IIT – Madras CLIMATE ACTION PLAN

2024

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EXECUTIVE SUMMARY

"IIT Madras is committed to pioneering sustainability as it sets course on a strategic journey to achieve a net-zero campus by 2040."

Our commitment to sustainability has been an integral part of our ethos at IIT Madras for many years. We recognize the importance of preserving our rich and diverse ecology, advancing groundbreaking technologies through research, developing innovative products, and providing accessible and scalable solutions that benefit society at large.

Aligned with our steadfast commitment to sustainability, we recognize the energy transition as a pivotal opportunity to foster enduring positive change. As a result, sustainability has become a focal point of our enterprise strategy. We are committed to setting and achieving meaningful sustainability goals, and to underscore the importance of transparent climate-related reporting and disclosure, we are enhancing our reporting in our upcoming Sustainability Report to be released in 2023.

By incorporating sustainability into our enterprise strategy alongside operational excellence and expanded research and development efforts, we are actively working towards fulfilling IIT Madras' climate-related objectives. Through investments in technology aimed at facilitating fuel transition, enhancing operational efficiency, and reducing. emissions, we aim to significantly decrease our carbon footprint while meeting performance requirements. This commitment extends to disseminating our progress to our various stakeholders, ensuring transparency and accountability. In 2023, we announced a series of projects aimed at contributing to a reduced-carbon future, demonstrating our dedication to sustainable progress. However, our commitment to the planet extends beyond environmental sustainability alone. We are actively engaged in creating a more diverse and inclusive campus environment that supports and protects some of the most beautiful yet endangered species. Additionally, we have launched the School of Sustainability, furthering our mission to build stronger, more resilient, and sustainable communities.

As an institution with a legacy of providing technologies and solutions that advance sustainable progress and improve standards of living, we are committed to supporting society throughout the energy transition phase.
By building a better, more sustainable world, we aim to create lasting positive impact and contribute to a brighter future

ROAD TO NETZERO

Decarbonization:
Implement energy efficiency measures across campus buildings and facilities to minimize energy consumption. This includes upgrading to energy-efficient lighting, cooling systems, and implementing smart building technologies

Energy Sourcing:
Transition of all energy consumption to renewable sources such as solar, wind, or hydroelectric power. This includes generating renewable energy on-site through solar panels or purchasing renewable energy from off-site sources.

Data analytics:
Regularly monitor emissions data and track progress towards zero carbon emissions goals. Continuously evaluate and update sustainability strategies to identify new opportunities for emission reduction and improvement.

EV – Hydrogen shift:
Electrification of Transportation to eliminate emissions from vehicles, the campus is planning to execute transition to electric or zero-emission vehicles for transportation needs. This could involve replacing gasoline or diesel vehicles with electric cars, buses, and other vehicles powered by renewable electricity.

Carbon neutrality:
Focusing on reducing its campus-related Scope 3 emissions and making strategic investments in sustainable technologies. One of the key areas of investment is in future Indian technological advancements, particularly in renewable energy, energy-efficient infrastructure, and sustainable campus design. The institution is actively involved in research and development (R&D) projects aimed at paving the way for a futuristic sustainable development.

Research and development:
The institution is actively engaged in R&D activities focused on sustainable solutions. These include projects related to clean energy generation, waste management, water conservation, and green transportation. The outcomes of these R&D initiatives are expected to play a crucial role in shaping IIT Madras's future sustainable path, driving innovation, and fostering a culture of environmental stewardship within the campus community.

BIO-DIVERSITY:

Over **5,000** native trees have been planted across the **611-acre** campus, fostering biodiversity and enhancing the natural environment. **68%** of landscape area.

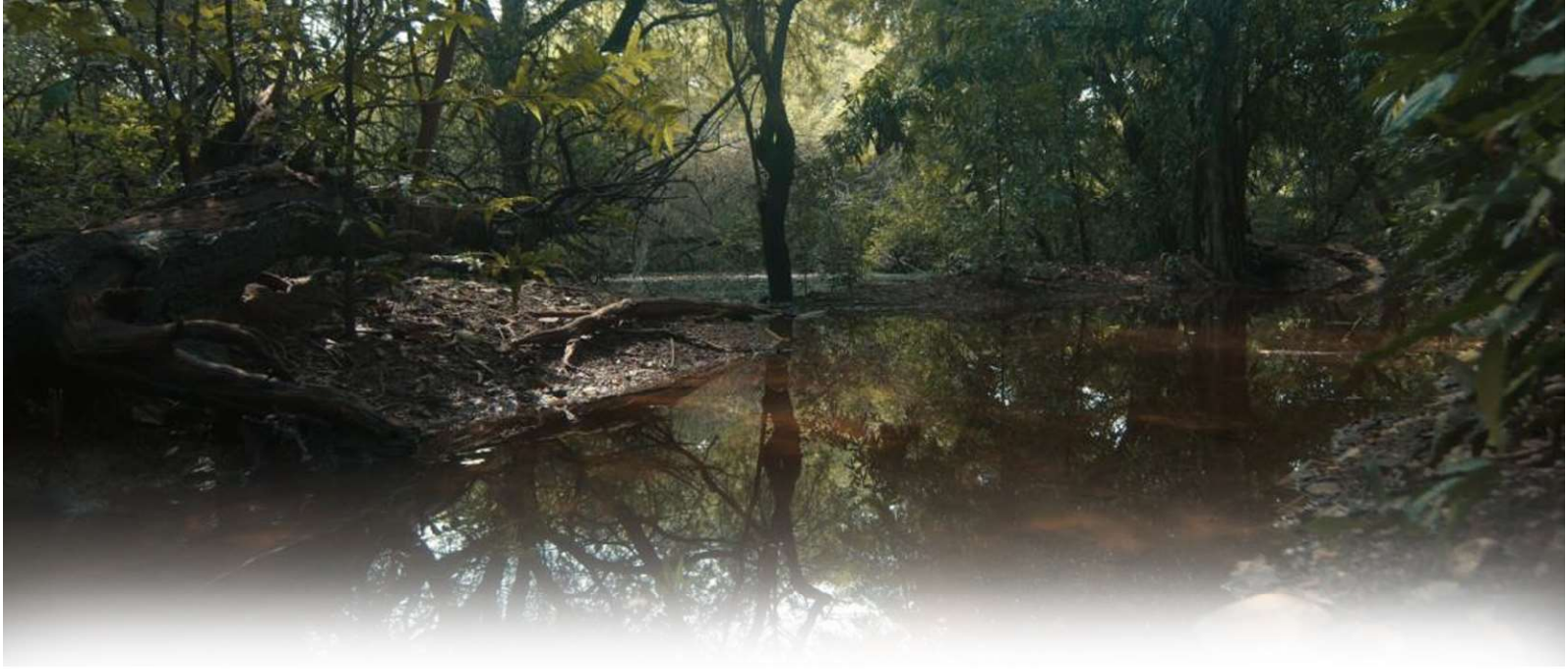
Landscaping efforts incorporate indigenous plant species, reducing water requirements by up to **40%** compared to non-native plants.

Rainwater harvesting systems with a combined capacity of **1 million liters** capture and store rainwater annually for irrigation and groundwater recharge.

Conservation of blackbucks, IIT-M has created **4 acres** of open space by removing juliflora growth and paved the way for a grassland.

The abundant and diverse flora **(298 observed species)** provides an ideal habitat for its equally diverse fauna **(35 species including endangered species like the black buck).** In addition, the campus attracts **51 species** of avifauna and an equal number of butterfly species.

The campus also has a deer park, where visitors can **witness Indian Spotted Deer (220-270) and the endangered species, Blackbucks (60-70)**



Selected Groups	Species observed	Species expected
Plants	298	350-400
Butterflies	50	50-55
Frogs and toads	8	09-10
Lizards	8	10-12
Snakes	4	15
Tortoise/Turtles	1	3
Birds	51	60-80
Mammals	12	20-25
Total	**432**	**517-600**

- Total green area = 661 acres × 68% = 449.48 acres
- Total carbon sequestration = 449.48 acres × 2.5 metric tons CO_2 per acre per year
- Total carbon sequestration =1123.7 metric tons CO_2 per year
- **The carbon sequestration estimated is equal to 11,23,700 kg CO_2 per year**
- **Number of fully-grown trees in the campus are over 50,000.**

WATER CONSERVATION:

Zero liquid discharge -IITM discharges no liquid effluent into surface waters, completely eliminating the environmental pollution associated with effluent water.

Rainwater harvesting structures capture and store an average of **500,000 liters** of rainwater per monsoon season, replenishing groundwater reserves and reducing reliance on municipal water sources.

Water-efficient landscaping techniques, including drip irrigation systems and native plant species, reduce outdoor water consumption by approximately **37000 liters.**

Installation of low-flow fixtures and water-saving devices in campus buildings has resulted in a **1500 liters** reduction in water consumption compared to baseline levels per day.

The state-of-the-art Sewage Treatment Plant of IIT madras (STP) produces a massive **98%** clean water and has a capacity of **4 million liters.** The treated water from the STP is used for flushing, landscaping water demand and air conditioning cooling water and excess water is diverted to the lake

Through the treatment and conjunctive use of treated water, the domestic water requirements reduction is about **1.8 million liters per year.**

WASTE MANAGEMENT:

Comprehensive waste segregation initiatives divert over **3450 kg/day** of waste from landfill, reducing **1.725 metric tonsCO2e** of emissions from landfill.

About **150-200 kg** of the raw-cut vegetable waste is composted and the resultant vermicomposting is utilized as fertilizer for the landscapes within the campus.

About **800 kg** of this food waste is fed to a biogas plant that generates fuel equivalent to **5-7 cylinders** utilizing LPG**.**

The campus has a solid waste incinerator facility with the capacity to process **two tons** of mixed waste per day

BEYOND ACADEMICS

- Technical Clubs: 20 clubs focusing on robotics, coding, electronics, and engineering projects
- Cultural Clubs: 15 clubs dedicated to music, dance, drama, and literature.
- Sports Clubs: 20 clubs for various indoor and outdoor sports like cricket, football, basketball, table tennis, and badminton.
- Entrepreneurship Clubs: 10 clubs supporting budding entrepreneurs and startup enthusiasts.
- Social Service Clubs: 10 clubs organizing community outreach programs and volunteering activities.
- Special Interest Clubs: 15 clubs for activities such as photography, astronomy, and gaming
- Academic Clubs: 10 clubs providing peer support, study groups, and academic assistance.
- Environmental Clubs: 5 clubs promoting sustainability and eco-friendly practices

ENERGY EFFICIENCY:

- Replacement of conventional lighting with energy-efficient LED fixtures has resulted in an annual energy savings of over **500,000 kWh** reducing **250 metric tons of carbon dioxide emissions.**
- BLDC fans installed in campus buildings have reduced electricity consumption by up to **60%** of energy consumption than conventional fans.
- Energy-efficient appliances and equipment have reduced energy consumption by an estimated **15%** across campus facilities.
- Solar photovoltaic panels with a total installed capacity of **3.3MW** generate approximately meeting more than **20%** of the institute's energy needs. The emission that can be avoided **16,26,357 kgco2e.**
- The hostels of IIT have solar water heaters with a capacity of **82.5 KLD**
- The Air conditioning systems have been replaced from R22 refrigerants to CFC free refrigerants. Emissions by approximately **113,500 kgco2e (or 113.5 metric tons)** can be reduced.

CAMPUS LIFE:

- Gyms: **3** well-equipped gyms.
- Athletics Tracks: one athletics track for running and track events.
- Sports Fields: football fields, cricket grounds, hockey fields, and rugby fields.
- Indoor Sports Complexes: 1 indoor sport complex housing basketball court, volleyball courts, badminton courts, squash courts, and indoor tennis courts.
- Swimming Pools: Some IITs have **2 swimming pools** for aquatic sports and recreational swimming.
- Table Tennis and Billiards Rooms: Indoor recreational spaces include 2 rooms for table tennis, billiards, and other indoor games.
- Multipurpose Courts: There are usually **2 multipurpose courts** for activities like basketball, tennis, and volleyball.
- Yoga and Meditation Centers: dedicated spaces for yoga, meditation, and other wellness activities.

BEYOND THE FENCE:

- **20 community outreach programs,** including tree planting drives and environmental education workshops, are conducted annually in collaboration withlocalNGOs and governmentagencies.
- These initiatives engage over **1,000 community** members and stakeholders, fostering partnerships for sustainable development and environmental protection in the broader community.
- **3450** students participate in community service activities, volunteering their time and skills to uplift underprivileged communities.
- About **2300** students engage in research collaborations beyond the campus, broadening their research horizons and accessing resources not available on campus.
- About **1500** students engage in research collaborations beyond the campus, broadening their research horizons and accessing resources not available on campus.
- **1750** students pursue international experiences through exchange programs, internships abroad, and participation in global conferences and competitions.

1. PREFACE

The Indian Institute of Technology Madras is known both nationally and internationally for excellence in technical education, basic and applied research, innovation, entrepreneurship and industrial consultancy. A faculty of international repute, a highly motivated and brilliant student community, excellent technical and supporting staff and an effective administration have all contributed to the pre-eminent status of IIT Madras. The Institute is proud to bear the laureate of being No.1 engineering university in India. More recently, IIT Madras has been given the title of Institute of Eminence. In 1956, the German Government offered technical assistance for establishing an institute of higher education in engineering in India. The first Indo-German agreement in Bonn, West Germany for the establishment of the Indian Institute of Technology at Madras was signed in 1959.

1.1. Key Data and achievements

- The Institute has eighteen academic departments and a few advanced research centers in various disciplines of engineering and pure sciences, with nearly 100 laboratories organized in a unique pattern.
- IIT Madras is a residential institute with nearly 650 faculty, 11,500 students and 15 administrative & supporting staff and is a self-contained campus.
- IIT Madras has been the top-ranked engineering institute in India for four consecutive years as well as the 'Best Educational Institution' in Overall Category in the NIRF Rankings of 2023 put out by the Ministry of Human Resource Development.

2. SETTING AND INFRASTRUCTURE

IIT Madras is one of the premier technical institutes in India, located in the city of Chennai. The campus is spread over an area of 661 acres and is known for its lush green landscape and serene atmosphere. Complimenting the natural greenery that it is blessed with; the institute has taken several initiatives to promote sustainability and has implemented several eco-friendly measures within and beyond the campus primarily considering the fragile ecosystem that it houses.

As per the Supreme Court of India, large areas of the campus qualify to be forest due to tree cover and the presence of wild animals and hence come under the provisions of the Forest (Conservation) Act, 1980.

IIT Madras boasts a range of academic buildings equipped with cutting-edge facilities for various departments and disciplines. These buildings include over 40 academic blocks, housing modern classrooms, laboratories, research centers, and lecture halls equipped with advanced technology to facilitate teaching, learning, and research activities.

2. SETTING AND INFRASTRUCTURE

2.1. Green Rated buildings inside the campus

IIT-Madras realized the requirement for a better campus infrastructure for a sustainable tomorrow and had taken an initiative to set up 611 acres green lavish campus in Chennai. The project team of IIT-Madras envisioned making their campus Green and to get recognition of Platinum Rated IGBC Green Existing Campus.

TUNGA & BADRA HOSTEL

The commissioned project team comprising IIT-Madras students, staff, and Earthonomic Engineer's sustainability consultants worked tirelessly in retrofitting the campus to achieve the IGBC Green Existing Campus Platinum rating IIT Madras has two GRIHA certified buildings on its campus with a rating of 4 stars out of a possible 5 for each building.

Tunga & Bhadra building is a hostel, the New Academic Complex is an academic building erected on 6 floors, and the NAC canteen is the campus.

SABARMATI HOSTEL

3.CAMPUS ECO-STEWARDSHIP – ON GOING PRACTICES

Over **5,000** native trees have been planted across the 611-acre campus, fostering biodiversity and enhancing the natural environment.

Landscaping efforts incorporate indigenous plant species, reducing water requirements by up to **40%** compared to non-native plants.

Rainwater harvesting systems with a combined capacity of 1 **million liters** capture and store rainwater annually for irrigation and groundwater recharge.

3.2. ENERGY EFFICIENCY MEASURES:

Replacement of conventional lighting with energy-efficient LED fixtures has resulted in an annual energy savings of over **500,000 kWh.**

BLDC fans installed in campus buildings have reduced electricity consumption by up to **60%** of energy consumption than conventional fans.

Energy-efficient appliances and equipment have reduced energy consumption by an estimated **15%** across campus facilities.

3.3. RENEWABLE ENERGY INTEGRATION:

Solar photovoltaic panels with a total installed capacity of **3300 kWp** generate approximately meeting more than **20%** of the institute's energy needs.

The hostels of IIT have solar water heaters with a capacity of **82.5 KLD**

3.4. WASTE MANAGEMENT:

- Comprehensive waste segregation initiatives divert over **60%** of waste from landfill.
- About **150-200 kg** of the raw-cut vegetable waste is composted and the resultant vermicomposting is utilized as fertilizer for the landscapes within the campus.
- About **800 kg** of this food waste is fed to a biogas plant that generates fuel equivalent to **5-7 cylinders** utilizing LPG.
- The campus has separate centralized waste yards for dry, hazardous, electronic waste.

BIOGAS PLANT

3.4 WATER CONSERVATION:

- Rainwater harvesting structures capture and store an average of **500,000 liters** of rainwater per monsoon season, replenishing groundwater reserves and reducing reliance on municipal water sources.
- Water-efficient landscaping techniques, including drip irrigation systems and native plant species, reduce outdoor water consumption by approximately **15%.**
- Installation of low-flow fixtures and water-saving devices in campus buildings has resulted in a **25%** reduction in water consumption compared to baseline levels.
- The state-of-the-art Sewage Treatment Plant of IIT madras (STP) produces a massive **98%** clean water and has a capacity of **4000 KLD.** The treated water from the STP is used for flushing, landscaping water demand and air conditioning cooling water and excess water is diverted to the lake.
- Through the treatment and conjunctive use of treated water, the domestic water requirements reduction is about **60-65%.**

LAKE

SEWAGE TREATMENT PLANT

3.5 SUSTAINABLE TRANSPORTATION:

- Bicycle-friendly infrastructure, including over **8000 bicycles**, bike racks and dedicated bike lanes, supports a cycling culture among students and staff.

- Carpooling initiatives organized through a campus-wide ride-sharing platform have reduced single-occupancy vehicle trips by over **30%** during peak hours.

Pedestrian-friendly pathways and walkable campus layouts encourage active transportation and reduce dependence on motorized vehicles.

3.6. GREEN BUILDING DESIGN:

- Green building features such as passive solar design and efficient insulation reduce energy consumption by up to **40%** in newly constructed buildings.

- Use of eco-friendly building materials, including recycled steel and low-emission paints, minimizes environmental impact during construction and operation.

- Solar panels installed on campus buildings provide additional roof level insulation, resulting in energy savings of up to **5%.**

3.7. GREEN BUILDING DESIGN:

- Over **100 workshops**, seminars, and guest lectures on sustainability topics are conducted annually, reaching over 5,000 students, faculty, and staff.
- **10 active eco-clubs** and environmental organizations engage students in hands-on projects and initiatives, fostering a culture of environmental stewardship and responsibility.
- Campus-wide awareness campaigns, including Earth Day celebrations and recycling drives, promote behavior change and encourage sustainable practices among the campus community.

3.8. RESEARCH AND INNOVATION:

- 50 interdisciplinary research projects focused on renewable energy, waste management, and climate change mitigation are currently underway, involving over **200 faculty** members and graduate students.
- Collaborative research initiatives with industry partners and government agencies have secured over **$5 million** in funding for sustainability-focused research over the past five years.

3.9. COMMUNITY ENGAGEMENT:

- 20 community outreach programs, including tree planting drives and environmental education workshops, are conducted annually in collaboration with local NGOs and government agencies.
- These initiatives engage over **1,000 community** members and stakeholders, fostering partnerships for sustainable development and environmental protection in the broader community.

3.10. COMMUNITY ENGAGEMENT:

- Through these detailed and quantifiable sustainable interventions, IIT Madras demonstrates its commitment to environmental sustainability and serves as a model for other academic institutions and organizations striving to create a more sustainable future.

3.11. BIO-DIVERSITY CONSERVATION:

- Conservation of blackbucks, IIT-M has created **4 acres** of open space by removing juliflora growth and paved the way for a grassland. The banyan trees at IIT Madras are some of the largest in the country, with some of them covering an area of more than an acre.

- They provide shade and a serene atmosphere, making it an ideal spot for students to relax and study and mitigate heat Island.

IITM is located adjacent to the Guindy National Park (GNP) unique for its rich biodiversity. The abundant and diverse flora **(298 observed species)** provides an ideal habitat for its equally diverse fauna **(35 species including endangered species like the black buck)**. In addition, the campus attracts 51 species of avifauna and an equal number of butterfly species.

“It is a campus where one can witness how humans and animals can coexist in harmony.”

ON-SITE SUSTAINABLE COMMITTEE

In the wake of escalating climate concerns and the pressing need for decisive action, the Indian Institute of Technology Madras (IIT Madras) has taken a bold stride towards environmental stewardship. In 2023, against the backdrop of global urgency, IIT Madras proudly inaugurated the Green Committee, a pivotal initiative aimed at spearheading sustainable change within its campus and beyond. The establishment of the Green Committee in 2023 marks a significant milestone in IIT Madras's ongoing commitment to sustainability and ecological preservation. The Green Committee stands as a testament to IIT Madras's unwavering commitment to sustainability and environmental responsibility. With a clear vision to foster a greener campus and contribute meaningfully to global efforts in combating climate change, this committee represents a collective effort from students, faculty, and staff. At its core, the Green Committee embodies the ethos of sustainability, innovation, and community engagement. By harnessing the collective expertise and passion of its members, the committee aims to develop and implement a comprehensive Climate Action Plan tailored to the unique needs and opportunities of the IIT Madras campus.

Landscape

Water management

Energy management

Waste committee

Education committee

To protect and conserve ecological systems and resources within the campus.

To ensure judicious use of environmental resources to meet the needs and aspirations of the MI present and future generations.

To integrate environmental concerns into policies, plans and programmes for social developml and outreach activities.

To work with all stakeholders and the local community to raise awareness and seek the adopti of environmental good practice and the reduction of any adverse effects on the environment.

SCHOOL OF SUSTAINABILITY-IITM

The School of Sustainability is a dynamic community of the IITM faculty members, IITM Centers of Excellence, research scholars and practitioners. We strive to foster creative modes of knowledge transfer, conduct integrated and actionable research in Sustainability Science and Technology, and maximize an impact through implementation and policy

- Foster interactive and innovative teaching approaches for students and professionals to deepen our understanding of sustainability.
- Drive integrated, interdisciplinary research on sustainability in areas such as climate change, decarbonization, sustainable settlements, and behavioral change.
- Create impactful change by collaborating with industry, engaging in policy dialogues, and helping implement solutions on the ground.

Behavioural change for Sustainability

Sustainable Human settlements and the F-E-W

Climate change impacts and adaptation (Scenario Modelling)

Ubiquitous Decarbonization (Materials and Energy)

CARBON TRACKING AND REPORTING

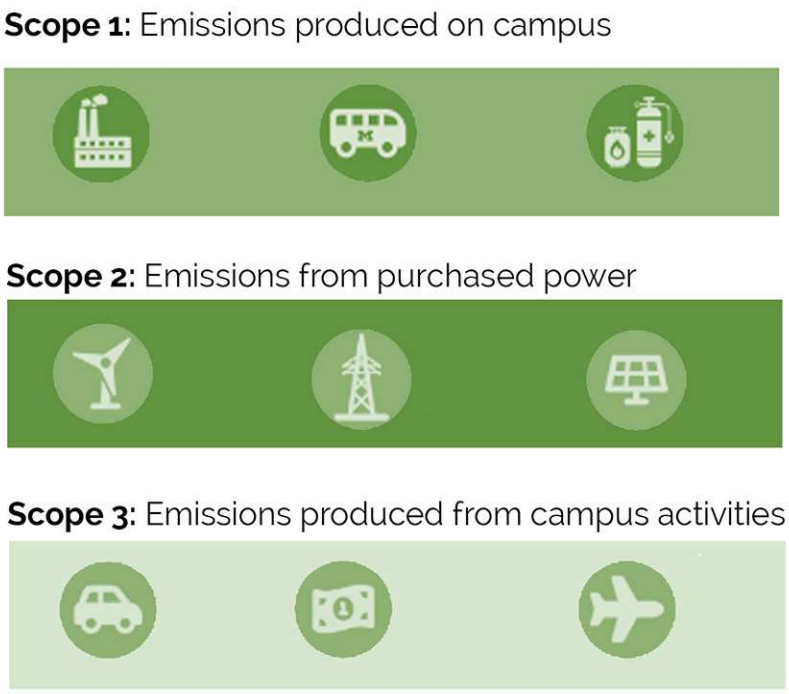
6.1. Carbon footprint

The carbon footprint is a crucial metric that quantifies the environmental impact of human activities by measuring the total amount of greenhouse gas emissions, primarily carbon dioxide (CO2), generated directly or indirectly

Scope 1 and Scope 2 emissions are two key categories used to assess the carbon footprint of an organization or entity. Scope 1 emissions refer to direct greenhouse gas emissions that result from sources owned or controlled by the organization, including activities such as combustion of fossil fuels, on-site fuel consumption, and emissions from owned vehicles and equipment.

These emissions are typically generated within the boundaries of the organization's operations and are under its direct management. Common examples include emissions from company-owned vehicles, boilers, and industrial processes.

On the other hand, Scope 2 emissions encompass indirect greenhouse gas emissions associated with the generation of purchased electricity, heat consumed by the organization. While these emissions occur outside of the organization's direct control, they are a consequence of its energy consumption.



6.2. Data acquisition and Analysis

At the IIT campus level, tracking the carbon footprint have been by assessing the environmental impact of various activities and operations within the campus boundaries.

1.Scope Definition: The energy consumption, transportation, waste generation, water usage, and other relevant factors have been considered.

2. Data Collection: Data on the various activities contributing to carbon emissions were collected

- Energy usage in buildings (electricity, cooling)-kWh
- Transportation emissions (commuting, campus vehicles)-Km/year
- Waste generation and disposal methods-Kg/Year
- Associated energy consumption and HVAC-TR
- Other Fuel Emissions-Liters/year

3.Emissions Calculation: Appropriate methodologies were used to calculate the carbon emissions associated with the collected data.

- Converting energy usage data into CO2 equivalents using emission factors
- Estimating transportation emissions based on vehicle types, distances traveled, and fuel consumption

4.Analysis: Based the calculated emissions data, hotspots and major sources of carbon emissions on campus were identified.

- Identifying buildings or facilities with high energy consumption
- Assessing the carbon intensity of transportation modes used on campus
- Evaluating the effectiveness of waste management practices in reducing emission

5. Reduction Strategies: Develop strategies to reduce the campus carbon footprint based on the analysis. This might include:

Implementing energy efficiency measures in buildings (e.g., lighting upgrades, insulation improvements)

- Promoting sustainable transportation options (e.g., public transit, biking, carpooling)
- Enhancing waste reduction and recycling programs
- Investing in renewable energy sources (solar panels, wind turbines)
- Encouraging behavior change and awareness campaigns among students, faculty, and staff

6. Monitoring and Reporting: Continuously monitor the effectiveness of implemented strategies and track progress towards carbon reduction goals. Regularly report on carbon footprint metrics to stakeholders and the wider campus community.

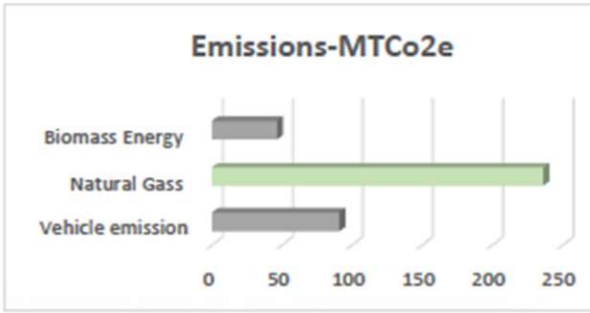
7. Continuous Improvement: Iterate on the process by periodically reassessing the carbon footprint, updating data, and refining reduction strategies to achieve further emissions reductions over time.

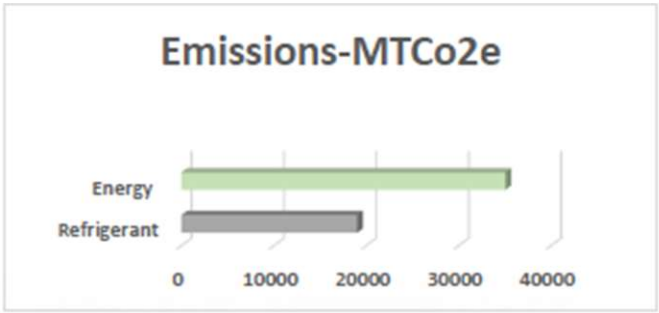
6.3. Boundaries and emissions

SUMMARY			
Scope 1	Vehicle emission	91,001.80	**1,94,22,195.82**
	Natural Gas	2,36,266.68	
	Biomass Energy	46,373.25	
	Refrigerant	1,90,48,554.09	
Scope 2	Energy	3,50,76,140.50	**3,50,76,140.50**
		TOTAL (Kg CO2e)	**5,44,98,336.32**

Avoidance

Overall Annual Solar Energy generation (kWh)	**22,71,448**
TOTAL (Kg CO2e) EMMISIONS AVOIDED	**16,26,357**

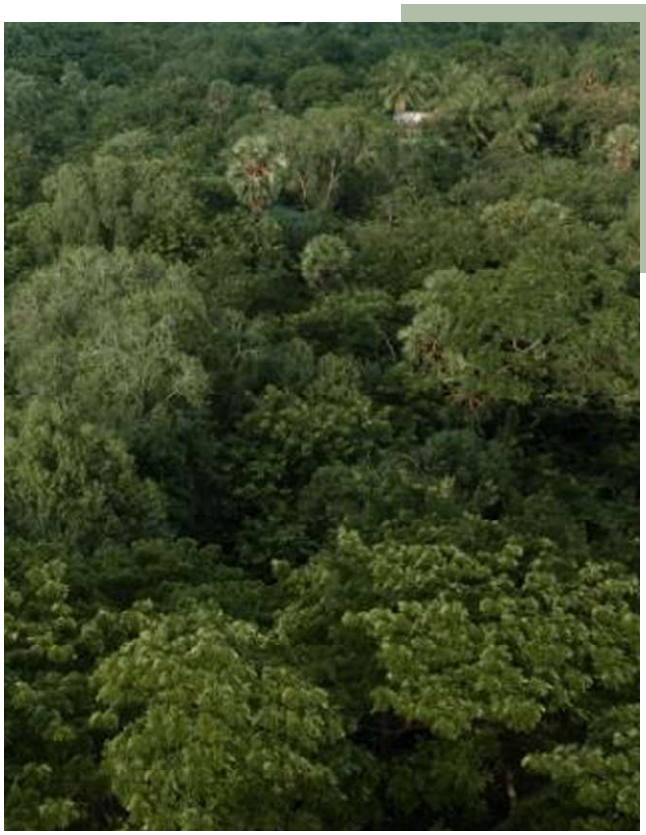


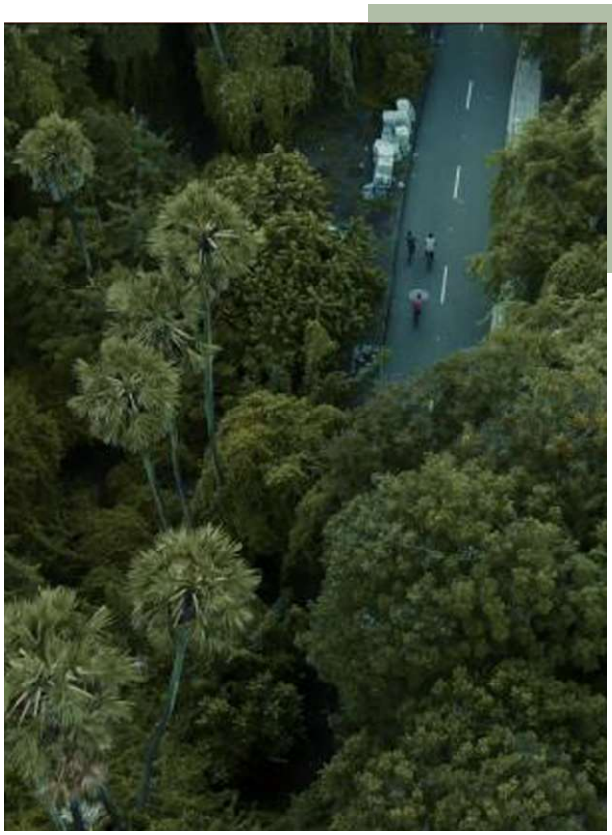


> **“IIT Madras demonstrate its commitment to sustainability and significantly contribute to mitigating climate change”**

6.3. Boundaries and emissions

Miyawaki gardens have been developed adjacent to the newly constructed housing complexes (Chera, Chola and Pandya) to improve the green cover, species variation and abundance in a consider- ably shorter time. These efforts have resulted in increased green cover





- Total green area = 661 acres × 68% = **449.48 acres**
- Total carbon sequestration = **449.48 acres × 2.5 metric tons CO2 per acre per year**
- Total carbon sequestration =**1123.7 metric tons CO2 per year**
- The carbon sequestration estimated is equal to **11,23,700 kg CO2 per year**
- Number of fully-grown trees in the campus are over **50,000.**

FUTURE ESTIMATIONS

Green Transportation solutions: The IITM team has procured EV vehicles for students and employee shuttle service. If an electric vehicle were used instead of the diesel bus for approximately 36400.72 km, the total reduction in CO2 emissions would be approximately 72801.44 kgCO2.The IITM campus has EV buggies for on-site transportation that reduces emission when compared to conventional fossil fuel based shuttling.

7.2. Scope 2 estimations

Net Zero Buildings: Embrace net-zero energy building standards for all new construction projects. Utilize energy-efficient technologies and renewable energy sources to minimize energy consumption and offset remaining carbon emissions. The IIT campus can use most of the rooftop for solar integration to reduce dependency on fossil fuel supplied power generations. The estimated capacity of the solar panel system required to generate 48,956,305 kWh of energy annually is approximately 30 MWp (or 30,000 KWp) that would require an area of around 2,10,000 sq.m of installation area.

Water Management Solutions: IIT-Madras has established a solid waste incinerator facility with the capacity to process two tons of mixed waste per day that otherwise goes out for landfilling.

- CO2 emissions minimized per day = 2 tons/day * 1-ton CO2e/ton waste = 2 tons CO2e/day
- Over a year, assuming the incineration process operates daily:
- CO2 emissions minimized per year = 2 tons CO2e/day * 365 days/year ≈ 730 tons CO2e/year
- So, by onsite incineration processing two tons of waste per day, approximately 730 tons of CO2e emissions from landfilling could be minimized annually.

7.3. Scope 3 estimates

With a day-scholar population of approximately 2500 individuals, including faculty, undergraduate, postgraduate, and research scholars, the campus engages in various activities that contribute to its carbon footprint. Understanding and estimating Scope 3 emissions are crucial for implementing effective sustainability measures.

Commuting Emissions: 1. Assumption: an average commuting distance of 15 kilometers per person per day. 2. Assumption: 50% of people use public transport (emission factor of 0.2 kg CO2e per passenger-kilometer) and 50% use private vehicles (emission factor of 0.25 kg CO2e per passenger-kilometer).

- **Public transport emissions: (1250 students × 15 km × 0.2 kg CO2e) = 3750 kg CO2e**
- **Private vehicle emissions: (1250 students × 15 km × 0.25 kg CO2e) = 4687.5 kg CO2e**
- **Total commuting emissions = 3750 kg CO2e + 4687.5 kg CO2e = 8437.5 kg CO2e per day**

Waste Generation Emissions:

1. Assume a per capita waste generation rate of 0.8 kg per day per student.
2. Assume emissions associated with waste management (transport, treatment, disposal) at 0.4 kg CO2e per kg of waste.
3. Waste generation emissions:
11500 students × 0.8 kg × 0.4 kg CO2e = 3680 kg CO2e per day

Procurement Emissions:
Assume procurement-related emissions at 100 kg CO2e per student per year.

- Procurement emissions: 11,500 students × 100 kg CO2e = 11,50,000 kg CO2e per year
- Commuting Emissions: 8437.5 kg CO2e per day
  (approximately 3.08 metric tons CO2e per year)
- Waste Generation Emissions: 3680 kg CO2e per day
  (approximately 0.29 metric tons CO2e per year)
- Procurement Emissions: 8,00,000 kg CO2e per year

CLIMATE ACTION PLAN

7.3. Scope 3 estimates

Immediate:
Standardize decarbonization practices for both new construction and retrofits, including implementing resource-saving technologies like efficient HVAC, BLDC fan upgrade, LED lighting, daylight harvesting, re-use of wastewater for flushing and dual-flush toilets.

Medium-term:

IIT Madras can enhance its infrastructure for upcoming buildings by integrating state-of-the-art building automation systems, energy-efficient HVAC systems, and sustainable materials like recycled steel and bamboo (non-AC) for construction ensuring reduced energy consumption and carbon footprint.

Facilitating the necessary systems by integrating various platforms such as RS485, LoRaGate, and BACnet to connect all buildings at IIT Madras, ensuring seamless communication and efficient management of infrastructure, energy usage, and security across the campus. This interconnected approach not only enhances operational efficiency but also lays the foundation for smart and sustainable campus development.

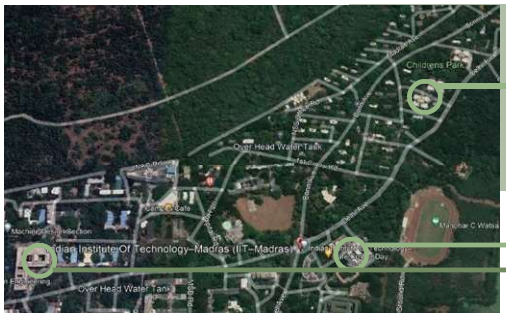
Long-term:

Implementing digital metering in IIT Madras marks a significant stride towards efficient energy management and resource utilization. With digital meters installed across campus buildings and facilities, real-time data on energy consumption, water usage, and other key metrics can be accurately monitored and analyzed. Providing and maintaining control systems for IIT Madras is crucial for ensuring efficient operations and optimal performance across campus facilities. By implementing state-of-the-art control systems, such as Building Management Systems (BMS) and Energy Management Systems (EMS), the institution can centrally monitor and manage various aspects like HVAC, lighting, security, and energy consumption in real time.

Goal: Maximize onsite and offsite renewable energy production

Immediate:

Identify the source, the unutilized roof and non-shaded roof areas can be used to place solar panels increase the capacity of on-site requirements and reduce emissions through fossil fuels.



Out of 2,18,661 sqm of roof area only 33,000 sq.m is utilized for solar panel, the exposed roof areas (free of tree cover) can be utilized for generating renewable energy through solar panels.

Lorem Ipsum

Medium-term:

The new upcoming buildings in IIT Madras will set to revolutionize sustainability with their fully solar-powered roofs. Integrating advanced solar panel technology, these buildings will harness the abundant sunlight to generate clean and renewable energy. This eco-friendly approach not only reduces the campus' carbon footprint but also contributes significantly to energy independence and cost savings.

Long-term:

- Estimate net metering for the campus to enhance energy efficiency.
- Set up net-zero targets for to utilize maximum on-site renewable energy

  a) 100% of on-site renewable energy utilization by 2030

  b) 50% of campus energy requirement met by Renewable energy on-site and off-site by 2035

  c) 100% of campus energy requirement met by Renewable energy on-site and off-site by 2035

- Generate off-site revenue (net-metering) by installing on-site renewable energy systems. Assess potential, calculate production, and negotiate renewable power purchase with vendors. Ensure grid connection, maintain systems, and market benefits.
- Identify off-site energy production investment opportunities – solar farms, wind farms, etc.
- Identify strategic technology and procurement partnerships fields of tidal and wind energy etc.

8.2. Transportation

Goal: Minimize vehicle-miles travelled to campus during commutes.

Immediate:

Continue to support the revitalized Bicycle share program run by the Sustainability Coordinator.

Medium-term:

Make use of a more effective ridesharing social network to help with carpooling for longer trips as well as daily commutes and to encourage the usage of EVs, place an EV charging station in prominent areas of the campus.

Goal: Minimize vehicle-miles travelled to campus during commutes.

Immediate:

All fossil fuel vehicles must be restricted at the IIT Madras gate. Within 24 hours or overnight, one can travel by bus or train; beyond 24 hours, one can fly; and within campus, one can explore by electric vehicle

Medium-term:

Develop a graphical and statistical program showcasing impacts due to various modes of transport for the same distance in terms of carbon emission.

This program will create awareness among the inhabitants about the carbon emissions associated with commuting.

Example: Estimating CO_2 emissions from
Chennai to Bangalore varies by mode of transport:

a) Car- Approximately 165 kg CO_2e for a patrol car and 115 kg CO_2e for a diesel car.
b) Bus- Around 90 kg CO_2e per person.
c) Train- Around 30 kg CO_2e per person for electric trains.
d) Flight- Around 210 kg CO_2e per person for a short-haul flight.

Long-term:

Digitalization of travel data, development of a tool to calculate carbon footprint, and examination of environmentally friendly transportation options.

Establish a staff incentive scheme for regular commuting and occasional business travel, and generate monthly data to ensure everyone's credentials can be reviewed.

8.3. Procurement and waste management

Goal: Sustainable sourcing and disposal

Immediate:

Sensitize on waste segregation at source
Sensitize on choice of packaging (paper vs plastic etc.) for goods procured

Medium-term:

Implementing a source waste segregation system at IIT Madras is a proactive step towards sustainable waste management. This system involves categorizing waste at its point of origin, such as offices, labs, and residential areas, into different streams like recyclables, organic waste, and non-recyclables.

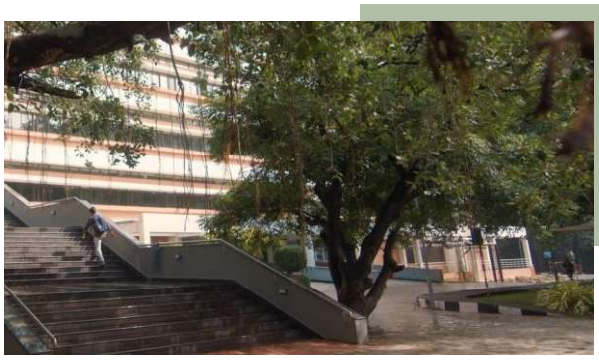
Color-coded bins and signage will be strategically placed across the campus to facilitate easy segregation and ensure compliance with the system. Implementing sustainable options for alternate procurement in a college campus involves sourcing products and materials that prioritize environmental conservation, resource efficiency, and reduced waste generation. One such example is replacing single-use milk packets with reusable glass bottles. By transitioning from disposable milk packets to reusable glass bottles, the college campus can significantly reduce plastic waste and environmental impact. Glass bottles can be washed, sanitized, and reused multiple times, minimizing the need for single-use plastics and promoting a circular economy approach.

Long-term:

Implementing a vendor onboard mechanism for incoming and outgoing goods with the following parameters:

a) Storage details-warehouse
b) Distance travelled in km
c) Vehicle type and model
d) Disposal practices

If a person travels 10 km per day to purchase goods using a gasoline-powered car with the assumed efficiency and emission rate, they would generate approximately 2.3 kgCO2 of emissions each day. This emission can be cut down by providing on-site facilities



Immediate:

An estimated 4000 members (staff, family) and 6000 students stay within the campus. With a fossil fuel ban for the students of the campus along with all amenities provided within, the estimated carbon avoidance is as follows:
Students - 6000 x 10kms/day x 250 days of avoided commute = 34,50,000 kgCO2 avoided
Staff Occupants - 4000 x 5kms/day x 365 days of avoided commute = 16,79,000 kgCO2 avoided

A total avoided emission estimate of 5129 tCO2 attributed to amenities and fossil fuel ban within the campus.

8.4. Curriculum and Research

Goal: Integrate climate action and learning together to create positive behavior change that reduces emissions among students, staff, and faculty alike, as well as campus visitors. In effect, evolve the campus into a "living laboratory" of sustainability.

Objectives:

The working group is not recommending specific objectives for Curriculum and Research at this time. The Working Group encourages the faculty to determine how best to integrate these issues into the academic program.

Goal: Become a shining light of sustainability and climate action in the region.

- Keep working together and establishing connections with institutions and groups nearby. Use these connections to your advantage for healthy competition, teamwork, and idea sharing.
- Send out invitations to locals and groups to interact with students, present their research or projects as visitors on campus, and work together for the good of all.
- increase the reach of campus programs into collaborations and instruction off campus.
- Coordinator to educate campus residents about their environmental impact and
- Establish volunteer sustainability leaders in campus offices and departments to bring about peer-to-peer sustainability education.
- Offer sustainability-related workshops for campus employees.
- Initiate behavior changes implement a sustainability pledge or dorm certification process.
- Renew sustainability in new student orientation and campus welcome to establish culture of accountability.
- Continue to coordinate with student groups to cooperate on campus events and efforts.
- Connect students with parents and alumni working in the fields of sustainability, renewable energy, climate change, environmental protection, and more.
- Find direct, meaningful ways for donors to the College to contribute to emissions reductions measures .
- Invite parents and alumni to sustainability programming or to be guest speakers, etc.

Year	Net equivalent consumption scope 1 and 2 emissions in kWh	Renewable energy production kWh	Short fall kWh	SOLAR PV Capacity required to neutralize Scope 1 and 2 emissions. MWp	Differential Capacity YoY to be added MWp
2023	4,23,18,481	36,00,000	3,87,18,481	24	24
2024	5,14,59,273	35,64,000	4,78,95,273	29	6
2025	5,96,92,757	35,28,000	5,61,64,757	34	5
2026	6,80,49,742	34,92,000	6,45,57,742	39	5
2027	7,62,15,712	34,56,000	7,27,59,712	44	5
2028	8,53,61,597	34,20,000	8,19,41,597	50	6
2029	9,56,04,989	33,84,000	9,22,20,989	56	6
2030	10,70,77,587	33,48,000	10,37,29,587	57	1
2031	11,99,26,898	33,12,000	11,66,14,898	58	1
2032	13,19,19,587	32,76,000	12,86,43,587	64	6
2033	14,51,11,546	32,40,000	14,18,71,546	71	7
2034	15,96,22,701	32,04,000	15,64,18,701	78	7
2035	17,55,84,971	31,68,000	17,24,16,971	86	8
2036	19,31,43,468	31,32,000	19,00,11,468	87	1
2037	21,24,57,815	30,96,000	20,93,61,815	88	1
2038	23,37,03,596	30,60,000	23,06,43,596	97	9
2039	25,70,73,956	30,24,000	25,40,49,956	107	10
2040	28,27,81,352	29,88,000	27,97,93,352	118	11

9. SUMMARY OF IMPLEMENTATION PLAN

- Decarbonization practices for construction and infrastructure upgrades aim to reduce energy consumption and emissions.
- Integration of building automation systems and digital metering enables efficient energy management and operational control across campus facilities.

- Digitalization initiatives include developing tools to calculate carbon footprints and exploring environmentally friendly transportation options.
- A staff incentive scheme for commuting is proposed, along with a graphical program showcasing carbon emissions from different modes of transport.

- Strategies include net metering, net-zero energy targets, and revenue generation through on-site renewable energy.
- Investments in tidal and wind energy technologies are suggested for long-term energy sustainability.

- Supporting a revitalized bicycle share program and restricting fossil fuel vehicles at the IIT Madras gate.
- Plans involve ridesharing networks, EV charging stations, and solar-powered roofs for upcoming buildings.

- Transitioning to reusable glass bottles from disposable milk packets at the college can drastically reduce plastic waste and environmental impact.
- Sensitization efforts focus on waste segregation at its source and the choice of eco-friendly packaging materials for procured goods.

10. ECOLOGICAL-STEWARDSHIP

"As stewards of the Earth, it's our duty to protect and preserve it. Let's embark on a journey of sustainability at IIT Madras, where every small effort counts"

At the Indian Institute of Technology Madras (IIT Madras), environmental harmony is pursued through a holistic approach to sustainability, surpassing the mere mapping of emissions. The institution's dedicated team endeavors to establish a symbiotic relationship with its surroundings and the broader environment. Through innovative initiatives and comprehensive strategies, IIT Madras aims to not only mitigate its ecological footprint but also actively contribute to the well-being of the ecosystem.

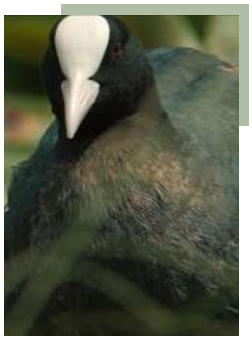
Habitat Restoration

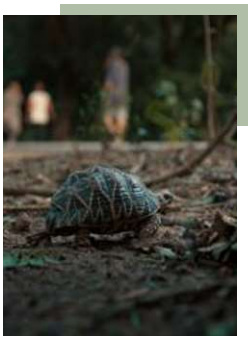
The IIT Madras campus is home to a diverse range of animals, both wild and domesticated. One can spot peafowls, Indian Pond Herons, Black-naped Hares, Common Palm Civets, and Indian Grey Mongoose roaming around the campus. The latest mammal addition is crocodiles residing in the rainwater lakes of the campus. The campus also has a deer park, where visitors can witness Indian Spotted Deer (220-270) and the endangered species, Blackbucks (60-70)

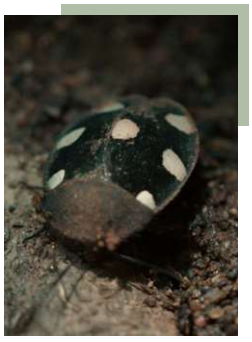
Native Species Reintroduction

IIT Madras is committed to reintroducing native plant species that have been lost or depleted from its campus over time. Through collaborative efforts with botanical experts and conservation organizations, the institution identifies suitable locations for reintroduction and propagation of endangered or threatened plant species. By reintroducing these species into their natural habitats, IIT Madras contributes to the restoration of local ecosystems and the preservation of biodiversity.

Selected Groups	Species observed	Species expected
Plants	298	350-400
Butterflies	50	50-55
Frogs and toads	8	09-10
Lizards	8	10-12
Snakes	4	15
Tortoise/Turtles	1	3
Birds	51	60-80
Mammals	12	20-25
Total	**432**	**517-600**





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