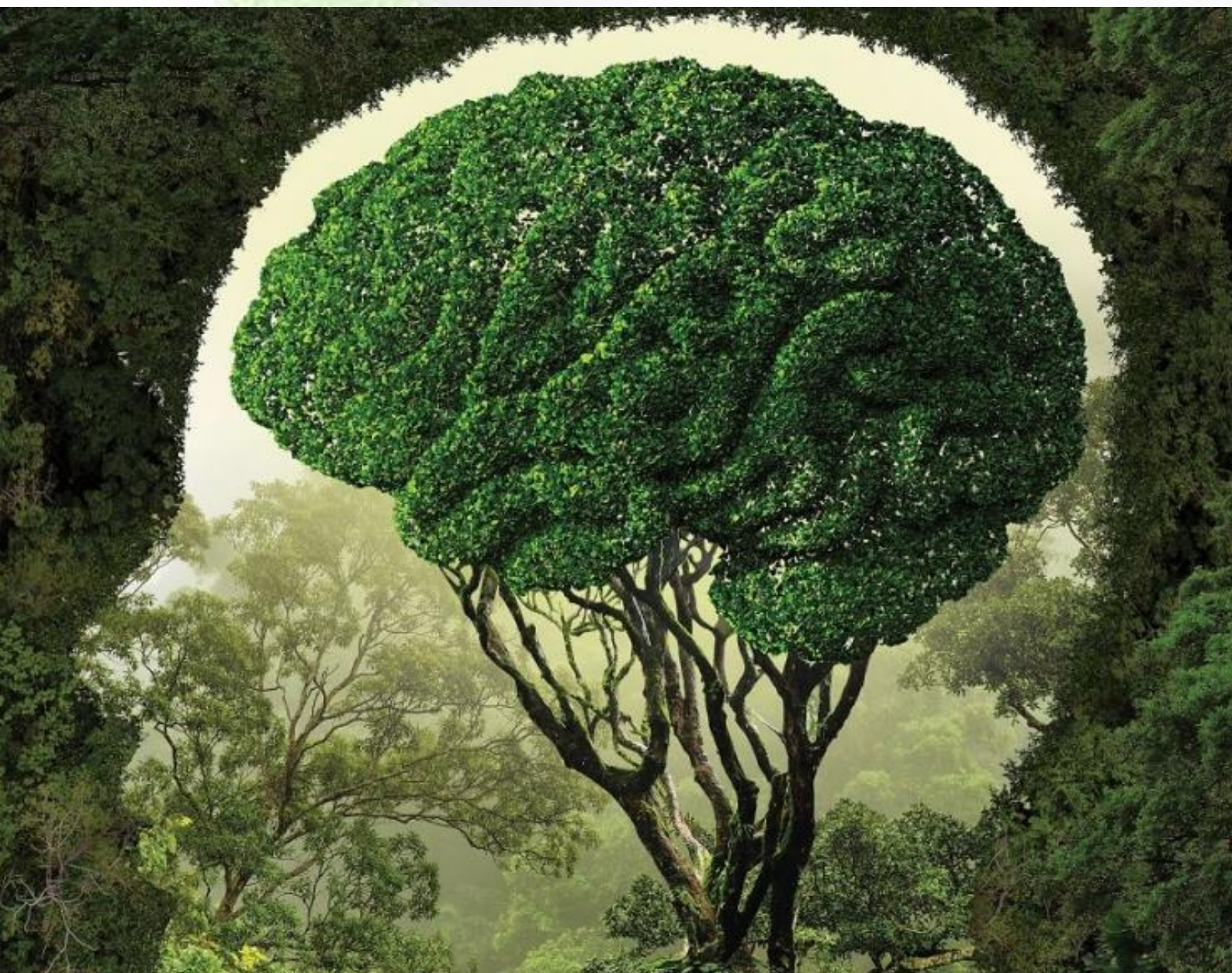




CARBON FOOTPRINT REPORT OF MAITREYI COLLEGE

Reporting Year 2018-19
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ACKNOWLEDGEMENT

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ABBREVIATIONS

Abbreviations	Full Form
GHG	Greenhouse Gases
CF	Carbon Footprint
FY	Financial Year
LPG	Liquefied Petroleum gas
Kg	Kilograms
Yr.	Year
IPCC	Intergovernmental Panel on Climate Change
KWh	Kilowatt hour
CNG	Compressed Natural Gas
e	equivalent
CO ₂	Carbon dioxide
CH ₄	Methane
N ₂ O	Nitrous oxide
BEE	Bureau of Energy Efficiency

1. EXECUTIVE SUMMARY

1.1 ABOUT THE PROJECT

Carbon Footprint refers to the potential climatic impact (Global Warming) of the **Greenhouse Gases (GHG)** emitted directly or indirectly due to an organization's activities. A Carbon Footprint Disclosure of any educational institution is very important to understand such that its key emission sources can be identified and necessary mitigation measures can be adopted for carbon reduction.

In today's date, very few colleges disclose their carbon emissions. Maitreyi College under Delhi University is a STAR College that has taken a first-time initiative to compute its carbon footprint and set a benchmark for other Colleges/Universities. The college has adopted a carbon reduction strategy to undertake this project.

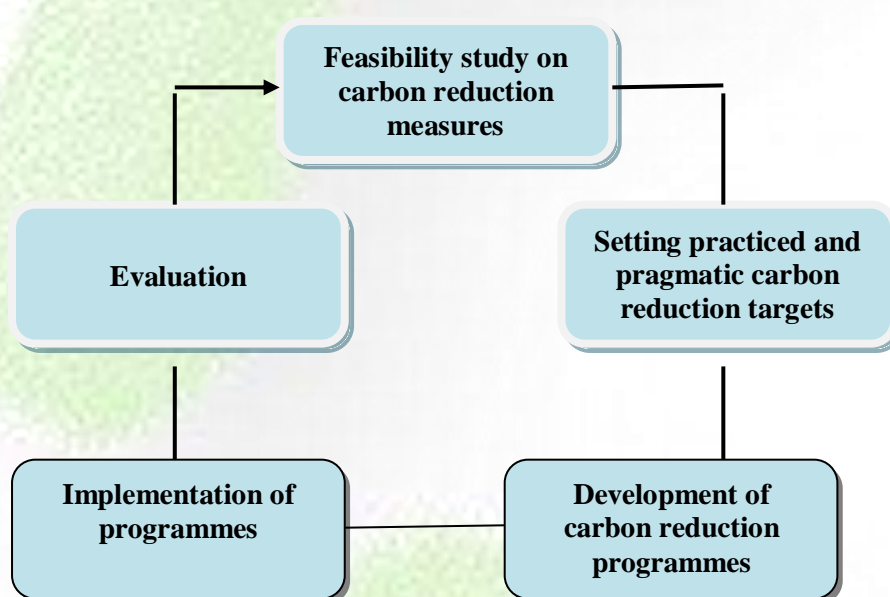


Figure 1: Carbon Roadmap Strategy

The report indicates GHG emissions assessed for **Maitreyi College** for the **Financial Year 2018-19**. The report highlights the current key emission sources of the college and sets a baseline data for setting up college-wide emission reduction targets for next Financial Years (FY). Several recognized national and international standards have been referred for the computation of the footprint of the college.

The project was carried out in three phases namely, **Planning, Collection of data and Estimation of CO₂** following with suggestive measures for reduction. The project was initiated with understanding the intent of management, post which a core team was formulated comprising of teachers and students from different departments. Several site visits and face to face interactions were done with the departments to collect the required data. The study included extensive research on latest emission factors for computing the footprint. Both

qualitative and quantitative data was collected from the college. An online survey was conducted for capturing data on commuting. The survey was carried out for a month and was rolled out to the teachers, non-teaching staff and students.

The successful completion of this project is dedicated to the entire college because of its hard work & enthusiasm shown. Cooperation from all the departments led to the smooth running of the project throughout 3 months.

Maitreyi College, through this project, has reported on its scope 1, 2 & 3 carbon emissions, emerging as the first Delhi University College to undergo such disclosure. Through this, other educational institutions will be motivated to undertake similar disclosure projects and bring to the table innovative & cost effective carbon reduction measures for education sector. The benefits of the project will manifest in substantial utility cost reductions across the on-campus operations and will lead to both financial as well as environmental sustainability of the college.

1.2 OBJECTIVES OF THE PROJECT

- Identify key emission sources of GHG at the campus
- Compute Scope 1, Scope 2 and Scope 3 emissions for operations carried out at Maitreyi
- Analyze the results and provide cost effective & efficient measures for reducing the GHG emissions.

1.3 RELEVANCE

Today's changing climate has resulted in an increased temperature (global warming) world-wide. In addition to this, the year 2018 experienced some of the catastrophic climate extremes, including disastrous storms, floods, droughts, heat waves etc. causing huge loss and damage to both life and property.

India's Nationally Determined Contributions (NDCs) commit to reduce its emission intensity per unit GDP by 33 to 35% below 2005 by 2030 under the Paris Agreement. This has resulted in the need for various sectors to come up and report their carbon emissions so that appropriate measures can be adopted. Reporting the emissions will enable them to set practical targets for carbon reduction in upcoming years.

An educational institution plays an influential role in both local and national policymaking, both by informing society through research and educating graduates. It sets ground for

imparting responsible perspectives to the young minds who act as successful incubators for innovation, from which many sustainability initiatives originate.

Computing Carbon Footprint of Maitreyi College will allow them to position themselves favourably in tackling the future challenges associated with a changing climate. Maitreyi College being a pioneer Delhi University College provides a diverse range of graduate, post graduate and other courses. Therefore, it holds a significant position in population, economic importance and societal influence.

With the help of such projects, students, teachers and other staff will get a chance to understand the importance & relevance of global warming, GHG emissions & carbon footprint. Such projects will help students develop knowledge on key areas and gain first-hand experience which will invite career opportunities for them in the field of climate change. The project will empower them to suggest new innovative ideas on how emissions can be reduced across the college operations. Prioritising carbon reductions at the college campus will not only yield environmental benefits to them but will also promote financial savings and increase competition among other educational institutions.

2. BACKGROUND

Currently, Global warming has become one of the most prominent issues faced by world community at local, national and global level. The most instant and obvious effect of global warming is the increase in temperatures around the world. GHG emissions are one of the primary causes of global warming. The valuable first step towards the emission reduction and understanding disaster risk, is quantifying the GHG emissions due to various human activities.

Carbon Footprint (CF), as an indicator of climate performance, helps identify major GHG emission sources & potential areas for improvement. It has been introduced as a tool to guide the relevant emission cuts and verifications that will facilitate the understanding of the risk of global warming at the very first stage. *According to Carbon Trust (2007), “Carbon Footprint is defined as a measurement of the total GHG emissions caused directly and indirectly by an individual, an organization, event or product and is expressed as a carbon dioxide equivalent (CO₂e)”*. An organizational carbon footprint measures the GHG emissions from all the activities across the organization, including energy used in buildings, industrial processes, fugitive emissions and organization’s vehicles. Besides quantifying organization’s total GHG impact, a CF analysis will provide the organization with a comprehensive GHG inventory, allowing it to identify and target reductions from its major emissions sources. Different sectors like Manufacturing Industries, Hospitality, Hotels, Educational Institutions, Agricultural Sector, Medical Industry etc. estimate their carbon footprint nowadays.

The study is an initial step of action, towards mitigating the emissions of the college and formulates an environmental policy framework. It will give an overall picture of the campus CO₂ emissions; help identify major emission sources & potential areas of improvement.

3. STUDY AREA

3.1. ABOUT REPORTING ENTITY: Maitreyi College, University of Delhi.

Carbon Footprint was carried out at the campus of Maitreyi College in Chanakyapuri spread over 10 acres of land in lush green surroundings with extensive play grounds and open spaces.

3.2.REPORTING PERIOD: 1 April 2018 to 31 March 2019

The emissions reported for FY 18-19 will be considered as baseline to set emission reduction targets for upcoming FYs.

3.3.SCOPE OF PROJECT:

a) Physical boundary

- *Location of the building:* Maitreyi College, Bapudham Complex, Chanakyapuri, New Delhi-110021
- *Description of areas excluded from GHG accounting:* The new Science block (non-operational) and the Girls Hostel (under construction) were not in the scope.

b) Operational boundary

- *Scope 1 Direct GHG emissions from:*
 - Combustion of fuels in stationary sources-diesel used in electricity generators
 - Combustion of fuels in stationary sources – LPG consumption in canteen and Chemistry laboratories
 - Combustion of fuels in mobile sources- CNG used in owned vehicle (College Bus)
 - Fugitive emissions from Refrigeration/air-conditioning equipment
- *Scope 2 Indirect emissions from:*
 - Purchased electricity
- *Scope 3 Other Indirect GHG emissions from:*
 - GHG emissions due to daily commuting of Teaching Staff, Non-Teaching Staff and Students to and from college
 - GHG emissions due to paper consumption
 - GHG emissions from garden waste generation across the campus

4. METHODOLOGY FOR GHG QUANTIFICATION

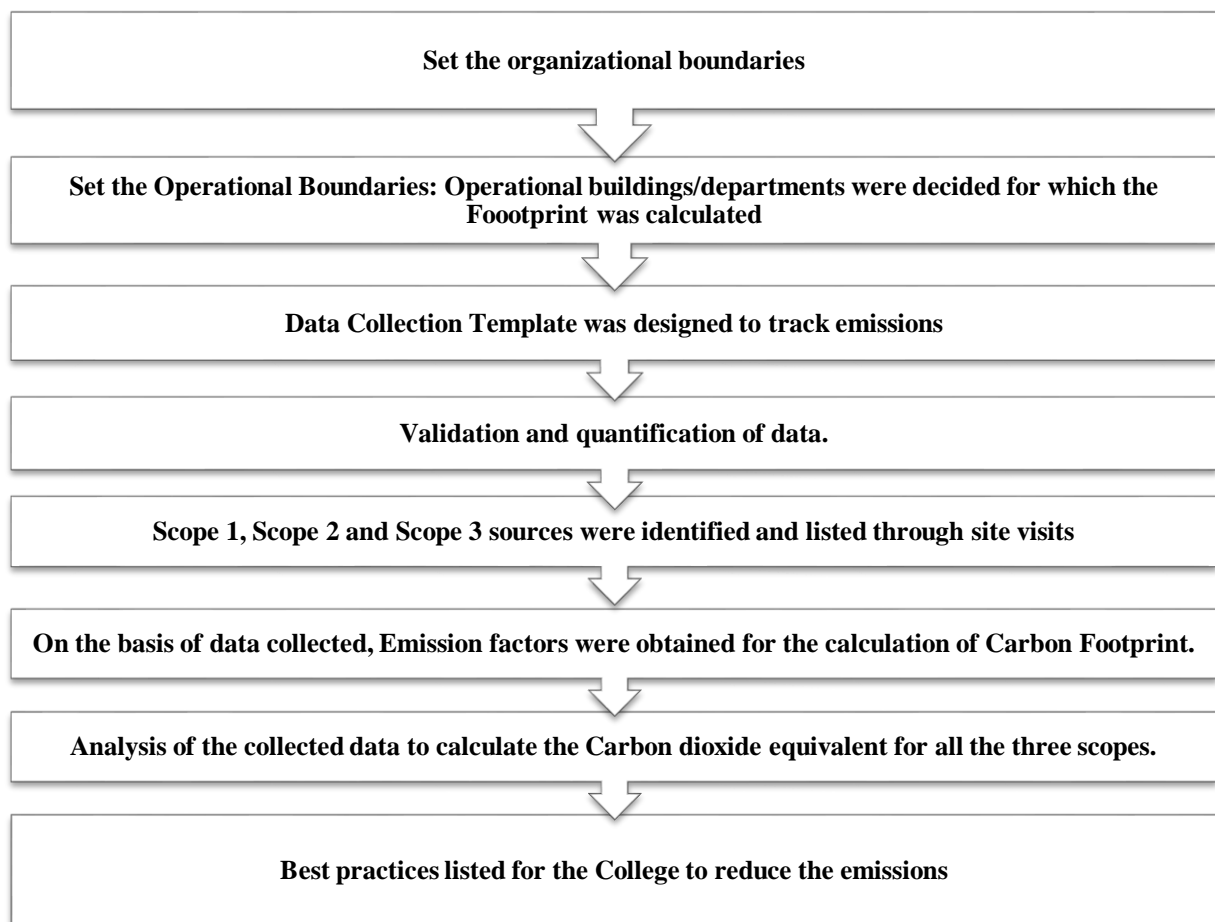


Figure 2: Flowchart showing adopted methodology for estimation of Carbon Footprint

Both qualitative and quantitative data was collected for the project:

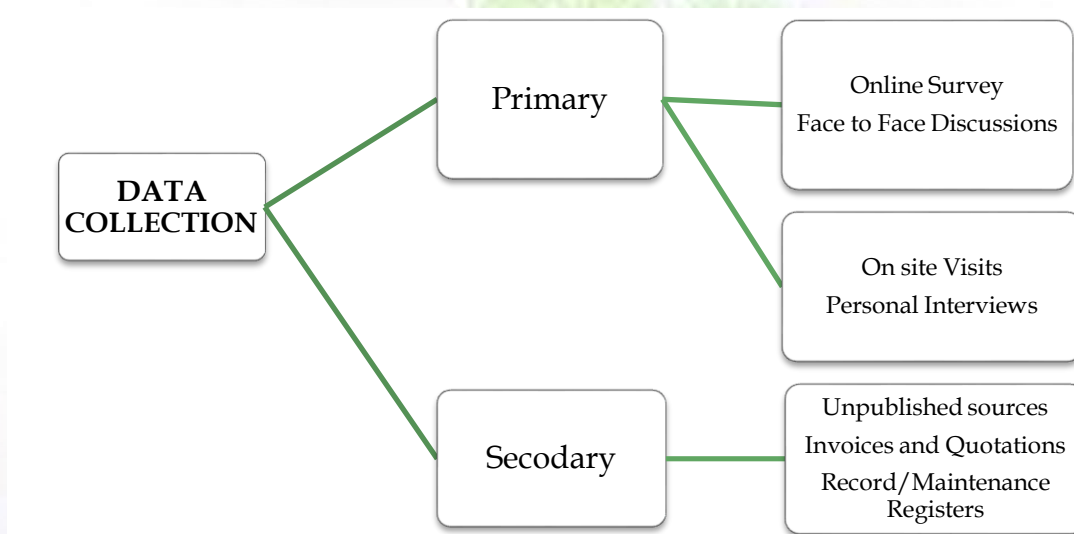


Figure 3: Types & methods of data collection

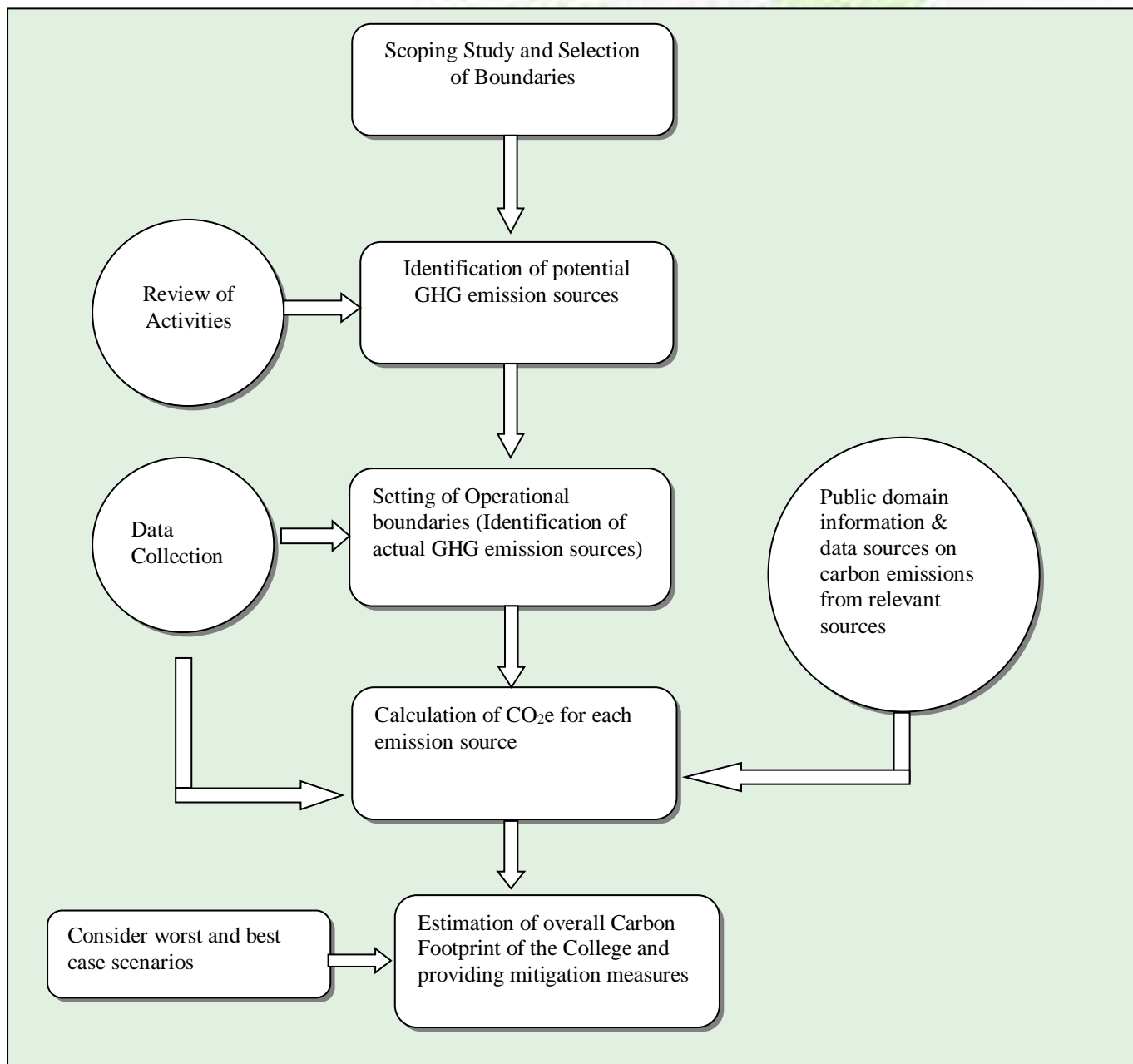


Figure 4: Scheme adopted for the implementation of CF methodology

Calculation of GHG emissions from the unit of activity data requires emission factors for various Greenhouse Gases (specifically CO₂, CH₄ and N₂O). These factors enable GHG emissions to be estimated from a unit of available activity data (e.g. Kg of fuel consumed, Kg of product produced etc.). These are multiplied with their respective conversion factors to be expressed in terms of kg CO₂ equivalent (kgCO₂e). These emission factors were researched and extracted from various national and international standards. Compilation of all the latest required factors was done in the Agile Carbon Footprint Toolkit[®] which was later used in the computation of the carbon footprint.

4.1.ABOUT THE AGILE CF TOOLKIT[®]

Agile CF Toolkit[®] is the software used for calculating the CO₂ equivalent. The software uses latest applicable emission factors sourced from published reliable databases for specific country of computation.

4.2.LIMITATIONS DISCLOSURES

- In the absence of exact quantity of refrigerant load on installed air conditioners, refrigerators and water coolers, industry recommended values for capacity and type of equipment were considered.
- The data used for computation of carbon footprint was as provided by the Institution. In case the data did not include travel related information for few employees and students, the same have been ignored.
- The electricity units were taken from the actual electricity meter bills and the same is considered to be accurate.
- There could always be a calibration error in the system while the computation was made.

5. DATA COLLECTION

5.1.SCOPE 1 DIRECT GHG EMISSIONS

Direct GHG emissions occur from sources that are owned or controlled by the organization, for example, emissions from combustion in owned or controlled boilers, furnaces; emissions from combustion of fuels in vehicles, fugitive emissions etc.

5.2.SCOPE 2 ELECTRICITY INDIRECT GHG EMISSIONS

Scope 2 accounts for the GHG emissions from the generation of purchased electricity consumed by the organization.

5.3.SCOPE 3 OTHER INDIRECT GHG EMISSIONS

It includes emissions from outsourced activities i.e. from the activities of members of the organization but occurred at sources owned/controlled by another organization. (E.g. commuting activities, waste generation etc.)

Table 1: Types of Data Collected and their source and units

GHG ACCOUNTING ACTIVITY	ACTIVITY SUBSET	DATA COLLECTION SOURCES	UNITS
Stationary Combustion	LPG Consumption in Canteen & Chemistry Lab	Record Registers from the respective department	Kg of LPG/ yr.
Stationary Combustion	Diesel used in DG	Purchase Record Books	Liters of Diesel/ yr.
Mobile Combustion	CNG used in College Bus/Distance Travelled by Bus in FY 18-19	Transport Record Books	Amount of Fuel or total distance covered/ yr.
Fugitive Emissions	Refrigerant used in Refrigerators & Air Conditioners	Invoices, Quotations, Equipment Photographs, On site Visits	Kg of Refrigerant/ year
Purchased Electricity	Units of electricity used during the FY 18-19	Monthly Electricity Bills	KWh / yr.
Employee Commuting	Distance travelled, Mode of Transport used	Online Survey	Distance travelled/ yr.
Students Commuting	Distance travelled, Mode of Transport used	Online Survey	Distance travelled/ yr.
Paper Consumption	Amount of paper (fresh & recycled) used	Data Shared by College Administration	Kg of Paper Consumption/ yr.
Garden Waste	Amount of garden waste generated	Data shared by college Gardner	Kg of waste/yr.

6. DATA ANALYSIS: CALCULATIONS AND RESULTS

With reference to the data provided by the college, the number of students, teaching staff and non-teaching staff considered for the project is:

- **Students:** 3106
- **Teaching Staff:** 156
- **Non-teaching staff:** 96

Table 2: A summary of the estimation of Maitreyi College for the Reporting Year 2018-19

GHG Emissions	Scope 1				Scope 2	Scope 3			Total
Total kgCO ₂ e	LPG Consumption	Diesel Consumption	Mobile Source emission	Fugitive Emissions	Purchased Electricity	Commuting	Paper Consumption	Garden Waste	(kgCO ₂ e)
	6,744.82	5,135.73	11.94	695.60	2,66,910.98	1,91,957.2	8860.3722	6	480322.64

In Financial Year 2018-19, Carbon Footprint of Maitreyi College was computed to be **480.32 tons of CO₂ equivalent** or **carbon intensity as 0.143 tCO₂e/individual** for the identified GHG emission sources. The major source of emissions came from **Scope 2 emissions i.e. 266.91 tCO₂e** followed by **Scope 3 which is 200.82 tCO₂e**. The minimum contribution is by **Scope 1** which was computed to be **12.59 tCO₂e**.

The scope wise breakdown is analyzed as follows:

6.1 SCOPE 1 GHG EMISSIONS

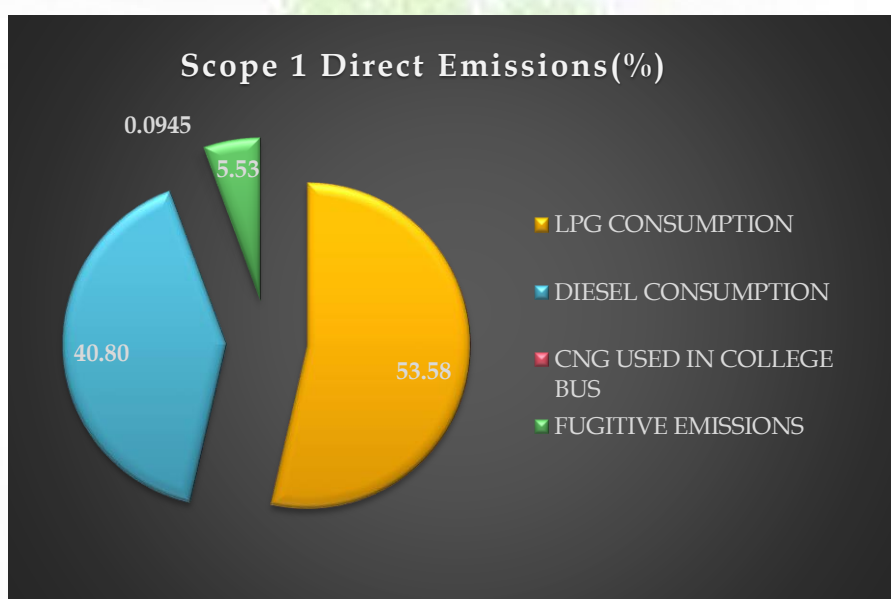


Figure 5: Pie chart showing Scope 1 emissions (%) emissions for different activities

As indicated above, the maximum GHG emissions are contributed by **LPG consumption i.e. 53.58% of the total scope 1 emissions**. The LPG cylinders are used in canteen for food preparation and chemistry lab for research purposes. It was estimated that a total of 97 commercial cylinders (19kg capacity) were used in the canteen during FY 2018-19. Hence, the total emissions computed for LPG cylinders was **6744.82 kg of CO₂ equivalent**.

This was followed by consumption of **diesel (i.e. 40.80% of total scope 1 emissions)** in Diesel Generator (DG) to provide power backup to the College during power cuts to sustain the ongoing operations across campus.

Diesel emissions were followed by the emissions from refrigerators and air conditioners installed across the college. The **fugitive emissions** made up a very little part of Scope 1 emissions i.e. **5.53% of the total scope 1 emissions**.

Minimum emissions were from mobile source i.e. CNG consumed by the college bus. It was computed to be **0.095% of the total scope 1 emissions**. The reason for low emissions from CNG bus can be estimated as less frequent trips made by the bus, especially during activities or competitions.

6.2 SCOPE 2 GHG EMISSIONS

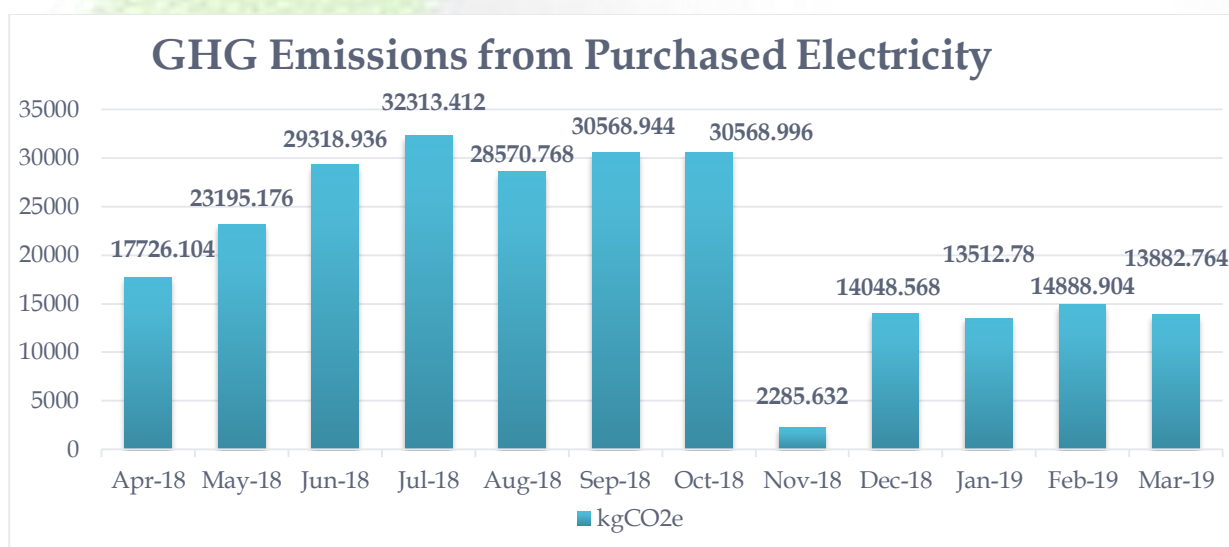


Figure 6: Bar Graph showing monthly GHG emissions due to electricity consumption under Scope 2

The maximum GHG emissions are the Scope 2 emissions. These are the emissions due to the electricity consumption by the college. The total emissions were estimated to be **2,66,910.98 kgCO₂e or 266.91 tCO₂e** for the reporting year 2018-19.

It was observed that the **maximum emissions** were made in the month of **July** followed by October, September and June and **minimum emissions** were reported in the months of **November**. The trend analysis indicates that emissions were maximum during the active months of the year and least during holidays and mid semester breaks.

6.3 SCOPE 3 GHG EMISSIONS

Table 3: GHG emissions for different activities under Scope 3

SCOPE ACTIVITY	CATEGORY	FOOTPRINT(kgCO _{2e})
Commuting (to and from college)	Teaching Staff	51897.1
	Non-Teaching Staff	16,475.7
	Students	123584.4
	TOTAL	1,91,957.2
Paper Consumption	Stationary paper	7807.125
	Waste paper scrap	29.5239
	Recycled paper	466.0767
	Answer sheets	1489.8
	TOTAL	8860.3722
Garden Waste Disposal	TOTAL	6
Total (kgCO_{2e})		200823.57

The **Scope 3 emissions** for Maitreyi College were computed to be approximately **2,00,823.57 kgCO_{2e}** or **200.82 tCO_{2e}**. The maximum emissions are due to commuting (i.e. 95.58% of the total scope 3 emissions). The emissions due to the paper consumption minus the recycled paper used by the college is about 4.41 % of the total scope 3 emissions. Negligible emissions are due to the garden waste i.e. 0.003% of the total scope 3 emissions. The garden waste is used for the production of compost.

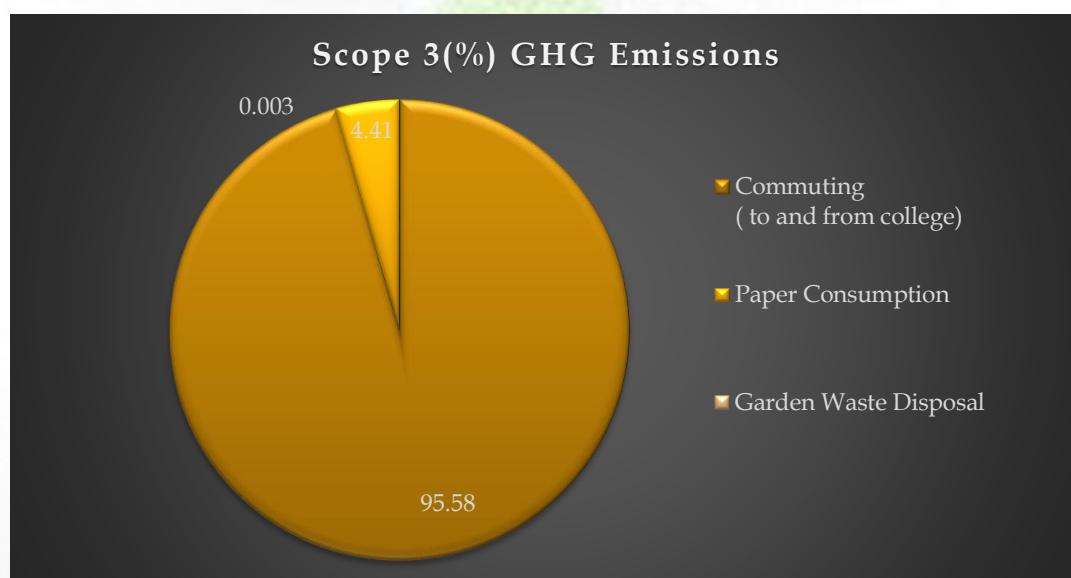


Figure 7: Percentage breakdown of GHG Emissions under the Scope 3 emissions

Though the absolute emissions indicate maximum commuting emissions from students, however the intensity calculations conclude that maximum emissions are done by the teachers (332 kgCO₂e per teacher) followed by non-teaching staff (181 kgCO₂e per non-teaching staff) and least by students (82 kgCO₂e per student). It was assumed that the higher emissions contributed by the teaching & non-teaching staff may be due to the private vehicles brought by them for daily commute.

7. RECOMMENDATIONS AND SUGGESTIONS

7.1. GENERAL

a. Building of GHG Information Management System

(CARBON POLICE OF MAITRETYI COLLEGE)

A carbon management team can be established comprising of representatives from teaching staff, students and other non-teaching staff of various departments. The team will enable the college to collect necessary data for computation, measure its carbon performance, to identify and implement improvements, to monitor progress, and internally verify results. The team will also encourage participation and consultation of students, teachers & non-teaching staff throughout the year. The team may also report progress on the performance periodically.

b. Formulating Environmental Policy

An Environmental Policy should be formulated by the Management to commit to adopt sustainable practices at the campus. The policy should be well communicated & displayed across the campus.

c. Set reduction targets

Based on the baseline and available resources, the College may develop its short / medium / long term reduction targets and plans to achieve the targets.

d. Green events

The activities carried out at the campus should be performed in light of low carbon emissions. The team may ensure low carbon products and strategies are adopted for various events.

e. CF Disclosure

With GHG accounting and management systems well in place, the College can demonstrate its best practices at public platforms. Besides recognition, this will be a step towards generating awareness to other universities and colleges to undertake similar disclosures for comparison. Through disclosures there can be an exchange platform developed for institutes to share eco-friendly and energy efficient techniques & equipment to be installed in colleges.

f. Awarding and labelling Departments

Department with minimum carbon emissions should be rewarded with eco-friendly labels/batches/medals/trophies/certificates to motivate other departments to work towards the same.

g. Eco suggestion box

A suggestion box can be placed at the campus inviting innovative ideas from students/teachers/other staff members for carbon reduction.

7.2. SCOPE WISE MITIGATION MEASURES

Scope 1:

- Retrofitting of the old air conditioners should be done in order to prevent any leakage.
- Regular maintenance of the air conditioners and refrigerators should be done and records should be maintained.

- New equipment to be procured should be assessed on its emissions prior to the purchase. (For ex. ACs and refrigerators should be checked on BEE star labeling)
- Reheating of food can be done on induction / microwave minimizing the use of LPG.
- All leakages should be checked regularly.
- The waste from compost pit can be used to generate biogas and the same pipeline may be extended to cafeteria for cooking.



Source: Petroleum Conservation Research Association (Google images)

Scope 2:

- Sub-metering system for electricity usage may help to identify high energy consumption areas.
- Posters should be displayed across the college, spreading awareness among the students, teachers and other staff members to switch off the lights and fans when not in use, switching off microwaves after use etc.



Source: Clipart Library (Google)

- The systems (computers, laptops, air conditioners, refrigerators etc.) should be procured for the college considering the latest energy efficient technologies in the markets. (For ex All in One Units etc.)
- Occupancy sensors should be installed in the classrooms and offices.
- LED lights should be installed in phase wise manner.

- Solar panels can be installed in the college to generate electricity.

Scope 3:

- Teachers and other staff members should be encouraged & rewarded for using carpool for their daily commuting. E.g.: Apps like BlaBlaCar, SRide, UberPool, OlaShare, Ridely, ToGo, QuickRide, ZIFY etc.
- A campaign can be run in the college- #ZEROCARBONCOLLEGE under which any event occurring in the college like Fresher's, Farewell or any other facilitation, the theme should be decided under this campaign. E.g. the decorations done during the event can be done by reused or recycled products.
- Online salary slips should be generated for staff instead of issuing paper slips. This will help preventing the use of fresh paper.
- Both teachers and students should be encouraged to use e-notes as study material.
- College should identify the types & quantity of waste generated. Relevant waste minimization strategies should be adopted to prevent the waste into landfills. Regular waste audits may be conducted to check the same.
- Teachers should encourage students to submit soft copy of their internal assignments to avoid wastage of paper.



Source: Wiki how images

- Food waste from kitchen should also be sent to the compost pit for making manure.
- Biogas generated within college can be used for small activities like cooking or lighting up small bulbs.
- A chemical effluent treatment plant can be built by the college to treat all the chemical waste generated in laboratories before releasing them into drain.
- Old Catalogues/records in the library should be saved in the computer and can be sent for phase wise discarding/recycling.
- College societies like dance society, drama society etc. should take initiatives to prepare their events/plays/performances with messages of conserving resources and saving environment.



Source: Google images

8. CONCLUSION AND DISCUSSION

The present study computes the carbon footprint of MAITREYI COLLEGE, University of Delhi for the Reporting Year 2018-19. It is a pioneer step undertaken by the college amongst other Delhi University colleges to report and reduce its carbon emissions. The study presents the Scope 1, Scope 2 & Scope 3 emissions of the scope location. It highlights, the top 3 areas of emissions within the campus i.e. electricity consumption (55.57% of the total emissions), commuting (39.96% of total emissions) and paper consumption (1.84% of total emissions). The total emissions computed for the college is 480322.64 kg of CO₂ equivalent, out of which the major contribution is of Scope 2 (55.57%) emissions, followed by Scope 3 (41.81%) and least by Scope 1 (2.62%).

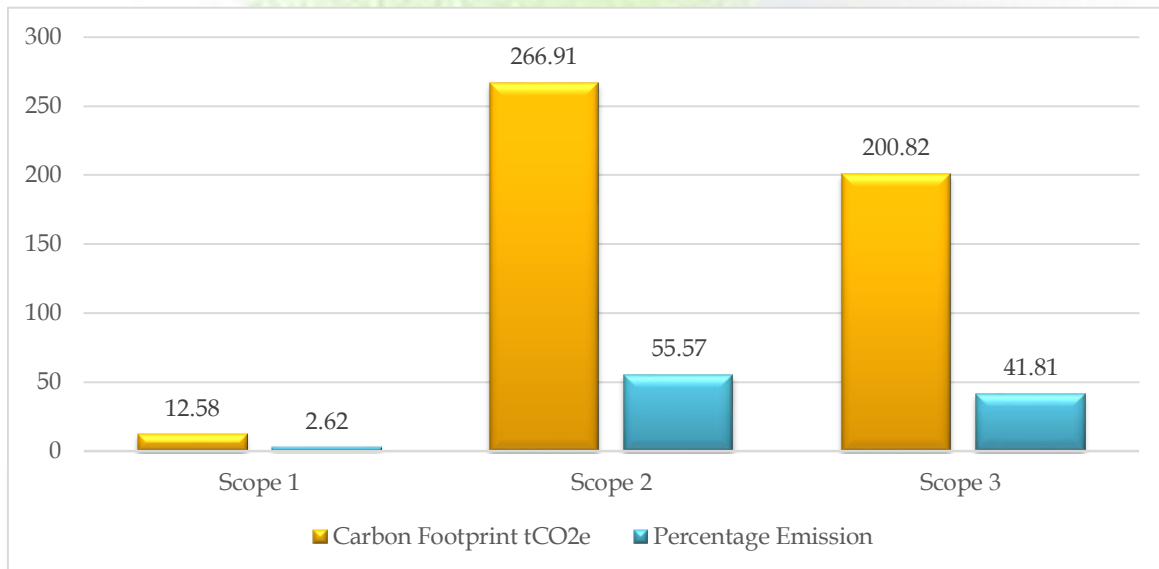


Figure 8: Carbon Footprint and percentage GHG emissions for Scope 1, Scope 2 and Scope 3

Thus, the baseline set for the college is 480.32 tons of CO₂ equivalent which can be further reduced using the recommended measures provided in chapter 7. The activity-wise analysis is indicated as below:

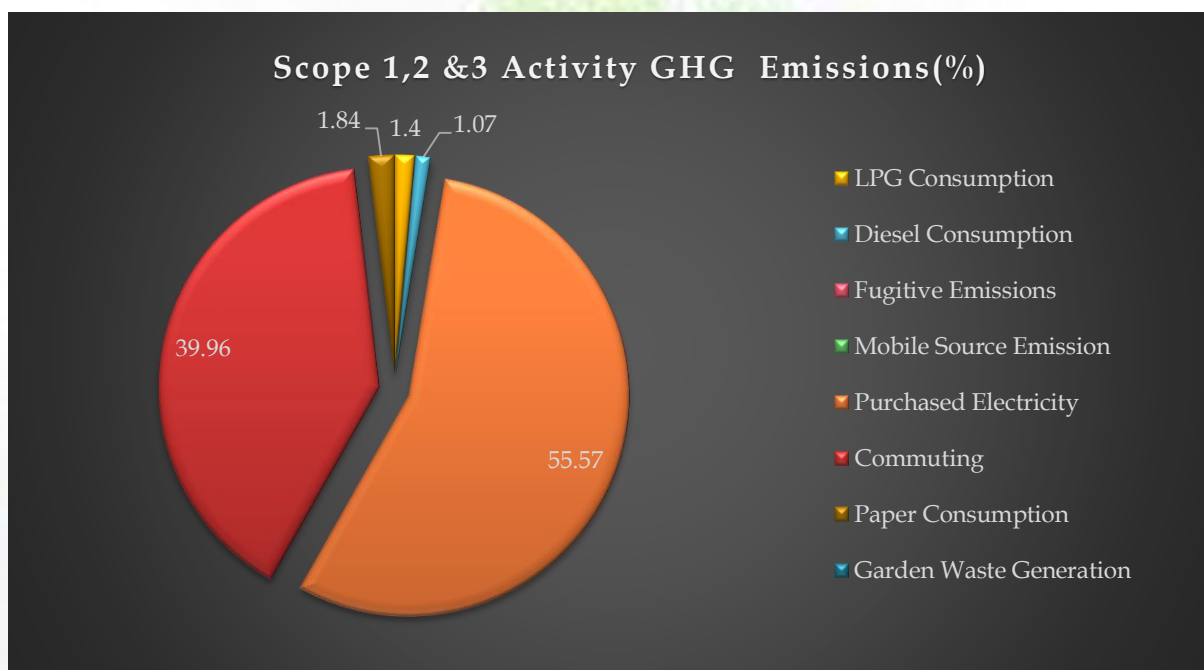


Figure 9: Percentage GHG emissions for various activities under Scope 1, Scope 2 and Scope 3

The study highlights negligible emissions from garden waste, mobile source and fugitive emissions. The awareness will invite career opportunities for the students in the field of environment & ecology.

Besides the computation of Carbon Footprint of Maitreyi, the study has raised a reasonable awareness amongst faculty and students about carbon footprint and impacts of global warming which was lacking initially.

Few of the several benefits associated with this study is implementing directional mitigation measures in the college, thereby, saving resources. Setting of policy & objectives will help the college to achieve both environmental & financial sustainability. The study will encourage other Universities & colleges to identify their key areas of emissions and report on the same. This will bring informational exchange between the colleges and universities to share latest, sustainable and cost-effective technologies & processes to the table.

Overall, this project / initiative is a step towards contributing to India's nationally determined goals and achieving carbon neutrality by Maitreyi College.

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