INDIAN INSTITUTE OF TECHNOLOGY DELHI

GREENHOUSE GAS EMISSION INVENTORY
CALENDAR YEAR 2024

Emission of Greenhouse Gases (GHGs) from human activities is the primary driver of climate change that is the most pressing environmental hazard faced by humanity today. As per the GHG Protocol emissions are categorized as (i) Scope 1, direct emissions due to the activity of an organization, (ii) Scope 2, emissions from purchased electricity, and (iii) Scope 3, indirect emissions in the value chain of the organizations.

IIT Delhi is committed to be a good global citizen by taking an active role in solving this crisis by attaining NetZero status by 2040. The annual GHG Emission Inventory mandated by the IIT Delhi Sustainability Policy is a key step in this regard. This inventory rigorously assesses the Scope 1 and Scope 2 emissions as well as some key components of our Scope 3 emissions as per the GHG Protocol.

Table 1 shows the Scope 1 and Scope 2 emissions. Table 2 shows the emissions by activity. It includes all Scope 1 and Scope 2 emissions. Scope 3 emissions are not in the control of IIT Delhi. Even the data required to estimate most of these emissions are not available to us. Hence, we report only those activities where we could estimate the emissions with a reasonable degree of confidence.

TABLE 1: GHG EMISSION INVENTORY

No	ACTIVITIES	EMISSION TONS CO2 EQ
1	Academic labs	0.692
2	R&I park	5.156
3	Restaurants and canteens	93.936
4	Hostel mess	715.549
5	Catering for events	0.265
6	IIT School bus and van	45.175
7	IIT bus	19.440
8	Construction and maintenance	21.074
9	Backup DG	43.114
	SCOPE I TOTAL	**944.401**
1	Electricity Academic and hostel areas	36692.159
2	Electricity markets, canteens and hospital	143.212
	SCOPE II TOTAL	**36835.371**

TABLE 2: GHG EMISSIONS FROM IITD ACTIVITIES

PURPOSE	ACTIVITIES	EMISSION TONS CO2 EQ	PRIMARY SOURCE OF EMISSION
R&D	Academic labs	0.692	LPG for experiments
	R&I park	5.156	Gas welding, 3D printing
FOOD PREP	Restaurants and canteens	93.936	LPG for cooking
	Hostel mess	715.549	PNG for cooking

	Catering for events	0.265	LPG for cooking
	Faculty and staff quarters	349.606	PNG for cooking
TRANSPORTATION	Resident faculty and staff commute	177.727	Fuel for personal vehicles
	Travel to non-academic events	7.330	Fuel for train and planes
	Travel to conferences and fieldwork by students	3433.850	Fuel for train and planes
	Travel to conferences and fieldwork by faculty	2014.000	Fuel for train and planes
	IIT School bus and van	45.175	Fuel for bus and van
	IIT bus	19.440	Fuel for bus
	Bank van	0.478	Fuel for van
	Hospital	3.540	Fuel for ambulance
WORKS	Construction and maintenance	21.074	Cement, paint, welding
WASTE	Residential	69.298	Organic waste
	Hospital and lab	0.100	Medical waste
ENERGY	Electricity Academic and hostel areas	36692.159	SCOPE 2 Emission from 45298962 kwh consumption
	Electricity markets, canteens and hospital	143.212	SCOPE 2 emission from 176806 kwh consumption
	Electricity Faculty/staff quarters	4309.200	SCOPE 2 Emission from 5320000 kwh consumption
	Backup DG	43.114	Diesel
TOTAL		41874.056	

SCOPE 1 SCOPE 2

Methods

1. R&D

1.1 Academic Labs: A survey is conducted to determine the amount of LPG used per year for combustion or heating purposes in all academic labs.
Emission Factor: 1.473 kg CO_2 per Liter or 2.89 kg CO_2 per kg.

1.2 R&I Park: A survey is conducted to assess the amount of gas used for welding in all startups and the emissions due to 3D printing.
Emission Factor:

- Gas welding = 20.8 g CO_2 per kg
- 3D printing = 1.6 g CO_2 per print

2. FOOD PREPARATION

2.1 Restaurants and Canteens: A survey is conducted to determine the annual LPG consumption in all restaurants and canteens on campus.
Emission Factor: 2.89 kg CO_2 per kg (LPG).

2.2 Hostel Mess: A survey is conducted to assess the annual PNG consumption in all hostel messes.
Emission Factor: 1.9 kg CO_2 per SCM (PNG).

2.3 Catering for Events: Information on events is gathered from email records over the past year. The amount of LPG used for additional dining is estimated based on discussions with catering staff. (2–3 events per three months, each serving approximately 400 extra meals).
Emission Factor: 2.89 kg CO_2 per kg (LPG).

2.4 Faculty and Staff Quarters: A survey is conducted to estimate the annual PNG consumption for 30 faculty and staff members, and the data is extrapolated to represent 1,000 campus residents.
Emission Factor: 1.9 kg CO_2 per SCM (PNG).

3. TRANSPORTATION

3.1 Resident Faculty and Staff Commute: A survey of 30 campus-resident faculty and staff members is conducted to determine their daily institutional travel distances.
Mode of Travel Distribution:

- 56.67% Bikes
- 18.34% Petrol Cars
- 9.9% Diesel Cars
- 6.6% CNG Cars
  Emission Factor:
- Bike = 0.111 kg CO_2 per km
- Car = 0.168 kg CO_2 per km

3.2 Travel to Non-Academic Events: Travel data for various tech and sports events from club members is collected for one year.
Emission Factor:

- Flight = 0.074 kg CO_2 per kg
- Train = 0.035 kg CO_2 per kg

3.3 Travel to Conferences and Fieldwork by Students: A survey of over 150 final-year Ph.D. students is conducted to determine the frequency and destinations of their international and national conference and academic event travels over their course duration. The data is extrapolated to represent all final-year Ph.D. students for the current year.

- Annual emissions from student travel = 1.2 * Number of final-year Ph.D. students (tonnes of CO_2).

3.4 Travel to Conferences and Fieldwork by Faculty: A survey of 30 faculty members is conducted to calculate the average emissions per faculty member from international and domestic travel. The data is applied to all faculty members using the same emission factors as in 3.2.

3.5 IIT School Bus: Data on the total number of school buses and vans, along with their annual fuel consumption, is gathered from IIT School.
Emission Factor:

- Diesel = 0.101 kg CO_2 per kg
- Petrol = 0.201 kg CO_2 per kg

3.6 IIT Buses: Data on the total number of buses and their annual fuel consumption is collected from the Institute's Junior Engineer.
Emission Factor: Diesel = 0.860 kg CO_2 per kg.

3.7 Bank Van: The bank van's annual fuel consumption data is collected from the bank's assistant manager. A fixed travel distance of 40 km per week is assumed based on discussions with authorities.
Emission Factor:

- Diesel = 0.101 kg CO_2 per kg
- Petrol = 0.201 kg CO_2 per kg

3.8 Hospital Ambulances: Fuel consumption data for both ambulances is collected from the Medical Administration Officer.
Emission Factor:

- Diesel = 0.101 kg CO_2 per kg
- Petrol = 0.201 kg CO_2 per kg

4. WORKS

4.1 Construction and Maintenance: The site engineer was unable to provide precise data. Therefore, information from tenders was analysed to estimate resource consumption. Since it was challenging to attribute values to a single year, the total material usage was divided by the overall tenure of the tender, and corresponding values were used for calculations.
Emission Factors:

- Cement = 0.979 kg CO_2 per kg
- Paint = 1.2 kg CO_2 per liter
- Welding = 20.8 g CO_2 per kg of weld material

5. WASTE

5.1 Residential Waste: Data was available for a single day. Assumptions were made for working and non-working days due to variations in waste generation. Based on the campus headcount:

- 85% of waste is allocated to hostels
- 15% of waste is allocated to residents
  For non-working days, it is assumed that only 15% of waste is generated from hostels.
  Emission Factor: 0.45 kg CO_2 per kg.

5.2 Hospital and Lab Waste: Medical waste is collected and sent for treatment on a weekly basis.

6. ENERGY

6.1 Electricity Consumption: Separate electricity bills are available for academic buildings, but data for all other facilities (e.g., hospitals, streetlights, residential areas, canteens, and markets)are collected through surveys and by obtaining bills from hospitals, hostels, canteens, and markets. Electricity consumption data was provided by Mr. Ashish Kumar Vinodiya, Executive Engineer, IITD.

Emission Factor: 0.495 kg CO_2 per kWh.

Total electricity consumption = 45298962 kwh from BSES + 1493065 kwh from IITD solar plant = 46792027 kwh

Note: Electricity consumption data is for 2024 calendar year. Other activities are for 2023 calendar year.

About the authors

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