



**Indian Institute of Technology Kanpur**

**Sustainability Report 2023**



## Foreword from the Director



With immense pleasure, I present the IIT Kanpur Sustainability Report, a testament to our institution's steadfast dedication to fostering a sustainable future. At IIT Kanpur, we recognize the urgent challenges posed by climate change and environmental degradation, and we firmly believe that universities must take a leading role in addressing these pressing issues.

This report exemplifies the collective efforts of our faculty, researchers, students, and staff, who have tirelessly pursued pioneering research and innovative solutions in various sustainability-related domains. From developing cutting-edge sustainable technologies to advocating for

responsible waste management practices, these endeavors showcase our unwavering commitment to positively impacting society and the planet. We are committing all our resources to making our IITK Campus a **"Carbon neutral"** campus by 2030.

Central to IIT Kanpur's ethos is the belief that knowledge and expertise must be leveraged to address real-world challenges. As we strive for academic excellence, we remain equally dedicated to contributing meaningfully to global efforts toward achieving sustainable development goals.

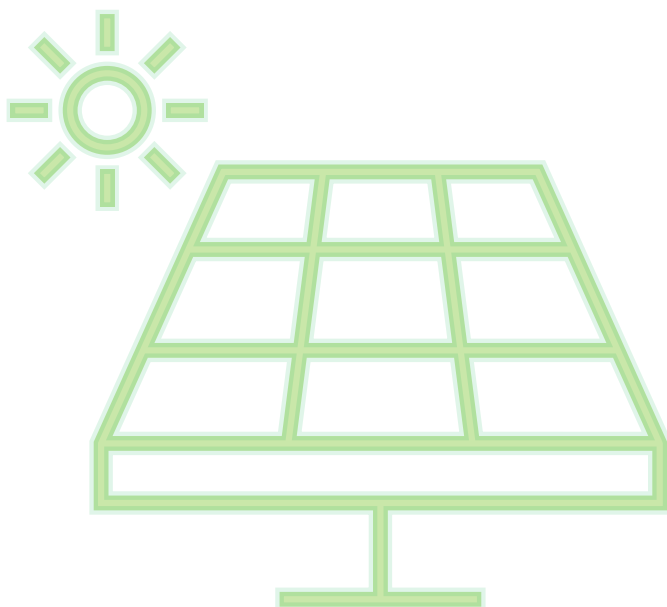
I commend the entire IITK community for their exceptional contributions and extend my heartfelt gratitude to all stakeholders who have supported and collaborated with us on this transformative journey. We will continue working to create a greener, more equitable, and sustainable world.

**Prof. Abhay Karandikar**  
*Indian Institute of Technology Kanpur*



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## Preamble

In our commitment to environmental stewardship and a sustainable future, the Indian Institute of Technology Kanpur (IITK) proudly presents this comprehensive Sustainability Report. Recognizing the significant impact of carbon emissions, water management, waste reduction, and energy efficiency, we endeavor to pave the way for a greener and more resilient tomorrow.

This report highlights IITK's efforts to assess and manage carbon emissions across its operations and activities, encompassing three crucial scopes: Scope 1, comprising direct emissions from sources like PNG usage, fuel consumption, and refrigerant leakages; Scope 2, covering indirect emissions from purchased electricity; and Scope 3, addressing indirect emissions related to procurement, travel, and waste management.

We acknowledge the role of academic institutions in contributing to global carbon emissions and affirm our dedication to driving positive change. By disseminating information on our current carbon footprint, we aim to raise awareness and foster a culture of sustainability within our institution.

Furthermore, this report delves into our initiatives to optimize energy consumption, harness renewable energy, and promote sustainable transportation. Our commitment to waste management is evident in various practices, including recycling, composting, and proper hazardous waste disposal. Moreover, we outline strategies to achieve water sustainability through conservation, recycling, and rainwater harvesting.

As an academic community, we recognize the significance of education and research in shaping a sustainable world. This report showcases our wide range of educational programs and research initiatives focusing on renewable energy, climate solutions, environmental engineering, and more.

We would like to acknowledge the support of the Chandrakanta Kesavan Centre for Energy Policies and Climate Solutions (CKCEPCS). Additionally, the active involvement of student bodies and startups underscores the dedication of the IITK community to promoting sustainable practices and innovative solutions.

Through this report, we reaffirm our dedication to continuous improvement and accountability in our sustainability journey. IIT Kanpur strives to inspire and collaborate with other institutions, government agencies, and stakeholders to collectively drive positive change for a greener and more sustainable planet.

# Current Carbon Emissions

IIT Kanpur is spread over an area of about 4.45 km<sup>2</sup> and like most of the lowland northern India, Kanpur has a monsoon-influenced hot semi-arid climate . The campus community consists of around 20,000 residents which includes current students, teaching and non-teaching staff and their family members. Carbon emissions due to our institute come from various sources, including, but not limited to, energy procurement, lab equipment & teaching aids, travel, waste management, and construction activities.

These are the emissions we, the campus community, generate through our activities:

- **Scope 1 (Direct Emissions):** Includes the direct emissions from sources owned or controlled by the institute. These emissions result from burning fuels on-site, operating institute-owned vehicles, and refrigerant leakages.
- **Scope 2:** Includes indirect emissions associated with the generation, transmission and distribution of the purchased electricity consumed by the institute.
- **Scope 3 (Indirect):** Includes all other indirect emissions due to the institute's activities not classified under Scope 1 or 2. These emissions can be attributed to activities such as the extraction, production, and transportation of purchased goods or services, business travel, employee commuting, construction and maintenance work undertaken on the campus, and waste disposal.

Type	Data		Amount	Unit	Emissions (tonnes of CO <sub>2</sub> eq.)
Scope 1	PNG		579,380	cu m	1170.35
	Fuel for Institute Vehicles & Diesel Generators	Petrol	3,170	L	7.41
		Diesel	23,960	L	64.69
		CNG	2,290	kg	5.81
	Refrigerant Leakage (Excluding CPs)	R22	450	kg	2,102.80
		R32	25	kg	
		R410	50	kg	
R134		5	kg		
Scope 2	Electricity Purchased		57,861,000	kWh	52,075
	On-site Solar Production		2,453,537	kWh	-
Scope 3	Procurement	Computers & Peripherals	<b>Collecting Data and calculating associated Carbon Emissions</b>		
		UPS Batteries			
		LAN Cables			
		Scientific Goods			
		Washer & Washing Machines			
		Laboratory Equipments			
		Laboratory Furniture			
		Chemicals			
		Consumables			
		Sports Items			
	Construction Work on the Campus		<b>Collecting Data and calculating associated Carbon Emissions</b>		
	Travel	Land Travel			
		Air Travel			
	Waste	Solid/ Cooked Food	4,229,940	kg	3,900.36
		Kitchen	4,25,746	kg	
Horticulture		3,470,400	kg		
Construction & Demolition		<b>Collecting Data and calculating associated Carbon Emissions</b>			
Hazardous					
Chemical					

Table 1: Carbon Emissions of the Institute for 2022

We adhere to the GHG protocol to calculate the institute's carbon emissions. Total carbon emissions for Scope 1 & 2 are estimated at **3,351 tonnes & 52,075 tonnes**, respectively; Scope 3 emissions are still being assessed. A significant source of carbon emission for the institute is the electricity purchased.

## Initiatives

### Energy

Energy consumption is the most significant contributor to carbon emissions from IIT Kanpur. Transitioning to renewable energy sources and improving energy efficiency are essential in reducing carbon emissions and mitigating climate change.

Renewable energy sources, such as solar, wind, hydroelectric, geothermal, and biomass, offer significant advantages over fossil fuels. We can significantly decrease carbon emissions by shifting away from fossil fuels and increasing the share of renewable energy in our energy mix. Also, we must reduce energy demand and carbon emissions by implementing energy-efficient measures in buildings, transportation, and appliances.

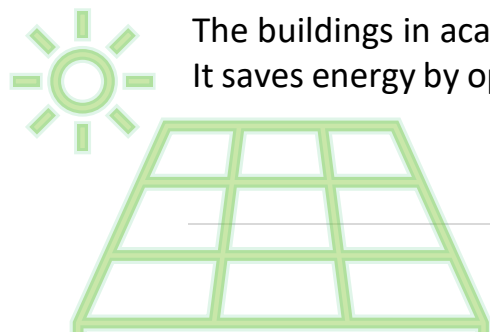
For the said purpose, IIT Kanpur has been actively promoting renewable energy and improving energy efficiency on its campus. The institute has undertaken various initiatives to reduce its carbon footprint and promote sustainable practices.

#### Current Initiatives

**Environmental Advisory Committee (EAC)** is a policymaking body on environmental issues and was constituted at IIT Kanpur in 2013.

#### Centralized Air Conditioning in Academic Area:

The buildings in academic area are cooled through the centralized air conditioning. It saves energy by optimizing cooling distribution, reducing redundant cooling units,



and improving temperature control. It allows for efficient energy use by using advanced technology and proper maintenance, resulting in a **40%** reduction in energy consumption and reduced greenhouse gas emissions.

### **Solar Water Heaters:**

Many Residential halls have installed solar water heaters. This renewable and sustainable technology reduces reliance on fossil fuels and significantly lowers energy consumption and associated carbon emissions.

**A solar facility:** of 200 KW was installed ( 150 kW at DJ and 50 kW at Environmental Engg). This is to continue the effort to move to cleaner energy sources.

### **Rooftop Solar:**

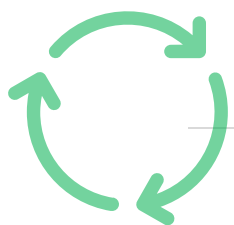
The campus presently has a Solar generation installation of capacity of 1 MW under CAPEX mode and 1.21 MW under RESCO Mode through Renew Power. Furthermore, a 0.4 MW PV system is being installed.



Solar Panel installation at the roof tops

### **Promoting bicycles for daily commute:**

The well-marked cycle paths run parallel to the roads and help in easy commute. Also, to commute within the campus the residents can avail a low-cost E-Rickshaw service.







Outside Lecture Hall



Low-cost E-Rickshaw service for campus residents

## Planned Initiatives

### Replacing CFL tube lights:

Many Lighting fixtures, especially in residential halls, use CFL tube lights. Recently the “Maintenance department” has decided on replacing the old CFLs, with new LED tube lights, on a maintenance priority basis. The replacement will help achieve about a **30-40%** reduction in lighting energy consumption across the campus.

### Expanding Rooftop Solar:

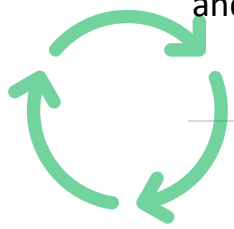
The installed Solar PV capacity is expected to increase significantly (**about 2-3 MW more**) as PV systems are planned to be installed in many rooftop spaces and other locations across the campus.

### NetZero Energy Building:

We plan to convert one of our existing buildings on campus to Net zero energy; this building will be off-grid and will be able to produce enough energy to complete its regular operation.

## Waste

A sustainable and healthy environment requires effective waste management. It encourages the wise use of resources, reduces the negative environmental impact, and promotes responsible consumption and production patterns. The objectives of



IIT Kanpur's waste management techniques are to effectively manage waste, minimise waste generation, promote recycling and reuse, and ensure proper waste disposal.

## Current Initiatives

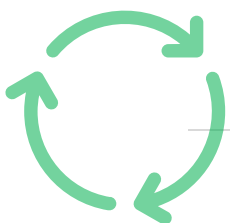
**An audit was done for all the waste generated @ IIT Kanpur:** The audit is the first step in creating the plan for a zero landfill IIT Kanpur campus.

**Waste Segregation:** Solid waste, food waste, horticulture & kitchen waste, chemical waste, and E-waste are segregated across the campus.

**Solid Waste/Cooked Waste:** As per the recent statistical data for 2022, this mode of waste collected from households, hostels, and the rest of campus is about **4,200 tonnes**. The solid waste is given off to *M/s. JTM Services Pvt. Ltd*, a government-approved vendor.

**Kitchen Waste:** This mode of waste is about **100 tonnes** from households and **325 tonnes** from hostels, as per the 2022 data. *Agnys Waste Management*, an IIT Kanpur incubated startup, composts the kitchen waste using the drum composting method. Each drum has a capacity of 200 kg, and it takes 20-22 days to complete one cycle. The compost thus generated is distributed free of cost among the campus residents.

**Horticulture Waste:** This mode of waste is about **3,470 tonnes** per year. IIT Kanpur produces vermin compost and leaf manure by collecting dry leaves, roots, grass, stems, kitchen waste, etc. The compost and manure are used in the nursery to nurture the soil. The tree woods are collected, segregated by the nursery, and auctioned by the State Office.





IIT Kanpur nursery

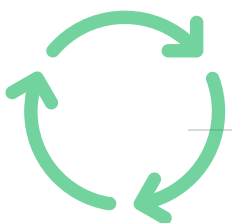


Agnys Waste Management Plant

**E-Waste and hazardous waste:** Various departments and halls collect and auction e-waste from academic areas and hostels, respectively. For residential areas, collection drives are held on every second Saturday of the month, in which residents can come and submit their hazardous waste items - like bulbs, batteries, electronics, broken glass, blades, scissors, mobiles, etc. - to the counters at a designated place which is then accumulated together and given to an authorised recycler once it reaches 2 tonnes.

**Chemical Waste:** Chemical waste is divided into three categories: *Chlorinated*, *Non-Chlorinated*, and *Solid*. Chlorinated and non-chlorinated liquid waste is collected in canes and later transferred to Master Bins kept at a Chemical Shed on the campus. Solid waste is also collected and dumped there. Later this waste is outsourced to ***Ranky Enviro Engineers Ltd.***, which works under the UP-Waste Management Project.

**Project Bhoomi:** In a significant development towards efficient waste management, Agnys Waste Management Private Limited, a SIIC (Startup Incubation and Innovation Centre) IIT Kanpur-incubated company, developed an automatic composting machine known as 'BHOOMI,' in collaboration with Imagineering Lab, IIT-Kanpur.



BHOOMI stands for Bio-composting of Horticulture and Organic waste into Manure Indigenously. Engineers India Limited supported the Research & Development of the device. The device has advanced features like carbon filters, shredders, air pumps, and solar panels, which systematically convert waste into manure in just 10-20 days. The process is more convenient and rapid than the conventional technologies.

## Planned Initiatives

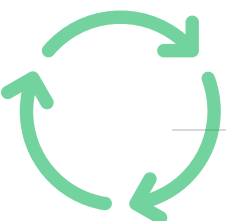
**Zero Landfill campus:** This initiative aims to convert our campus into a zero-landfill campus through a comprehensive and sustainable waste management initiative.

Key components of the plan include:

**1. Waste Segregation and Collection:** While segregating most wet and dry waste across the campus, we plan to further segregate plastics, glass, metals, and other materials at the source. This measure will lead to proper waste management and reduce human efforts.

**2. Waste-to-Energy Technologies:** We plan to set up a BIOGAS Plant on a zonal or central level on the campus to deal with all kinds of organic waste effectively. Until now, organic waste goes to composting, and the cooked food waste is handled in an unorganized and inefficient way. Installed effectively at various levels in IITK, we can use the biogas released from the BIOGAS plant as an energy resource and by-products of the treatment can be used as compost or manure.

**3. Collaborations and Partnerships:** We look forward to potential collaborations with NGOs that can help us recycle and reuse our dry waste to the maximum extent, such as discarded shoes, cardboard, tin boxes, etc., that usually go into the waste stream.



Waste management at the institute level is essential for environmental preservation, health and hygiene, resource conservation, sustainability education, cost-effectiveness, regulatory compliance, and social responsibility. Through the successful implementation of this project, the IIT Kanpur campus may serve as a model for other educational institutions and communities.

## Water

Water sustainability on campus is a vital aspect of environmental stewardship. It involves reducing water consumption, promoting conservation, and safeguarding management, including availability, quality, and distribution. These challenges are interconnected within the circular economy, emphasizing sustainability, and addressing fundamental water security issues.

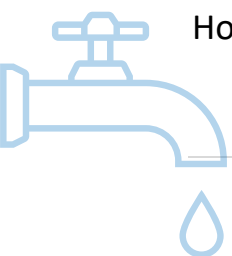
To achieve water sustainability, it is essential to focus on water conservation. This involves practicing responsible water consumption, implementing water recycling and reuse practices, and adopting strategies that minimize water waste.

### Current Initiatives

The water requirement for our campus is solely fulfilled by groundwater. We have ten tube wells, each approximately 1000 feet deep. The water is pumped from a depth of around 100 feet, as the groundwater level is reasonably good due to the amount of rainfall in Kanpur and the influence of the nearby River Ganges. This ensures a sufficient water supply for the campus.

Considering the large population of our campus, the water demand is high. The estimated consumption is **4 million liters per day (MLD)**.

To address wastewater management, IITK has a network of Sewage Treatment Plants (STPs) having a total treatment capacity of **1.35 MLD**. These plants play a crucial role in reducing the discharge of untreated water from the main campus. However, at present, we do not segregate greywater for recycling. The treated



wastewater from the STP is currently utilized for horticultural purposes, such as irrigation & gardening.



Oxidation Pond is a great place to spot birds.

While our campus treats wastewater and reuses it for non-potable purposes, there is room for further improvement. Implementing a system for the segregation and treatment of greywater and blackwater can enhance water sustainability and reduce the strain on freshwater resources. This segregation method would involve treating different types of wastewater separately, allowing for better resource management and potentially expanding the reuse of treated water in various applications.

**A water monitoring system:** with a dashboard was established at 32 locations to start a journey towards a water-neutral IIT Kanpur. This is the first step in creating a measurement system.



## Planned Initiatives

The existing water supply network at IITK is being analyzed to identify areas where improvements must be made. This analysis involves assessing the efficiency of the network, identifying any bottlenecks or areas of water loss, and exploring ways to optimize the system. The institute must ensure a more reliable and sustainable water supply by identifying and addressing inefficiencies.

**Measuring and Monitoring Equipment:** We plan to install measuring and monitoring equipment to enable regular checks on the water parameters, ensuring that the water supplied to the campus meets the required quality standards. Tracking the water quantity will also help identify potential issues, such as leaks or excessive consumption.

**Greywater Segregation:** The institute plans to implement the greywater segregation method from wastewater to promote water sustainability. Greywater refers to domestic wastewater generated from laundry, showers, and handwashing. This type of wastewater can be treated and reused for various purposes, including irrigating gardens and flushing toilets. Greywater typically makes up **50% to 80% of the total wastewater** produced by a building. Greywater is generally safer and easier to treat for non-potable uses than blackwater.

Common greywater sources include sinks, showers, baths, and washing machines. Since greywater is mostly free from pathogenic contamination, it can be repurposed effectively for toilet flushing and other non-potable applications.

Post-treatment, using greywater for toilet flushing is a practice that helps conserve freshwater resources. By repurposing greywater, the institute can reduce its dependence on potable water for non-potable uses, contributing to water conservation efforts and promoting a more environmentally friendly approach to wastewater management.



**Rainwater Harvesting:** The institute plans to expand the existing rainwater harvesting infrastructure on campus. Rainwater harvesting effectively collects and stores rainwater for various uses rather than allowing it to run into the wastewater stream. The process involves collecting rainwater from surfaces such as rooftops and directing it to a storage tank or reservoir for later use.

**Aerators and Self-resetting taps:** Implementing aerators and self-resetting fixtures can significantly contribute to water conservation efforts at IIT Kanpur. A faucet aerator, which mixes air with water, reduces water flow and pressure while maintaining a positive user experience. The institute can achieve substantial water savings without compromising functionality by installing aerators in all the new and old taps and incorporating self-resetting taps in upcoming buildings.

**Waterless Urinals:** The institute plans to study the feasibility of water-less urinals and implement them. Traditional urinals contribute significantly to water wastage, causing environmental, social, and economic problems. These urinals operate without water and utilise a special liquid or cartridge as a sealant to trap urine and prevent odours. Waterless urinals would help conserve water and offer several other benefits, such as reduced maintenance costs, improved restroom hygiene, and a positive environmental impact.

These planned initiatives demonstrate IITK's commitment to water sustainability. By monitoring water quality and quantity, analysing and optimising the water supply network, implementing greywater segregation, and adopting rainwater harvesting techniques, the institute aims to promote efficient water use, conserve resources, and contribute to a more sustainable campus environment.





# Academics

Along with becoming a more sustainable and carbon-neutral campus, IIT Kanpur also aims to educate its students, staff, and the community about the social, environmental, and governance aspects of sustainable development. Many of the institute's departments and centres are collaboratively working towards this aim.

## Department of Sustainable Energy Engineering

The department aims to contribute to the national vision of energy sustainability of meeting a large proportion of the nation's energy needs through new and renewable energy technologies in the future for better health of its citizens and energy security. It has partnered with Mehta Family Foundation (USA) and Rice University (USA) to achieve excellence in energy sustainability education, research, and technology development. Cutting-edge research is being done on various topics like Solar Photovoltaics, Solar Thermal, Wind Energy, Batteries and Supercapacitors, Fuel Cells, Electric Vehicles, Hydrogen and Alternative Fuels, Carbon Capture and Utilization, Smart Grids and Renewables Integration, Energy Policy, and Regulation, etc.

## Chandrakanta Kesavan Centre for Energy Policies and Climate Solutions (CKCEPCS)

This centre was established to assist policymakers with practical solutions to the problems of climate change. As a signatory to the Paris Climate Agreement, India must develop, adapt, and implement technologies to reduce emissions and grow sustainably. The centre aims to spearhead the development of technology and policy solutions to help India and the world combat climate change.



## **The Kotak School of Sustainability**

The school opened in partnership with Kotak Mahindra Bank in December 2023 aims to excel in sustainability education, research and innovation, technology development, entrepreneurship, and outreach. The school will spearhead the development of holistic end-to-end technology solutions for sustainable development for a healthy planet and species.

## **Centre for Environmental Science and Engineering**

The mission of this centre is to carry out high-quality, interdisciplinary research, leading to technology development and competency building in various areas related to environmental problems, thereby providing solutions to the Indian industry, medical professionals, and policymakers. Broad research areas include Water and Wastewater Treatment, Aerosol Properties and Regional Climate Change, Air Quality Modelling, and Management.

## **National Aerosol Facility**

The National Aerosol Facility is a multi-purpose facility for studying aerosol behavior under simulated conditions. IIT Kanpur successfully conducted its first artificial rain test under the supervision of this facility.

## **Academic Programs which lead to a degree in Sustainable Development**

1. Master of Technology (M.Tech.) in Sustainable Energy Engineering
2. Master of Science by Research (M.S.R) in Sustainable Energy Engineering
3. Ph.D. in Sustainable Energy Engineering
4. eMasters in Climate Finance & Sustainability
5. eMasters in Sustainable Construction Practices & Project Management
6. eMasters in Renewable Energy & e-Mobility



## Academic Courses covering various topics related to sustainable growth

#	Topic of the course	Offering Department	Level (UG/ PG)	Code
1	ENVIRONMENT AND SUSTAINABILITY	Civil Engineering	UG	CE212
2	ENVIRONMENTAL QUALITY AND POLLUTION	Civil Engineering	UG	CE311
3	QUALITY AND SAFETY IN CONSTRUCTION	Civil Engineering	UG/ PG	CE645 M
4	AIR POLLUTION AND ITS CONTROL	Civil Engineering	UG/ PG	CE666
5	SURFACE WATER QUALITY MODELING	Civil Engineering	UG/ PG	CE760 M
6	WATER SUPPLY AND WASTE WATER DISPOSAL SYSTEMS	Civil Engineering	UG	CE412A
7	ENVIRONMENTAL FLUID MECHANICS	Civil Engineering	UG/ PG	CE656
8	HUMANS, ENVIRONMENT AND SUSTAINABLE DEVELOPMENT	Civil Engineering	UG/ PG	CE663
9	ENVIRONMENTAL QUALITY & POLLUTION MONITORING TECHNIQUES	Civil Engineering	UG/ PG	CE668
10	SURFACE WATER QUALITY MODELING	Civil Engineering	UG/ PG	CE760
11	SOLID AND HAZARDOUS WASTE MANAGEMENT	Civil Engineering	UG/ PG	CE763
12	AGRICULTURAL SUSTAINABILITY AND CLIMATE CHANGE	Civil Engineering	UG/ PG	CE766
13	INTRODUCTION TO CLIMATE CHANGE ECONOMICS AND POLICY	Management Science	UG/ PG	MBA667
14	INTRODUCTION TO POLICY MAKING	Management Science	UG/ PG	MBA669
15	SOCIO-POLITICAL AND ETHICAL ASPECTS OF BUSINESS	Management Science	UG/ PG	MBA617

16	SUSTAINABLE DEVELOPMENT FOR BUSINESSES	Management Science	UG/ PG	MBA72 5M
17	DERIVATIVES & RISK MANAGEMENT FOR THE ENERGY AND ENVIRONMENTAL MARKETS	Management Science	UG/ PG	MBA78 4M
18	ECONOMIC GROWTH AND GEOPOLITICS	Economics	UG/ PG	ECO715
19	EMPIRICAL METHODS IN HEALTH ECONOMICS AND PUBLIC POLICY	Economics	UG/ PG	ECO717
20	AGRICULTURAL ECONOMICS	Economics	UG/ PG	ECO718
21	ENVIRONMENTAL ECONOMICS LEGISLATION AND SOCIAL IMPACT	Economics	UG/ PG	ECO747 A
22	SOLAR PHOTOVOLTAIC TECHNOLOGIES	Electrical Engineering	UG/ PG	EE615
23	PHOTONIC NETWORKS & SWITCHING	Electrical Engineering	UG/ PG	EE646A
24	SMART GRID TECHNOLOGIES	Electrical Engineering	UG/ PG	EE679A
25	ENVIRONMENTAL SOCIOLOGY	Humanities & Social Sciences	UG/ PG	SOC475
26	SOCIOLOGY OF ENVIRONMENT	Humanities & Social Sciences	UG/ PG	SOC742
27	PSYCHOLOGY OF WELLBEING	Humanities & Social Sciences	UG	PSY470
28	CONTEMPORARY APPLICATIONS OF SOCIAL DEMOGRAPHY	Humanities & Social Sciences	UG	SOC476
29	DISASTER MENTAL HEALTH	Humanities & Social Sciences	UG/ PG	PSY794
30	HUMAN RIGHTS THEORY AND PRACTICE	Humanities & Social Sciences	UG	SOC486 A
31	LAW AND SOCIAL CHANGE	Humanities & Social Sciences	PG	SOC757
32	SOLAR ENERGY TECHNOLOGY	Mechanical Engineering	UG/ PG	ME645
33	ALTERNATIVE FUELS & ADVANCE IN IC ENGINES	Mechanical Engineering	UG/ PG	ME690

34	ELECTRONIC AND METALLURGICAL WASTE RECYCLING	Material Science & Engineering	UG/ PG	MSE662
35	INTRODUCTION OF BIOMATERIALS	Material Science & Engineering	UG	MSE204 A
36	PHYSICS OF ENERGY MATERIALS	Sustainable Energy Engineering	UG/ PG	SEE602
37	INTRODUCTION TO BIOENERGY AND BIOFUELS	Sustainable Energy Engineering	UG/ PG	SEE608
38	SUSTAINABLE ENERGY AND ENABLING NET ZERO EMISSIONS	Sustainable Energy Engineering	UG/ PG	SEE622
39	DESIGN STRATEGIES FOR NET-ZERO ENERGY BUILDINGS	Sustainable Energy Engineering	UG/ PG	SEE624
40	ELECTRIC VEHICLES	Sustainable Energy Engineering	UG/ PG	SEE627
41	ENERGY, CLIMATE CHANGE & SUSTAINABILITY	Sustainable Energy Engineering	UG	SEE211
42	AN INTRODUCTION TO SUSTAINABLE ENERGY TECHNOLOGIES	Sustainable Energy Engineering	UG/ PG	SEE605
43	HYDROGEN ENERGY: PRODUCTION STORAGE AND UTILIZATION	Sustainable Energy Engineering	UG/ PG	SEE607
44	SOLAR PHOTOVOLTAICS	Sustainable Energy Engineering	UG/ PG	SEE613
45	WIND ENERGY	Sustainable Energy Engineering	UG/ PG	SEE614
46	SOLAR THERMAL ENGINEERING	Sustainable Energy Engineering	UG/ PG	SEE615
47	RENEWABLES INTEGRATED SMART POWER SYSTEMS	Sustainable Energy Engineering	UG/ PG	SEE616
48	ECOLOGICAL PRINCIPLES AND BIODIVERSITY FOR SUSTAINABILITY	Sustainable Energy Engineering	UG/ PG	SEE626 M
49	POLICY PROCESSES AND ANALYTICAL METHODS:	Sustainable Energy Engineering	UG/ PG	SEE628

	APPLICATION TO CLIMATE POLICIES			
50	Essential Electrical Engineering for Renewables Integration	Sustainable Energy Engineering	UG/ PG	SEE616
51	Introduction to Sustainable Energy Policy	Sustainable Energy Engineering	UG/ PG	SEE617
52	Energy Efficient Building Design	Sustainable Energy Engineering	UG/ PG	SEE618

## **Workshops/ conferences/ FDPs on topics related to sustainable development.**

#	Topic of the workshop/ conference	Time period
1	Global Just Transition Network	01.06.2022 - 30.06.2023
2	Supporting the ICCC Studies and Actions	20.08.2022 - 10.10.2022
3	Strengthening Capacity at the District level on Air Pollution and Health	27.09.2022 - 01.10.2022
4	Regulatory Certification Program on Renewable Energy: Economics, Policy, and Regulation	07.10.2022 - 23.10.2022
5	Towards Sustainable and Resilient Power System	17.10.2022 - 21.10.2022
6	Mitigating Climate Change while Harnessing Renewable Energy	16.11.2022 - 25.11.2022
7	Workshop on Social Aspects of India Energy Transitions: Enablers, Barriers, and Opportunities	16.11.2022 - 17.11.2022
8	Capacity Building Program for Officers of CERC and JERCs: Regulatory Perspectives on Network, Renewable Energy and Market Development	03.02.2023 - 09.02.2023
9	India-UK symposium on Sustainability: Addressing the Water-Energy-Food Nexus	17.04.2023- 19.04.2023
10	Applications of Solar Energy Systems	22.05.2023 - 24.05.2023
11	Fundamentals of Energy Transition for Achieving Net-zero	01.06.2023 - 20.06.2023

12	Training on Net-zero Campuses	04.07.2023 - 05.07.2023
13	International Workshop on Sustainable Materials Development Energy & Environmental Applications	30.10.2023 - 02.11.2023
14	Sustainable Management of Tailings Storage Facilities	14.11.2023 - 16.11.2023
15	Carbon Neutrality & related Certifications	04.12.2023 - 05.12.2023
16	Sustainable Scale and Storable E-Fuels for Decarbonising Transport sector	07.12.2023 - 10.12.2023
17	Annual Day of the institute's Cell for Differently Abled Persons (CDAP)	13.01.2024
18	International Workshop on Sustainable Energy, Power, and Propulsion	19.01.2024- 21.01.2024
19	3rd Regulatory Certification Program on Renewable Energy: Economics, Policy, and Regulation	09.03.2024 - 24.03.2024
20	Delegation from University of Melbourne (discussions on Renewable Energy sources, Climate Change, Water Quality Monitoring, Remote Sensing)	08.04.2023- 12.04.2023
21	India Green Summit & Expo 2024	22.04.2024
22	ASIAN CONFERENCE ON GAS TURBINES 2024	21.08.2024 - 23.08.2024
23	Sustainable Production of Green Steel	16.09.2024 - 19.09.2024

### **Webinars on topics related to sustainable growth**

1. Pathways to a Net Zero Future: Contributions of Startups & Industries by Mr. Abhijeet Sinha, 13<sup>th</sup> March 2024.
2. Building a sustainable future by Prof. Priyanka Ghosh, 28<sup>th</sup> February 2024.
3. Integrating climate considerations into business strategies by Prof. Wasim Ahmad, 7<sup>th</sup> March 2024.
4. Sustainability as a business imperative: Balancing profit and purpose by Ms. Bhuvana Subramanyan, Mr. Ashok John, Mr. Mohaniraj Khodade, MR. Shekhar Sood, 4<sup>th</sup> February 2024.

5. ESG Risk Assessment: Identifying financial risks associated with environmental and social factors by Mr. Sanket Agarwal, Ms. Parvati Neelkantan, Ms. Neha Gupta, Mr. Seshadari Sevalgi, 3<sup>rd</sup> February 2024.
6. ESG Branding: Building a sustainable and socially responsible brand by Mr. Ankit Chaturvedi, Dr. Ram Manohar Vikas, Mr. Karan Rajpal, Mr. Milind Tapaswi, 3<sup>rd</sup> February 2024.
7. Predictive analysis for ESG by Mr. Bhupesh Sharma, 2<sup>nd</sup> February 2024.
8. Transforming waste flowers into sustainable leather to create a positive social impact by Mr. Gaurav Rawal, Research Scientist at Phool.Co, 13<sup>th</sup> January 2024.
9. Exploring the potential of drones in AgriTech, revolutionizing how we approach agriculture by Prof. Rajiv Sinha, 13<sup>th</sup> January 2024.
10. Harnessing technology to improve soil health, paving the way for a greener, more sustainable future by Mr. Rajat Vardhan, CEO - AgroNxt Services Pvt Ltd, 13<sup>th</sup> January 2024.
11. Some technological challenges and sustainable practices in agriculture by Dr. Anil K Rajvanshi, Director Nimbkar Agricultural Research Institute, 12<sup>th</sup> January 2024.
12. Sustainability in manufacturing systems by Dr. Amandeep Singh, 9<sup>th</sup> July 2022.

## Research

IIT Kanpur's research publications on sustainability span diverse disciplines, addressing climate change, renewable energy, waste management, and sustainable technologies. These cutting-edge studies offer innovative solutions to global challenges, fostering a greener and more sustainable future.

Some of the research at IITK focuses on the following aspects:

- Developing multifunctional hybrid nanostructures for energy and environmental applications; synthesizing nanomaterials through eco-friendly methods. Explore the charge transport properties of semiconducting materials to design efficient photocatalysts for wastewater treatment and investigate the potential of





nanostructured metal oxides as electrode materials for high energy/power density energy storage systems.

- Exploration of perovskite materials for photovoltaic applications, focusing on understanding film formation, composition/interface engineering, and device degradation to optimize the performance and reliability of perovskite solar cells.
- Developing sustainable energy conversion systems, including electrolysis, fuel cells, and batteries. Efforts revolve around enhancing these technologies' efficiency, durability, and cost-effectiveness to make them mainstream solutions for the future.
- Work on innovations like solar reflector/concentrator and PV panel dust deposition, heat transfer fluids for solar thermal systems, and simulations for turbulent fluid flow.

## Publications

Every year we publish 100s of papers in the field of energy materials, wind energy, solar energy, green solutions, photovoltaics, smart grids, waste management, renewable energy, climate & policy, and various other topics covering environmental, social and governance aspects of sustainable development.

## Student bodies at IITK

IIT Kanpur's student bodies for sustainability are e for their dedicated promotion of sustainability. Initiatives, awareness campaigns, and eco-conscious efforts set an inspiring example for a greener future.

1. **Sustainability Cell:** The Sustainability Cell, founded in early 2023, is an independent student body mentored by the Department of Sustainable Energy Engineering and supported by the Chandrakanta Kesavan Centre for Energy Policy and Climate Solutions.



The primary aim of the cell is to work in close collaboration with the institute's administration and the campus residents to make the campus more sustainable and healthier to live, study & work in. Also, to educate & engage the community on various issues and foster a culture of debate & discussion on the global polycrisis. (Website: [Sustainability Cell](#))

2. **IGBC Student Chapter:** The IGBC Student Chapter fosters student interest in sustainable development, green building, and conservation. It promotes eco-conscious professionals for a greener future through workshops and networking opportunities. (Web: [IGBC inaugural event](#))
3. **Prakriti:** Prakriti is dedicated to the environment and sustainability as a part of the Community Welfare Cell. Their mission is to inspire EcoEngineers, drive sustainable innovation, and raise climate change awareness for a greener future. (Website: [Prakriti](#))





Prakriti organized a Cleanliness drive on 9th April, 2023

## Startups incubated at IITK

IIT Kanpur's sustainability-driven startups showcase innovation and commitment to a greener future, inspiring positive change, and impactful solutions for environmental challenges.

### List of Startups

**Agnys Waste Management Private Limited:** The company is making a "Bio-composting of Horticulture & Organic waste into Manure Indigenously (BHOOMI)" composter. The composter has Carbon filters, Solar panels, Air pumps, Shredders, Mixers, and Separate liquid & solid waste compartments to ensure odourless, aerobic, eco-friendly, and rapid composting.

**Baud Resources Private Limited:** Baud Scientific Resources is working in the domain of Energy Storage space. The company has two proprietary products, DeepStorage Technology, and wind-train technology.



**Climec Labs:** The Climec Startup is a climate tech-based startup trying to revert and fix the damage caused to our environment due to Climate change and Global warming. They specialise in carbon capture and have made a unique domestic air purifier which creates a hyperlocal clean air zone by not only filtering air off its harmful components like bacteria, viruses, Particulate matter 2.5 and 10, VOC and other pollutants but at the same time produces oxygen worth of 22 trees and sequesters six trees worth of carbon-dioxide and holistically ameliorates the quality of air inside your house. It comes with more unique features that offer a bunch of useful value propositions to the customers.

**Cultech Wave Private Limited:** The company is a creative and cultural enterprise that aims to strengthen heritage education through content, Olympiad, excavation kits and virtual experiences.

**Cycle Spirit Private Limited:** Cycle Spirit is building low-cost, affordable electric bicycle and tricycles.

**Deusent:** Green hydrogen production

**Earthface Analytics Private Limited:** Earthface Analytics have developed a device for analysing and monitoring water quality through an easy-to-use colourimetric test strip based on smartphone technology that screens multiple important water quality parameters in less than 2 minutes.

**Green Trek:** Green Trek is an eco-friendly brand focusing on resource efficiency. It strives to positively impact the planet through smart ways of recycling steel waste. It does this through innovative melting processes where GHGs are minimised, the environment is safeguarded, and a circular economy is implemented.

**IAP Media:** India Action Project is a collection of young Indians trying to unlock Bharat's social, economic, and political potential. The civic-tech startup is on a mission to solve the most pressing issues using technology and data. The entity



developed a Jan Sampark App, with the help of which they are trying to make public welfare schemes accessible and hassle-free for all.

**Jalconserve Technologies Private Limited:** The company has developed an on-site, low-cost, sustainable solution for recycling residential greywater.

**Jivoule:** Bio CNG production from organic biomass

**Kritsnam Technologies Private Limited:** Kritsnam Tech has developed a cost-effective infrastructure for low-power, long-range RF-based wireless communication systems that will enable continuous real-time monitoring in the rural landscape for smart irrigation, education, health, smart grids and hydrological research and efficient water resource management.

**LCB Fertilizers:** It is a farming company. Their flagship project is NavyaKosh, a high yield organic fertilizer. Farmers using this fertilizer need less water and fertilizer to grow their crops, which reduces investment and increases farmer revenue.

**Offgrid Energy Labs Private Limited:** Offgrid is building novel, cost-efficient & sustainable batteries for utility & mobility markets. Its first product, 'ZincGel® battery', is packed with breakthrough innovations that enable it the performance of lithium-ion at one-third the cost, creating a disruptive impact on target markets.

**Oxy Neuron India Private Limited:** The company makes "The Lipon Inverter," a new and innovative device that helps store electricity and reduce carbon footprint. The company manufactures an optimum quality assortment of Solar AC, Solar Water geysers, Solar fridges, Solar Water pumps, and Solar generators.

**Pi Hemp Private Limited:** Pi Hemp provides zero-waste, sustainable alternatives to petrochemical plastics using the power of industrial hemp. Being anti-bacterial and biodegradable, it has potential applications in medical devices, healthcare products,



dental office equipment, packaging solutions, the sports industry, and 3D printing filaments.

**Prayas Environment system:** Prayas is an environmental management solution provider company with a CEMS approach, while Plasma provides solutions for Plastic Waste (PW) with plants supplied in India and Europe. They convert the IW as a resource with a solution that fits the circular economy with technological intervention to close open loops of the environment. Currently, for PW they have developed a decentralised solution for a plastic waste processing modular facility with financial viability. This unique approach is viable locally for plastic waste with global applicability. This is currently at the Validation stage. This solution can potentially resolve the global menace of plastic – on land/water generated/accumulated.

**Virya Paramita Energy Private Limited:** Virya Paramita is developing a wave energy-based desalination technology for harvesting wave energy for seawater desalination (producing freshwater).

## **Community Outreach:**

### **a. MOU signed with MES Jhansi to help them become carbon neutral; various tasks carried out so far are:**

- Two hands-on training sessions were conducted.
- We plan to do a land availability audit to help them create a solar power system.
- We are working with them to create two IBGC platinum-rated buildings (one hospital and one officers' building).
- Discussions are underway to help them create a net-zero energy, net-zero water and waste building at Jhansi.



**b. MOU signed with MES Lucknow to help them become carbon neutral; various tasks carried out so far are:**

- One training session was conducted for the whole cantt.
- A proposal was submitted to make a DPR for them to become carbon neutral.
- Plan to work on three buildings this year to reduce the EPI of those buildings by > 30%.

**c. MOU signing underway with ALIMCO, Kanpur to be their carbon-neutral partners.**

**d. Training conducted at HAL, Kanpur.**

**e. Training conducted at IGBC, Lucknow.**

## **Concluding Statement**

In conclusion, the IIT Kanpur Sustainability Report reflects our institution's unwavering commitment towards creating a greener and more sustainable future.. Through collective efforts and innovative solutions, we plan to take significant strides in addressing climate change, managing carbon emissions, conserving water resources, and promoting responsible waste management. Our dedication to academic excellence, research, and partnerships will continue to drive positive change for a more resilient planet as we move forward.

One of the first steps is expanding renewable energy capacity, particularly Solar PV. Moreover, our commitment to sustainability goes beyond energy generation. We are resolute in making a tangible difference in building operations as well. We pledge to transform at least one of our buildings into a net-zero energy structure. Through innovative design, energy-efficient technologies, and smart practices, we aim to ensure that the energy consumed by this building is entirely offset by renewable energy generation. Our third major step will be becoming a Zero Landfill waste campus.



We aim to stand at the forefront of sustainability, inspire others to follow suit and create a lasting positive impact on society, the environment, and future generations. We hold the key to shaping a better, more sustainable future.

**“ We are committed to making our campus a Carbon neutral campus by 2030.”**

