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# Sustainability in Academia: Evaluating the Carbon Footprint as an Indicator of Environmental Responsibility at Higher Education Institutions

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**ABSTRACT**

The current study aims to evaluate the environmental performance of International Islamic University Islamabad (IIUI) by assessing the carbon footprint of its on-campus activities, following the guidelines given by the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard. The objectives of the study are: 1) to identify the scope of activities for carbon footprint assessment; 2) to quantify the IIUI's organizational carbon footprint; and 3) to identify the major contributors (sources) for greenhouse gas (GHG) emissions at the university. Three emission sources were identified (Scope 1: natural gas, diesel combustion, university-owned transportation, refrigerants and fugitive emissions; Scope 2: purchased electricity; Scope 3: business travel and paper usage). Carbon footprint of IIUI was found to be 4660.38t$CO_2$e, with per capita carbon footprint to be 0.16t$CO_2$e. Scope 1 accounted for the largest share of emissions (80.96%), followed by Scope 2 (18.76%), with Scope 3 contributing only 0.28% in 2023. The greatest emissions stem from university-owned transport, accounting 1729.85t$CO_2$e (37%). The finding of this study can support efforts to improve environmental sustainability and contribute to higher education institution's participation in national and global ranking systems.

## 1. Introduction

Due to the changing climate, humans have experienced detrimental effects appearing as extreme weather events like droughts, floods, cyclones, glacial melting, and most significantly global warming. The global warming which is caused by amplified concentrations of anthropogenic greenhouse gases is the most urgent challenge that the world faces today (Li et al., 2015). According to the Global Climate Risk Index, Pakistan is among the list of countries recurrently impacted by climate change catastrophes and ranks to be the most afflicted nations from the past two decades with the loss of nearly ten-thousand lives and 3.8 billion United States Dollar (USD) from 1999 to 2018 (Eckstein et al., 2019). Though the emissions are less as compared to the levels of developed nations, Pakistan faces adverse climatic effects. Since there has been an unremitting rise in greenhouse gas emissions coupled with anthropogenic drivers, nations are encouraged to extend their efforts to include sustainability and climate-related mitigation plans in their agenda. Universities should act as actors by executing climate change adaptation and mitigation strategies on their premises and as observers of the implementation of actions into their policy mechanism (Güereca et al., 2013).

Sustainable Development Goals (SDGs) executed by United Nations serve to maintain global balance by improving the prevailing economic growth trends (Ahmad et al., 2024). The notion of Education for Sustainable Development (ESD) given by United Nations Educational, Scientific and Cultural Organization (UNESCO) has gained massive attention. UNESCO aims at strengthening the capacities of governments to provide quality education on climate change, guiding policies, providing technical support, implementing climate projects and non-formal education programs. Seeing the number of its ecological and renewable energy policies, Pakistan has the potential to transform to clean and green energy sources and sustainable future (Raza and Cucculelli, 2024). In 2018, the Government of Pakistan and the United Nations (UN) in Pakistan signed a UN Sustainable Development Framework (UNSDF) which is a strategic planning document with planned results and focusing on achieving key outcomes, eventually contributing to the pursuit of SDGs in Pakistan (United Nations Pakistan, 2024).

Developed world is making significant improvements in achieving environmental sustainability, whereas growing economies are still struggling with elevated levels of greenhouse gas (GHG) emissions. One reason for such high emissions is their dependency on fossil fuels (Abbasi et al., 2024). The first step towards carbon neutrality of higher education institutions (HEIs) is to measure, assess, and report the environmental damage and resulting impacts on climate caused by their day-to-day activities (Samara et al., 2022). Therefore, it is imperative to quantify GHG emissions from university campuses to find the sources of these emissions and areas that require immediate and prioritized carbon reduction actions (Adeyeye et al., 2023). This process of quantification of carbon emissions is known as carbon footprint assessment. The carbon footprint assessment of universities connects anthropogenic actions to their impacts on global climate. It also increases awareness and builds connections between the staff and students on campus. By conducting such assessment, organizations can manage their actions, engage in carbon accounting, pursue carbon reduction measures, and participate in carbon trading by offsetting carbon credits (Adeyeye et al., 2023).

Among the most commonly used methods for carbon footprint assessment are environmental extended input-output (EEIO) analysis, life-cycle analysis (LCA), and hybrid life-cycle analysis (HLCA). The GHG Protocol Corporate Accounting and Reporting Standard formulated with the collaboration of the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) in 2004, provides guidelines for measuring the organizational

carbon footprint. Greenhouse gas protocol is focused on the procedure adopted for the analysis and the analysis results which are used for carbon reduction and trading (Gao et al., 2014). It provides a set of guidelines that categorize emissions into three scopes:

**Scope 1 (Direct emissions):** These are the direct emissions that the organization manages or control. Examples include emissions from burning of fossil fuels in boilers and furnaces, company-owned vehicles, and chemical production in process equipment.

**Scope 2 (Indirect emissions):** Indirect emissions from purchased electricity consumed by the company.

**Scope 3 (Other indirect emissions):** Other indirect emissions that are a result of the activities of the company but sources are not owned or controlled by the company. Some examples of scope 3 activities are abstraction and manufacture of purchased materials; transportation of purchased fuels; and use of sold products and services (WRI and WBCSD, 2004).

Pakistan is a participating member of many international treaties including the Kyoto Protocol, which collectively work to make the planet a better place to live. These international treaties require their members to submit annual progress reports, making sure participants comply with their obligations. Besides that, universities are compelled to participate in ranking programs to improve their academic and social image. The inadequate availability of data on carbon footprint assessment in institutions in Pakistan causes the country to lag in the race towards sustainability. Universities are thus required to conduct their annual carbon footprint assessment. International Islamic University Islamabad (IIUI), being an internationally recognized university can play a role by exhibiting its status as a green university. The current study aims to improve the environmental performance of IIUI by assessing the carbon footprint of its on-campus activities. It can help the university focus on the parameters that generate emissions and take corresponding actions to lessen the impacts on the environment.

Universities act as microcosms of cities with numerous activities contributing to climate change. The assessment of their activities, reporting of greenhouse gas emissions, and taking corresponding remedial actions can help universities and the overall urban environment reach the goal of sustainability. The amount of GHG emissions from HEIs depends on size, types of activities, transportation, waste generated, processes, and equipment used (Gómez et al., 2016; Lozano et al., 2013). Studies do not follow any specific internationally accepted methodology but follow the procedures provided by already available standards. Several institutions have used the life-cycle assessment (LCA) approach including the Indian "Birla Institute of Technology and Science" (Sangwan et al., 2018) and Clemson university (Clabeaux et al., 2020). Some HEIs such as the University of Leeds and the Norwegian University of Technology and Science have used environmental extended input-output (EEIO) analysis which provides an indication of the sources contributing to the total carbon footprint and is a comprehensive and reliable method relatively (Larsen et al., 2013; Townsend and Barrett, 2015). Many researchers use a hybrid LCA approach to overcome the weaknesses of prior methods (Gómez et al., 2016; Kiehle et al., 2023; Thurston and Eckelman, 2011). GHG Protocol is the most commonly adopted method, used by a large number of universities, the "American University of Sharjah" (Samara et al., 2022), "Diponegoro University" (Syafrudin et al., 2020), "University of Talca" (Yañez et al., 2020), "The Technological University of Pereira" (Hoyos et al., 2021), and the "University of Ibadan" (Adeyeye et al., 2023).

Universities in Pakistan are now assessing their carbon footprints and reporting their findings as well. NED University of Engineering and Technology found scope 3 as the leading cause of carbon

emissions using the GHG Protocol (Mustafa et al., 2022). Researchers at the Mehran University of Engineering and Technology used their self-made model ARIMA technique based on Python and concluded that electricity is the main contributor at the university campus causing around 93% of the total emissions (Memon et al., 2022). University of Punjab and University of Haripur used GHG protocol and found electricity as the significant contributor to emissions (Haseeb et al., 2022; Ullah et al., 2020).

## 2. Materials and Methods

### 2.1. Study Area

International Islamic University Islamabad (IIUI) is one of the leading internationally recognized universities in Pakistan. It has its main campus in Islamabad with some offices and hostels located in the annex of Faisal Mosque. The targeted area of this study is the International Islamic University Islamabad, H-10 Campus (Figure 2.1). This is a public research university, providing quality higher education and research and is spread over an area of about 704 acres (2.94 km2) of Islamabad. Presently, the university has eleven (11) faculties and around one hundred twenty (120) academic programs with an enrollment of around 25,221 students. The total land area covered by buildings including faculty blocks, library, administration block, transport section, gymnasium, and hostels is around 164905m2. About 86.97% of the area is open space of which 17.23% (506535m2) has planted vegetation. International Islamic University Islamabad ranks 56th in the country category of the UI GreenMetric World University Ranking, with a total score of 2830. The current study is proposed to conduct a carbon footprint assessment of the H-10 campus.

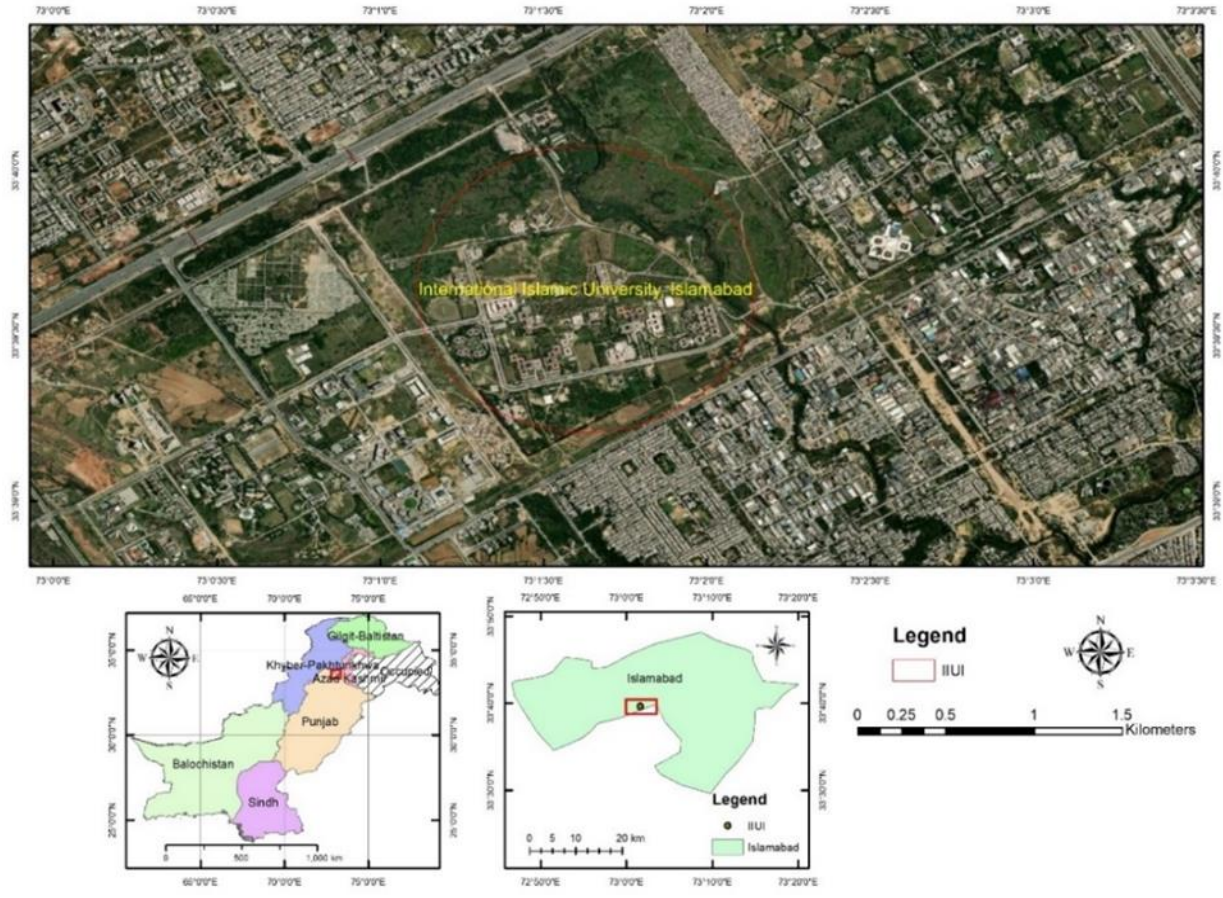


**Figure 1:** *Location Map of IIUI*

## 2.2. Study Design

The study follows a multiple-step procedure:

Setting the organizational limits, setting the operational limits; collecting data, calculating GHG emissions, calculating the carbon footprint, and finally interpreting the outcomes of the study as shown in Figure 2.

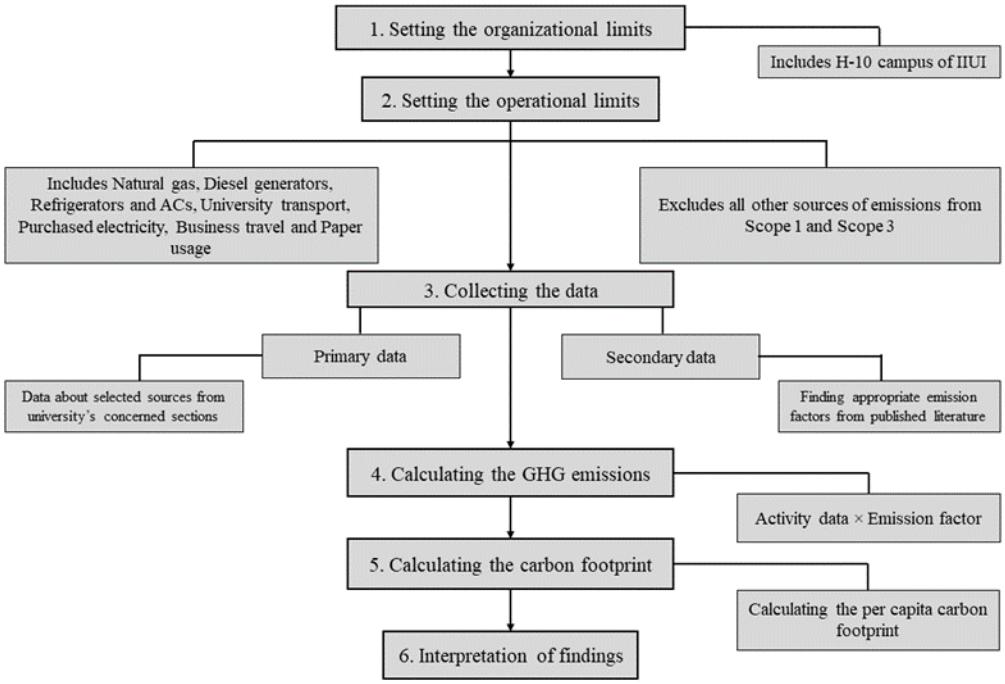


**Figure 2:** *Methodological framework of the study*

## 2.3. Organizational Boundaries

The organizational boundaries help understand the extent of the study area, specifying whether the emissions are measured for the entire campus, some of its buildings/departments, or any specific department. Depending on the organizational boundary, the relevant departments, facilities, and their operations are determined. For this study of International Islamic University Islamabad, the H-10 campus was carefully chosen as the organizational boundary.

## 2.4. Operational Boundaries

Setting the operational limits helps to understand the parameters to focus on and those that are excluded from the study. The operational limits of this study comprise emissions from three scopes. Following the GHG Protocol's three-scope guidelines, the boundary of this study covered on-campus natural gas consumption for heating, on-campus energy use in generators, use of refrigerants in refrigerators and air conditioners (ACs) for cooling purposes, university-owned transportation, purchased electricity, business travel, and paper usage. The rest of the sources under Scope 1 and Scope 3 are excluded due to the unavailability of data. The scope-wise operational limits of the study are summarized in Figure 3.

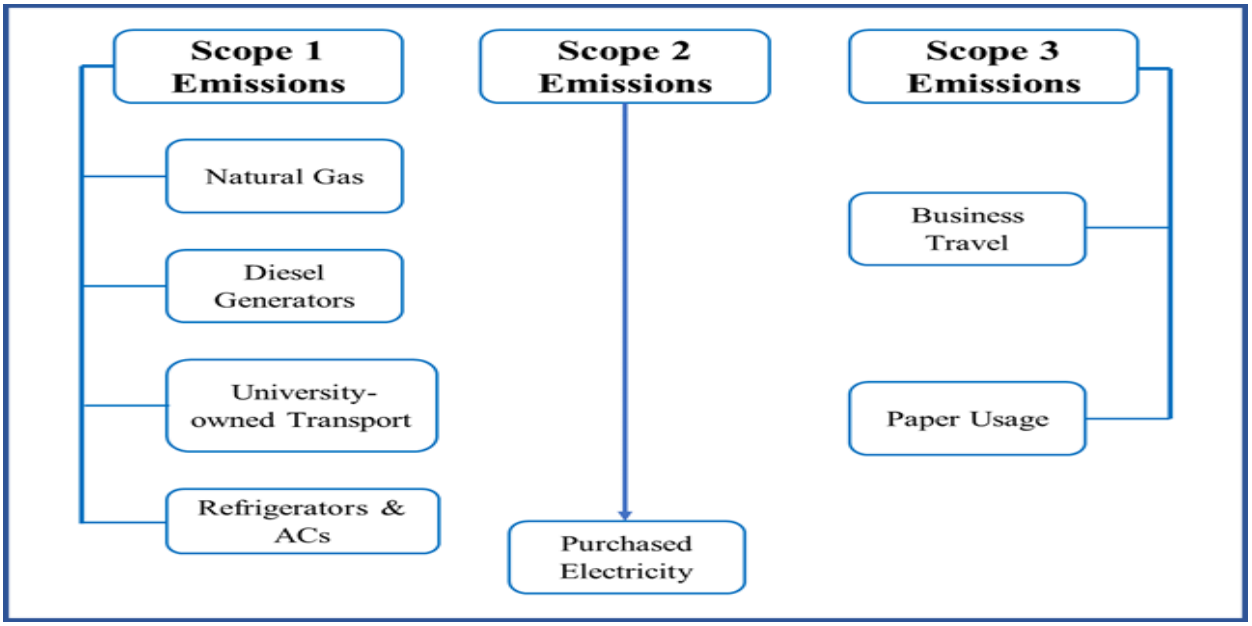


**Figure 3:** *Operational boundaries of the study*

### 2.5. Data Acquisition

The collection of data involved both primary and secondary sources. Primary data regarding the selected scopes was obtained from the university's concerned sections. Data about Scope 1 included sources such as natural gas for which data was taken from the Directorate of Finance, data for diesel fuel was taken from the Directorate of Administration Electrical Section, university-owned transport data was taken from the Transport Section, and data for refrigerants and ACs was collected from the Directorate of Administration Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) section (Table 1). For Scope 2, data about purchased electricity was extracted from monthly utility bills provided by the Directorate of Administration Electrical Section. Data regarding Scope 3 sources including business travel and paper usage was taken from the Office of Research Innovation and Commercialization (ORIC) and Directorate of Administration respectively. Emission factors from the Environmental Protection Agency (EPA), Intergovernmental Panel on Climate Change (IPCC), and the International Energy Agency (IEA) are the sources of secondary data.

**Table 1:** *Primary data from selected emission sources during the year 2023*

| Emission Source | Unit | Amount/Year |
|---|---|---|
| Natural Gas | MMBtu | 7057.03 |
| Diesel | MMBtu | 968.971 |
| University-owned transport | liters | 651,233.54 |
| Refrigerants and fugitives | kg | 367.8 |
| Purchased Electricity | kWh | 6156800 |
| Business Travel (distance) | miles | 16101.492 |
| Paper (weight) | kg | 7947.5 |

Greenhouse gas emission factors (EFs) for natural gas are provided in Table 2 hereunder.

**Table 2:** *Emission factors for natural gas*

| **Emission Source** | **Emission Factors** | | | **Source** |
|---|---|---|---|---|
| | **$CO_2$ Factor** ($kgCO_2$/MMBtu) | **$CH_4$ Factor** ($kgCH_4$/ MMBtu) | **$N_2O$ Factor** ($kgN_2O$/ MMBtu) | |
| Natural Gas | 53.06 | 0.001 | 0.0001 | EPA |

The type of diesel used by generators has specific GHG emission factors provided in Table 3 below;

**Table 3:** *Emission factors for diesel used in generators*

| **Emission Source** | **Emission Factors** | | | **Source** |
|---|---|---|---|---|
| | **$CO_2$ Factor** ($kgCO_2$/ MMBtu) | **$CH_4$ Factor** ($kgCH_4$/ MMBtu) | **$N_2O$ Factor** ($kgN_2O$/ MMBtu) | |
| Diesel (Distillate Fuel Oil No. 2) | 73.96 | 0.003 | 0.0006 | EPA |

Each mode of transportation has its specific emission factors. The emission factors to be used also depend upon the type of fuel being used in the vehicle. International Islamic University Islamabad has heavy duty vehicles such as buses, tractors, dozer machine and excavator that make use of diesel. On the other hand, university also owns a fleet of passenger cars and motorcycles that run on gasoline. Based on the modes of transportation and fuel used in vehicles in the university, the selected emission factors are given in Table 4;

**Table 4:** *Emission factors for university-owned transport*

| **Emission Source** | **Emission factors** | **Type of fuel** | | **Source** |
|---|---|---|---|---|
| | | **Diesel (Medium and heavy-duty vehicles)** | **Gasoline (Passenger cars and motorcycles)** | |
| University-owned transport | $CO_2$ Factor ($kgCO_2$/Liters) | 10.21 | 8.78 | EPA |
| | $CH_4$ Factor ($kgCH_4$/Liters) | 0.00004488 | 0.00038925 | |
| | $N_2O$ Factor ($kgN_2O$/Liters) | 0.00004224 | 0.000081 | |

Each type of refrigerant and coolant has its specific global warming potential. The details of gases and their respective GWPs are given below in Table 5;

**Table 5:** *GWPs of refrigerants and fugitives*

| **Refrigerant name** | **100-Year GWP** | **Source** |
|---|---|---|
| R-22 | 1760 | IPCC |
| R-134 | 1120 | |
| R-410A | 1924 | |
| R-407C | 1624 | |

The emissions factors of purchased electricity for this study were taken from IEA and given in Table 6;

**Table 6:** *Emission factors for purchased electricity*

| **Emission Source** | **Emission Factors** | | | **Source** |
|---|---|---|---|---|
| | **$CO_2$ Factor** ($kgCO_2$/ kWh) | **$CH_4$ Factor** ($kgCH_4$/ kWh) | **$N_2O$ Factor** ($kgN_2O$/ kWh) | |
| Purchased Electricity | 0.141996448 | 4.1505E-06 | 7.292E-07 | IEA Electricity Composite Factor |

Various modes of travel release different concentrations of greenhouse gases and thus have their specific emission factors (Table 7);

**Table 7:** *Emission factors for business travel*

| **Emission Source** | **Emission factors** | **Modes of transport** | | **Source** |
|---|---|---|---|---|
| | | **Air** | **Bus** | |
| Business Travel | $CO_2$ Factor ($kgCO_2$/mile) | 0.163 | 0.071 | EPA |
| | $CH_4$ Factor ($kgCH_4$/mile) | 0.0000006 | 0 | |
| | $N_2O$ Factor ($kgN_2O$/mile) | 0.0000052 | 0.0000021 | |

The emission factors of office computer paper are given below in Table 8;

**Table 8:** *Emission factors for paper consumption*

| Emission Source | Emission Factor | | | Source |
|---|---|---|---|---|
| | **$CO_2$ Factor** $kgCO_2/kg$ | **$CH_4$ Factor** $kgCH_4/kg$ | **$N_2O$ Factor** $kgN_2O/kg$ | |
| Office Paper | 1.22 | 0.046 | 0.028 | EPA |

### 2.6. Calculating GHG Emissions

The emissions from the selected sources were calculated by following the calculation procedure provided by the GHG Protocol Corporate Accounting and Reporting Standard. It involves a formula that is based on the activity data and emission factors of the corresponding gas to be measured.

$$GHG\ Emission = Activity\ data \times Emission\ factor$$

Once the emission is calculated, the answer is divided by 1000 to obtain the emissions in "tonnes".

The total carbon footprint of International Islamic University, Islamabad was calculated by adding the emissions from all sources as given below in equation (8);

$$CF_{IIUI} = \sum(GHGE_n + GHGE_d + GHGE_{tr} + GHGE_r + GHGE_e + GHGE_{tl} + GHGE_p)$$

For calculating the per capita carbon footprint, the formula is given below;

$$Per\ capita\ CF = \frac{Total\ carbon\ footprint}{Total\ population}$$

## 3. Results

In this study, GHG emission sources were classified into three scopes (direct, indirect, and other indirect emissions). The sources analyzed under Scope 1 emissions included natural gas, diesel fuel, university-owned transportation, and refrigerators and ACs. Scope 2 included emissions from energy consumption i.e., purchased electricity, and Scope 3 covered other indirect emissions such as from business-related travel and paper usage. Each of these sources was analyzed separately. The greenhouse gases released from these sources include carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Carbon dioxide is the gas that is released in greater concentrations than the other two gases. Results show that the total carbon footprint of IIUI from various categories of three scopes is 4660.38 tonnes of carbon dioxide equivalent (tCO2e) for the year 2023. The per capita carbon footprint came out to be 0.16 tCO2e. A detailed account of greenhouse gas emissions released from each category of the three scopes is given in Table 3.1. It is evident from the table that the highest rate of emissions is from Scope 1 sources which caused a total of 3773.1964 tCO2e emissions out of the total. The prime contributing source to the total carbon footprint is university-owned transport which released around 1729.85 tCO2e in one year. The share of each source in the total emissions is shown in Figure 3. Figure 3 illustrates that emissions from university-owned vehicles share around 37.12% of the total carbon footprint. The second largest contribution is of natural gas which makes 29.2% (1361.19 tCO2e) part in the total carbon footprint, followed by purchased electricity (18.76%), refrigerators and ACs (13.1%), diesel (1.54%), paper (0.22%), and

lastly business travel (0.06%). Out of the three gases included in the study, carbon dioxide is released in greater quantities. The total carbon dioxide released from the selected sources for the year 2023 is about 4045.320 tonnes. Overall, Scope 1 categories accounted for the greatest emissions i.e., 80.96%, followed by Scope 2 having 18.76% share and then Scope 3 with a minimum fraction of 0.28% in total greenhouse gas emissions during 2023 (Table 8). Figure 4 gives the graphical representation of the percentage contribution by each scope of emissions.

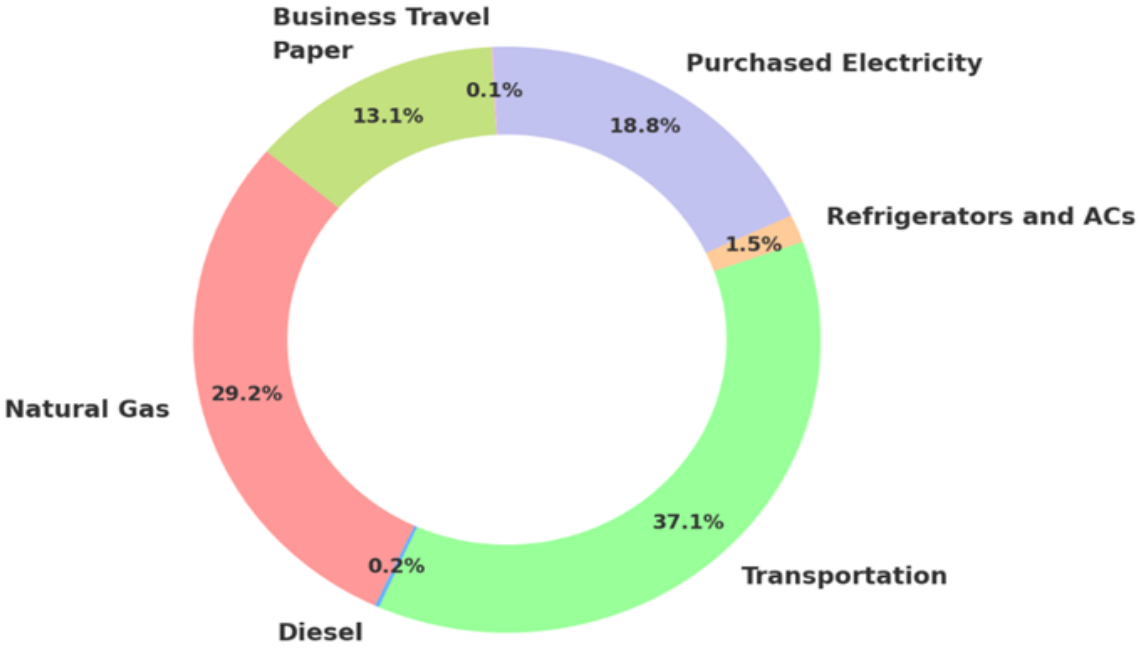


**Figure 3:** *Share of each source in GHG emissions*

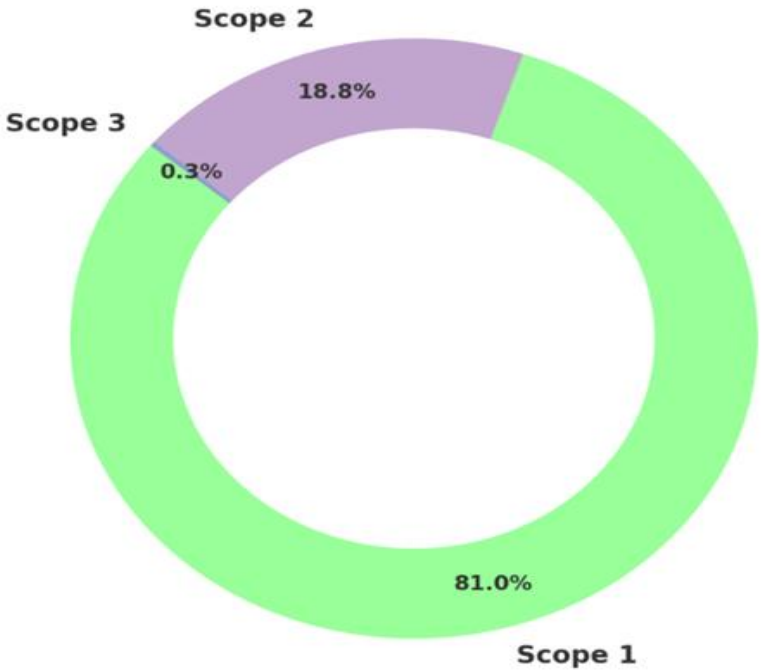


**Figure 4:** *Percentage contribution of each scope in GHG emissions*

**Table 8:** *Total GHG emissions of IIUI from various categories of three scopes*

| Scopes of emissions | Categories of emissions | GHG Emissions | | | | |
|---|---|---|---|---|---|---|
| | | **$CO_2$ (tonnes)** | **$CH_4$ (tonnes)** | **$N_2O$ (tonnes)** | **Total GHG Emissions $CO_2e$ (tonnes)** | **Percentage contributions (%)** |
| **Scope 1** | Natural Gas | 1359.797 | 0.0256275 | 0.0025626 | 1361.19 | 29.2 |
| | Diesel | 71.665 | 0.0029069 | 0.0005814 | 71.90 | 1.54 |
| | Transportation | 1727.303 | 0.014754 | 0.008058 | 1729.85 | 37.12 |
| | Refrigerators and ACs | | | | 610.2564 | 13.1 |
| | | | | | **3773.1964** | **80.96%** |
| **Scope 2** | Purchased Electricity | 874.243 | 0.025536 | 0.0044839 | 874.273 | 18.76 |
| | | | | | **874.273** | **18.76%** |
| **Scope 3** | Business Travel | 2.616263 | 9.61E-06 | 8.34E-05 | 2.62 | 0.06 |
| | Paper | 9.69595 | 0.365585 | 0.22253 | 10.284 | 0.22 |
| | | | | | **12.904** | **0.28%** |
| **Total** | | 4045.320 | 4.34E-01 | 2.38E-01 | **4660.38** | **100%** |

From all the emissions, the per capita carbon footprint of International Islamic University Islamabad was calculated to be 0.16 tCO2e. It is further interpreted that each student of the university left carbon footprint of 0.18 tCO2e during the year 2023. This per capita carbon footprint is only of the selected operations performed during the working hours in the campus.

The findings of the study help to identify the major and minor contributors towards greenhouse gas emissions. This study represents itself as an initial step towards implementing sustainable development goals in the university. University transport being the largest sector of International Islamic University Islamabad consumed around 651233.54 liters of fuel generating 1729.85 tCO2e emissions, representing 37.12% of the total carbon footprint. This is the greatest source of emissions in the university. These results are similar to the findings of a study conducted at Kelappaji College of Agricultural Engineering and Technology, India. Emissions were assessed from sources such as food, energy, transportation, agriculture, forestry and other land use (AFOLU), and waste. The highest emissions recorded were from the transportation sector. About 215.765 tCO2e emissions were released which make 42% of the total carbon footprint, close to the percentage contribution from transportation (37.12%) of the present study (Gopika et al., 2024).

It is significant to mention that scope 1 remained the greatest contributor of GHG emissions (CO2e) accounting for 3773.1964 tonnes of carbon dioxide equivalent and share 80.96% to the total GHG emissions among all the scopes during 2023. This is in coherence with the results of the carbon footprint assessment of University of Bologna. The university emitted a total of 15,753 tCO2e in 2020. The highest emissions were from scope 1 sources which included emissions from stationary sources and fugitive emissions, representing 43% of the total (Battistini et al., 2023).

Overall, the analysis of IIUI's carbon footprint and per capita impact indicates that the university's environmental impact and that of the students of IIUI on the environment is lower compared to many other national universities. IIUI's carbon footprint of 4660.38 tCO2e is significantly less

than the University of Punjab, which emitted about 18324.12 tCO2e, primarily from transportation, electricity and waste. The highest emissions were from electricity (59%) (Haseeb et al., 2022). Similarity is seen in the case of NED University of Engineering and Technology where the total emissions from several categories of three scopes were about 21,500 MtCO2e. The per capita carbon footprint of NED University 1.79 MtCO2e is higher than the present study with per capita carbon footprint of 0.16 tCO2e (Mustafa et al., 2022).

The carbon footprint of International Islamic University Islamabad is much higher compared to many other national universities of the same status. Some notable universities with lower carbon footprint include University of Haripur which emitted 578.898 tCO2e during one year (Ullah et al., 2020) and the University of Baluchistan which emitted around 1256.682 metric tonnes of greenhouse gases per year significantly lower than the emissions from IIUI (Sajjad et al., 2023).

### 3.1. Mitigation Measures

Based on the analysis of this study, the university management should revise its policy and strategic plan and need to incorporate sustainability-related strategies for the future. University could formulate its climate-action plan aimed at assessing the greenhouse gas emission levels and reducing the carbon emissions. University students and staff hold an influential role in generating emissions therefore they can play their role in reducing emissions from various activities. Awareness campaigns, seminars, webinars, workshops, training sessions and off-curriculum activities involving students on campus can be highly effective in educating individuals about the need to reduce their carbon footprint. Stakeholder involvement including leaders, administrators, teachers, and students is an essential step in transforming the university into a carbon-neutral institution (Hassan et al., 2024). Future constructions should focus on building energy-efficient buildings with better insulation to reduce the need of using chillers and heaters amid of extreme weathers. Incorporating green technology can provide a better solution to lessen the environmental impact of our consumption patterns such as by efficient use of resources, reducing waste, and decreasing the demand for new resources (Ali et al., 2023).

Carbon-reduction should be the utmost necessity that needs to be implemented. University can switch to renewable energy sources to reduce the greatest portion of emissions generating from purchased electricity. Planting more on bare spaces can be another method to reduce the impacts of emissions from daily-life activities. Limiting the intrusion of vehicles using carbon-intensive fuels can be a great way to reduce emissions from transport.

International Islamic University Islamabad had a successful tree plantation campaign during summer season in 2022 in which as many as 15000 saplings were planted. Recently, the department of environmental science, IIUI has launched a new program named “Environmental sustainability and climate change” aimed at promoting environmentally sustainable and socially equitable economic growth. This is a step forward towards raising awareness among youth through sustained efforts and implementation. University has taken a step towards managing waste effectively by implementing waste segregation techniques at campus premises. This way not only the individuals are educated, but waste is also managed effectively at the time of production.

## 4. Conclusions and Recommendations

Climate change is a serious threat to humanity for which nations must adapt themselves and implement mitigation measures. Given the multitude of activities conducted within universities, it becomes imperative to assess the levels of their greenhouse gas emissions. This study, following the GHG Protocol Corporate Accounting and Reporting Standard, estimated the emission levels of a public sector institution, International Islamic University Islamabad (IIUI). The study

successfully identified the three scopes of emission sources for assessment. Next the organizational carbon footprint of IIUI was calculated to be 4660.38 tCO2e. University-owned transport was identified as the largest emitter, accounting for approximately 37% emissions, followed by natural gas contributing around 29%. The outcomes of the current research will serve as a reference case study for developing greenhouse gas inventory and implement carbon reduction strategies and plans of action. However, the inventory remains partial, as there are additional direct and indirect sources not included in this analysis due to inadequate data availability. The reported carbon footprint represents partial assessment of university's activities because it does not take into account the 24-hour operations and activities of individuals outside the standard working hours. Future research could expand upon these findings by incorporating more comprehensive data to provide a more holistic assessment of IIUI's carbon footprint and identify additional areas for emissions reduction strategies.

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