30 Sept - 01 Oct, 2025

Pondicherry University :

Roadmap to Net-Zero Carbon by 2035

ICEWSE 2025

International Conference on Energy and Water for Sustainable Environment

Pondicherry University

Sustainium Inc.

GSES India

UNESCO Chair

South Asia Foundation

Participating Organisations

Pondicherry University

Pondicherry University is a Central University of national importance established in 1985. Its 800-acre coastal campus in Puducherry hosts more than 7,000 students and over 400 faculty members, supported by extensive residential, academic, and research facilities. The University has become a national model for sustainable campus development, integrating large-scale solar power, advanced water and waste management systems, and biodiversity conservation initiatives. The Department of Green Energy Technology at the Madanjeet School of Green Energy Technologies, in collaboration with the UNESCO Chair established in 2024 to promote "Renewable and Clean Energy for Sustainable Development" demonstrates its commitment to research, education, and innovation in renewable energy and low-carbon development.

South Asia Foundation (SAF)

The South Asia Foundation is an intergovernmental, non-profit organisation that promotes regional cooperation, peace, and sustainable development through education and cultural exchange. Established by UNESCO Goodwill Ambassador Madanjeet Singh, SAF supports institutions of learning across South Asia, creating opportunities for research, scholarships, and cross-border dialogue. The foundation promotes innovation and mutual understanding to address shared challenges, including energy security, environmental protection, equitable economic growth and promote sustainable development.

Sustainium Inc.

Sustainium Inc. is a sustainability-technology company dedicated to enabling transparent and science-based climate action. Headquartered in the United States with operations in India, Sustainium develops digital tools for carbon accounting, greenhouse-gas (GHG) reporting, and ESG (environmental, social, and governance) management. Its flagship product, Sustainium.io, is a cloud-based platform that provides accurate GHG inventories, scenario modelling, and compliance-ready outputs aligned with global standards such as the Greenhouse Gas Protocol and GRI. Sustainium serves enterprises, institutions, and governments seeking robust, data-driven pathways to net-zero emissions.

Global Sustainable Energy Solutions (GSES) India

Founded in 1998 in Sydney, Australia, and active in India since 2012, Global Sustainable Energy Solutions (GSES) is a multidisciplinary organisation specialising in engineering, consultancy, and professional training across renewable-energy technologies. Certified to ISO 9001:2015, GSES delivers services in project planning and design, engineering and project management, techno-economic due diligence, and capacity building. The company has executed assignments in over 36 countries and maintains a well-established library of technical and training publications that are regularly updated to reflect the latest international standards.

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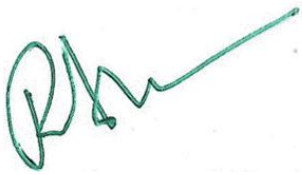
Preface

Professor Ramaswamy Arun Prasath

The promise of sustainable transformation grows stronger with every sunrise over Pondicherry University's sprawling campus. This report, "Roadmap to Net Zero Carbon by 2035," reflects a decade of determined action and a vision of what universities can become when sustainability is at the heart of their mission. Our journey—from reducing annual greenhouse gas emissions by 20% in ten years, to building robust solar, water, waste, and e-mobility systems—demonstrates how growth and decarbonisation coexist. It is worth to mention that under our team, a detailed project proposal on the "Solar Campus Master Plan" for Pondicherry University was submitted in 2012-13 and the proposal has contributed in promoting solar energy generation in the campus with the current capacity of 2.6 MWp from 2021 onwards, making Pondicherry University one of the largest and affordable clean energy generation in an educational institute in India. Now, I submit that achieving net-zero emissions by 2035 is a bold target, but an essential one. Through collaborative efforts with GSES India, Sustanium Inc., and international certification bodies, we seek to lead and inspire collaboration and partnership among fellow institutions. We align ourselves with India's climate vision and global best practices by setting ambitious milestones. Our research, verified and projected through advanced platforms like Sustainium.io, ensures trust and transparency at every step.

At Pondicherry University, we ensure that these efforts resonate far beyond the campus by fostering pioneering research, outreach programmes, global partnerships, and innovative technology development under the recent established UNESCO Chair to promote Renewable and Clean Energy for Sustainable Development—driving real-world impact in climate action and clean energy education. I hope that these shared ambitions will inspire the academic community, industry, policymakers, and the wider public to join in this compelling journey toward a net-zero future.



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Acknowledgments

Pondicherry University Administration

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- Prof. K. Tharanikkarasu, Director (SEI&RR)
- Prof. Clement S. Lourdes, Director (Culture & Cultural Relations)
- Prof. Rajneesh Bhutani, Registrar(i/c)
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1. Executive Summary

Pondicherry University has reduced its annual greenhouse gas (GHG) emissions from 9,831 tCO_2e in 2014 to 7,691 tCO_2e in 2024—a 20% reduction achieved even as academic, residential, and research activities have grown.[1]

This milestone is the result of a multi-pronged sustainability programme:

- Energy transformation: 2.6 MWp of solar photovoltaic systems now meet around 30 % of the University's electricity demand and avoid ~3,000 tCO_2e annually from 2021 onwards. LED lighting, smart fans, and star-rated appliances further trim consumption.[2], [3]
- Water and waste management: Rainwater harvesting recharges about 7.8 lakh m^3 of groundwater annually, and ~ 700 kL/day wetland-type sewage treatment plant enables nearly complete reuse. A five-bin segregation system, composting, e-auctions for recyclables, and sanitary-waste incineration ensure near-zero landfill waste.[4], [5]
- Biodiversity and E-mobility: Of the 800-acre campus, 320 acres are natural ecosystems supporting 139 tree species and 96 fauna species. Electric buggies, e-two-wheelers and shared buses cut transport emissions.[6]

All emissions data from 2014 to 2024 were compiled and verified on the Sustainium.io carbon accounting and ESG reporting platform. This provided the University with a robust, auditable emissions inventory, enabling accurate projections and the design of a decarbonization strategy.[7]

The report recommends Net Zero Carbon by 2035 as an aspirational benchmark (not a formal pledge). This target aligns with India's expected next Nationally Determined Contribution (NDC) cycle and emerging international norms while remaining scientifically and operationally feasible.[8] The proposed pathway foresees:

- More than 90% absolute reduction in campus GHG emissions from the 2014 baseline by 2035.
- Residual less than 10% neutralised through on-campus carbon sinks and carefully selected, verifiable carbon credits.
- Target dual certification under IGBC Net Zero Carbon and the Global Network for Zero (GNFZ) for national and global credibility.[9], [10]

Through clear milestones—50% reduction by 2028, 75% by 2032, and full Net Zero readiness by 2035—this roadmap positions Pondicherry University as a national model for climate leadership in higher education.

2. Introduction

Universities are uniquely positioned to spearhead the transition to a low-carbon future. Their campuses are microcosms of urban systems, consuming energy, managing water and waste, supporting transportation and housing, and influencing thousands of young minds each year. By transforming their operations, universities can reduce emissions directly and demonstrate to society how climate solutions can be implemented at scale.[11]

Pondicherry University, established in 1985 as a Central University of national importance, occupies an 800-acre coastal campus in Kalapet, Puducherry. The University supports over 7,000 regular students, more than 400 faculty members, and a large residential and administrative staff. Academic programmes span sciences, humanities, engineering, management, and the arts, and include 15 schools, 41 departments, and nine specialised centres.[4]

The campus is already recognised for pioneering initiatives in renewable energy, sustainable water management, biodiversity conservation, and circular economy practices. By pursuing Net Zero Carbon, the University now aims to integrate these achievements into a single, verifiable framework for climate leadership.[12]

2.1. Global and National Context

The drive towards Net Zero Carbon—balancing greenhouse gas (GHG) emissions with removals (or offsets)—has become the defining challenge of our century. International frameworks such as IGBC Net Zero Carbon[13], GRIHA[14], USGBC LEED Zero Carbon, The Global Network for Zero (GNFZ), The Science Based Targets Initiative (SBTi), and The GHG Protocol provide measurement and verification methods to ensure integrity.

At the national level, India's official commitment is Net Zero by 2070. Yet current discussions ahead of upcoming UN climate conferences indicate that India may revise its NDC to include stronger 2035 milestones. By setting an internal Net Zero 2035 benchmark, Pondicherry University aligns with the direction of emerging national policy and places itself among the country's most forward-looking academic institutions.[8]

2.2. About Pondicherry University Campus

The main campus spans approximately ~800 acres of coastal land, with ~320 acres designated as forests, scrublands, and wetlands. This green expanse sequesters carbon, moderates the local microclimate, and supports a rich biodiversity.

2.2.1. Academic and Residential Infrastructure

The campus hosts 15 schools, 41 departments, nine centres, and three endowed chairs, together offering more than 200 academic programmes. Supporting infrastructure includes:

- Libraries and laboratories with high-end equipment and IT networks.

- Residential facilities comprising student hostels, staff quarters, guest houses and dining halls.
- Recreational and sports complexes.
- Utility systems: electricity distribution substations, solar arrays, water-supply and sewerage networks, internal roads and parking facilities.

2.2.2. Community and Governance

A vibrant community of over 7,000 students, 400+ faculty members, and administration and service staff, gives the campus the complexity of a small town. This allows the University to model integrated solutions in energy, mobility, water, waste, and landscape management.

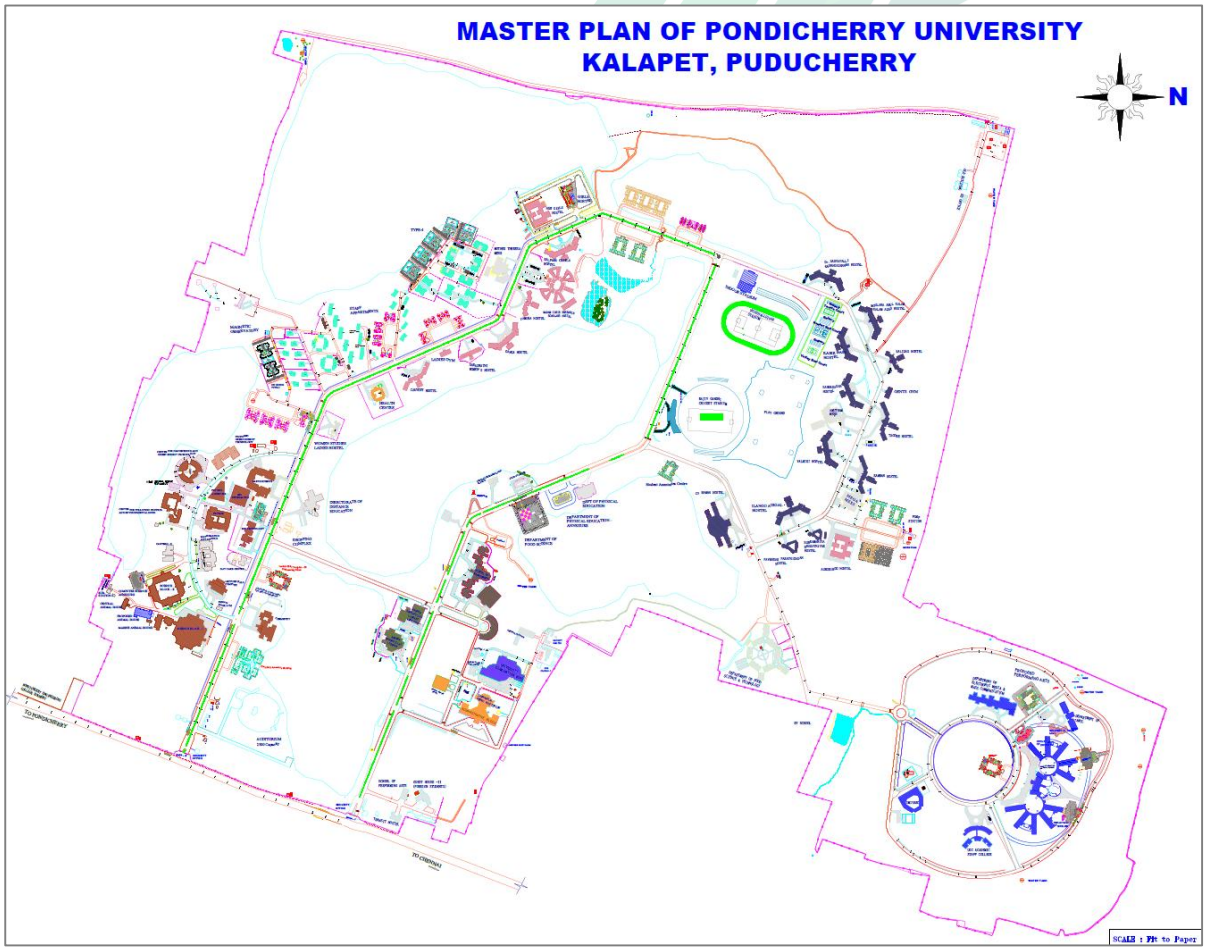

Figure 1 Master plan of the Pondicherry University campus

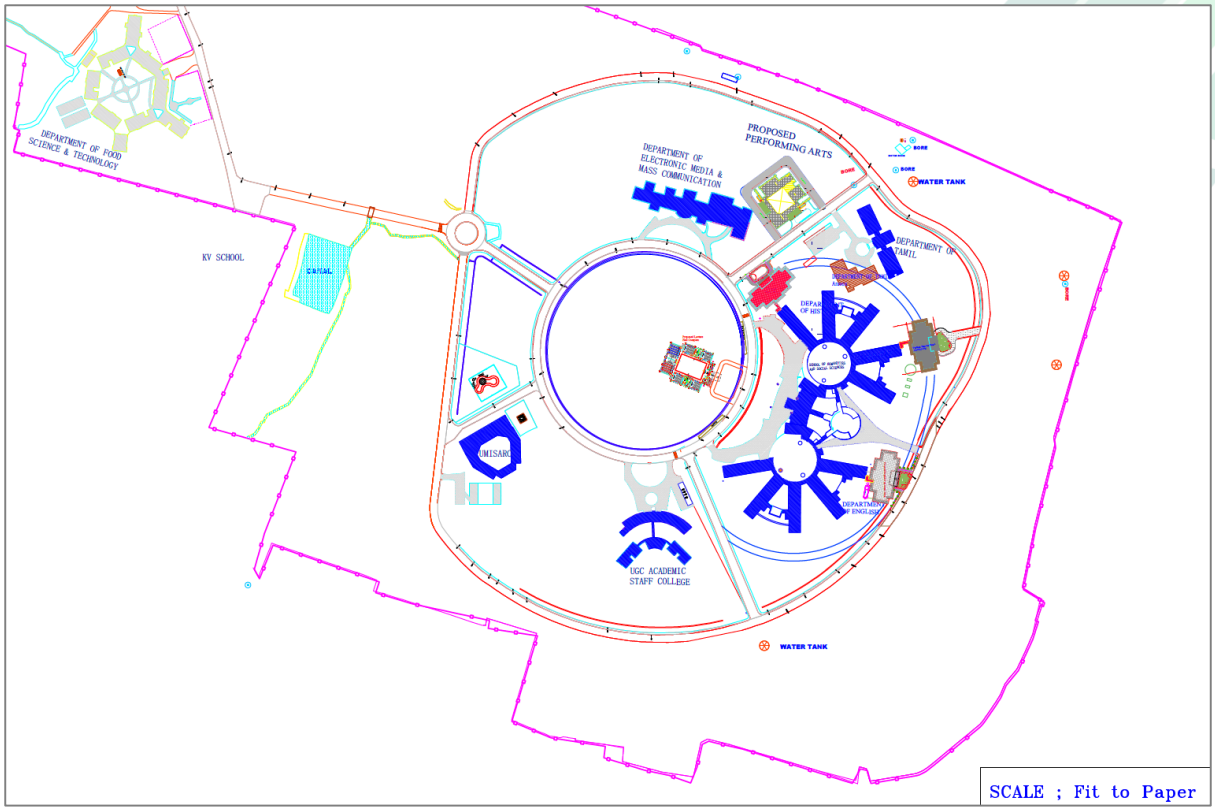

Figure 2: Silver Jubilee campus at Pondicherry University main campus.

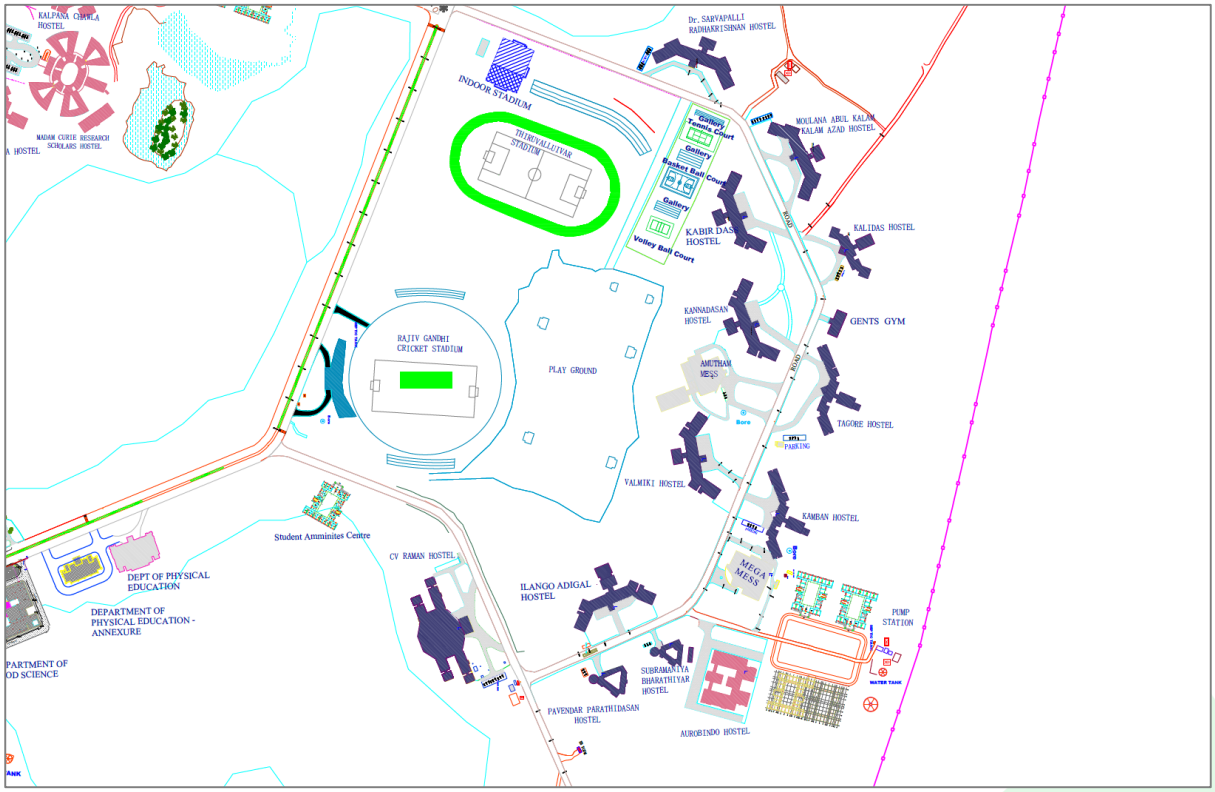

Figure 3: Stadium, hostels and other infrastructure at Pondicherry University

Figure 4: Staff quarters and hostels at Pondicherry University

2.3. Madanjeet School of Green Energy Technologies

The Department of Green Energy Technology in the Madanjeet School of Green Energy Technologies (MSGET) is a cornerstone of Pondicherry University's sustainability vision. Established in 2010, embodies the University's commitment to renewable energy research, advanced technology development, and climate education.

Figure 5: DGET in the Madanjeet School of Green Energy Technlogies

2.3.1. Origins and Growth

The DGET was conceived with endowment support from the South Asia Foundation and is named after its founder, visionary philanthropist Madanjeet Singh. The aim was to create a regional hub for green energy research and capacity building that could catalyse sustainable development across South and South-East Asia.

From its modest beginnings, the DGET from MSGET has evolved into a leading research and teaching, and outreach department:

- The UNESCO Chair to promote Renewable and Clean Energy was established under Prof. R. Arun Prasath in the Department of Green Energy Technology to promote renewable and clean energy technologies (2024-2028).
- Interdisciplinary B. Tech (from 2024), M.Tech and PhD (from 2010) programmes attract students from India and neighbouring SAARC countries.
- State-of-the-art laboratories for solar PV, bioenergy, energy storage, smart grids, and life cycle assessment.

2.3.2. Academic and Research Impact

DGET has produced more than 300 M.Tech. Graduates and over 50+ PhD scholars. Collectively, its faculty and students have published 300+ peer-reviewed papers, secured multiple patents, and presented at leading global conferences on renewable energy, microgrids, and low-carbon technology.

The DGET alums occupy key positions in academia, industry, policy think tanks, and international agencies. Many are involved in implementing renewable energy and climate mitigation projects across South Asia, ensuring that the school's influence extends well beyond Pondicherry University.

2.3.3. A Living Laboratory

MSGET's building is GRIHA-rated for green construction and incorporates passive design, efficient lighting and cooling systems, a rooftop solar PV system, rainwater harvesting, *etc.* It serves as a demonstration site for energy management, featuring real-time monitoring and analytics that inform student projects and research.[15]

2.3.4. Role in the Net Zero Roadmap

The DGET is central to the Net Zero Carbon 2035 benchmark recommended for the University:

- It trains the human capital—engineers, scientists, and policy professionals—who will implement and continually improve decarbonisation strategies.

- It drives applied research on topics like energy conversion to storage, grid integration, and carbon sequestration, ensuring that the University remains at the forefront of technology.
- It fosters regional and international collaborations, enhancing the University's ability to meet global reporting and certification requirements such as IGBC Net Zero Carbon and GNFZ.

The DGET from MSGET school thus acts as both the brain and engine of the University's sustainability journey, linking education, research, and operations in a single integrated mission.

3. Green Initiatives at Pondicherry University

Pondicherry University has steadily transformed its campus into a living model of sustainability, embedding green practices across energy, water, waste, biodiversity, transport, and awareness.

3.1. Sustainable Energy Management

- 2.6 MWp solar photovoltaic (PV) installations generate about 3.5 million kWh annually, meeting roughly 30 % of total electricity demand.[4]
- This green solar energy generation currently avoids around 3,000 t CO_2e annually and saves over ₹1 crore in annual electricity costs.
- Widespread LED lighting, smart fans, sensor-based controls, and star-rated appliances further reduce grid dependency.
- The University aims to evolve into a net electricity exporter by integrating battery storage and a campus microgrid.

3.2. Sustainable Water Management

- Rainwater harvesting structures capture ~7.87 lakh m^3 of water each year, recharging groundwater tables by roughly 2 metres and preventing saline intrusion.
- A 700 kL/day wetland-type sewage treatment plant (STP) recycles wastewater for horticulture and flushing, ensuring near-zero untreated discharge.[4]

3.3. Sustainable Waste Management

- Five-bin segregation system—blue (paper), green (biodegradable), yellow (recyclables), red (hazardous), and a dedicated feminine hygiene bin—enables precise waste tracking.
- Food waste from student kitchens is diverted to piggeries.
- E-waste and paper are auctioned to authorised recyclers, creating revenue streams.
- Sanitary napkin incinerators, a MoU with a common biomedical waste facility, and take-back protocols for hazardous chemicals and batteries complete a circular approach.

3.4. Biodiversity Stewardship

- Out of 800 acres, about 320 acres are maintained as natural ecosystems—forests, scrubs, savannas, and sandstone ridges.

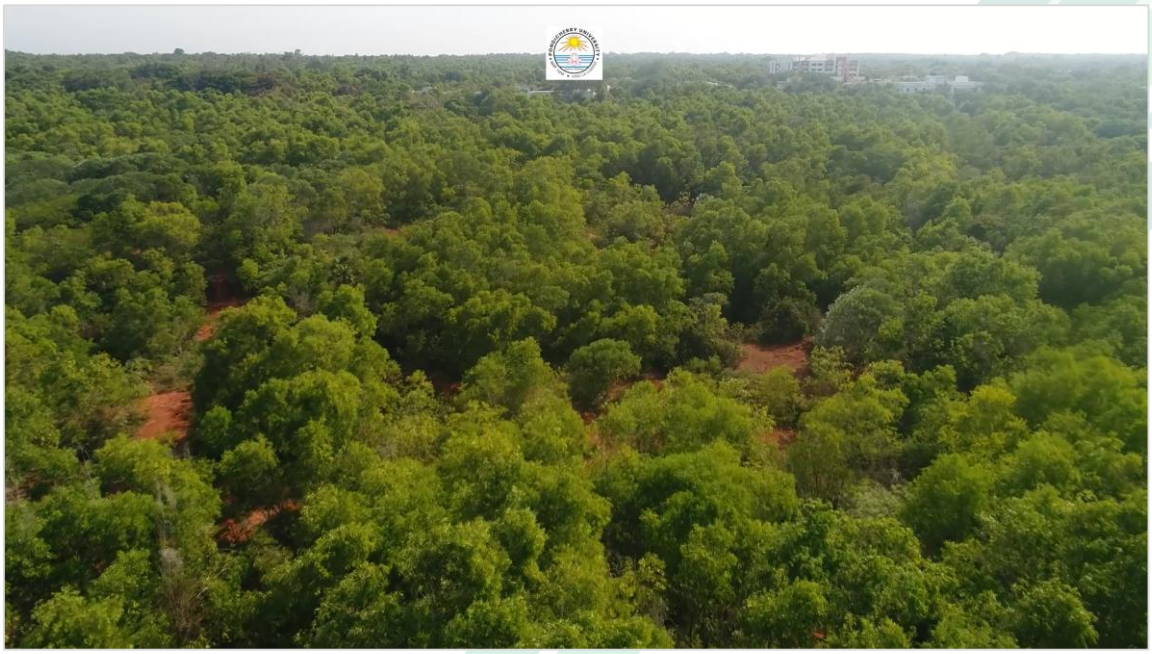

Figure 6: Extensive green cover of over 40 percent of the total land area at Pondicherry University

- Surveys record 139 tree and 96 animal species, making the campus an urban biodiversity hotspot.
- Extensive tree-plantation drives and green corridors strengthen carbon sequestration and enhance habitat quality.

3.5. Sustainable Transportation

- The University deploys electric buggies and electric two-wheelers for administrative and student movement.
- Dedicated EV charging stations are installed, with planned expansion for personal electric vehicles.
- Shared transport is encouraged through university buses and vans, which lower per-capita transport emissions.

3.6. Awareness and Community Engagement

- UNSDG standees and information communicate sustainability goals.
- Plastic bans and the promotion of cloth or glass alternatives reinforce behavioural change.
- Continuous capacity-building programmes foster a culture of environmental responsibility.

These initiatives not only fulfil several IGBC and GRIHA green building criteria but also establish a strong foundation for the Net Zero 2035 benchmark.

4. Solar Journey of Pondicherry University

The University's most visible climate action is its solar power expansion, a story of systematic planning and steady growth.

4.1. Phase 1: Pilot and Proof of Concept (2012–2015)

A Detailed Project Report (DPR) on Solar Campus (2012–2014) by Prof. R. Arun Prasath's team (Sponsored by MNRE) - identified over 1.6 MWp solar potential and informed subsequent procurement and phasing. [16] The solar resource assessment (in 2014) and project report recommended a modest 80 kW rooftop pilot on the Examination Wing. This phase validated the design parameters, load-matching strategies, and economic feasibility, demonstrating a payback period that falls within acceptable norms.[17]

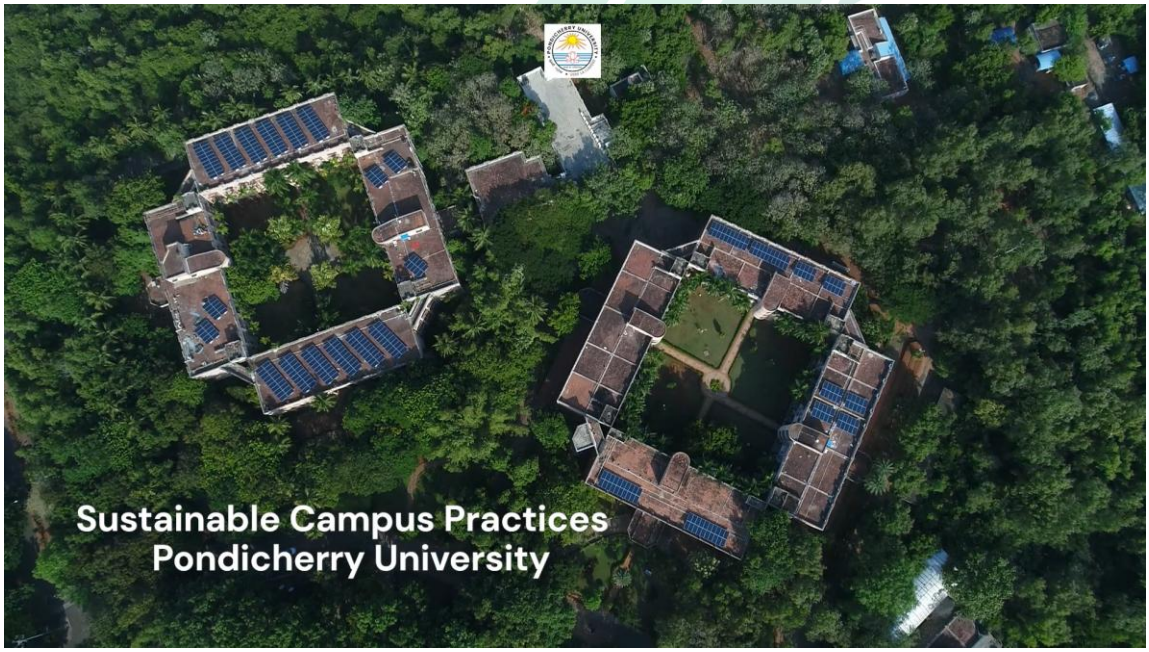

Figure 7: Rooftop solar installation across the campus

4.2. Phase 2: Campus-wide Rooftop Growth and Ground-mounted in Large-scale Integration (2016–2021)

Encouraged by the pilot's success, installations expanded across key academic and hostel buildings. Capacity crossed 1 MWp, and smart metering with remote monitoring was introduced. The University gained valuable experience in O&M (operation & maintenance) and grid integration. The Silver Jubilee campus and other open spaces hosted larger ground-mounted systems. Combined with continued rooftop additions, capacity reached 2.4 MWp. SCADA-based monitoring improved real-time performance assessment.[17][2]

Figure 8: The rooftop solar installation and the ground-mounted solar plant at the Silver Jubilee Campus inside the university

Figure 9: Ground-mounted solar plant of 2.4 MWp capacity

4.3. Phase 3: Consolidation and Expansion (2023–2024)

By 2024, the total installed capacity had exceeded 2.6 MWp, paving the way for a future campus grid/microgrid and a potential round-the-clock renewable supply.[17]

4.4. Impact

- 3,000 tCO_2e of emissions avoided annually, verified *via* Sustainium platform analytics.
- Electricity cost savings of over ₹1 crore per year from 2022 onwards.

- A living laboratory for students and researchers in renewable energy and smart grid management.

This decade-long solar journey provides both the technical confidence and operational savings necessary for the University to meet its recommended Net Zero 2035 benchmark.

5. India's University Net-Zero / Carbon Neutral Trends — A Comparative Survey

Achieving a fully Net Zero campus is still emerging in India, but a growing number of higher education institutions have public commitments, pilot projects, or roadmaps toward carbon neutrality. Below is a snapshot of select universities and their status, followed by key insights relevant to Pondicherry University.

Institution	Commitment / Target	Key Actions / Capacity	Notes & Status
Nalanda University (Rajgir, Bihar)	Net Zero / eco-recycling campus	6.5 MW solar farm, 1.5 MW biogas plant, green buildings, wastewater systems.	The campus is designed from the ground up with integrated systems. Full operational validation is still emerging.
Woxsen University (Hyderabad, Telangana)	Net Zero by 2030; Carbon Neutral by 2026	Phase-1: 1 MW solar plant commissioned; pipeline for up to 4 MW total solar potential.	One of the first private universities in India to make a formal Net Zero pledge.
IIM Nagpur	Zero emissions / net-zero ambition	Building a 2 MW solar park (in progress).	As a business school, its infrastructure is less energy-intensive, but its ambitions are high.
IIT Kanpur	Waste-Free & Carbon-Neutral campus ambition	MoU with Lucknow Cantonment Board, integrated waste/energy systems.	Emphasis on combining waste systems with carbon goals to scale the model.
VIT (Vellore Institute of Technology)	Climate neutral by 2050	Long-term sustainability plan, including a clean energy portfolio.	Longer horizon than many peers, allowing an incremental approach.
PDPU / PDEU (Gujarat)	Institutional targets in energy/sustainability	Commissioned a 1 MW solar plant on campus.	A domain-focused university (energy) with built capacity for on-campus energy demonstration.
IIM Bangalore (IIMB)	Scope 2 neutrality by 2030; Scope 1 by 2035	Energy efficiency measures, new renewables, mobility upgrades.	A high-profile business school is making concrete timeline commitments.

5.1. Comparative Observations & Lessons for Pondicherry University

1. Early commitments and transparency help attract support: Institutions like Woxsen and IIMB made explicit Net Zero targets, which help catalyse investment, media attention, and stakeholder buy-in.[18], [19]
2. Hybrid approaches are common: Even for campuses with Net Zero ambition, institutions combine renewable energy (solar, biogas) with efficiency, passive design, waste integration, and offsets. Nalanda is exemplary in this integrated design. [20]
3. Phased scaling is the norm: Few campuses leap directly to MW solar arrays. Many begin with pilot rooftop systems (as Woxsen has), then scale to ground-mounted or campus-wide systems. This cautious growth can reduce technical risk.
4. Long timelines reflect operational realism: Many institutions adopt multi-decade horizons *(e.g.,* VIT 2050), acknowledging infrastructure, financing, and operational constraints. [21]
5. Waste, water, and biomass are often paired with energy: In Indian campuses, waste-to-energy (biogas) and advanced wastewater treatment are commonly tied to net-zero schemes, as seen in Nalanda. [20]
6. Integration with urban or municipal systems is necessary: IIT Kanpur's model, which links campus waste and services with city systems, provides a scalable template for universities in dense or constrained land settings. [22]
7. Institutional domain alignment matters: Universities with an energy or engineering focus (e.g. PDEU) have built-in expertise that helps de-risk solar / energy projects.[23]

5.2. Relevance for Pondicherry University's Net Zero Roadmap

- Pondicherry University can benchmark against these Indian peers—both in ambition and pace.
- Starting with rooftop or campus-scale pilots (as in Woxsen) could reduce risk before scaling to MW levels.
- A holistic strategy integrating energy, waste, water, and offsetting (as in Nalanda does) offers resilience against single-point failures.
- Transparent, phased target setting (*e.g.* 2030 partial goals, 2035 full Net Zero) incentivises accountability and progress.
- Partnerships with municipalities or local bodies (for waste, transport) may unlock economies of scale and integrated systems.

6. Greenhouse Gas Inventory and Analysis

A decade-long greenhouse gas (GHG) emissions inventory provides the foundation for Pondicherry University's Net Zero Carbon roadmap.[11]

This section describes the methodology, presents scope-wise trends, and highlights earlier studies that laid the groundwork.

6.1. Methodology and Boundaries

- **Standards and Principles:** The inventory follows the Greenhouse Gas Protocol – Corporate Standard[24] and incorporates relevant principles of ISO 14064-1.
- **Operational Boundaries:** All academic, residential, and support facilities on the main campus are included. Emission sources were classified as:
    - Scope 1: Direct on-site fuel combustion, primarily diesel for DG sets and LPG for kitchens and laboratories.
    - Scope 2: Indirect emissions from purchased electricity.
    - Scope 3: Other indirect emissions such as commuting by students and staff, outsourced services, and waste disposal.
- **Activity Data and Emission Factors**
    - Electricity consumption and solar generation records supplied by the Electrical Department.
    - Diesel and LPG purchase records from stores and accounts.
    - Transport data from bus logs, parking passes, and sample commuting surveys.
    - Waste management figures from the Office of Green Campus and authorised vendors.
    - Emission factors from the Central Electricity Authority (CEA) for each year's grid mix and from IPCC 2019 Refinement and DEFRA for fuels and transport.
- **Data Management Platform:** The entire dataset was consolidated and analysed in Sustainium.io, ensuring consistency, validation, and traceable calculations.

6.2. Historical Emissions Studies and Continuity

Pondicherry University has a long tradition of carbon accounting that strengthens the credibility of the current inventory.

- Silver Jubilee Campus Footprint (2012–2015): The first comprehensive audit estimated 1,387 tCO_2e/year for that precinct alone, with electricity contributing over 80 % of emissions. Key recommendations—expanding rooftop solar and switching to LED lighting—are now a reality.[2], [16]

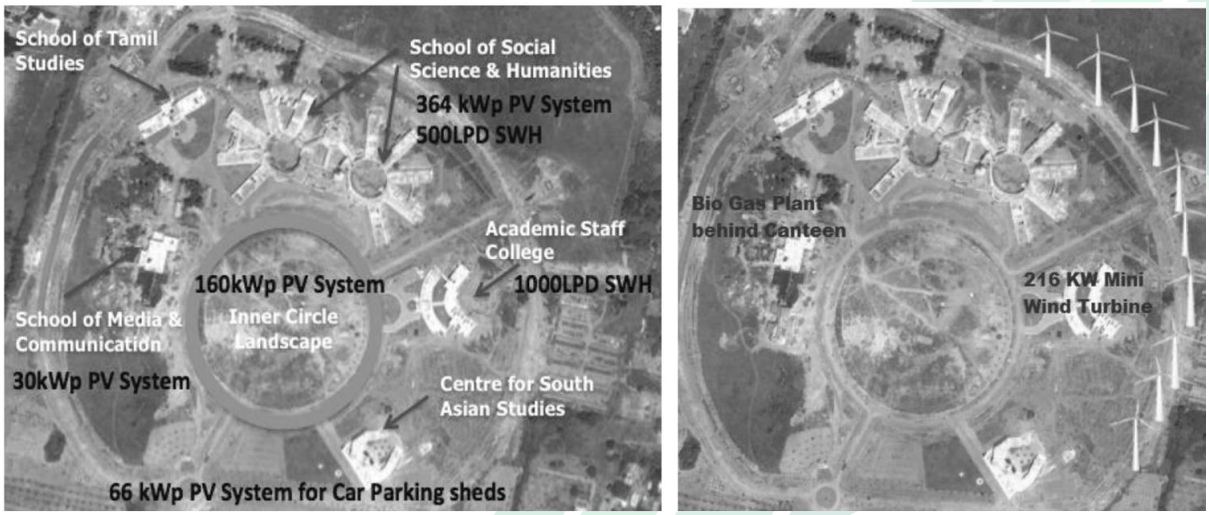

Figure 10: Snapshot from the study "Carbon Footprint Assessment and Mitigation Strategies for Sustainable Development" of 2014, which calculated emissions for the Silver Jubilee campus

- Detailed Project Reports (DPRs) and Solar Campus Plans (2013–2014): Sponsored by MNRE, -identified over 1.6 MWp solar potential and informed subsequent procurement and phasing.[16]
- Academic Chapters and Research Publications: Chapters authored by Prof. R. Arun Prasath, Dr. Dwipen Boruah, and collaborators advanced methodologies for renewable energy integration and campus-scale carbon management.[25], [26]

This continuity of evidence and practice demonstrates that the University's current decarbonization strategy is grounded in deep, long-term engagement with scientific research and operational data.

6.3. Analysis of Emissions Inventory

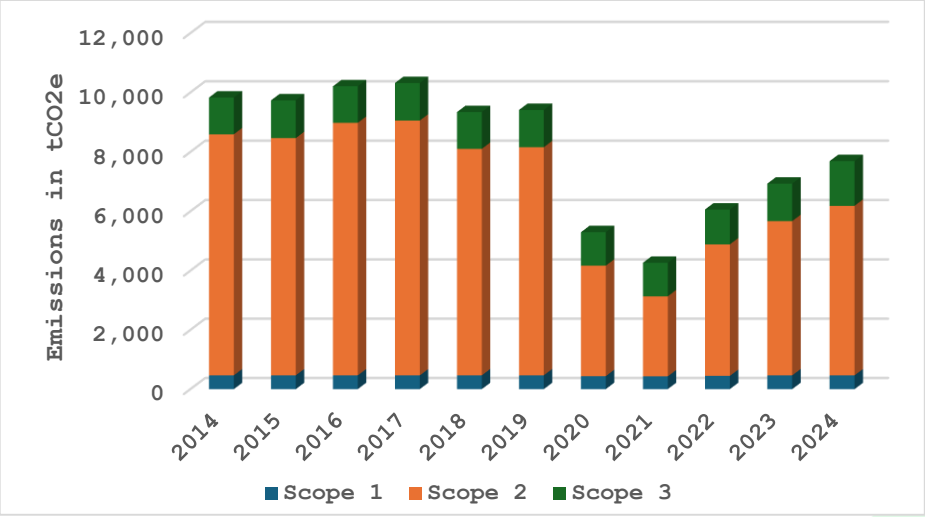

Figure 11: Emissions (in tCO2e) for the period 2014-2024 for the Pondicherry University main campus

6.3.1. Scope 1 — Direct Emissions

Relatively stable (465 tCO_2e) for most of the decade, with a brief dip in 2020–2021 when pandemic restrictions reduced generator and transport use. Opportunities remain in electrifying the campus fleet and replacing DG sets with renewable-based back-up.

6.3.2. Scope 2 — Purchased Electricity

Initially above 8,000 tCO_2e, Scope 2 shows a dramatic downward trend, especially after 2018, with the rapid deployment of solar PV. The low point of 2,701 tCO_2e in 2021 coincided with both the expansion of solar capacity and COVID-19-related load reductions. Although emissions have rebounded with the full reopening, they remain 30% lower than the pre-2018 baseline.

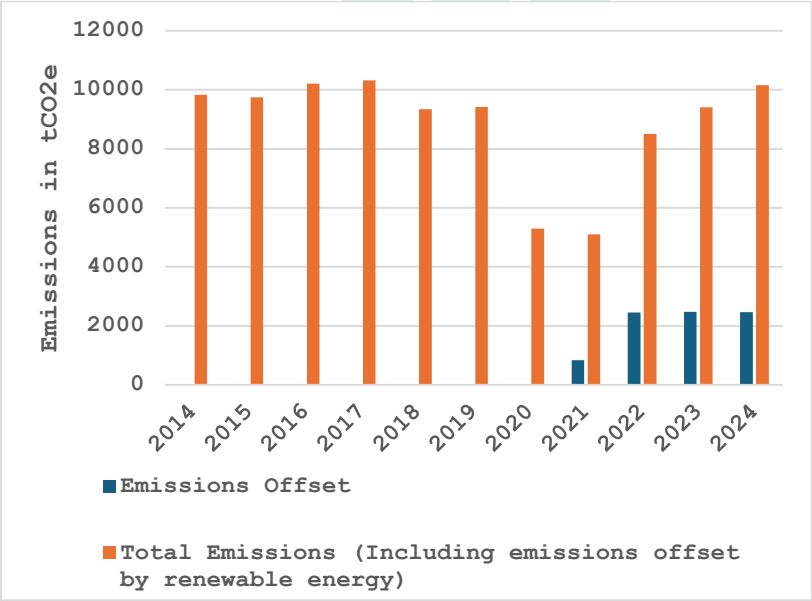

Figure 12: Emissions are offset by the renewable energy systems installed on the campus. The total emissions here include both actual and offset emissions.

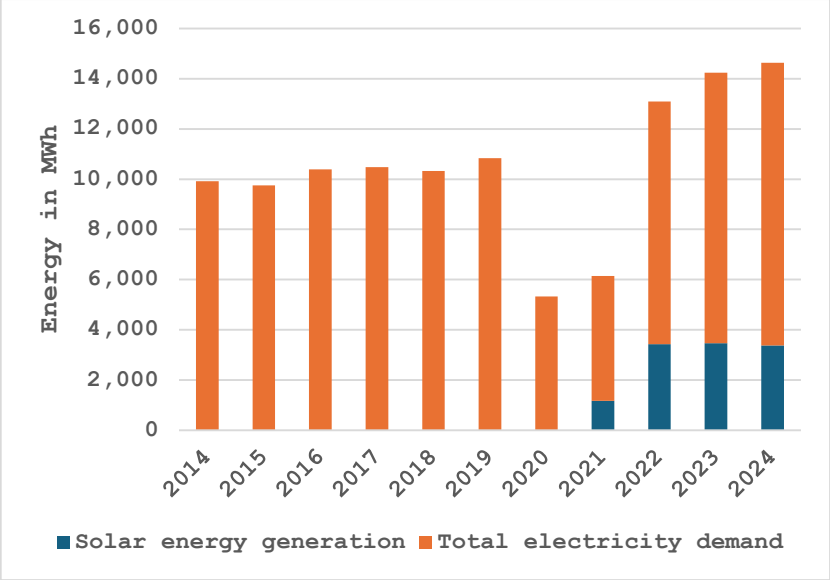

Figure 13: Total electricity demand of the campus and the impact of solar energy generation

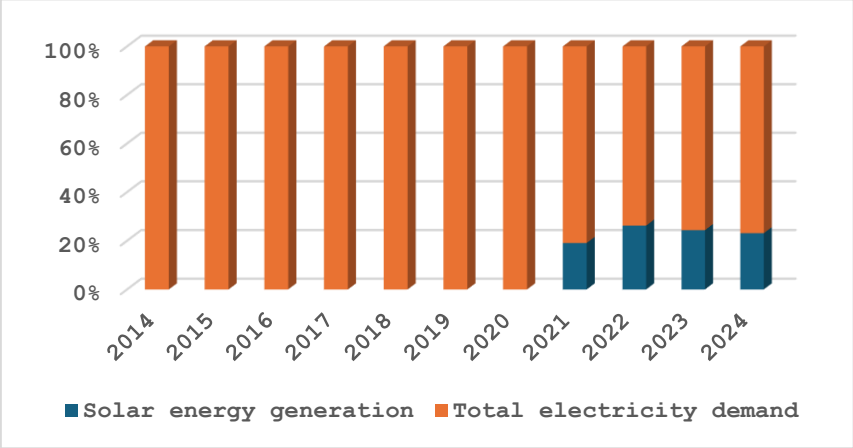

Figure 14: Total electricity demand and percentage contribution of solar energy

6.3.3. Scope 3 — Other Indirect Emissions

Scope 3 emissions include purchased goods and services, employee commuting, upstream and downstream transportation and distribution, waste generation in operations, and fuel- and energy-related activities. Between 2014 and 2019, total Scope 3 emissions remained around 1,200 tCO_2e, declined temporarily to approximately 1,130 tCO_2e during 2020–2021 due to reduced campus activity, and have since increased to about 1,507 tCO_2e in 2024 as on-site operations resumed.

While every effort has been made to capture major indirect emission categories, there remains scope to expand data coverage as more activity areas are identified—such as procurement of laboratory supplies, outsourced services, or student travel—to improve completeness and category-level accuracy.

Reducing Scope 3 emissions will require:

- **Low-carbon mobility** initiatives (electric buses, shared transport, cycling infrastructure).
- **Sustainable procurement policies** that favour low-emission materials and service providers.
- **Waste minimisation and recycling systems** to reduce embodied carbon.
- **Digital or remote engagement** practices that limit travel-related emissions.

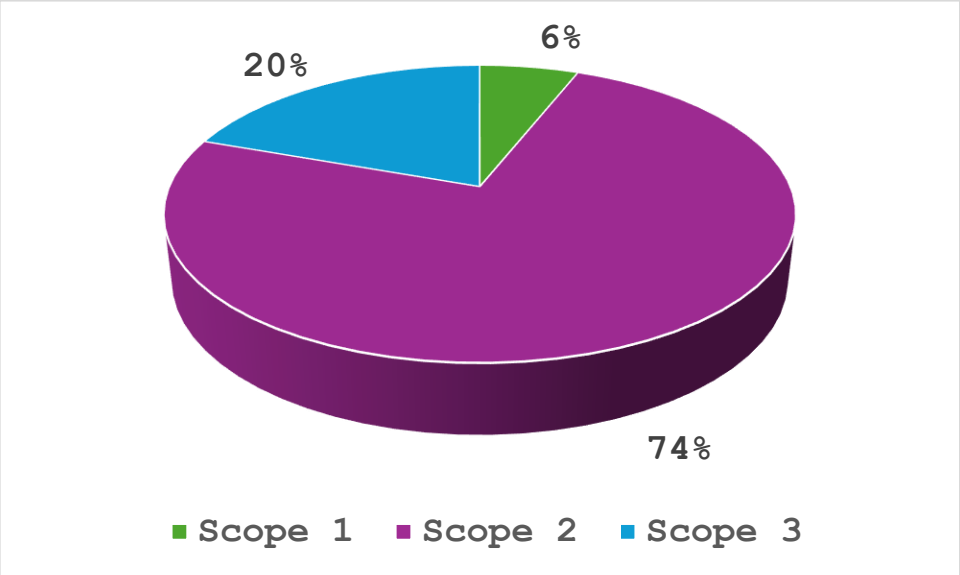

Figure 15: Breakup of scope 1, 2 and 3 emissions for the year 2024. Scope 2 emissions related to purchased electricity are still the largest contributor to GHG emissions

6.4. Role of the Sustainium Platform in Emissions Accounting and Strategy

Preparing an accurate and verifiable greenhouse gas (GHG) inventory for a campus the size of Pondicherry University required robust data management and analytical tools. The University adopted Sustainium.io, a cloud-based carbon accounting and ESG reporting platform, as the central engine for emissions quantification and scenario modelling.

Comprehensive Data Integration (2014–2024)

- **Multi-year data import:** All electricity, diesel, LPG, solar generation, commuting, and waste-management data from 2014 to 2024 were uploaded to Sustainium.
- **Automated factor updates:** The platform automatically applied year-specific emission factors from the Central Electricity Authority (CEA) for grid electricity and from the IPCC 2019 Refinement and DEFRA for fuels and transport.
- **Data validation:** Built-in checks flagged anomalies and missing values, prompting clarification from relevant university departments.

This ensured that every tonne of carbon dioxide equivalent (tCO_2e) reported could be traced back to verifiable activity data.

Real-Time Analytics and Decision Support

- The annual totals and scope-wise breakdowns, highlighting emission hotspots and progress over time.
- Scenario modelling simulated the effect of new solar capacity, microgrid integration, and fleet electrification on future emissions.
- Comparative analytics helped prioritise investments by quantifying the cost-per-tonne of each intervention.

Foundation for Decarbonisation Strategy

By revealing emission drivers and potential reduction pathways, Sustainium directly shaped the Net Zero Carbon 2035 benchmark and the phased decarbonisation roadmap. For example:

- Quantifying the ~3,000 tCO_2e annual savings from 2.6 MWp solar reinforced the case for expanding to 8–10 MWp with storage.
- Identifying stable but persistent Scope 1 emissions (~465 tCO_2e) clarified the need for fleet electrification and diesel generator phase-out.
- Mapping Scope 3 commuting trends informed proposals for enhanced public transport and cycling infrastructure.

Compliance and Certification Readiness

Sustainium's GHG Protocol–aligned outputs and GRI-compatible reporting meet the documentation requirements of IGBC Net Zero Carbon and Global Network for Zero (GNFZ) certifications.
The platform's audit trail and automated calculations reduce verification costs and build credibility with external certifiers.

Living Data Infrastructure

Perhaps most importantly, Sustainium is not a one-time tool but a continuously updated system. It enables annual emissions tracking, supports research and student projects, and informs policy-making and operational planning, thereby becoming a permanent component of the University's sustainability governance.

7. Net Zero Carbon Roadmap

7.1. Net Zero 2035 — Recommended Benchmark in the National Context

In this report, the target of Net Zero Carbon by 2035 is proposed as an aspirational benchmark, based on more than a decade of measurable action and in anticipation of India's evolving climate commitments.

Why 2035?

1. **Track Record of Emission Reductions:** From a baseline of nearly 9,800 tCO_2e in 2014, the University has already reduced annual emissions by roughly 20%, primarily through 2.6 MWp of solar installations, energy-efficiency upgrades, and sustainable water and waste management.
2. **Alignment with National Policy Signals:** India's official target remains Net Zero by 2070. Yet, as part of the Paris Agreement's "ratchet mechanism", countries are expected to enhance their Nationally Determined Contributions (NDCs) every five years.
    - Policy discussions and media reports leading to the next UN Climate Conference indicate that India is analysing sectoral and mid-term targets up to 2035, with stronger renewable-energy and emissions-intensity goals under consideration.
    - An institutional target of 2035 positions the University ahead of likely national policy developments, giving it flexibility to adjust as those commitments solidify.
3. **Technological and Economic Feasibility:** Rapid cost declines in solar PV, energy storage, and electric mobility, coupled with emerging carbon-market mechanisms, make a 2035 benchmark technically achievable and economically sound.

7.2. Definition of the 2035 Benchmark

- More than 90% absolute reduction in combined Scope 1, Scope 2, and significant Scope 3 emissions from the 2014 baseline.
- Residual less than 10% neutralised through a combination of on-campus carbon sinks and high-quality, verifiable carbon credits.

7.3. Strategic Value

Setting this benchmark now provides:

- Clarity for investment decisions in buildings, energy, mobility, and procurement.
- Eligibility for national and international funding mechanisms, including green bonds and climate finance lines.

- Academic leadership, allowing the campus to act as a teaching and research laboratory for Net Zero solutions.

This is not a formal legal pledge, but a science-based, forward-looking target that guides planning, attracts partnerships, and prepares the University for more stringent national or international obligations.

7.4. Decarbonisation Strategy to Achieve the 2035 Benchmark

The recommended Net Zero Carbon 2035 benchmark provides a clear horizon for planning and action. The decarbonisation strategy outlined below integrates renewable energy, efficiency, electrified transport, circular resource management, natural sequestration, and robust governance to achieve at least a 90% reduction in greenhouse gas (GHG) emissions from the 2014 baseline.

Strategic Goal: Reduce net GHG emissions more than 90% by 2035 relative to the 2014 baseline; neutralise the less than 10% residual through verifiable carbon sinks and credits.

7.4.1. Phase-wise Targets: Phase Period Core Milestones

Foundation (2025–2028): Reach ≥4 MWp solar; complete campus-wide LED/HVAC retrofits; 50 % emissions reduction; begin large-scale fleet electrification and on-site composting for all organic waste.

Integration (2029–2032): Deploy 6–8 MWp solar + storage and microgrid; 80% fleet electrified; achieve 75% emission reduction; introduce low-carbon procurement protocols.

Net Zero Delivery (2033–2035): Reach 8–10 MWp solar capacity; ensure more than 90% emission reduction; implement residual-offset strategy; obtain IGBC Net Zero Carbon and Global Network for Zero (GNFZ) certification.

7.4.2. Pillars of Decarbonisation

1. **Renewable Energy Expansion & Smart Grids**

   - Grow solar capacity to 8–10 MWp and smart grid control.
   - Integrate off-campus green power purchase agreements (PPAs) or renewable energy certificates (RECs) to cover night-time and seasonal needs.

2. **Deep Energy Efficiency & Green Construction**

   - Retrofit existing facilities with high-performance building envelopes, efficient HVAC systems, and automated controls.
   - Ensure that all new buildings meet or exceed GRIHA 4-Star or IGBC Gold standards, embedding life-cycle carbon considerations from the design stage.

3. **Sustainable Mobility**

   - Electrify all campus buses, service vans, and administrative vehicles by 2030.

- Provide EV charging stations for faculty and students.
- Incentivise cycling, walking, and shared transport to cut commuting emissions.

4. Circular Waste and Water Systems

- Maintain five-bin segregation and ensure 100% of biodegradable waste is composted or used as animal feed.
- Enhance the wetland-type sewage treatment plant to expand water reuse in landscaping and utilities.
- Implement sustainable procurement policies to cut embodied emissions in purchased goods and services.

5. Low-Carbon Campus Kitchens

- Introduce solar water heating and thermal cooking systems for low and medium-temperature applications to replace part of the LPG demand.
- Shift to electric or hybrid cooking technologies, shift to energy-efficient cooking methods such as improved cooktops and optimised kitchen operations.
- Earlier feasibility work, including the Detailed Project Report on Solar Water Heating and Steam Cooking, demonstrates the technical and economic viability of campus-wide CST-based steam cooking. Implementing these recommendations will expedite the transition to clean, solar-powered kitchen operations.[27]

6. Carbon Sinks and Verified Offsets

- Strengthen natural carbon sinks across 320 acres of green cover through tree-planting, wetland restoration, and soil-carbon enhancement. The campus currently contains approximately 185 hectares of woody vegetation capable of sequestering roughly 1,036 tonnes of CO_2 equivalent per year, accounting for approximately 14% of the total 2024 emissions. When combined with the avoided emissions from the 2.6 MWp solar installations (approximately 3,000 t CO_2e annually), the University effectively offsets about 46% of its annual footprint. This sequestration potential forms the core of Pondicherry University's nature-based offset strategy, supporting its Net Zero 2035 target while preserving campus biodiversity.[28], [29]
- For unavoidable emissions, invest only in high-quality, verifiable carbon credits with clear permanence.

7. Governance, Monitoring and Reporting

- Embed annual Sustainium-based GHG inventories into university governance.
- Conduct third-party verification every three to five years.
- Provide open-access dashboards and reports for transparency and stakeholder engagement.

7.4.3. Cross-cutting Enablers

- Curricular Integration: Embed low-carbon design, renewable energy, and life-cycle analysis in courses and student projects.
- Finance and Partnerships: Mobilise green bonds, CSR funding, and ESCO models to fund retrofits and renewable energy expansion.
- Risk and Adaptation Planning: Incorporate climate resilience measures (flood management, heat-resistant landscaping) into all projects.

7.4.4. Leveraging the Indian Carbon Market (CCTS) for Future Offsets

India's compliance carbon market framework, the Carbon Credit Trading Scheme (CCTS 2023), has now been operationalized under the Bureau of Energy Efficiency (BEE) and the Ministry of Power. This national mechanism enables entities to generate and trade carbon credits arising from verified emission reductions.

Although higher-education institutions are currently not covered under the compliance category, voluntary participation through project-based credit registration remains possible once the market stabilises.

Pondicherry University can prioritise meeting its Net Zero 2035 target through internal offsets first—via renewable energy expansion, electrification, efficiency, and biodiversity-based carbon sinks.

Only after internal neutrality is achieved can any verified surplus offsets (*e.g.,* additional sequestration or excess renewable generation) be registered under CCTS or voluntary carbon markets to generate revenue for reinvestment in sustainability initiatives.

To prepare for this opportunity, the University should:

- Maintain CCTS-compliant emissions records on Sustainium.io (GHG Protocol + ISO 14064-1 alignment).
- Engage with the Designated National Authority for the Indian Carbon Market (BEE) for methodology registration and future credit issuance.
- Conduct pre-feasibility studies on campus-based renewable and sequestration projects suitable for credit generation.

8. Certifications to validate the achievement of Net Zero Carbon status

8.1. IGBC Net Zero Carbon Certification Pathway

The Indian Green Building Council (IGBC) provides a nationally recognised framework for verifying and certifying Net Zero Carbon performance in buildings, campuses, and entire institutions. For Pondicherry University, IGBC certification will give independent assurance that emissions reductions are both measurable and sustained.

Key Steps

1. Pre-registration & Gap Analysis: Benchmark current campus performance against IGBC Net Zero Carbon rating criteria.
2. Comprehensive Carbon Footprint: Annual Scope 1, Scope 2 and relevant Scope 3 inventories—already integrated on Sustainium.io—form the core evidence.
3. Reduction & Offsetting Plan: Demonstrate that at least 90% of GHG emissions are eliminated through on-campus measures, with only the remainder offset.
4. Third-party Review & Audit: Submit documentation and undergo site verification by IGBC-approved auditors.

Best Practices for IGBC Readiness

- Campus-wide real-time metering of energy and water flows for transparent monitoring.
- Life-cycle carbon assessments for all new construction and major retrofits.
- Integration of renewable energy procurement and demand-side management to ensure true net zero on an annual basis.
- Annual third-party verification to maintain compliance and credibility.

8.2. Global Network for Zero (GNFZ) — Campus & Community Pathway

The Global Network for Zero (GNFZ) is an international alliance of cities, companies, and campuses dedicated to full-scope net zero. Its Campus & Community Pathway is particularly suited for large educational institutions with complex supply chains and commuting patterns.

Key Steps

1. Joining the GNFZ Network: Enrol and submit a verified baseline emissions inventory.
2. Adopting a Science-Based Net Zero Plan: Demonstrate that the 2035 benchmark aligns with a 1.5°C-compatible pathway.
3. Annual Reporting and Independent Verification: Show year-on-year emission reductions and transparent documentation.

4. Final Net Zero Recognition: Achieve and sustain net zero for a defined period to earn the GNFZ seal.

Best Practices for GNFZ Readiness

- Extend accounting to full Scope 3 emissions, including supply chains and outsourced services.
- Maintain publicly accessible dashboards for transparency.
- Support student- and faculty-led "living laboratory" projects, integrating research with decarbonisation.
- Build regional and international partnerships to share methods and data for peer benchmarking.

Strategic Value of Dual Certification

Pursuing IGBC Net Zero Carbon and GNFZ certification together provides multiple benefits:

- Credibility: Independent, science-based validation of emission reductions and net zero status.
- Policy alignment: Future-proofs the University against strengthening national and international climate targets.
- Educational impact: Positions Pondicherry University as a global leader in campus sustainability, inspiring students and peers alike.

Green Building Certification Measures

Pondicherry University has long been committed to sustainable infrastructure. This section outlines the existing green building measures already in place across the campus and the additional actions needed to achieve certification under IGBC Net Zero Carbon and GRIHA frameworks.

Existing Green Building Practices

1. **Energy Efficiency and Performance**
    - The University has retrofitted over 50% of its existing campus infrastructure with LED lighting, smart HVAC systems, and high-efficiency appliances.
    - The new buildings—including the Madanjeet School of Green Energy Technologies (MSGET)—are GRIHA-rated and incorporate energy-efficient envelopes, daylighting, and passive cooling designs.
    - Real-time metering of energy consumption in academic and residential areas ensures constant monitoring and optimisation.

2. **Solar Integration**

   - The University operates ~2.6 MWp solar PV system—one of the largest in India's higher education sector. This solar system accounts for around 30% of total electricity demand, saving the University over ₹1 crore annually.
   - Solar power generation has also reduced Scope 2 emissions by over 60% compared to pre-2018 levels.

3. **Water Management**

   - The University's water infrastructure includes rainwater harvesting systems that recharge 7.87 lakh m^3 of groundwater annually.
   - A 700 kL/day sewage treatment plant (STP), which is designed to meet future demand, treats wastewater for non-potable uses like irrigation and landscape watering.

4. **Waste Management**

   - The University employs a five-bin segregation system for waste management—separating paper, glass, plastics, organic waste, and hazardous materials.
   - Food waste is composted or redirected to local farms for use as piggery feed.
   - E-waste and other recyclables are auctioned periodically, generating revenue and promoting recycling.

5. **Biodiversity and Landscaping**

   - 320 acres of the campus are dedicated to natural ecosystems, promoting biodiversity. The campus hosts 139 tree species and 96 species of fauna.
   - Tree plantation drives and green corridors further enhance the campus's ecological footprint.

Additional Steps to Achieve Full Green Building Certification

1. **Scope of Retrofits**

   - Energy efficiency retrofits should be extended to remaining academic and support buildings, with a focus on building envelope improvements, HVAC optimisation, and the use of high-performance materials.
   - All new constructions must adhere to GRIHA 4-Star or IGBC Gold certification requirements.

2. **Water Efficiency**
    - Greywater reuse should be integrated into the water management system for applications like cooling and toilet flushing.
    - Low-flow fixtures (for faucets, showerheads, and toilets) should be deployed in all new buildings.
3. **Sustainable Materials**
    - For constructing or renovating buildings, the use of locally sourced, low-embodied-carbon materials (such as fly-ash bricks, recycled steel, and timber from certified sustainable sources) should be prioritised.
4. **Indoor Environmental Quality (IEQ)**
    - Increase the focus on indoor air quality (IAQ), with increased natural ventilation, the use of low-VOC paints, and the installation of green roofs for better air quality and insulation.
5. **Green Transport Infrastructure**
    - Expand the electric vehicle (EV) infrastructure, ensuring that all university-owned vehicles are electric by 2035.
    - Provide more bicycle racks and EV charging stations across the campus.
6. **Monitoring and Reporting**
    - Real-time monitoring systems for energy, water, and waste data should be enhanced and extended across all buildings, providing a granular view of performance.
    - Implement third-party verification for carbon and energy savings to comply with certification standards and ensure continual improvement.

Strategic Value of Green Building Certifications

Achieving IGBC Net Zero Carbon and GRIHA ratings provides Pondicherry University with a host of strategic benefits:

- Credibility in national and international climate dialogues.
- Leadership in sustainable campus management, setting an example for other educational institutions.
- Cost savings from efficient use of resources (water, energy) and from leveraging green building incentives.
- Increased resilience against climate risks, including heat stress, flooding, and resource scarcity.

With green building certifications, Pondicherry University will not only meet national and global standards but also further reinforce its commitment to sustainability across every aspect of campus life.

8.3. Monitoring, Reporting, and Verification (MRV)

To ensure that Pondicherry University meets its Net Zero Carbon 2035 target, robust Monitoring, Reporting, and Verification (MRV) systems are essential. These systems will track the progress of the decarbonization strategy, verify emission reductions, and enable course corrections when needed.

Key Components of the MRV System

1. **Annual Carbon Inventory**
    - The Sustainium.io platform will continue to serve as the backbone for emissions tracking, providing an annual, scope-wise carbon footprint for the entire campus.
    - The carbon inventory will include Scope 1, 2, and Scope 3 emissions, including those from commuting, waste, and procurement.
    - Annual reports will be compared against the baseline established in 2014 to measure progress toward the Net Zero target.
2. **Third-party Verification**
    - Independent auditors will assess the University's progress every 3–5 years, ensuring transparency and the credibility of emissions reductions.
    - GHG Protocol and ISO 14064-1 standards will guide verification, ensuring that emissions data is complete, consistent, and transparent.
3. **Public Dashboards**
    - Real-time data on emissions, energy use, water consumption, and waste management will be made available through publicly accessible dashboards.
    - These dashboards will provide students, staff, and the general public with ongoing insights into the University's sustainability performance, fostering a culture of transparency and accountability.
4. **Annual Sustainability Report**
    - In addition to MRV data, an Annual Sustainability Report will be published, detailing key actions taken, energy savings, carbon reduction progress, and the University's compliance with IGBC Net Zero Carbon and GNFZ certification pathways.
    - The report will also highlight challenges, lessons learned, and future initiatives

9. Financing Strategy

Achieving Net Zero Carbon by 2035 requires substantial capital investment and operational expenditure. To fund this transition, the University will leverage multiple financing mechanisms, including green bonds, partnerships, and innovative financing models.

9.1. Key Financing Mechanisms

1. **Green Bonds**
    - Pondicherry University should explore issuing Green Bonds to finance large capital investments in renewable energy infrastructure (*e.g.,* solar PV expansion, bio-energy, electrification in cooking) and energy efficiency retrofits.
    - Green bonds can attract investors interested in supporting long-term sustainability projects with proven financial returns from energy savings and reduced operating costs.

2. **Corporate Social Responsibility (CSR)**
    - The University should engage with both private and public-sector partners for CSR funding. Many corporations are actively investing in environmental sustainability, and partnering with the University on green initiatives could provide mutual benefits.
    - Additionally, foundations and NGOs focused on renewable energy, education, and climate resilience may also be viable funding sources.

3. **Energy Service Company (ESCO) Model**
    - For efficiency upgrades, Pondicherry University could enter into an ESCO contract, where an external service provider finances, implements, and operates energy-saving measures, and the University repays through the savings generated.
    - This model requires no upfront capital investment and spreads costs over time, making it an attractive option for funding retrofits without budget constraints.

4. **Government Grants and Subsidies**
    - Government funding through MNRE (Ministry of New and Renewable Energy) and State Energy Efficiency Programs will be sought for solar expansion, battery storage installations, and electric vehicle charging infrastructure.
    - The University should continue to apply for climate-related grants and research funding from both national and international sources to support its sustainability projects.

5. **Internal Savings and Reinvestment**

   - Energy savings from solar PV, energy-efficient systems, and waste-to-energy projects will directly offset capital and operational expenditures. The savings generated each year can be reinvested into further sustainability measures (e.g., increasing solar capacity, electrifying transport).

9.2. Research and Outreach

The University's research, education, and community outreach efforts are central to making sustainability a core component of campus life and academic identity. These activities will further the University's role as a global leader in sustainability and Net Zero research.

Key Research Areas

1. **Low-carbon Technologies**

   - Pondicherry University will continue to lead research on solar PV, bio-energy, microgrids, carbon capture, and energy efficiency technologies. These technologies are central to the University's decarbonisation strategy and will help develop solutions that can be applied in other campuses and communities.

2. **Circular Economy & Sustainable Materials**

   - Ongoing studies in waste-to-energy, biomass utilisation, and green materials (*e.g.,* High SRI Paints, efficient batteries, low-carbon concrete, etc.) will help reduce the University's overall environmental footprint.

3. **Carbon Sequestration & Offsets**

   - Research on natural carbon sequestration techniques—such as enhancing campus forests, and organic sustainable farming—will contribute to the University's offset strategy. Additionally, studies on high-quality carbon credits will enable the University to engage in credible market-based emissions neutralisation strategies.

Community Engagement and Outreach

1. **Student-Led Sustainability Initiatives**

   - The University's students will be actively involved in sustainability projects, whether it's through living laboratories, research projects, or awareness campaigns.
   - Students will also participate in data collection, analysis, and outreach to ensure that the University's Net Zero strategies reflect both scientific rigor and campus involvement.

2. **Collaboration with Local Communities**

   - The University will collaborate with local businesses, communities, and government agencies to expand its sustainability impact beyond the campus.
   - By sharing best practices and co-developing projects with local stakeholders, the University will foster broader regional climate resilience.

3. **International Partnerships**

   - The University will pursue international collaborations with other higher education institutions, NGOs, and industry leaders to share knowledge, gain access to funding, and create climate resilience models that can be replicated globally.

9.3. Risk, Resilience, and Adaptation

While the University's Net Zero Carbon roadmap aims primarily at mitigation—reducing greenhouse gas emissions—it must also ensure resilience to the unavoidable impacts of climate change. The campus's coastal location, complex infrastructure, and large community make climate adaptation essential.

Key Climate Risks

1. **Heat Stress and Urban Heat Island Effect**

   - Rising temperatures and more frequent heatwaves threaten thermal comfort and result in increased energy demand for cooling.

2. **Intense Rainfall and Flooding**

   - The Puducherry region is vulnerable to cyclonic storms and short-duration, high-intensity rainfall events, which can lead to flooding of low-lying areas and disrupt power and transport systems.

3. **Coastal Salinity and Sea-level Rise**

   - Saltwater intrusion into groundwater threatens drinking water supplies and can affect vegetation and soil fertility.

4. **Extreme Weather Disruption**

   - Strong winds and cyclonic events pose risks to buildings, solar installations, and the electric grid.

Adaptation and Resilience Strategies

To address these risks, Pondicherry University will integrate adaptation measures into every stage of planning and development.

1. Climate-Resilient Infrastructure

- Green roofs and reflective building materials to reduce heat gain and improve indoor thermal comfort.
- Permeable pavements and expanded drainage systems to manage stormwater and reduce urban flooding.
- Wind-resistant building designs and storm-secure mounting systems for solar PV arrays.

2. Nature-based Solutions

- Mangrove and coastal vegetation restoration to buffer against storm surges and limit saltwater intrusion.
- Expansion of green corridors and tree plantations to cool ambient temperatures and store carbon.

3. Water Security

- Enhance rainwater harvesting capacity and storage reservoirs to secure freshwater supply during dry spells.
- Strengthen wetland STP systems to handle storm water surges and maintain treatment performance during extreme rain events.

4. Energy and Operational Resilience

- Battery-backed microgrids to ensure uninterrupted power supply to critical facilities such as laboratories, IT systems, and healthcare services.
- Fuel-switch contingency plans for backup power in case of extended grid failure.

5. Emergency Preparedness and Community Safety

- Regular climate risk assessments integrated into campus emergency plans.
- Evacuation drills and communication protocols to protect students, staff, and visitors during extreme weather events.

Embedding Resilience into Governance

Resilience planning can be institutionalised through:

- The Office of Green Campus, supported by the Electrical, Civil, and Administration Departments, coordinates risk assessments and adaptation projects.
- Annual climate risk reviews as part of the Sustainium-based MRV process, ensuring that adaptation measures evolve with emerging science.
- Capacity-building and training programmes to keep staff, faculty, and students informed about climate-related risks and emergency responses.

By addressing climate risks proactively, Pondicherry University will not only protect its infrastructure and community but also demonstrate how mitigation and adaptation can work hand in hand to build a truly sustainable and resilient campus.

9.4. Implementation Timeline: 2025–2035

The Net Zero Carbon 2035 benchmark will be realised through a phased implementation plan that aligns technical, financial, and academic priorities. Each phase combines infrastructure deployment, behavioural change, and governance.

Phase 1: Foundation (2025–2028)

- Expand on-site solar from 2.6 MWp to 4 MWp, supported by advanced metering and SCADA systems.
- Retrofit all major academic and residential buildings with LED lighting, efficient HVAC, and building management systems.
- Electrify at least 30 % of the university-owned fleet and install multiple EV charging points.
- Institutionalise annual Sustainium-based carbon inventories and publish annual sustainability reports.
- Integrate sustainability modules into curricula, establishing the campus as a living laboratory.

Phase 2: Integration (2029–2032)

- Scale solar to 6–8 MWp, and implement a campus microgrid to ensure grid stability and renewable dominance.
- Achieve 75% emission reduction relative to the 2014 baseline.
- Electrify at least 80% of the fleet, with expanded electric bus and e-mobility networks for commuting students and staff.
- Strengthen Scope 3 mitigation through low-carbon procurement, shared transport, and telepresence options.
- Initiate IGBC Net Zero Carbon and GNFZ pre-certification audits.

Phase 3: Net Zero Delivery (2033–2035)

- Reach 8–10 MWp solar capacity and fine-tune storage for year-round energy security.
- Achieve more than 90% absolute emissions reduction.
- Neutralise residual emissions (less than 10%) through verified carbon credits and enhanced on-campus sequestration.
- Complete IGBC Net Zero Carbon and GNFZ certification and publicly declare Net Zero status.
- Embed continuous improvement cycles, ensuring that decarbonisation remains dynamic and resilient to technological or policy changes.

10. Conclusion

Pondicherry University has emerged as one of India's leading examples of campus sustainability over the past decade. From an initial carbon footprint of nearly 9,800 tCO_2e in 2014, Pondicherry University has reduced emissions by approximately 20% through the adoption of solar power, now exceeding 3 MWp (2.6 MWp by 2021), advanced energy efficiency, comprehensive water and waste management, and the preservation of 320 acres of biodiversity-rich land.

The University's sustainability culture dates back to 2012, when a detailed Solar Campus Master Plan was prepared by our team, laying the groundwork for today's achievements. That proposal catalysed large-scale renewable adoption and made the campus one of India's largest and most cost-effective clean-energy generators.

This Net Zero Carbon roadmap extends that pioneering vision. Recommending Net Zero carbon emissions by 2035 is a bold yet essential next step—aligning with India's evolving climate commitments and global best practices. Supported by rigorous data, digital accounting through the Sustainium.io platform, and verifiable milestones, this strategy positions Pondicherry University as a national model for climate leadership in higher education.

By integrating research, education, and operations and by pursuing dual certification under IGBC Net Zero Carbon and the Global Network for Zero (GNFZ), the University will not only neutralise its greenhouse gas emissions but also serve as a replicable model for higher education institutions worldwide. Its integrated approach—combining renewable energy, biodiversity-based sequestration, and readiness for India's emerging carbon-market framework—ensures long-term climate and financial sustainability.

This journey underscores a broader truth: universities, as centres of knowledge and innovation, can transform from passive consumers of resources into active agents of planetary stewardship.

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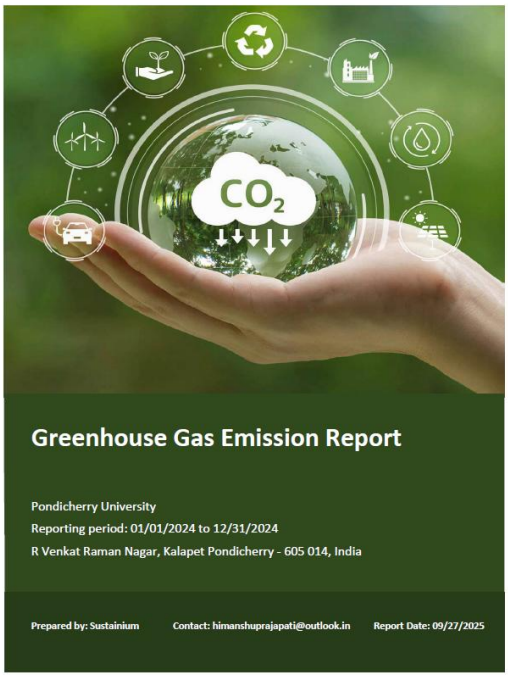
Annexures



Report Structure

GHG report generated by the Sustainium.io platform. This platform was used to estimate the total GHG emissionss (Scope 1, 2 and 3), manage the inventory for the last 11 years and generate a GHG report in alignment with the GHG protocol.

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