UNIVERSITAS PENDIDIKAN INDONESIA

GREENHOUSE GAS (GHG)
EMISSIONS INVENTORY REPORT

Prepared with reference to the GHG Protocol Corporate Accounting and Reporting Standard

2025

Foreword

As an educational institution carrying the vision of The Education University, Universitas Pendidikan Indonesia (UPI) is committed to taking an active role in climate change mitigation and advancing sustainability principles within the academic environment. This greenhouse gas (GHG) emissions inventory is prepared as an initial step toward understanding UPI's emission profile comprehensively.

The emission quantification in this report follows the GHG Protocol Corporate Accounting and Reporting Standard, the globally recognised framework for calculating GHG emissions across three main scopes (Scope 1, 2, and 3).

This report is exploratory in nature and compiled from data available at the time of preparation, with a number of limitations and assumptions documented transparently throughout — see in particular Section 7 (Exclusions and Uncertainty).

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About Universitas Pendidikan Indonesia

Universitas Pendidikan Indonesia (UPI) is a leading public university in Indonesia, committed to academic excellence, research advancement, and meaningful contributions to sustainable development, under the identity of The Education University.

UPI's main campus is located at Bumi Siliwangi, Bandung, West Java, with regional campuses in Cibiru, Tasikmalaya, Sumedang, Purwakarta, and Serang. The campus population ranges between 46,000 and 52,000 people depending on the recording period.

UPI's operations encompass teaching and learning, research, community engagement, student programmes, and the management of supporting facilities such as internal transportation, energy utilities, and waste management.

Inventory Objectives

- Identify and quantify the main sources of GHG emissions arising from UPI's operational activities;
- Establish a multi-year emission baseline (2023–2025) as a reference for trend comparison;
- Provide an initial foundation for developing emission-reduction policies and strategies at university level;
- Support the integration of sustainability principles into campus management systems.

Reporting Boundaries

Organizational Boundary

This inventory applies an operational control approach, covering operational vehicles, electricity consumption, and vehicle movement into and out of UPI's main and regional campuses, to the extent data are available.

GHG Boundary

- Scope 1 – Mobile combustion: fuel used by university operational vehicles
- Scope 2 – Electricity purchased from the PLN grid (location-based)
- Scope 3 – Category 7 (Commuting): vehicle movement within the campus area

Other Scope 3 categories (purchased goods & services, business travel, waste) are excluded due to limited data availability and will be considered in subsequent inventory phases.

Data and Methodology

Total Emission Summary

This section presents UPI's total GHG emissions for the 2023–2025 period, calculated for Scope 1, Scope 2, and Scope 3 (Category 7) in accordance with the GHG Protocol Corporate Standard. Results are expressed in metric tons of carbon dioxide equivalent (tCO2e).

Scope	2023	2024	2025
Scope 1 (vehicle fuel)	91.6 tCO2*	91.6 tCO2*	91.6 tCO2
Scope 2 (electricity)	6,332.7 tCO2	5,165.1 tCO2	5,423.4 tCO2
Scope 3 (commuting)	162.2 tCO2	169.2 tCO2	160.7 tCO2
TOTAL	**6,586.4 tCO2e**	**5,425.9 tCO2e**	**5,675.7 tCO2e**

**Original Scope 1 data are available only for 2025; the 2023 and 2024 values are filled with a carry-back assumption equal to 2025, as no historical data exist. **The 2025 Scope 2 covers Jun 2025–May 2026 (12 months) as per UPI's GreenMetric evidence document. ***Because Scope 1 for 2023/2024 is an assumption, the totals are not fully equivalent methodologically across years — see Section 7.*

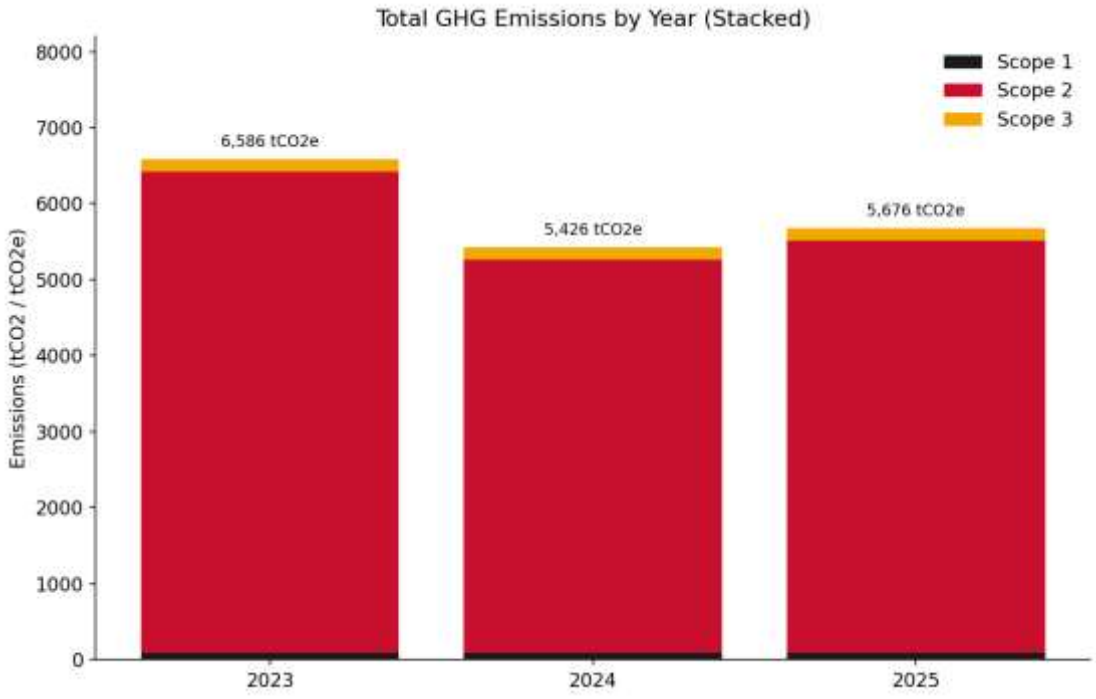


Figure 1. Total GHG emissions by year (stacked).

Scope 1 Methodology – Mobile Combustion

Activity data: recap of operational vehicle fuel consumption at UPI (Pertamax, Pertalite, Dexlite), from internal UPI documentation for 2025.

- Pertamax: 24,960 litres × 2.31 kg CO2/litre = 57.66 tCO2
- Pertalite: 7,680 litres × 2.31 kg CO2/litre = 17.74 tCO2
- Dexlite: 6,060 litres × 2.68 kg CO2/litre = 16.24 tCO2
- Total Scope 1 = 91.64 tCO2 (CO2 only; CH4/N2O not yet included)

The tailpipe emission factors for gasoline (2.31) and diesel (2.68) kg CO2/litre follow the values used in the Universitas Indonesia GHG Emissions Inventory Report (CSWM UI, 2025), which references Pertamina's GHG accounting practice and the national emission-factor framework of the Ministry of Energy and Mineral Resources (ESDM). The 2023 and 2024 figures are assumed equal to 2025.

Scope 2 Methodology – Electricity (Location-Based)

Activity data: annual electricity consumption from UPI's data, sourced from PLN bills.

- 2023: 7,278,920 kWh (calendar Jan–Dec 2023)
- 2024: 5,936,953 kWh (calendar Jan–Dec 2024)
- 2025: 6,233,801 kWh (Jun 2025–May 2026, 12 months, as per UPI GreenMetric evidence document)
- Jamali (Java–Madura–Bali) grid emission factor: 0.87 ton CO2/MWh, methodology Operating Margin (OM) 0.5 + Build Margin (BM) 0.5, excluding wind and solar generation

Formula: E Scope 2 = Total electricity use (MWh) × 0.87 (tCO2/MWh)

The 0.87 tCO2/MWh), sourced from ESDM, selected because its methodology is explicitly documented. Location-based method only; no evidence of REC/PPA purchases by UPI was found, so a market-based figure was not calculated.

Scope 3 Methodology – Category 7 (Commuting)

Activity data: daily count of vehicles (cars & motorcycles) recorded entering campus, from UPI's documents.

- Travel distance: 200 metres one-way (within-campus distance only), equal to 0.4 km round-trip per vehicle per day
- Working days: assumed at 240 days/year
- Emission factors: cars 0.171 kg CO2/km; motorcycles 0.113 kg CO2/km
- 2023: 1,959 cars/day, 11,986 motorcycles/day → 162.18 tCO2
- 2024: 2,035 cars/day, 12,514 motorcycles/day → 169.16 tCO2
- 2025: 2,065 cars/day, 11,686 motorcycles/day → 160.67 tCO2

With the 200 m (within-campus only) distance definition, home-to-campus commuting emissions — intuitively far larger — are NOT captured in Category 7 in this version of the report. The vehicle emission factors are generic international values, not yet validated against Indonesian fleet characteristics.

Emission Proportion Analysis by Scope

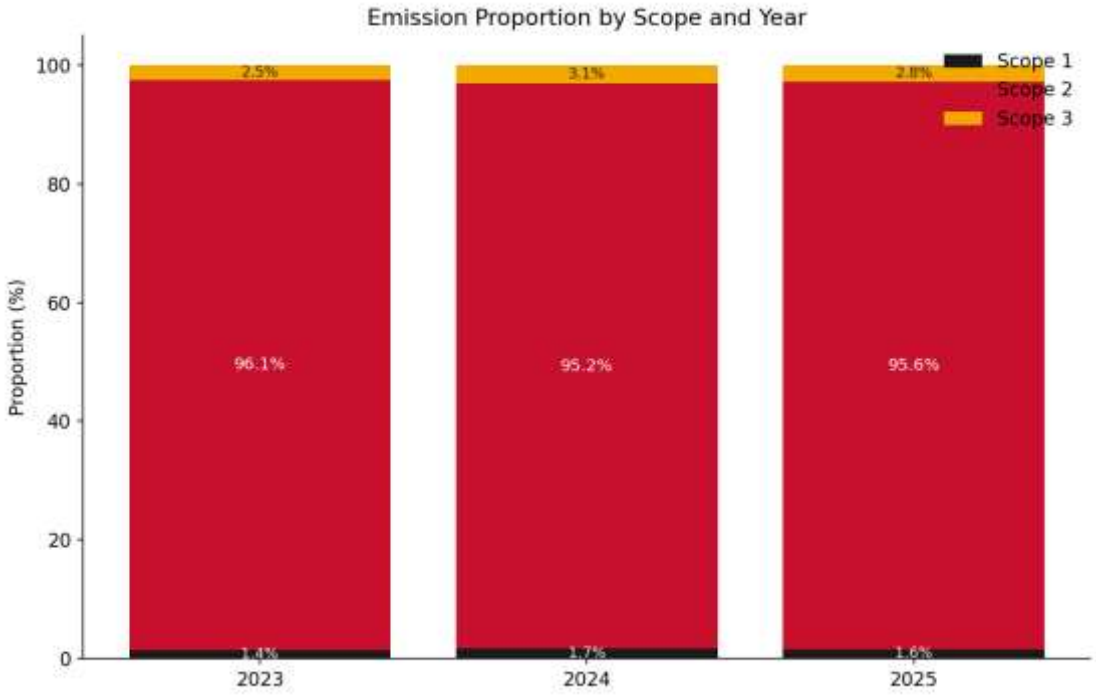


Figure 2. Emission proportion by scope and year (100% stacked).

Scope	2023	2024	2025
Scope 1	1.4%	1.7%	1.6%
Scope 2	96.1%	95.2%	95.6%
Scope 3	2.5%	3.1%	2.8%

Interpretation

Scope 2 (electricity) consistently dominates UPI's emission profile, contributing 92.9–96.1% of total emissions across all three years. This pattern is typical for educational institutions: buildings, cooling systems, and laboratory/office equipment contribute far more than operational vehicles or within-campus vehicle movement.

The Scope 1 proportion rises gradually from 1.4% (2023) to 2.6% (2025). This increase is a mathematical artefact of the declining Scope 2 figure (a shrinking denominator), NOT an actual increase in fuel consumption, since the absolute Scope 1 value is identical across all three years (carry-back assumption). This proportion must not be read as an actual Scope 1 trend.

The Scope 3 proportion remains relatively stable at 2.5–3.1% for 2023 and 2024, declining slightly to 2.8% in 2025 as the 2025 Scope 2 figure returns to a higher level. Because Scope 3 covers only 200 metres of within-campus movement, this proportion very likely understates the true transport-related emission profile.

Practical conclusion: UPI's emission mitigation strategy is most effectively focused on electricity efficiency (Scope 2), as its scale dominates the other two scopes combined across the entire period analysed.

Exclusions and Uncertainty

Exclusions

Category	Reason for Exclusion
Scope 3 – Home-to-campus commuting	Actual home-to-campus travel distance data are unavailable; only within-campus distance (200 m) is calculated.
Scope 3 – Purchased Goods & Services	Procurement data (including paper) are not yet centrally compiled.
Scope 3 – Business Travel	Cross-unit business travel data are not yet integrated.
Scope 3 – Waste	Waste generation measurement system is still under development.
Scope 1 – Gensets & fugitive AC/fire extinguishers	Inventory data for gensets, AC refrigerants, and fire-extinguisher refills at UPI are not yet available.

Uncertainty

- Scope 1 data for 2023 and 2024 are a carry-back ASSUMPTION from 2025, not actual measurements — high uncertainty.
- Scope 2 data for 2025 cover the period Jun 2025–May 2026 (12 months), which differs from the calendar year basis of 2023/2024 (Jan–Dec). Cross-year trend comparisons should account for this difference in reporting period.
- Scope 3 is calculated using a fixed 200 m distance assumption and 240 working days/year, not GPS data or an actual survey.
- Vehicle entry counts may record the same vehicle multiple times per day (multiple entries).
- Per-km vehicle emission factors (cars, motorcycles) are generic international values, not specific to the Indonesian fleet.
- The sharp Scope 2 decline from 2023 to 2024 (−18.4%) has not been investigated — possible causes include a change in the buildings covered by metering, improved recording methodology, or a genuine energy-efficiency intervention.

Base Year

Establishing a base year provides the starting point for UPI's future GHG monitoring system.

In this report, 2025 is designated as the base year, as it is the only year with actual (non-assumed) Scope 1 data and has the most complete coverage among the three years analysed.

- Establish a unified calculation framework and data collection system across UPI work units;
- Identify major emission sources and data gaps (particularly historical Scope 1 and home-to-campus Scope 3);
- Serve as the starting point for developing a more comprehensive annual monitoring and reporting system.

Should UPI's data collection systems improve significantly — particularly verified historical Scope 1 data and an actual commuting distance survey — the base year may be reviewed following the GHG Protocol base year recalculation guidance.

References

A. GHG Accounting Standards and Guidance

- World Resources Institute (WRI) & World Business Council for Sustainable Development (WBCSD). (2004). The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised Edition. Available at: https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf
- World Resources Institute (WRI) & WBCSD. (2011). Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Available at: https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf
- World Resources Institute (WRI) & WBCSD. (2015). GHG Protocol Scope 2 Guidance. [Supplementary document to the Corporate Standard governing dual location-based and market-based reporting]

The three documents above are the core standards underpinning the Scope 1/2/3 classification and reporting principles (relevance, completeness, consistency, transparency, accuracy) used in this report. Status: existence verified.

B. Emission Factors

- Ministry of Energy and Mineral Resources (ESDM), Republic of Indonesia. Emission factor for the Java–Madura–Bali (Jamali) electricity system: 0.87 ton CO2/MWh, methodology Operating Margin (OM) 0.5 + Build Margin (BM) 0.5.
- Fuel tailpipe emission factors: gasoline 2.31 kg CO2/litre; diesel 2.68 kg CO2/litre.
- Department for Energy Security and Net Zero (DESNZ), UK Government. (2024). Government greenhouse gas conversion factors for company reporting (also known as the DEFRA factors).

C. UPI Primary Data Sources

- Universitas Pendidikan Indonesia. Recapitulation of Operational Vehicle Fuel Expenditure over One Year. [Internal document, 2025]
- Universitas Pendidikan Indonesia. Electricity Usage per Year — (2023, 2024, and Jun 2025–May 2026). [Sourced from PLN bills]
- Universitas Pendidikan Indonesia. The Total Number of Vehicles.

D. Report Structure and Design References

- ISO 14064-1:2018 — Greenhouse gases, Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals. [Cited as the report-structuring framework in the UI reference document; this UPI report does not yet fully meet all ISO 14064-1 requirements]

E. Verification Note

In line with the GHG Protocol transparency principle, it should be noted that: (1) the GHG Protocol standards in Section A have been verified as existing; (2) the emission factor values in Section B are adopted from a third-party report (CSWM UI, 2025) and have not been directly verified against the original source documents from ESDM/Pertamina/DESNZ; (3) the per-km vehicle emission factors are generic indicative values. Before this report is used for official reporting, audit, or ranking submissions, all emission factors in Section B must be verified directly against the publications of their issuing bodies.