calculation methodology, assumptions made, time-series comparisons, and recommendations for reduction strategies and improvement for future inventories. We compile our organizational GHG emissions inventory once every five years. We developed our base year inventory in 2009, and to keep our time series consistent, a retroactive inventory for 2014 is anticipated to be developed in the forthcoming year.

Project Goals and Purpose

As a leader in GHG management education and professional development, one of our objectives in measuring our emissions impact is to lead by example, publishing an estimate of the GHG emissions emitted from our operations consistent with the international standards we teach. We aim to set the standard for meeting the inventory quality principles of transparency, completeness, accuracy, relevance, and consistency throughout our inventory time-series.

Our emission inventories uphold our organizational reputation as experts in this space, inform stakeholders of our organizational practices and carbon footprint, and align our practices with our internal mission, vision, and values. In addition to maintaining our integrity as GHG management leaders, we hope to use the data gleaned from our inventories to make informed decisions regarding reduction targets and potential carbon offset purchases. Further, throughout the inventory process, we initiated an inventory structure and data archiving process to maximize efficiency for future inventories.

Organizational Description and Boundary

GHGMI is a USA-based 501 (c) (3) non-profit organization focused on addressing climate change through building a global community of experts in GHG management. In addition to offering a variety of online courses on GHG accounting, verification, reporting, and management, we conduct forward looking independent research and work with public and private sector organizations to build capacity for meaningful climate action. We are a 100 percent virtual organization that owns zero buildings, facilities, vehicles, or other assets.

We define our inventory boundary to include work-related activities of all permanent[2] staff and behavior of our online learners. This comprises home office energy consumption, ground and air transportation of our employees, as well as energy used by our online learner pool to

[2] "Permanent" refers to all staff that received GHGMI's "home office rent" benefit and are part of GHGMI's payroll.

participate in GHGMI programs. We did not include emissions from non-permanent staff, contractors, or service providers, including the Caribbean Cooperative MRV Hub (MRV Hub).

As a virtual organization, we have staff in various regions of the globe. The region in which a staff conducts their work is relevant for determining the fuel mix of that region (i.e., to determine what type of fuel(s) is being used to power their work activities). The regional breakdown of staff included in the 2019 inventory is included below:

Seattle, WA, USA	3 people
San Diego, CA, USA	3 people
Coronado, CA, USA	1 person
Missoula, MT, USA	2 people
Denver, CO, USA	1 person
Chapel Hill, NC, USA	1 person
Wellington, NZ	1 person

Our 2019 inventory includes three significant gases: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). All other GHG gases were not included, as they are assumed to contribute a trivial amount to our overall GHG emissions output.

We followed the guidance of the GHG Protocol Corporate Accounting and Reporting Standard[3] in compiling this emissions inventory. To maintain time-series consistency, we used the organizational control consolidation approach. Using the organizational control approach also permits us to better understand the emissions impact of our operations and activities within our control. We, unfortunately, note that the structure of the GHG Protocol does not facilitate our inventory being comparable with that of other organizations due to the Protocol's lack of proper standardization.

II) Inventory Management & Methodology

In initiating the inventory process, we outlined our organizational goals and purposes for the emissions inventory (listed above). We then identified the anticipated project tasks, expected deliverables, and resources needed, as indicated in Table 2.

Table 2: Project tasks, activities, and expected deliverables

TASK	ACTIVITIES	DELIVERABLES
Assign resources	• Identify project leader • Designate inventory team	A designated group of staff to conduct the inventory process with

[3] https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

	• Determine management support and project roles	oversight from appropriate supervisors
Define *organizational* and *operational* boundaries within the calendar year 2019	• Determine control approach used to define organizational boundaries • Classify activities that emit GHGs within organizational boundary (are they direct or indirect? Which scope are they?)	• A clear boundary that defines emission producing activities that we have operational control over • Identification of one control approach that will be consistently applied throughout the accounting process • An accounting approach that is most straightforward for GHGMI's purposes and will be comparable to our base year inventory
Collect data and identify calculation methodology	• Itemize emission sources within boundary defined by control approach • Inform appropriate staff of data needed • Identify local-specific emission factors for all separate activity data • Develop GHG emission calculation tool in Excel, specific to GHGMI operations	• A list of emission sources to be included in inventory • A set of emission factors to be used in calculations • An archive-able set of activity data from appropriate staff • A calculation tool for GHGMI that can be used for future GHG inventories
Calculate emissions	• Input activity data and emission factors into GHGMI's GHG emission calculation tool • Organize emissions by scope, entity, emission source, and type of gas emitted • Conduct a qualitative and quantitative key category analysis (KCA) that will identify emission-producing activities contributing more than 95% to the total emissions output (i.e., activities producing less than 5% of the emissions yield will not be included).	A GHG emissions inventory with a list of significant emission-producing activities under GHGMI operations

Develop an inventory report	• Interpret inventory results in the context of organizational goals and project scope • Provide information on GHG performance to relevant stakeholders • Identify opportunities to improve/decrease emission output • Address uncertainties and limitations of inventory methodologies • Provide guidance on future GHG reduction policies and carbon offset purchases	A clean and transparent GHG inventory report that can be shared internally and externally.
Finalize internal documentation and archiving system	Throughout the inventory process, we will determine the archiving and documentation methods that are best suited for GHGMI. These methods will be recorded and maintained for future inventories.	An internal protocol, specifically for GHGMI staff, that will outline how to document, record, and archive data for ease of systematic GHG emission compilation in the future.

Activity Data Collection

Staff Activity Data

Activity data were voluntarily disclosed by permanent GHGMI staff or estimated in cases where data was not available. This included providing data on the total square footage of their homes, the square footage of their home offices (or the percentage of space occupied by their home office), as well as their utility bills, which included their total kilowatt hour and thermal usage for each month in 2019.

Activity data collected from and for relevant GHGMI staff included the following:

- Work-related air travel and third-party mobile combustion data occurring within the inventory year, including mileage travelled or dollar amount spent, vehicle and fuel type (if available), and location of travel
- Mobile combustion data from personal vehicle used for work-related tasks, including vehicle make, model, and year, fuel type, combustion efficiency, and mileage travelled or gallons used
- Square footage of home for each staff member and square footage or proportion of home used for office space (i.e., a percentage)
- Kilowatt hour usage for each staff member's home for each month within the inventory year, obtained via staff utility bills

- Number of thermal units used by each staff member's home, obtained via staff utility bills

Learner Activity Data

During the registration process, learners indicate their course selection(s) and country of residence, which is then stored in their GHGMI learning management system (LMS) profile. Assumptions regarding device usage as well as hours spent per course were made to estimate emissions from 2019 learner behavior.

Activity data collected for learners and members that used the GHGMI LMS within the 2019 calendar year:

- Approximate number of learners that used the LMS within the inventory year
- Approximate number of hours spent per course
- Approximate allocation of course registration per learner
- Approximate proportion of learners located in various global regions (i.e., Africa, Asia, Caribbean, Central America, Europe, Latin America, Middle East, North America, and Oceania)
- Approximate wattage allocated to learners' devices (i.e., those using laptop computers vs. desktop computers)

Emission Calculation

After collecting the relevant activity information from staff and the LMS, we input the data into our internal organizational emissions calculator, built specifically for GHGMI operations. Emission factors (EF) used in the 2019 inventory can be found in Appendix A.

Emissions resulting from each staff's work-related activities were then computed for each gas (i.e., CO_2, CH_4, and N_2O) by the calculator according to the following equation:

$$\textit{Emissions}\ (\textit{gas/activity}) = [\textit{activity data}] \times [\textit{EF}] \times [\textit{conversion factor}, \text{if needed}]$$

Emissions associated with learner behavior and interaction with our LMS were computed according to the following equation (for each global region):

$$\textit{Regional emissions}\ (\text{metric tons of } CO_2) = [\textit{hours per region x \%DESK} \times (200W/1000) \times \textit{EF}\ (gCO_2/kWh)/1000000] + [\textit{hours per region x \%LAP} \times (50W/1000) \times \textit{EF}\ (gCO_2/kWh)/1000000]$$

Where:

%DESK = percentage of learners using a desktop to access the LMS in a given region

%LAP = percentage of learners using a laptop to access the LMS in a given region

Non-CO_2 gases were converted into CO_2 equivalent (CO_2e) using global warming potential (GWP) values[4]:

GAS	GWP (100-YEAR TIME HORIZON)
CO_2	1
CH_4	29.8
N_2O	273

We further disaggregated emissions by staff member, learner pool, activity (electricity and thermal use, air travel, and mobile combustion), and gas (CO_2, CH_4, and N_2O).

III) Uncertainties & Assumptions

Despite efforts to minimize uncertainties[5] throughout the inventory process, in some cases we needed to use assumptions to estimate emissions. Uncertainties or assumptions for specific emissions-producing activities within our boundary are listed Table 3.

Table 3: Unknowns and assumptions for each activity

ACTIVITY	UKNOWNS/ASSUMPTIONS
Electricity and thermal usage from 5 staff members that currently do not work at GHGMI, but were permanent employees for all or part of the year in 2019	There were 5 permanent staff members in 2019 that we could not obtain direct data for, as they do not currently work at GHGMI. To estimate emissions for these staff members, we used the average kilowatt hour and thermal usage from existing staff data and applied it to these individuals. Emission factors for their location during time of employment at GHGMI were applied.
Mobile combustion outside of USA; occurring due to staff travelling internationally and using taxi services (i.e., Uber, Lyft, taxis, etc.)	Due to lack of international mobile combustion data, U.S. based EFs were used.
Mobile combustion from taxi services	There were situations in which mobile combustion data was only provided in the amount spent (i.e., from a

[4] GWP values are produced by the Intergovernmental Panel on Climate Change (IPCC) assessment reports (AR). We used the GWP values from the latest report, AR6, 2021.

[5] Suggested improvements to inventory processes and methodologies, for the purpose of mitigating assumptions and uncertainties, are stated in section VI.

	receipt or transportation ticket/pass). In these cases, mileage was calculated based on a typical taxi charge for given area in the given time of year.
Mobile combustion from trains, trams, buses, metros, subways, and transit rails	In many cases, emissions occurring from staff travel using pass-based transportation could not be calculated due to insufficient data. Often when traveling via pass-based transportation methods, although we know the amount spent, the miles associated with that pass are unknown. In some of these cases, travel was occurring in Amsterdam, where most public transportation is powered by alternative energy sources. For this reason, we assume these emissions are negligible.
Learner behavior and interaction in GHGMI online programs	Quantifying emissions associated with learner behavior requires knowing from where, for how long, and how each learner accessed our LMS. A series of assumptions were made to glean this information: **1. Time spent on GHGMI courses:** GHGMI does not track how much time each learner spends taking our courses. To estimate time spent, we first identified the percentages of learners that registered for each course using internal records (e.g., 20% registered for 201, 10% for 301, etc.). We then applied these percentages to the number of active learners within the LMS in 2019 to arrive at an estimated number of enrollees per course. Using the hours advertised on our website for expected course working hours (e.g., completing course 201 requires about 16 working hours, while 501 requires about 40), we were able to estimate how much time learners were spending on our courses. Activity data needed to be disaggregated in this way due to the variability in expected study-time amongst GHGMI courses and diplomas. **2. Regional allocation of learners** While GHGMI does collect location information from learners, estimating emissions from each country represented by our 2019 learner pool would have

required a high-level of effort and time. We instead aggregated country data into the following regions:

- Africa
- Asia
- Caribbean
- Central America
- Europe
- Latin America
- Middle East
- North America
- Oceania

To estimate the hours spent per region, we looked at the number of active learners from each region and multiplied that percentage by the total estimated number of hours spent in 2019[6].

Once we arrived at an approximated percentage of active learners accessing our programs from each global region, we could estimate the number of hours being spent on GHGMI courses from each region, and thus, roughly calculate how much electricity was being purchased in each area to participate in GHGMI courses. Emission factors for electricity generation vary significantly depending on the type of fuel combusted for energy, and other local and generator-specific contexts, which is why disaggregating learner hours by global region was valuable.

3. Energy-use based on device

Different devices use different amounts of energy, and GHGMI does not currently collect data related to learner devices used to access our courses. We therefore needed to make certain assumptions regarding the computer processing power of and number of learners that access the LMS by laptop or desktop computer.

Government employees make up a large portion of our 2019 learner pool, and we assume government employees primarily use desktop computers. We therefore assumed around 65% of learners used desktop computers and 35% used laptops to take our courses. Our courses do not require much computer processing

[6] This breakdown is displayed in the section IV.

	power. A laptop computer typically uses 30 - 120 watts of energy per hour so we assumed a rate of 50 watts. A desktop computer typically uses 60 - 300 watts of energy per hour, so we assumed a rate of 200 watts.

IV) Results

Our emissions output for 2019 totaled 40.29 $MtCO_2e$.

Operational boundary

As a fully virtual organization, GHGMI does not own any buildings, facilities, vehicles, or any stationary combustion sources. Therefore, all our emissions are considered scope 3. We further categorized our scope 3 emissions according to the GHG Protocol Corporate Value Chain Accounting and Reporting Standard[7], the fractionation of which is illustrated in Figure 1, and further elaborated in Table 4.

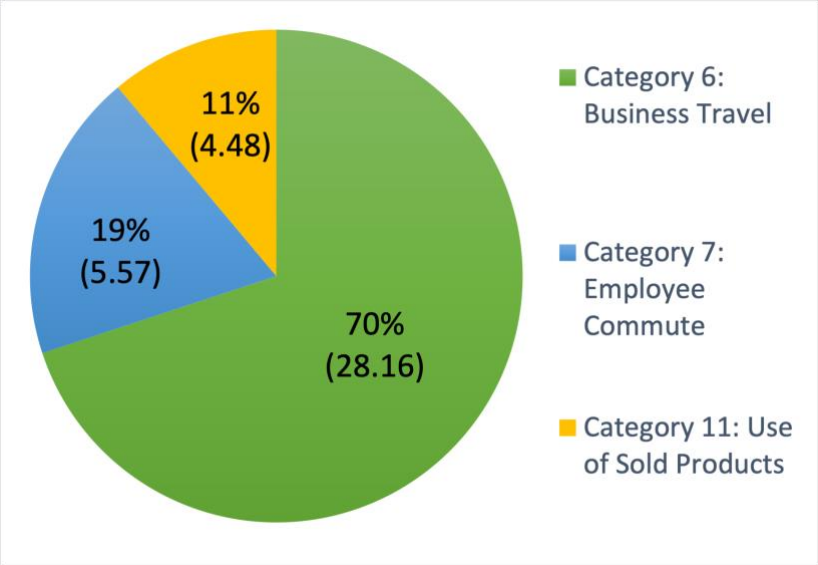

Figure 1: Percent contribution of scope 3 emission categories to total 2019 emissions (value in metric tons indicated in parenthesis)

Category 6 makes up most of our emissions output at 70 percent, which comprises mobile combustion from motor vehicles as well as air travel. In 2019, GHGMI staff travelled 184,142 miles via air, and 1,655 miles via motor vehicles[8].

[7] https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf

[8] Emissions accounted from mobile combustion from motor vehicles included light-duty passenger cars (including Lyft and Uber), taxis, transit rails, subways, and buses.

Table 4: Explanation of inventory activities included in each Scope 3 category

CATEGORY	EXPLANATION OF ACTIVITIES INCLUDED
Category 6: Business Travel	This category includes emissions associated with staff business-related travel, specifically including emissions from mobile combustion from motor vehicles and air travel. We did not include emissions from travel if said travel was paid for and organized by a third party[9], as this fell outside of our inventory boundary.
Category 7: Employee Commute	Included in this category are emissions associated with staff home-office use, including emissions from purchased electricity and thermal usage (e.g., residential natural gas combustion) attributed to home office space.
Category 11: Use of Sold Products	As GHGMI's online courses and programs are products that are sold, the emissions associated with GHGMI learner interaction and behavior within our LMS are included in this category.

Activities

Emission-producing activities that fell within our inventory boundary consists of purchased electricity and natural gas for staff home-offices, mobile combustion from staff using personal vehicles for work-related activities, mobile combustion from staff using third-party vehicles for business travel (e.g., rental cars), staff business travel via air transit, and purchased electricity used by our 2019 learners while interfacing with our e-learning platform. Figure 2 illustrates the breakdown of emissions data for each activity.

[9] This refers to non-billable GHGMI expenses, where project funders paid directly for GHGMI travel.

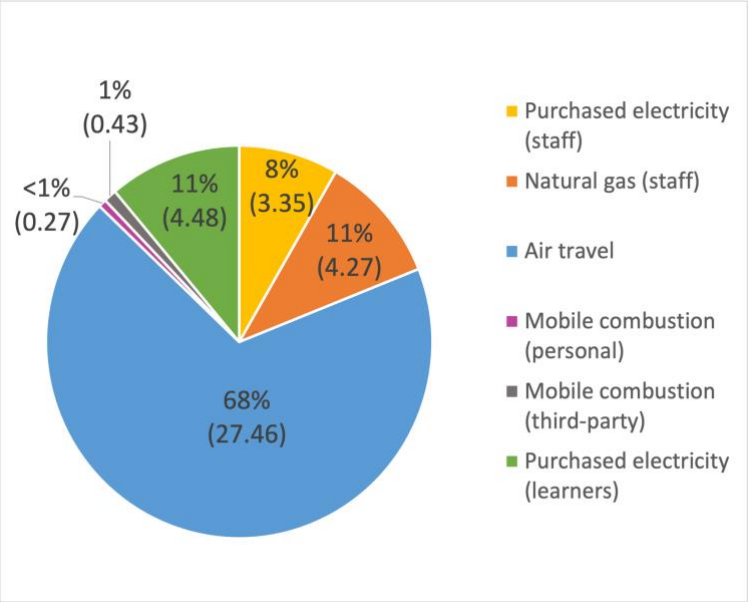

Figure 2: Percent contribution of emissions allocated for each activity included within the inventory (value in metric tons indicated in parenthesis)

Learner Emissions

Emissions from our 2019 learner pool are estimated to be 4.48 $MtCO_2e$. However, we surmise these emissions are likely underestimated due to the number of assumptions made in our estimations[10].

GHGMI learners log into GHGMI courses from all over the world. The regional breakdown is displayed in Table 5.

Table 5: Geographical breakdown of 2019 learner pool

REGION	% OF LEARNERS
Africa	19%
Asia	17%
Caribbean	9%
Central America	2%
Europe	7%
Latin America	10%
Middle East	6%
North America	25%
Oceania	5%

[10] Assumptions and unknowns for each activity can be found in section III.

Using laptop and desktop assumptions for each region, we applied regional-specific emission factors[11] to arrive at the CO_2 estimation for each region, illustrated in Table 6. CH_4 and N_2O emissions were not estimated for this activity.

Table 6: CO_2 emissions from 2019 learner pool per global region

REGION	CO_2 EMISSIONS (metric tons)
Africa	0.78
Asia	0.93
Caribbean	0.56
Central America	0.05
Europe	0.27
Latin America	0.28
Middle East	0.37
North America	0.99
Oceania	0.23

Figure 3 displays the estimated amount of 2019 learners from each global region, compared against the region's contribution to the total emissions from our 2019 learners. There is a positive correlation between the number of hours contributed from each region and the aggregate emissions resulting from that region.

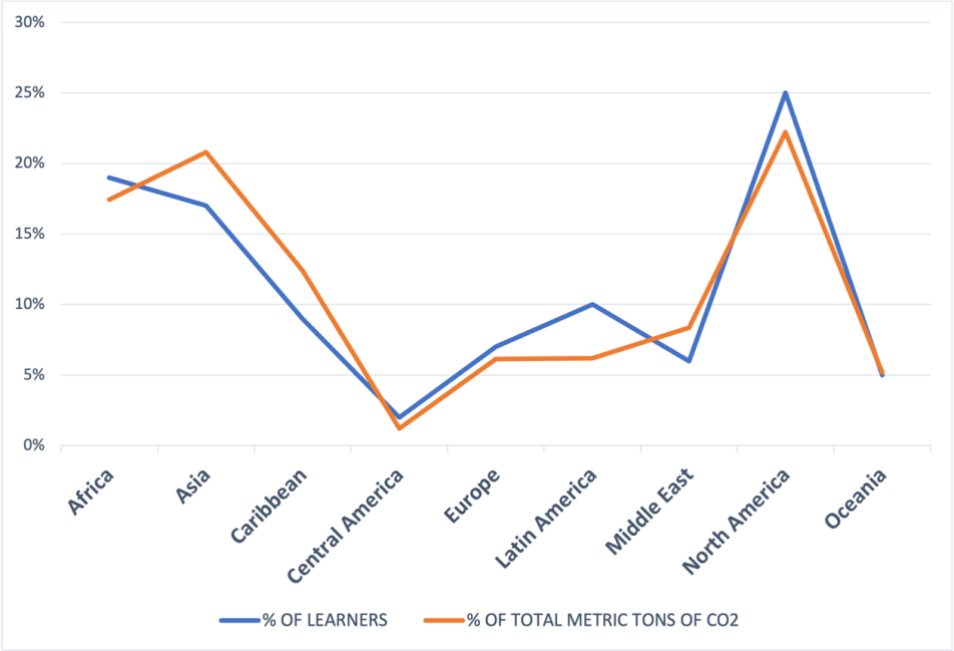

Figure 3: Regional learner allocation vs. regional contribution to total emissions from 2019 learner pool (in percentages)

[11] References for emission factors can be found in Appendix A.

Gas Emissions

Overwhelmingly, CO_2 comprised most of our inventory, with 39.94 metric tons emitted. In comparison, CH_4 and N_2O contributed very little, with 0.0019 and 0.00097 metric tons of each gas emitted, respectively.[12]

V) Time-Series Comparisons

GHGMI used the same consolidation approach and followed the same guidance from the GHG Protocol Corporate Accounting and Reporting Standard in its 2009 base year and 2019 inventory. Our original base year inventory boundary included emissions from sources that do not fit within our redefined boundary. Table 7 highlights the boundary differences between our base year and 2019 inventories. We executed a recalculation of our base year inventory due to the differences in boundary setting between the base year and 2019 inventories[13].

Table 7: Explanation of boundary differences between the 2009 base year and 2019 inventories and implications for base year recalculation

ORIGINAL 2009 BOUNDARY	2019 BOUNDARY	JUSTIFICATION FOR DIFFERENCE	IMPLICATIONS FOR RECALCULATION
Included permanent and non-permanent staff	Only includes permanent staff	We determined that non-permanent staff do not fit within our organizational boundary description, as we do not have "control" over them	Our base year inventory was recalculated to remove non-permanent staff
Included emissions from our server, which hosts our online programs	Does not include emissions from our server	We determined that server emissions do not fit within our boundary as we do not control the servers	Our base year inventory was recalculated to remove server emissions
Included emission estimates from service providers	Does not include emissions from service providers	We determined that service providers do not fit within our organizational boundary description, as we do not have "control" over them	Our base year inventory was recalculated to remove service provider emissions

In 2009, GHGMI operations emitted 9.48 $MtCO_2e$, with 7.68 $MtCO_2e$ emitted from GHGMI staff and 1.8 $MtCO_2e$ emitted from the 2009 learner pool. Figure 4 below features the emission

[12] Non-CO_2 gas estimations provided in this report represent a likely underestimate, due to insufficient data to estimate non-CO_2 emissions from learner behavior.
[13] A recalculation of our 2009 inventory can be found in Annex C.

totals from our base year and current inventories, which is disaggregated between staff and learner emissions.

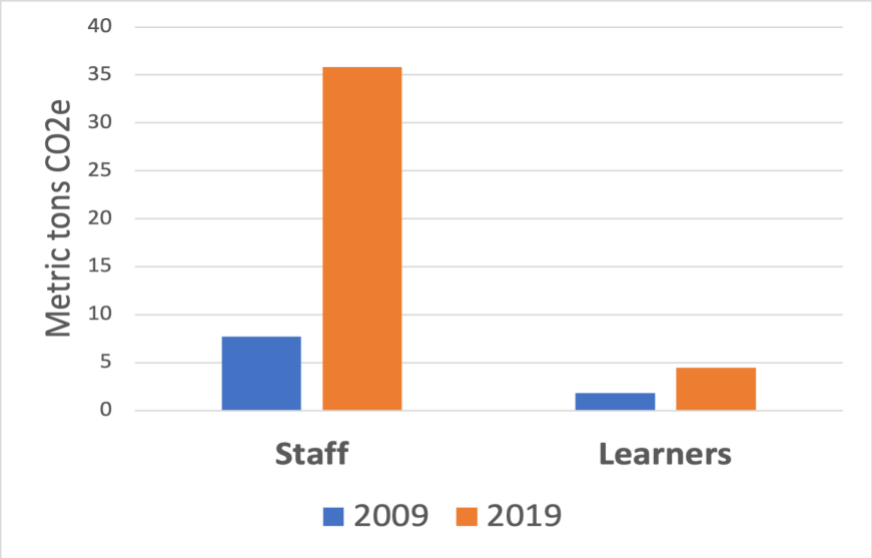

Figure 4: 2009 emissions vs. 2019 emissions (in $MtCO_2e$)

Over a ten-year period, our total emissions output has increased by 325%, with the majority of that increase ensuing from staff activities. Much of this increase can be attributed to GHGMI's increase in air travel, which was significantly less in 2009[14]. GHGMI has grown significantly in the ten years since our base year inventory; our revenue alone increased over 200% and we have doubled the number of permanent staff.

GHG Emissions Intensity

Table 8 below indicates the emissions intensity metrics of our 2019 inventory compared against our base year emissions. The intensity is expressed in metric tons of CO_2 equivalent.

Table 8: Emission intensity metrics for 2009 and 2019 (metric tons CO_2e)

Metric	2009	2019
Per individual staff	1.28	2.98
Per individual learner	0.007	0.004
Per dollar of revenue (gross)	0.0000013	0.0000017

[14] Our emissions output from air travel in 2009 was 6.94 $MtCO_2e$. As our organization has grown, so has our need to travel for in-person workshops.

VI) Recommendations for Emission Reduction Strategies and Inventory Improvements

Recommendations for Emission Reduction Strategies

We completed a key category analysis (KCA) to identify which activities contributed the most to our emission inventory[15]. The KCA established the following three categories as dominant contributors to our inventory (in order from greatest to lowest): staff air travel (scope 3 category 6), purchased electricity from learners (scope 3 category 11), and natural gas usage from staff (scope 3 category 7). These categories likely represent the greatest potential for reducing our emissions, and organizational efforts shall be made both to 1) reduce emissions associated with the above categories and 2) improve the confidence and accuracy of estimates for these key categories.

While the KCA identified the categories that contribute the most to our inventory, it does not inform which categories we have the most control over. For example, purchased electricity from learners was a key category, but we have little control over how learners interact with our LMS. Table 9 indicates lists the activities that contributed to our inventory, the KCA, and the level of control GHGMI has over that activity.

Table 9: Key categories and GHGMI's level of control

ACTIVITY	KEY CATEGORY	LEVEL OF CONTROL
Business air travel	Yes	High
Learner purchased electricity	Yes	Low
Staff natural gas usage	Yes	Medium
Staff purchased electricity	No	Medium
Third-party mobile combustion	No	Low
Staff mobile combustion	No	Low

Using Table 9, we can make informed decisions regarding our future reduction strategies. Focusing first on categories that contribute the most to our inventory (the key categories) and those over which we have the most control, and proceeding with those over which we have medium control. The least amount of attention will be given to categories that are not key and have a low-level of control (i.e., both mobile combustion categories).

Instead of focusing reduction efforts on emissions from learner purchased electricity, due to our low-level of control and a lower confidence level for the emissions estimates for that

[15] The emission contribution to our total emissions output for each category is illustrated in Figure 2, and our full KCA is in Appendix B.

activity, efforts for future improvement in estimation accuracy shall be made in this category. Recommendations are discussed in the following section.

Recommendations for Future Inventory Improvement

Our priorities for improving the inventory compilation process and accuracy of future emission inventories are based on our experiences developing past inventories. Table 10 lists the unknowns, assumptions, or obstacles encountered during the compilation process, as well as recommendations for mitigation.

Table 10: Unknowns, assumptions, or obstacles encountered in the 2019 inventory and suggestions for improvement. Recommendations are listed in order of priority, starting with the highest, and are color-coded to indicate level of priority (i.e., red = high priority, yellow = medium priority, and green = low priority)

UNKNOWN, ASSUMPTION, OR OBSTACLE	RECOMMENDATIONS FOR INVENTORY IMPROVEMENT
Activity data (i.e., mileage) for mobile combustion from taxi services, trains, trams, buses, metros, subways, and transit rails was sometimes unavailable or unreliable	Recommended for staff to record either a) their start point and end point, or b) the total milage travelled when they submit an expense report
Assumed 60% of learners were using desktop computers and 40% using laptops	In the Annual Alumni Survey, or in each course evaluation, ask what type of device was used to access GHGMI courses
Activity data collection for staff was time-consuming due to lack of centralized record-keeping practices	Have a centralized location where activity data can be stored and updated on a regular basis (i.e., every inventory year)
Assumed that the percentage of registrants for each course in 2019 matched the percentage of active learners in 2019	Explore technological improvements to the LMS that would allow for the collection of bulk learner data related to course enrollments
Performance benchmarks against other academic institutions were unable to be made, due to lack of recent and comparable data	Invest more time into finding institutions or university with similar registration size that also have GHG inventories
Emission factors for mobile combustion occurring outside of the USA were unavailable	No recommendations as GHGMI does not have influence to mitigate
Unable to estimate non-CO_2 emissions from learners due to lack of available emission factors	No recommendations as GHGMI does not have influence to mitigate

QA and/or QC Procedures

We employed a variety of different QA and/or QC procedures to ensure the accuracy of our 2019 inventory. For future inventory compilation, we recommend building upon the current list of QA and/or QC procedures below, and adjusting processes as needed to accommodate organizational needs.

List of QA and/or QC procedures undertaken during the 2019 inventory process:

1. Before we began collecting activity data, an inventory process and management plan[16] was distributed to the GHGMI Management Team. The proposed inventory process, boundaries, deliverables, and overarching purpose were formally approved.
2. After an initial inventory calculation, our internal emissions calculator was circulated amongst staff that had their work-related emissions included in the inventory. During this time, staff confirmed that their activity data inputs were correct, as well as validated the associated emission calculations for their activities.
3. GHGMI's emissions calculator was then approved by the Management Team, establishing organizational consensus of activities included in the inventory and the associated emission calculations.
4. A final draft of the GHG Inventory Report was approved by the Management Team, where the Team evaluated the report based on the following qualifications:
    - The report is based on the best data available at the time of publication
    - The report is transparent about any data limitations, assumptions, and/or uncertainties
    - The report clearly states the organization's gross emissions within its organizational boundaries, as well as reporting each scope separately
    - The report adheres to the GHG accounting principles[17] to be relevant, complete, consistent, transparent, and accurate

[16] The inventory management plan can be found in section II, Table 2

[17] GHG accounting and inventory principles can be found in chapter 9 of the GHG Protocol Corporate Accounting and Reporting Standard

Appendix A: Emission Factors

Electricity

	Region	CO_2 (lb/MWh)	CH_4 (lb/MWh)	N_2O (lb/MWH)
eGRID (USA)	NWPP	715.2	0.068	0.01
	RMPA	1242.6	0.117	0.017
	SRVC	675.4	0.058	0.008

Source: US EPA Center for Corporate Climate Leadership: Emission Factors for GHG Inventories (April 1, 2021)

International	CO_2 (kg/kWh)	CH_4 (kg/kWh)	N_2O (kg/kWh)
NZ	0.097	0.0039	0.00014

Source: Ministry for the Environment Guidance for Voluntary GHG Reporting, 2018

Natural Gas

	CO_2 (kg/mmBtu)	CH_4 (g/mmBtu)	N_2O (g/mmBtu)
USA	53.06	1	0.1
	1242.6	0.117	0.017
	675.4	0.058	0.008

Reference: US EPA Center for Corporate Climate Leadership: Emission Factors for GHG Inventories (April 1, 2021)

International	CO_2 (kg/mmBtu)	CH_4 (g/mmBtu)	N_2O (g/mmBtu)
NZ	N/A*	N/A*	N/A*

** Staff in New Zealand did not use natural gas in their home office*

Source: Ministry for the Environment Guidance for Voluntary GHG Reporting, 2018

Mobile Combustion

	CO_2 (kg/gallon)	CO_2 (kg/mile)	CH_4 (kg/gallon)	CH_4 (kg/mile)	N_2O (kg/gallon)	N_2O (kg/mile)
Light-duty passenger cars	8.78	0.343	0.00038925	0.019	0.000081	0.011

	CO_2 (kg/km)	CH_4 (g/km)	N_2O (g/km)
Taxis	0.14886	0.00000308	0.00132

	CO_2 (kg/mile)	CH_4 (g/mile)	N_2O (g/mile)
Metros (transit rail, subway)	0.119	0.0025	0.0017
Buses	0.10391	0.00003	0.00077

Reference: GHG Emissions Calculation Tool_0 from the GHG Protocol

Air Travel

Type of flight	CO_2 (kg/passenger mile)	CH_4 (g/passenger mile)	N_2O (g/passenger mile)
Short (<300 miles)	0.206	0.0071	0.0065
Medium (301 – 2,300 miles)	0.131	0.0006	0.0042
Long (>2,300 miles)	0.161	0.0006	0.0051

Reference: US EPA Center for Corporate Climate Leadership: Emission Factors for GHG Inventories (April 1, 2021)

Regional Electricity Use (learners)

Region*	g CO_2/kWh
Africa	426.56
Asia	568.87
Caribbean	641.2
Central America	284.2
Europe	407.49
Latin America	288.4
Middle East	647.43
North America	412.69
Oceania	482

**Country-specific EFs were aggregated by region and then averaged together to produce a regional-specific EF*

Reference: The Climate Registry's default emission factors, April 2020

Appendix B: Key Category Analysis

All inventory categories and their associated emissions are listed in descending order by contribution to the total absolute emissions (including sinks). Summing the cumulative contribution of absolute emission sources and sinks, until you reach but do not exceed 95%, displays your key categories.

EMISSION CATEGORY	$MtCO_2e$	% of TOTAL	SUM
Business air travel	27.46	68%	68%
Learner purchased electricity	4.48	11%	79%
Staff natural gas usage	4.27	11%	90%
Staff purchased electricity	3.35	8%	98%
Third-party mobile combustion	0.43	1%	99%
Personal mobile combustion	0.27	1%	100%

Annex C: Recalculation of 2009 Inventory

The original 2009 inventory estimated GHGMI emissions at 23.1 $MtCO_2e$. The 2009 base year inventory boundary originally included emissions from permanent and non-permanent staff[18], contractors and service providers, learners, instructors, and servers used to host our LMS and website(s). Below illustrates the original emissions estimates for our 2009 base year inventory and changes made in the 2023 recalculation.

ORIGINAL 2009 ESTIMATE		**2023 RECALCULATION**		**JUSTIFICATION**
ACTIVITY	**TOTAL EMISSIONS ($MtCO_2e$)**	**ACTIVITY**	**TOTAL EMISSIONS ($MtCO_2e$)**	
Permanent staff	7.68	Permanent staff	7.68	Permanent staff fit within our inventory boundary
Non-permanent staff	1.18	Non-permanent staff	NE	Non-permanent staff do not fit within our redefined inventory boundary
Contractors and service providers	9.65	Contractors and service providers	NE	Contractors and service providers do not fit within our inventory boundary
Learners	1.8	Learners	1.8	Learners fit within our inventory boundary
Servers	2.65	Servers	NE	Server emissions do not fit within our inventory boundary
Instructors	0.14	Instructors	NE	Instructors in 2009 did not receive GHGMI benefits and are therefore considered non-permanent staff
TOTAL	**23.1**	**TOTAL**	**9.48**	

NE = Not Estimated

[18] Activity data collected from staff included energy usage for home office as well as business travel.