Beni-Suef University BSU's Carbon Footprint report (CFR)

The reporting period is from 2024 – 2025.

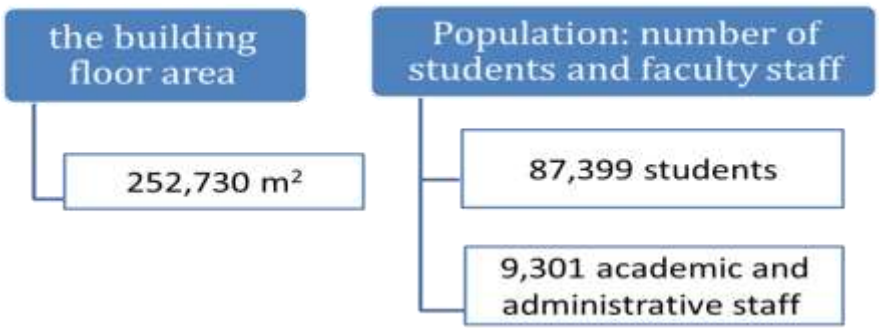
This report covers Scope 1, 2 and selected scope 3 activities.

1. Introduction

This report presents Carbon Footprint (CFR) report for the university, covering the main emission sources: electricity consumption, water consumption, transport activities, fuel usage, and waste disposal. All results are expressed in **tons of CO2 equivalent (tCO2e)**.

2. System Boundaries

A. Institutional boundaries for BSU



B. Operational boundaries for BSU

The operational boundaries for BSU's Carbon Footprint report include the following:

Scope 1	Scope 2	Scope 3
• Stationary combustion (Fuel burning on-site) • Mobile combustion (University fleet) • Campus shuttle buses	• Purchased energy (Purchased Electricity)	• University commutes by employee-owned vehicles • Waste generated in operations • water usage

3. Methodology

The Carbon Footprint Report (CFR) methodology follows internationally recognized accounting principles for greenhouse gas (GHG) emissions. It is based on quantifying all relevant emission sources and converting them into carbon dioxide equivalent (CO_2e).

A. Data collection

Activity data were collected for all relevant emission sources. These include:

- Fuel consumption (liters or cubic meters)
- Electricity consumption (kWh)
- Waste generation (tons)
- Water usage (cubic meters)
- Transportation activities (distance or ton-kilometers)

All data were converted into consistent units to ensure accuracy in calculations.

B. Emission Factors

Emission factors were selected from internationally recognized sources, including the IPCC and other standard databases. These factors represent the amount of greenhouse gases emitted per unit of activity.

C. Emissions Calculation

The general calculation approach for the emissions, counted in mtCO2e, is multiplying the activity with its corresponding emission factor. The following equation was applied throughout the report: $A \times EF = E$ Where, (A) is the activity data and EF is emission factors of GHG. Activity data is a measure of the level of activity that results in GHG emissions (either directly or indirectly). Emission factors (EF) are representing the quantity of GHGs released to the atmosphere caused by a certain activity. The emission factor is usually expressed as the carbon dioxide equivalent (CO2e) emissions generated by a unit weight, volume, distance, or duration of the activity, e.g., CO2e / liter fuel consumed, CO2e / km driven or CO2e / kWh of purchased electricity etc.

Each emission source was calculated separately and then aggregated.

D. Conversion to CO_2 Equivalent

Different greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) were converted into CO_2 equivalent (CO_2e) using Global Warming Potential (GWP) values. This ensures comparability of emissions across different gases.

E. Aggregation of Emissions

Total emissions were calculated by summing emissions across all sources and scopes:

Total Emissions=Scope 1+Scope 2+Scope 3

F. Assumptions and Limitations

- Emission factors are based on standard reference values and may vary depending on location and technology.
- Some data may rely on estimates where direct measurements were unavailable.
- The results represent an approximate carbon footprint suitable for preliminary assessment.

4. Results

First: Scope 1 emissions

A. Stationary and mobile combustion

This refers to the diesel used in the university's generators and to the university-owned vehicles utilized in commuting either inside or outside the vicinity of the university. The observed vehicles at the main campus in the reporting period consumed a total of 358,250 L of diesel and 203,300 L gasoline over the academic year 2024 - 2025.

For BSU, the database was used to determine fuel type and fuel consumption in liters. These data were used to calculate the emissions using the below equation:

- **Carbon emission for benzene (tCO_2e)** = Fuel consumption (L) x EF (tCO_2e/ L) = 182,780 x 0.00231 = 422.221 tCO_2e

- **Carbon emission for diesel (tCO_2e)** = Fuel consumption (L) x EF (tCO_2e/ L) = 358,250 x 0.00268= 960.11 tCO_2e

B. Campus shuttle buses

This refers to university transport emissions without fuel consumption.

❖ First, we calculated the approximated total daily distance based on the following data:

- 5 = number of shuttle buses
- 7 = number of daily trips per bus
- 0.5 = approximate distance per trip inside the campus (km)

Hence, total daily distance = $5 \times 7 \times 0.5 = 17.5$ km/day

❖ Second, we calculated the daily emissions using an average emission factor EF for diesel buses: 1 km ≈ 0.1 kg CO_2e = 0.0001 tCO_2e per km

Hence, the daily emissions = $17.5 \times 0.0001 = 0.00175$ tCO_2e/day

❖ Finally, we calculated the annual emissions in 365 days.

Hence, the daily emissions= $0.00175 \times 365 = 0.63875$ tCO_2e/year

C. Total scope 1 emissions

Diesel and benzene fuel consumption (1382.332 tCO_2e) + University shuttle buses' emissions (0.64 tCO_2e) =**1382.97 ~ 1383 tCO_2e**

Second: Scope 2 emissions

Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the organization. The annual electricity consumption at BSU in 2024 – 2025 was 20,545,394 kWh. Carbon Footprint Calculation (tCO_2e): Using Egypt's emission factor is 0.5 kg CO_2 per kWh.

Hence, purchased Electricity Emissions (tCO_2e) = Electricity Consumption (kWh) x EF (tCO_2e/kWh)/1000 (to convert kg to metric tons t)

$= 20,545,394 \times 0.5 \div 1000 \approx$ 10,272.7 tCO_2e annually

Third: Scope 3 Indirect GHC Emissions

A. Emissions from university commutes

This section shows the carbon footprint due to daily university commutes of faculty members, staff, and employees. Most of the faculty members reside on campus; therefore, their projected emissions due to university commutes would be rather negligible and were not accounted for in the study. On the other hand, most students and staff used different means of transportation to commute to and from university.

Cars (University campus travel):

- 215 = number of cars entering the university
- 2 = number of daily trips per car inside the campus
- 0.5 = approximate distance per trip inside the campus (km)

We used the above data to calculate the following:

- Total daily distance = 215×2×0.5 = 215 km/day
- We used an average emission factor for cars traveling inside campus: 1 km ≈ 0.192 kg CO2e = 0.000192 tCO_2e per km
- The daily emissions were calculated as follow: 215×0.000192 = 0.04128 tCO_2e/day
- The annual emissions were then calculated as follow: 0.04128×365 = **15.06 tCO2e/year**

Motorcycles (University campus travel):

- 117 = number of motorcycles entering the university
- 2 = number of daily trips per motorcycle
- 0.5 = approximate travel distance per trip inside the campus (km)

We used the above data to calculate the following:

- Total daily distance = 117×2×0.5=117 km/day
- We used the average emission factor for motorcycles traveling inside campus: 1 km ≈ 0.072 kg CO_2e = 0.000072 tCO_2e per km
- The daily emissions were calculated as follow: 117×0.000072 = 0.008424 tCO_2e/day
- The annual emissions were then calculated as follow: 0.008424×365 = **3.07 tCO_2e/year**

B. Emissions from water consumption

The total annual water consumption at BSU in 2024 – 2025 was 420,866.58 m^3. Carbon Footprint Calculation (tCO_2e): Using Egypt-estimated emission factor = 0.6 kg CO_2 per m^3.

Hence, water consumption Emissions (tCO_2e) = Water Consumption (m^3) x EF (tCO_2e/kWh)/1000 (to convert kg CO_2e to metric tons $mtCO_2e$)

= 420,866.58 × 0.6 ÷ 1000 = 252.16 tCO_2e annually

C. Emissions from waste streams

This presents an estimation of greenhouse gas (GHG) emissions from different waste streams generated in operational activities. Emissions were calculated using the standard equation:

GHG Emissions (tCO_2e) = Waste Quantity (tons) × Emission Factor (tCO_2e/ton)

1. Emission Factors Used for waste streams:

Waste Type	Emission Factor (tCO_2e/ton)
Plastic	2.5
Paper	1.0
Organic / Food / Leaves / Fruits	0.5
Inorganic Waste	0.2
Toxic Waste	2.0
Electronics	1.2
Laboratory Chemicals	2.0

2. Waste Quantities in 2024-2025

- Plastic: 0.047 ton
- Paper: 0.035 ton
- Organic Waste: 1700 kg = 1.7 ton
- Food Waste: 650 kg = 0.65 ton
- Leaves: 90 kg = 0.09 ton
- Fruits: 1200 kg = 1.2 ton
- Inorganic Waste: 75 kg = 0.075 ton
- Toxic Waste: 1.25 ton
- Electronics: 0.4 ton
- Laboratory Chemicals: 2 ton

3. Emissions Calculation Results

Waste Type	Emissions (tCO_2e)
Plastic	0.1175
Paper	0.035
Organic Waste	0.85
Food Waste	0.325
Leaves	0.045
Fruits	0.6
Inorganic Waste	0.015
Toxic Waste	2.5
Electronics	0.48
Laboratory Chemicals	4.0
TOTAL	**9.97 tCO_2e**

D. Total greenhouse gas emissions from scope 3 are: 280.61 tCO2e

E. Summary of emission showing the total carbon foot print

SCOPE 1 – DIRECT EMISSIONS (tCO_2e)	2024 - 2025		
Stationary and mobile combustions	1382.332	11.58%	
Shuttle buses	0.63875	0.005%	11.6%
Total Scope 1 (tCO_2e)	1383		
SCOPE 2 – INIRECT EMISSIONS (tCO_2e)	2024 - 2025		
Purchased Energy	10,272.7	86%	86%
Total Scope 2 (tCO2e)	10,272.7		
Total Scope 1 & 2 Emissions	11,655.7	$mtCO_2e$	
SCOPE 3 – INDIRECT EMISSIONS (tCO_2e)	2024 – 2025		
University commute	18.13	0.15%	
Water usage	252.16	2.11%	
Waste generated in operations	9.97	0.08%	2.34%
Total Scope 3 (tCO2e)	280.61		
Total Scope 1, 2 and 3 Emissions (Total Carbon Footprint)	11,936.31	tCO_2e	
Net Carbon Footprint (Carbon intensity) per person per year	0.12	tCO_2e/person	
Net Carbon Footprint (Carbon intensity) per m^2	0.05	tCO_2e/m^2	