



Greenhouse Gas Emissions Inventory

FY 2025–26 | April 2025 – March 2026



Pharmanza Herbal PVT. LTD.

[Plot No.214, Borsad-Tarapur Road, Kaniya, Petlad, Anand, Gujarat-388430, India]

Operational Control Boundary | GHG Protocol Corporate Standard | ISO 14064-1

Report Status
DRAFT v1.0

Issue Date
June 2026

Standard
GHG Protocol / ISO 14064-1





DOCUMENT CONTROL

Field	Details
Document Title	GHG Inventory Report — FY 2025-26
Organization	Pharmanza Herbal Pvt. Ltd.
Reporting Period	1 April 2025 to 31 March 2026 (FY 2025-26)
Reporting Standard	GHG Protocol Corporate Accounting & Reporting Standard; ISO 14064-1:2018
GWP Values	IPCC Sixth Assessment Report (AR6, 2021) — 100-year time horizon
Inventory Boundary	Operational Control — Scope 1 & Scope 2
Version	Draft v1.0
Confidentiality	Confidential — For Internal and Authorized External Use Only

Revision History

Version	Date	Description	Author
Draft v1.0	June 2026	Initial GHG inventory report for FY 2025-26	



Table of Contents

DOCUMENT CONTROL	2
Revision History	2
EXECUTIVE SUMMARY	4
Organization Overview	4
Key Findings	4
Emission Hotspots	4
Key Recommendations	5
1. INTRODUCTION	6
1.1 Purpose of This Report	6
1.2 Benefits of GHG Accounting	6
1.3 Intended Use of This Report	6
2. ORGANIZATIONAL AND OPERATIONAL BOUNDARIES	7
2.1 Reporting Approach	7
2.2 Organizational Boundary	7
2.3 Scope Definitions	7
3. METHODOLOGY	8
3.1 Applicable Standards and Guidance	8
3.2 Calculation Approach	8
3.3 Biomass Treatment	9
4. GHG EMISSIONS INVENTORY RESULTS	10
4.1 Summary of All Emissions	10
4.2 Scope 1 : Detailed Analysis	11
4.3 Scope 2 : Detailed Analysis	11
4.4 Biogenic Emissions	11
4.5 Emission Intensity Metrix	12
5. EMISSION HOTSPOT ANALYSIS	13
5.1 Ranked Emission Sources	13
6. DATA QUALITY ASSESSMENT (DQI)	15
6.1 DQI Scoring Criteria	15
6.2 DQI Scores by Emission Source	15
7. UNCERTAINTY ASSESSMENT	17
8. REDUCTION OPPORTUNITIES AND PRIORITIZATION	18
9. DECARBONIZATION ROADMAP	19
9.1 Emission Trajectory	20
10. CONCLUSIONS AND KEY RECOMMENDATIONS	21
10.1 Conclusions	21
10.2 Priority Recommendations	21
11. Records Retention	22
APPENDIX A: EMISSION FACTOR DATABASE	23
APPENDIX B: ACRONYMS AND DEFINITIONS	23



EXECUTIVE SUMMARY

This report presents the Greenhouse Gas (GHG) Emissions Inventory for **Pharmanza Herbal Pvt. Ltd.** for the financial year 2025-26 (1 April 2025 to 31 March 2026). The inventory has been prepared in accordance with the GHG Protocol Corporate Accounting and Reporting Standard and ISO 14064-1:2018, and covers direct (Scope 1) and energy indirect (Scope 2) emissions arising from the organization's operations under the operational control approach.

Organization Overview

Pharmanza Herbal Pvt. Ltd. is an industrial manufacturing organization located in Gujarat, India. The facility undertakes [manufacturing/processing] operations and utilizes a range of energy sources including diesel, natural gas, biomass, and grid electricity. The organization has implemented on-site solar power generation as part of its renewable energy commitment.

Key Findings

TOTAL EMISSIONS (NET)	SCOPE 1	SCOPE 2 (Net)	BIOGENIC CO ₂
2,212.20 tCO ₂ e	1,002.47 tCO ₂ e 45.5%	1,209.73 tCO ₂ e 54.5%	3,467.51 tCO ₂ Disclosed separately

Emission Hotspots

The following five emission sources account for approximately 94% of total Scope 1 + Scope 2 emissions and represent the highest-priority targets for decarbonisation intervention:

Rank	Emission Source	Scope	tCO ₂ e	% of Total
1	Grid Electricity (Gross)	2	1,729.68	63.31%
2	Spray Dryer – Diesel	1	343.82	12.58%
3	R-22 Refrigerant (Fugitive)	1	366.52	13.42%
4	Biomass Briquette (CH ₄ + N ₂ O)	1	90.47	3.31%
5	R-404A Refrigerant (Fugitive)	1	83.21	3.05%

Key Observation

Grid electricity is the single largest emission driver, contributing 78% of gross Scope 1+2 emissions. Refrigerant leakage from HVAC/cooling systems, particularly R-22 (GWP: 1,960) constitutes the most critical Scope 1 fugitive hotspot. The solar generation offset of 517.15 tCO₂e represents a meaningful carbon reduction already in place.



Key Recommendations

Based on this inventory, the following priority actions are recommended:

- Accelerate solar PV capacity expansion to reduce Scope 2 electricity emissions : highest impact, proven ROI in Gujarat's solar irradiance context.
- Transition Spray Dryer operations from diesel to cleaner fuels (natural gas or biomass/biogas) to reduce the largest Scope 1 fossil emission source.
- Phase out R-22 refrigerant and transition to low-GWP alternatives (R-32, R-290) to eliminate the largest fugitive emission source.
- Implement a refrigerant management programme with formal leak detection, mandatory logging, and quarterly audits.
- Engage the electricity utility or procure Renewable Energy Certificates (RECs) to address residual Scope 2 emissions.
- Establish FY 2025-26 as the base year and develop a formal Net Zero roadmap aligned with the Science Based Targets initiative (SBTi).

1. INTRODUCTION

1.1 Purpose of This Report

This GHG Inventory Report documents the greenhouse gas emissions associated with the operations of **Pharmanza Herbal Pvt. Ltd.** for the financial year 2025-26. The report has been prepared to establish a robust, credible, and verifiable baseline of the organization's carbon footprint in accordance with internationally recognized standards.

The specific objectives of this inventory are:

- To quantify and report Scope 1 (direct) and Scope 2 (energy indirect) GHG emissions arising from all operations within the defined organizational boundary.
- To identify and prioritize the major emission sources and hotspots contributing to the organization's carbon footprint.
- To assess data quality and uncertainty inherent in the inventory, enabling a credible representation of emissions.
- To provide a foundation for setting science-based reduction targets and developing a structured decarbonisation roadmap.
- To support disclosures to customers, investors, regulatory bodies, and ESG rating agencies.

1.2 Benefits of GHG Accounting

A systematic and standards-based GHG accounting programme provides significant strategic and operational benefits:

- **Regulatory Readiness:** Positions the organization to comply with India's Carbon Credit Trading Scheme (CCTS), BRSR Core requirements, and future mandatory climate disclosures.
- **Customer and Supply Chain Expectations:** Increasingly, B2B customers, particularly MNCs — require suppliers to disclose and reduce Scope 3 emissions, which begin with the supplier's own Scope 1 & 2 inventory.
- **Risk Identification:** Identifies operational vulnerabilities such as refrigerant leakage, diesel dependency, and grid emission exposure, enabling proactive risk management.
- **Cost Reduction:** Energy efficiency and fuel optimization measures identified through GHG accounting typically yield measurable cost savings.
- **ESG & Investor Relations:** Demonstrates commitment to climate governance and supports ESG ratings, green financing, and responsible investment criteria.

1.3 Intended Use of This Report

This report is intended for use by:

- Senior management for carbon strategy and investment decisions.
- Sustainability and EHS teams for target-setting and performance monitoring.
- External customers and procurement teams for supply chain due diligence.
- Third-party auditors and certification bodies for GHG assurance.
- ESG reporting platforms including GRI, CDP, BRSR, and TCFD frameworks.

2. ORGANIZATIONAL AND OPERATIONAL BOUNDARIES

2.1 Reporting Approach

The inventory has been prepared using the **Operational Control approach**, as defined under the GHG Protocol Corporate Standard. Under this approach, the organization accounts for 100% of the GHG emissions from operations over which it has operational control — defined as the authority to introduce and implement operating policies.

Key Observation

The Operational Control approach is the most appropriate boundary for this inventory, as the organization directly controls all energy-consuming and emission-generating activities within the facility boundary. Financial control or equity share approaches would yield identical results given the facility structure.

2.2 Organizational Boundary

Boundary Element	Details	Included?
Primary Facility	Pharmanza Herbal Pvt. Ltd, Gujarat, India	Yes
Production Operations	Spray dryer, boilers, process equipment	Yes
Utility Operations	DG sets, HVAC, compressed air, cooling systems	Yes
Transport (On-site)	Staff buses, forklifts, company cars	Yes
Solar Power (On-site)	On-site rooftop/ground-mounted solar generation	Yes (Offset)
Scope 3 (Value Chain)	Upstream raw materials, logistics, waste disposal	Not in scope (FY26)
Contractor Operations	Third-party contractors not under operational control	Excluded

2.3 Scope Definitions

In accordance with the GHG Protocol:

- Scope 1 (Direct Emissions): All GHG emissions from sources owned or controlled by the organization, including stationary combustion, mobile combustion, and fugitive releases.
- Scope 2 (Energy Indirect Emissions): Emissions from the generation of purchased electricity consumed by the organization, reported on both gross and market-based (net of solar offset) bases.
- Scope 3 (Other Indirect Emissions): Value chain emissions not directly controlled by the organization. Scope 3 data is not available for FY 2025-26 and will be developed in a subsequent reporting cycle.

Management Recommendation

We recommend the organization initiate a Scope 3 emissions screening assessment in FY 2026-27, prioritizing Category 1 (Purchased Goods & Services) and Category 11 (Use of Sold Products), which typically represent the highest-materiality Scope 3 categories for manufacturing organizations.

3. METHODOLOGY

3.1 Applicable Standards and Guidance

Standard / Guidance	Application
GHG Protocol Corporate Accounting and Reporting Standard (WRI/WBCSD)	Primary framework for emission categorization, boundary-setting, and calculation methodology
ISO 14064-1:2018	Organizational-level GHG quantification and reporting specification
IPCC 2006 / 2019 Refinement Guidelines	Tier 1 emission factors for stationary and mobile combustion; biomass CH ₄ and N ₂ O factors
IPCC AR6 (2021) — Sixth Assessment Report	100-year Global Warming Potential (GWP100) values for all greenhouse gases
UK DEFRA GHG Conversion Factors (2024)	Fuel-specific emission factors for diesel, petrol, CNG, LPG (per litre/kg activity data)
Central Electricity Authority (CEA) — India Grid EF	Indian electricity grid emission factor: 0.71 tCO ₂ e/MWH (FY 2022-23 national average)

3.2 Calculation Approach

All emissions are calculated using the Activity Data × Emission Factor methodology:

$$\text{GHG Emissions (tCO}_2\text{e)} = \text{Activity Data (UOM)} \times \text{Emission Factor (kgCO}_2\text{e/UOM)} \div 1,000$$

Source Category	Activity Data	Emission Factor Source	GWP Source
Diesel (Stationary & Mobile)	Fuel purchase records (litres)	DEFRA 2024 (2.5376 kgCO ₂ e/L)	IPCC AR6
Petrol (Mobile)	Fuel purchase records (litres)	DEFRA 2024 (2.0552 kgCO ₂ e/L)	IPCC AR6
CNG (Mobile)	CNG consumption records (kg)	DEFRA 2024 (2,570.42 kgCO ₂ e/tonne)	IPCC AR6
LPG (Stationary)	LPG purchase records (kg)	DEFRA 2024 (2,935.18 kgCO ₂ e/tonne)	IPCC AR6
Biomass Briquette	Weighbridge / purchase records (kg)	IPCC 2006 Table 2.2/2.3 (30 kg CH ₄ /TJ; 4 kg N ₂ O/TJ)	IPCC AR6
Refrigerants (Fugitive)	Refrigerant top-up logs (kg)	GWP per refrigerant type (IPCC AR6)	IPCC AR6
Grid Electricity	Electricity bills / meters (kWH)	CEA India Grid EF: 0.71 tCO ₂ e/MWH	N/A
Solar Offset	Generation meter logs (MWH)	Same as grid EF: 0.71 tCO ₂ e/MWH (avoided)	N/A

3.3 Biomass Treatment

In accordance with the GHG Protocol Corporate Standard and ISO 14064-1:

- Biogenic CO₂ from biomass combustion (3,467.51 tCO₂) is excluded from Scope 1 totals and disclosed as a separate memo item, as the carbon was recently absorbed from the atmosphere.
- CH₄ and N₂O arising from biomass combustion are non-biogenic (arising from incomplete combustion chemistry) and are included in Scope 1 emissions at their GWP100-weighted CO₂ equivalent values.
- Emission factors applied: CH₄ — 30 kg/TJ; N₂O — 4 kg/TJ (IPCC 2006 Table 2.3, boiler/industrial furnace). Calorific value: 3,750 kcal/kg (15.69 GJ/tonne) — mid-point of client-supplied range.

4. GHG EMISSIONS INVENTORY RESULTS

4.1 Summary of All Emissions

Scope / Category	Emission Source	Consumption	CO ₂ (tCO ₂ e)	CH ₄ (tCO ₂ e)	N ₂ O (tCO ₂ e)	HFC (tCO ₂ e)	PFC (tCO ₂ e)	SF ₆ (tCO ₂ e)	Total (tCO ₂ e)
SCOPE 1 — DIRECT EMISSIONS									
Stationary Combustion									
	DG Set Diesel	7,800 L	19.794	0.002	0.257	0	0	0	20.052
	Spray Dryer Diesel	133,740 L	339.383	0.039	4.4	0	0	0	343.821
	LPG – Canteen	0.911 Ton	2.674	0.002	0.001	0	0	0	2.677
	Biomass Briquette (CH ₄ + N ₂ O only)	2,989,230 kg	0	39.256	51.216	0	0	0	90.472
	Subtotal — Stationary Combustion		361.851	39.299	55.874	0	0	0	457.023
Mobile Combustion									
	Car – Petrol	4,179 L	8.589	0.034	0.025	0	0	0	8.647
	Staff Bus – Diesel	6,654.55 L	16.887	0.002	0.219	0	0	0	17.108
	Forklift – Diesel	1,845 L	4.682	0.001	0.061	0	0	0	4.743
	CNG Vehicles	3.763 Ton	9.672	0.014	0.004	0	0	0	9.691
	Subtotal — Mobile Combustion		39.83	0.051	0.309	0	0	0	40.189
Fugitive Emissions									
	FE CO ₂ Refilling	6.5 kg	0.007	0	0	0	0	0	0.007
	R-22 (GWP 1,960)	187 kg	0	0	0	366.52	0	0	366.52
	R-410A (GWP 2,255.5)	22.6 kg	0	0	0	50.97	0	0	50.97
	R-32 (GWP 771)	5.9 kg	0	0	0	4.549	0	0	4.549
	R-404A (GWP 4,728)	17.6 kg	0	0	0	83.213	0	0	83.213
	Subtotal — Fugitive Emissions		0.007	0	0	505.252	0	0	505.262
TOTAL SCOPE 1			401.658	39.35	56.183	505.252	0	0	1,002.47
SCOPE 2 — INDIRECT EMISSIONS FROM PURCHASED ENERGY									
Purchased Energy									
	Grid Electricity (2,421.45 MWh × 0.71 EF)	2,436.17 MWh	1,729.68	0	0	0	0	0	1,729.68
	Steam	0	0	0	0	0	0	0	0
	Subtotal — Scope 2 (Gross)		1,729.68	0	0	0	0	0	1,729.68
RE Offset	Solar Generation (728.375 MWh × 0.71) — Deducted from Scope 2	728.375 MWh	-519.947	0	0	0	0	0	-519.947
TOTAL SCOPE 2 (NET, after RE Offset)			1,209.73	0	1603.742	0	0	0	1,209.73
GRAND TOTAL — SCOPE 1 + SCOPE 2 (NET)							0	0	2,212.21

4.2 Scope 1 : Detailed Analysis

Scope 1 direct emissions total 1,002.47 tCO₂e, representing 45.31% of the organization's combined Scope 1 and Scope 2 footprint (net basis). The three subcategories: stationary combustion (457.02 tCO₂e), fugitive emissions (505.26 tCO₂e) and mobile combustion (40.19 tCO₂e,) reveal that refrigerant leakage is the dominant Scope 1 driver, followed closely by diesel combustion in the spray dryer.

The inclusion of biomass briquette-associated CH₄ and N₂O emissions (90.47 tCO₂e) reflects the GHG Protocol's requirement to account for these non-biogenic gases regardless of the carbon-neutrality of the fuel itself. This is an important distinction that is frequently misunderstood in reporting practice.

Key Risk

R-22 refrigerant (GWP: 1,960) accounts for 366.52 tCO₂e — the single largest Scope 1 source — from just 187 kg of leakage. R-22 is an ozone-depleting substance scheduled for phase-out under the Montreal Protocol. Its replacement with low-GWP alternatives represents both a compliance obligation and the highest-impact Scope 1 reduction opportunity.

4.3 Scope 2 : Detailed Analysis

Scope 2 electricity emissions, reported on a market-based basis net of on-site solar generation, total 1,209.734 tCO₂e. On a gross basis (before solar offset), electricity emissions are 1,729.68 tCO₂e 63.31% of combined gross emissions. The Indian grid emission factor of 0.71 tCO₂e/MWH applied here reflects the carbon-intensive mix of the national grid, underscoring the significant emissions reduction benefit achievable through renewable energy expansion.

The organization's solar generation of 732.32 MWH provides an avoided emission of 517.15 tCO₂e — a meaningful contribution representing approximately 30.1% of gross Scope 2 emissions avoided. This represents a substantial decarbonisation achievement already in operation.

Improvement Opportunity

To achieve Scope 2 net-zero, the organization would need approximately 2,212 MWH of renewable energy generation or procurement equivalent to roughly 3.3x the current solar capacity. A phased capacity expansion plan with a target of 100% RE coverage by FY 2028-29 is recommended as a medium-term goal.

4.4 Biogenic Emissions

Biogenic CO ₂ Emissions (Reported Separately – Not Included in Scope 1 Total)					
Sr	Category	Fuel Consumed (tonnes)	EF (kg CO ₂ /tonne)	Biogenic CO ₂ (kg)	Total (tCO ₂ e)
1	Biogenic CO ₂ from Biomass Combustion	2,989.23	1,160.00	3,467,506.80	3,467.51
Total Biogenic CO ₂ Emissions					3,467.51



4.5 Emission Intensity Metrix

Emission Intensity Metrics	
Production Output	358.64 Tonnes
Gross Emission Intensity (tCO ₂ e / tonne product)	7.61 tCO ₂ e/tonne
Net Emission Intensity after RE Offset (tCO ₂ e / tonne product)	6.16 tCO ₂ e/tonne
Biogenic CO ₂ from Biomass Combustion Intensity	8.33 tCO ₂ e/tonne

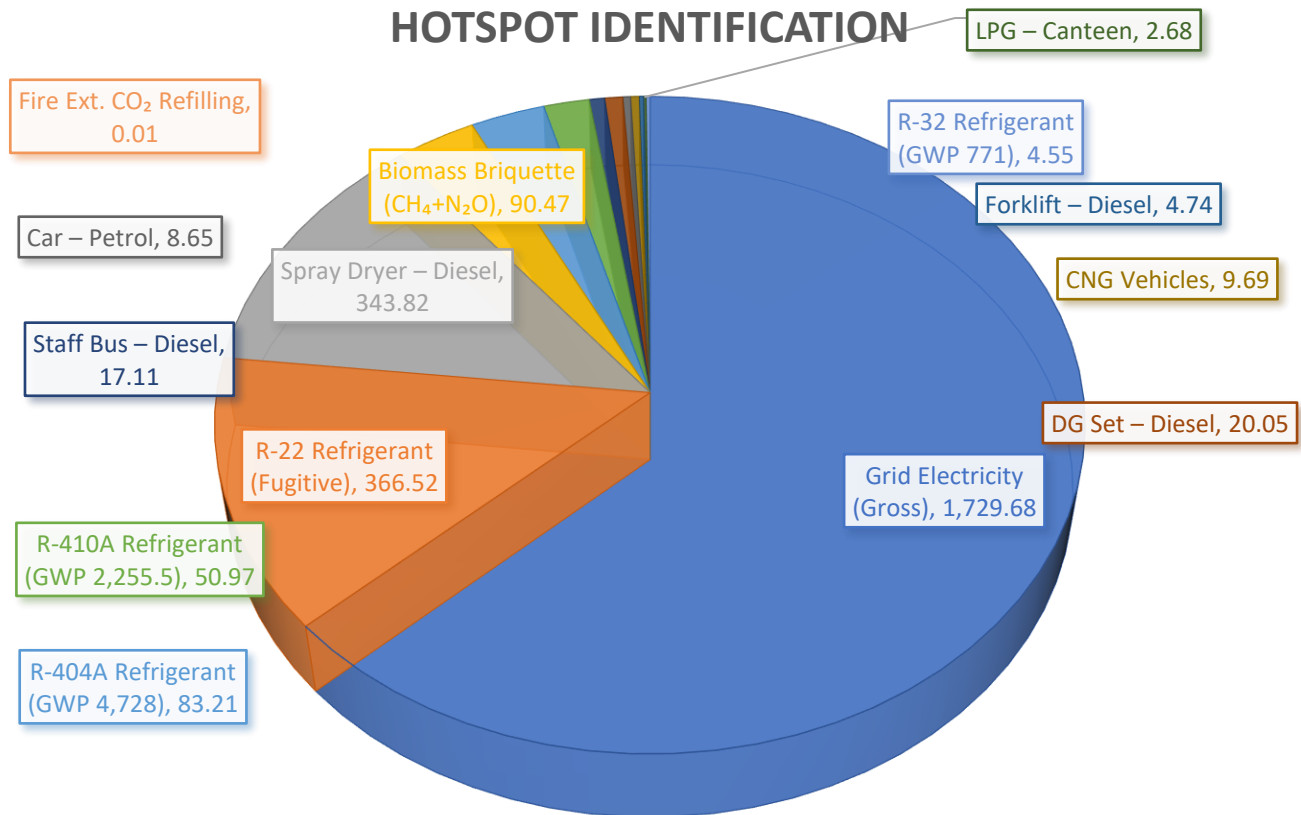
5. EMISSION HOTSPOT ANALYSIS

A Pareto analysis of all identified emission sources reveals that five sources account for approximately 94.7% of total gross Scope 1 + Scope 2 emissions. The 80/20 principle (Pareto principle) holds strongly in this inventory, where three sources alone, grid electricity, Spray Dryer diesel, and R-22 refrigerant contribute over 88% of the gross total.

5.1 Ranked Emission Sources

	Emission Source	Scope	Category	tCO ₂ e	% of Total	Cumulative %
1	Grid Electricity (Gross)	2	Energy Indirect	1,729.68	63.3%	63.3%
2	R-22 Refrigerant (Fugitive)	1	Fugitive	366.52	13.4%	76.7%
3	Spray Dryer – Diesel	1	Stationary Combustion	343.82	12.6%	89.3%
4	Biomass Briquette (CH ₄ +N ₂ O)	1	Stationary Combustion	90.47	3.3%	92.6%
5	R-404A Refrigerant (GWP 4,728)	1	Fugitive	83.21	3.0%	95.7%
6	R-410A Refrigerant (GWP 2,255.5)	1	Fugitive	50.97	1.9%	97.5%
7	Staff Bus – Diesel	1	Mobile Combustion	17.11	0.6%	98.2%
8	DG Set – Diesel	1	Stationary Combustion	20.05	0.7%	98.9%
9	Car – Petrol	1	Mobile Combustion	8.65	0.3%	99.2%
10	CNG Vehicles	1	Mobile Combustion	9.69	0.4%	99.6%
11	Forklift – Diesel	1	Mobile Combustion	4.74	0.2%	99.7%
12	LPG – Canteen	1	Stationary Combustion	2.68	0.1%	99.8%
13	R-32 Refrigerant (GWP 771)	1	Fugitive	4.55	0.2%	100.0%
14	Fire Ext. CO ₂ Refilling	1	Fugitive	0.01	0.0%	100.0%
—	Solar RE Offset (Deducted)	2	RE Generation	(519.94)	—	—

HOTSPOT IDENTIFICATION



Key Observation

The top three emission sources — grid electricity, R-22 refrigerant, and spray dryer diesel — collectively represent 84.0% of gross total emissions. A focused intervention on these three hotspots alone, rather than a broad portfolio approach, would deliver the greatest emissions reduction with the most efficient allocation of management resources and capital.

6. DATA QUALITY ASSESSMENT (DQI)

Data quality is assessed using the Pedigree Matrix methodology (ISO 14044 / ecoinvent standard), adapted for corporate GHG inventories per ISO 14064-1. Each major emission source is scored across five dimensions on a 1–5 scale (1 = highest quality; 5 = lowest quality). A lower DQI score indicates higher data quality.

6.1 DQI Scoring Criteria

Score	Reliability	Completeness	Temporal	Geographic	Technological
1	Verified/metered data	Full coverage	Same year	Same site	Exact process
2	Measured, unverified	>95% coverage	<3 years	Same region	Similar process
3	Calculated from records	>75% coverage	<6 years	Same country	Related process
4	Estimated from incomplete data	>50% coverage	<10 years	Similar country	Proxy process
5	Engineering judgement	<50% coverage	>10 years	Different region	Different sector

6.2 DQI Scores by Emission Source

Emission Source	Reliability	Completeness	Temporal	Geographic	Technological	Avg DQI	Rating
Grid Electricity	1	1	2	2	1	1.4	HIGH
Diesel — Spray Dryer	2	1	1	2	2	1.6	HIGH
Diesel — DG Set	2	1	1	2	2	1.6	HIGH
Biomass Briquette	2	1	1	2	2	1.6	HIGH
R-22 Refrigerant	3	2	1	1	1	1.6	HIGH
R-410A Refrigerant	3	2	1	1	1	1.6	HIGH
R-404A / R-32 Refrigerant	3	2	1	1	1	1.6	HIGH
Mobile Combustion (all)	2	2	1	2	2	1.8	HIGH
LPG — Canteen	2	2	1	2	2	1.8	HIGH
Solar Generation	1	1	1	1	1	1.0	HIGH
OVERALL INVENTORY DQI	—	—	—	—	—	1.6	HIGH

Overall Data Quality Assessment: The inventory achieves a HIGH-quality rating with an average DQI of 1.6. The primary data reliability concern relates to refrigerant leakage measurement — top-up records provide a reasonable proxy for leakage but do not capture sub-detection leaks or unmeasured releases. A formal refrigerant management system with calibrated leak detectors would upgrade the reliability score for fugitive emissions from 3 to 1.



Improvement Opportunity

Install continuous or semi-annual refrigerant leak detection monitoring across all HVAC and cooling equipment. Maintain a formal refrigerant logbook per ASHRAE 15 or LEED requirements. This will improve DQI reliability score from 3 to 1–2 for all fugitive sources and will satisfy requirements under ISO 14064-1 third-party verification.

7. UNCERTAINTY ASSESSMENT

Uncertainty in a GHG inventory arises from two primary sources: activity data uncertainty (how accurately consumption is measured) and emission factor uncertainty (inherent variability in published conversion factors). This section quantifies and classifies the combined uncertainty for each major emission source.

Emission Source	Activity Data Uncertainty	EF Uncertainty	Combined Uncertainty	Classification	Key Rationale
Grid Electricity	±2%	±5%	±5.4%	LOW	Metered; CEA EF updated annually
Diesel — Spray Dryer	±3%	±5%	±5.8%	LOW	Purchase invoices; DEFRA 2024 EF
Diesel — DG Set	±5%	±5%	±7.1%	MEDIUM	Fuel tank estimate; no flow meter
Biomass Briquette	±5%	±20%	±20.6%	MEDIUM	IPCC Tier 1; CV varies ±7%; moisture content unknown
R-22 Refrigerant	±15%	±5%	±15.8%	MEDIUM	Top-up records only; sub-detection leaks not captured
R-410A / R-404A / R-32	±15%	±5%	±15.8%	MEDIUM	Top-up records; leak path not characterized
Mobile Combustion (Diesel/Petrol)	±5%	±5%	±7.1%	MEDIUM	Distance/fuel logs; no odometer verification
CNG / LPG	±5%	±8%	±9.4%	LOW	Utility billing/purchase records
Solar Generation	±2%	±5%	±5.4%	LOW	Generation meter; MNRE data
OVERALL INVENTORY	—	—	±10–15%	MEDIUM	Driven by refrigerant leakage uncertainty

The overall inventory uncertainty is assessed at medium (±10–15%), primarily driven by the uncertainty associated with refrigerant leakage measurement. For sources comprising approximately 82% of total emissions (electricity and diesel combustion), the combined uncertainty is low (<10%), reflecting the strong quality of activity data and well-established emission factors. Implementing a formal refrigerant management and monitoring programme would reduce overall inventory uncertainty to low (<10%).

8. REDUCTION OPPORTUNITIES AND PRIORITIZATION

The following reduction measures have been identified through analysis of the emission hotspots, technological options available in the Indian market, and the feasibility of implementation within the operational constraints of the facility.

	Reduction Measure	Hotspot Addressed	Est. Reduction (tCO ₂ e/yr)	Ease	Investment Category	Priority
1	R-22 Phase-Out: Replace with R-32 or R-290	Fugitive (R-22: 366.52 tCO ₂ e)	~310–350	Medium	Medium Investment	CRITICAL
2	Solar PV Capacity Expansion (3x current)	Scope 2 Electricity	~1,000–1,200	Medium	Strategic	CRITICAL
3	Spray Dryer Fuel Switch: Diesel → Natural Gas	Stationary Combustion (343.82 tCO ₂ e)	~120–150	Medium	Medium Investment	HIGH
4	Refrigerant Leak Detection System (all HFCs)	Fugitive — All Refrigerants	~50–80	High	Low-Cost	HIGH
5	Energy Efficiency — LED, VFDs, Compressed Air	Scope 2 Electricity	~100–200	High	Low-Cost	HIGH
6	RE Certificate (REC) Procurement for Residual Scope 2	Scope 2 (Net balance)	Up to 1,202	High	No-Cost/Low-Cost	MEDIUM
7	Fleet Electrification (Forklift → Electric)	Mobile Combustion (Forklift: 4.74 tCO ₂ e)	~4–5	Medium	Medium Investment	MEDIUM
8	Biomass Briquette Quality Improvement	Stationary Biomass — (90.47 tCO ₂ e)	~10–20	High	No-Cost	MEDIUM

Management Recommendation

Prioritize Measures 1, 4, and 5 (refrigerant management and energy efficiency) in the immediate term — these are achievable within 12 months with low-to-medium investment and yield tangible, verifiable Scope 1 reductions. Measure 2 (solar expansion) should be initiated in parallel as a medium-term strategic investment given Gujarat's exceptionally high solar potential (GHI: ~5.5–6.0 kWh/m²/day).

9. DECARBONIZATION ROADMAP

The following roadmap presents a structured pathway to achieve substantial emission reductions over a 10-year horizon, categorized into three implementation phases. The roadmap is designed to be ambitious yet operationally feasible, aligned with India's nationally determined contributions (NDCs) and consistent with a 1.5°C-aligned trajectory.

Phase	Timeframe	Key Actions	Est. Reduction (tCO ₂ e/yr)	Cumulative Reduction
Phase 1 Quick Wins	FY 2026-27 to FY 2027-28	- Refrigerant leak detection system installation - R-22 replacement programme (Phase 1: largest units) - LED lighting retrofit (facility-wide) - VFD installation on major pumps and fans - Compressed air system audit and leak repair - REC procurement for residual Scope 2 balance	300–450	~15–20%
Phase 2 Transformation	FY 2028-29 to FY 2030-31	- Solar PV capacity expansion to 2,000+ MWH/yr - Spray dryer fuel switch to natural gas or biogas - Complete R-22 and R-404A phase-out - Fleet electrification (forklifts, staff buses) - BESS (battery storage) integration with solar - ISO 14064-1 third-party verification of inventory	700–900	~50–60%
Phase 3 Net Zero	FY 2031-32 to FY 2034-35	100% renewable electricity (solar + PPAs/RECs) - Process electrification or green hydrogen for heat - Scope 3 supplier engagement programme - Carbon offset for residual unavoidable emissions - SBTi target validation and public commitment	~1,800–2,200	~90%+



9.1 Emission Trajectory

Year	FY 25-26 (Base)	FY 26-27	FY 27-28	FY 28-29	FY 29-30	FY 30-31	FY 31-32	FY 32-33	FY 33-34
Projected Emissions (tCO ₂ e)	2,212	1,900	1,600	1,200	900	700	400	200	~200
% Reduction vs Base	—	14%	27%	46%	59%	68%	82%	91%	91%

10. CONCLUSIONS AND KEY RECOMMENDATIONS

10.1 Conclusions

This GHG Inventory for **Pharmanza Herbal Pvt. Ltd.** establishes a comprehensive and credible baseline of greenhouse gas emissions for FY 2025-26, covering all material Scope 1 and Scope 2 emission sources within the facility's operational boundary. The key conclusions are:

- Total Scope 1 + Scope 2 emissions are 2,204.56 tCO₂e (net of solar offset), with grid electricity (54.5%) and direct emissions (45.5%) as near-equal contributors.
- Refrigerant leakage — particularly R-22 (366.52 tCO₂e) — is the most significant and concentrated Scope 1 emission hotspot, driven by the high GWP of legacy refrigerants rather than large volumes.
- Spray dryer diesel combustion (343.82 tCO₂e) is the dominant fossil fuel emission source and a high-priority fuel switching candidate.
- The existing solar generation (728.375 MWH) already avoids 517.15 tCO₂e annually, demonstrating the high leverage of renewable energy in this context.
- Biogenic CO₂ from biomass combustion (3,467.51 tCO₂) is significant in absolute volume but is correctly excluded from inventory totals per GHG Protocol. The associated CH₄ and N₂O (90.47 tCO₂e) are included as required.
- Overall inventory data quality is HIGH (DQI: 1.6), with medium uncertainty (±10–15%) driven principally by refrigerant leakage measurement limitations.

10.2 Priority Recommendations

Priority	Recommendation	Timeline		Expected Impact
P1	Phase out R-22; install leak detection across all refrigerant systems	FY 27	2026-	Eliminate ~310–350 tCO ₂ e/yr; compliance with Montreal Protocol obligations
P2	Expand solar PV to 2,000+ MWH/yr (3x current capacity)	FY 29	2027-	Avoid ~1,000–1,200 tCO ₂ e/yr; substantially offset Scope 2
P3	Switch spray dryer fuel from diesel to natural gas or biogas	FY 28	2027-	Reduce ~120–150 tCO ₂ e/yr; lower fuel costs per GJ
P4	Establish FY 2025-26 as base year; submit SBTi commitment letter	FY 27	2026-	Unlock SLL financing; strengthen customer ESG positioning
P5	Initiate Scope 3 screening inventory in FY 2026-27	FY 27	2026-	Enables full value chain carbon accounting; customer supply chain readiness



11. Records Retention

PHARMANZA HERBAL Pvt. Ltd. maintains a structured records retention process to ensure transparency, traceability, and verification readiness of its greenhouse gas (GHG) inventory.

All records and supporting documentation used in the preparation of this GHG inventory will be retained for a minimum period of **five (5) years** from the date of report publication. These records include, but are not limited to:

- Electricity utility bills and fuel purchase invoices
- Activity data logs, meter readings, and internal operational records
- Emission factor references and calculation worksheets
- Assumptions, methodological notes, and data quality assessments
- Internal review, validation, and approval documentation

This retention period enables effective internal review, supports future third-party verification, and ensures consistency in year-on-year GHG reporting

APPENDIX A: EMISSION FACTOR DATABASE

Fuel / Activity	UOM	EF (CO ₂)	EF (CH ₄)	EF (N ₂ O)	GWP CH ₄	GWP N ₂ O	Source
Diesel	L	2.5376	0.00029	0.0329	27.9	273	DEFRA 2024
Petrol	L	2.0552	0.00806	0.00587	27.9	273	DEFRA 2024
CNG	tonne	2,570.42	3.853	1.192	27.9	273	DEFRA 2024
LPG	tonne	2,935.18	2.554	1.627	27.9	273	DEFRA 2024
Grid Electricity (India)	MWH	0.71	N/A	N/A	—	—	CEA FY22-23
Biomass — CO ₂ (Biogenic)	t fuel	1,160 kg CO ₂ /t	30 kg/TJ	4 kg/TJ	27.9	273	IPCC 2006 T2.2/2.3
R-22 (HCFC-22)	kg	GWP: 1,960	—	—	—	—	IPCC AR6
R-410A	kg	GWP: 2,255.5	—	—	—	—	IPCC AR6
R-404A	kg	GWP: 4,728	—	—	—	—	IPCC AR6
R-32	kg	GWP: 771	—	—	—	—	IPCC AR6
CO ₂ Fire Extinguisher	kg	GWP: 1	—	—	—	—	IPCC AR6

APPENDIX B: ACRONYMS AND DEFINITIONS

Acronym	Definition
BRSR	Business Responsibility and Sustainability Report (SEBI, India)
CCTS	Carbon Credit Trading Scheme (MoEFCC, India)
CEA	Central Electricity Authority (India)
DEFRA	Department for Environment, Food & Rural Affairs (UK) — GHG Conversion Factors
DQI	Data Quality Index
EF	Emission Factor
GHG	Greenhouse Gas
GWP	Global Warming Potential (100-year time horizon, IPCC AR6)
HFC	Hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
LPG	Liquefied Petroleum Gas
MWH	Megawatt Hour
PPA	Power Purchase Agreement



Acronym	Definition
REC	Renewable Energy Certificate
SBTi	Science Based Targets initiative
tCO ₂ e	Tonnes of Carbon Dioxide Equivalent
VFD	Variable Frequency Drive
WRI	World Resources Institute