PLAKSHA UNIVERSITY

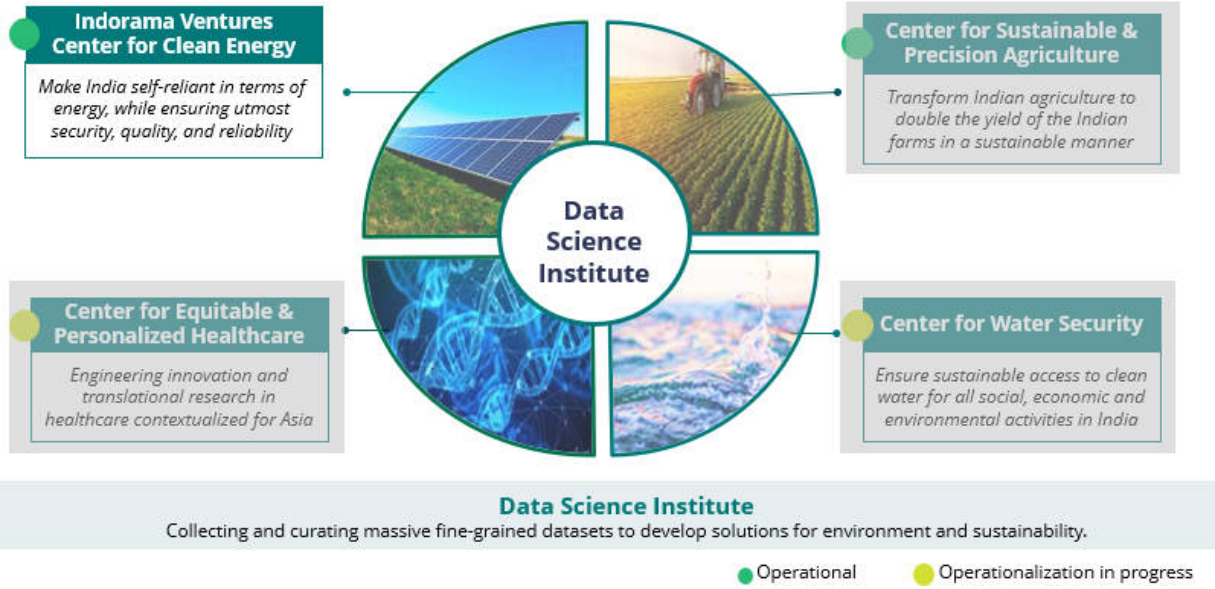
Indorama Ventures Center for Clean Energy

ANNUAL REPORT

FY 2023-24

Introduction

Indorama Ventures Center for Clean Energy (IVCCE) at Plaksha was set up to lead the clean energy transition through education and research. The Center aims to operate at the intersection of energy and digitalization to enable scalable, sustainable, and affordable clean energy solutions and develop industry-relevant professionals and entrepreneurs. It is guided by an advisory committee consisting of international experts from academia and industry.



Vision

Envisioning a future where India's energy sector is characterized by d**ecarbonization, self-reliance,** and **grid security,** providing **clean** and **secure energy to all.**

Mission

To support India's transition to a **net zero-carbon, self-reliant, and energy-secure future** and contribute to the global effort in reducing carbon emissions through interdisciplinary **research,** industry and government **partnerships,** and public **awareness campaigns** on clean energy.

From the Director's Desk

Prof Vishal Garg

University Chair Professor
Dean Research and Director
Indorama Ventures Center for Clean Energy
Plaksha University

I'm pleased to present our Financial Year 2023-24 report, providing an overview of the Center's activities, achievements, and future endeavours.

I extend my heartfelt gratitude to Indorama Ventures for their invaluable support in laying the foundation of the Center. Their trust in our vision brought the Indorama Ventures Center for Clean Energy (IVCCE) to fruition at Plaksha University. We are committed to honouring this trust by establishing the Center as a hub for interdisciplinary exploration, dedicated to spearheading the transition to clean energy through education and research.

At the Indorama Ventures Center for Clean Energy, our focus is on making a tangible impact in the realm of energy efficiency and decarbonization. We believe that combating climate change demands swift action towards cleaner energy solutions, which is why we prioritize advanced research. Our approach isn't just about technological advancements; It's about ensuring that these solutions are economically feasible, culturally relevant, and supported by strong policy frameworks.

To tackle the complexity of these issues, we encourage an interdisciplinary approach, considering every facet of the problem at hand. We are proud to foster an environment where undergraduate students are not just encouraged but are actively engaged in research through the seamless integration of the ILGC program. This proactive approach and immersive learning environment inspire students to tackle real-world challenges confidently and effectively from the get-go.

In its year of establishment, our focus at the center was on building both infrastructure and our team. We set up laboratories to facilitate our research endeavours and assembled a team of nine full-time researchers who remain deeply committed to their areas of study.

Over the past year, the Center has been engaged in several diverse and impactful activities. From surveying and monitoring homes for energy consumption and efficiency to studying the microclimate of the Plaksha Campus and developing tools for simulating building energy consumption for early design and exploring district cooling solutions.

On the policy front, we've been actively engaged

in assisting various state governments in formulating policies to mitigate urban heat island (UHI) effects. We've collaborated closely with organizations such as Bureau of Energy Efficiency (BEE) and Indian Society of Heating, Refrigerating and Air Conditioning Engineers (ISHRAE) in crafting the development of the Energy Conservation and Sustainability Building Code (ECSBC). Additionally, our efforts have led to a case study on district cooling and the performance evaluation of cool roof on unconditioned building.

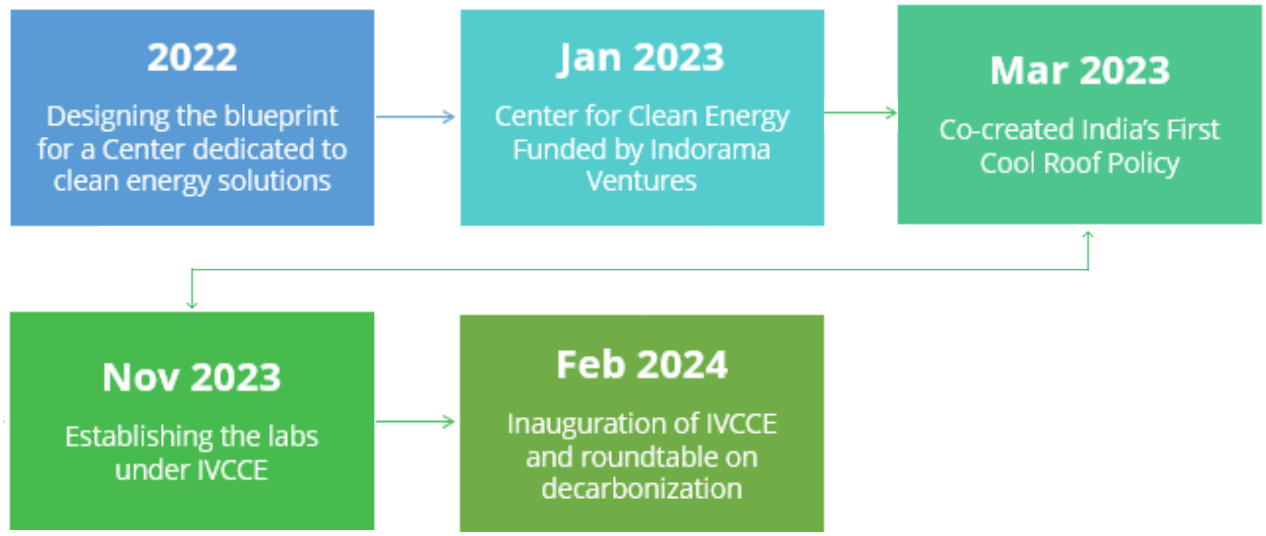
The team at the Center has made substantial strides in research dissemination, leading to several publications both at the national and the international level that establish our presence in the academic community. The major achievement was the launch of the Telangana Cool Roof Policy, which was supported by the Center.

As we move forward, our Center envisions transforming our campus into a living lab with a smart microgrid. Our primary focus remains on decarbonizing residential energy consumption and making our cities cooler for better liveability and reduced energy consumption.

Continuing our dedication to research, we will persist in our efforts and work towards Urban Heat Island (UHI) mitigation alongside smart grids, smart homes, building energy simulation, and district cooling. Through these endeavours, we aim to make an impact at the societal level.

I sincerely thank all our team, collaborators, and supporters. I extend a heartfelt invitation to all stakeholders to join us in our pursuit in transitioning towards clean energy, ensuring an equitable and just transition in every step of the way.

IVCCE has made substantial progress: the journey so far



Plaksha's Foundation Day and Inauguration of Indorama Ventures Center for Clean Energy

Over 200+ individuals, including prominent industry leaders, founders, faculty, researchers, students, and supporters, commemorated the inauguration of Indorama Ventures Center for Clean Energy on the Foundation Day, February 17, 2024.

Team

In 2023, the Center proudly built a dynamic and multidisciplinary team of experts. The diversity of our team's skills and knowledge is a testament to our commitment to interdisciplinary research and innovation in the field of clean energy. At Plaksha, faculty members are encouraged to engage in cross-disciplinary endeavours by associating themselves with one or more research centers. This approach has enabled us to assemble a team with a rich tapestry of expertise, not only in clean energy but also in related disciplines that contribute to the development of comprehensive solutions.

As we continue our journey in 2024, we are excited to further expand our team and continue fostering a collaborative and innovative research environment. We remain committed to tackling some of the most pressing challenges in clean energy and sustainable urban living, driven by a team that is as diverse as the problems we aim to solve.

In the year 2023, the following faculty members and researchers were associated with the Indorama Ventures Center for Clean Energy:

Faculty

Vishal Garg
Professor & Director
Smart Buildings,
UHI Policy, District Cooling
Ph.D IIT Delhi

Areas of interest: Building energy informatics, smart energy homes, cool surfaces for Urban Heat Island (UHI) mitigation, decarbonizing residential AC energy consumption.

Shashikant Pawar
Assistant Professor
Urban Heat Island and
Microclimate Studies
Ph.D IISc Bangalore

Areas of interest: Buoyancy driven (environmental) turbulent flows, Fluid dynamics and heat transfer of Bio-inspired systems, Light propagation in turbulent media.

Anupam Sobti
Assistant Professor
Geospatial and Embedded
Perception, **Ph.D IIT Delhi**

Areas of interest: UHI studies, Low-cost health diagnostics, Smart Agriculture, Sustainability Sensing for buildings, rivers, and forests.

Vivek Deulkar
Assistant Professor
Smart Grid Optimization
Ph.D IIT Bombay

Areas of interest: Managing renewable uncertainties via battery storage systems, Stochastic modeling, Reinforcement learning, Machine learning, Control & Optimization.

Researchers

Aaina Dutta
Center Manager
Ph.D. TERISAS, Delhi
Energy Economics

Anand Sharma
Project Associate
Remote Sensing,
Microclimate Simulations

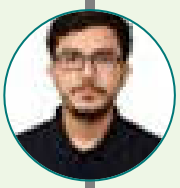
Madhan Kumar
Intern
Pursuing MS (R)
IIIT Hyderabad
District Cooling

Shishir Maurya
Research Fellow
Pursuing MS (R)
IIIT Hyderabad Smart
Home Energy Management

Sukanta Roy
Project Research Scientist
Ph.D. **IISc Bangalore**
Remote Sensing
Image analysis

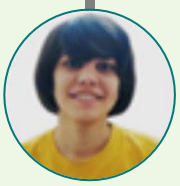
Amal Nair
Research Fellow
Energy efficiency and quality
of lighting system design
for buildings

Aviruch Bhatia
Senior Research Scientist
Ph.D. **IIIT Hyderabad**
Building Energy Simulation



Sahil Chilana
Intern
Pursuing MS (R),
IIIT Hyderabad SHEMS

Sraavani Gundepudi
Research Consultant
M. Arch. JNFAU Hyderabad
Cool Roofs



Varchita Lalwani
Research Assistant
Machine Learning and
Computer Vision

Visiting Researchers

Kopal Nihar
Stanford University
Occupant thermal comfort

Raj Gupta
MNIT Jaipur
Weather File Classification

Students

Chandan Yadav
Area of Interest:
Application of virtual reality in sustainable building design.

Arnab Dey
Area of Interest:
Non - intrusive load monitoring

Eshwar SK
Area of Interest:
Automatic controls for window blinds for energy & daylight optimization.

Saumya Chaudhary
Area of Interest: Control with gesture recognition.

Hriday Rathi
Area of Interest: Control with gesture recognition.

Shreevardhan Shah
Area of Interest: Control with gesture recognition

Progress in 2023-24: A Remarkable Inaugural Year

Research Highlights

In our inception year 2023, the Center aimed to establish itself as a hub of innovation and scholarly excellence. With a remarkably short timeframe, we initiated numerous research activities, all emphasizing our dedication to a multidisciplinary approach and the integration of diverse perspectives.

Throughout this year, our center has not only embraced the complexity of sustainable energy challenges but also celebrated the collaborative spirit that research demands. We have actively engaged undergraduate students in our research processes, fostering a dynamic learning environment that sparks curiosity and invites practical contributions to real-world issues.

Our projects this year, encompassed a wide spectrum, from developing Smart Home Energy Management Systems (SHEMS) to mitigating Urban Heat Islands (UHI). Each endeavour benefited from the combined expertise of our faculty, researchers, and students, spanning various fields of engineering, technology, and environmental sciences.

The research highlights of our founding year reflect a promising trajectory for the Center's future endeavours and its potential to influence and shape discussions on sustainable urban development. Below are some notable projects from our inaugural year.

a) Smart Home Energy Management System (SHEMS)

Over the past year, we conducted a detailed study in Hyderabad to understand residential electricity consumption patterns. We leveraged available device-level monitored data from 20 households, which was pivotal in identifying both household and appliance-specific consumption trends across seasons.

Our analysis generated electric load profiles for major household appliances. We observed that air conditioners, water heaters (geysers), refrigerators, and washing machines were responsible for approximately 60% of the total daily electricity usage. Notably, water heaters were utilized year-round, while air conditioners saw increased use during summer.

Additionally, we investigated the feasibility of shifting the operation of high-energy-consuming appliances to coincide with solar energy peak production times. This strategy aims to enhance the integration of renewable energy sources in meeting residential electricity demands.

In a subsequent phase, we initiated Smart Home Energy Management System (SHEMS) pilot installations in five households in Mohali. This preliminary step sets the stage for a more extensive study

focused on user engagement with energy feedback mechanisms. Our upcoming research will delve deeper into the intricacies of energy management in home environments.

b) Impact of Urban Heat Island Effect and Air Pollution on Tri-City Microclimate

In the thriving tri-city region, the microclimatic impact of urbanization has become increasingly evident. Our research in the past year has delved into the implications of the Urban Heat Island (UHI) effect and air pollution, two interlinked phenomena that significantly alter local climates. The focus will be to quantify and analyze how these factors modify temperature patterns, air quality, and overall livability within the tri-city area.

The UHI effect, a consequence of modern urban development, has led to elevated temperatures in urban areas compared to their rural counterparts. In conjunction with the growing concerns over air quality, this effect has the potential to compound environmental and health issues, demanding immediate scientific attention and action.

Our research aims not only to map and measure these changes but also to provide insights into mitigation strategies that could be employed to counter the adverse effects. By integrating data analysis, field measurements, and modeling techniques, we seek to offer a comprehensive overview of the current state and future trajectory of the tri-city microclimate. This work will lead to informing policy decisions and urban planning, ensuring sustainable development while enhancing the well-being of our communities.

i. Modelling of UHI

A study has been initiated with a focus on a modelling the Plaksha University Campus, with plans to subsequently expand the study to encompass the Chandigarh Tri-city. To validate the measurements, a series of simulations were conducted using the Envi-met tool on the campus model. Figure 1 shows the Plaksha campus model prepared for the validation. To acquire real-time weather data on-site, a weather station has been installed.

Additionally, work is underway to utilize satellite data for the creation of a comprehensive three-dimensional model of a sector in Chandigarh as part of the on going study.

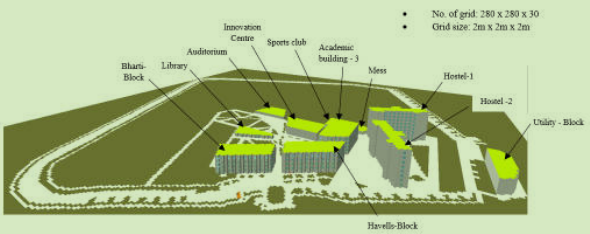


Figure 1 Isometric view of the Plaksha University model prepared in ENVI-met.

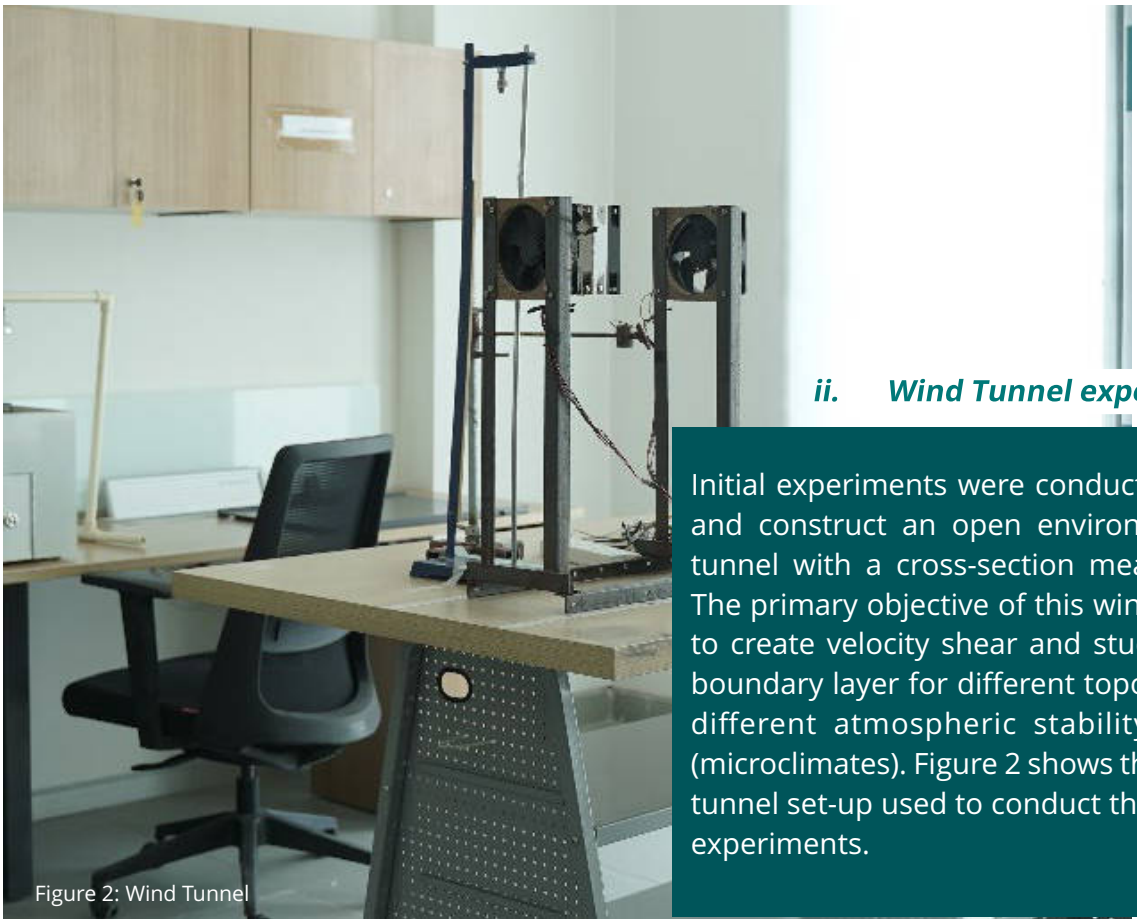


Figure 2: Wind Tunnel

ii. Wind Tunnel experiment.

Initial experiments were conducted to design and construct an open environmental wind tunnel with a cross-section measuring 2'x2'. The primary objective of this wind tunnel was to create velocity shear and study the urban boundary layer for different topologies under different atmospheric stability conditions (microclimates). Figure 2 shows the initial wind tunnel set-up used to conduct the preliminary experiments.

iii. Cool Roof Dashboard

The Center has developed a dashboard designed to monitor the adoption of cool roofs within urban areas. In this work, we have used satellite imagery to track the implementation of cool roofs. We have been developing a cool roof tracker that uses multi-spectral satellite imagery to determine if a building roof has been painted with reflective coating to implement a cool roof.

We extracted building boundaries using the Open Buildings dataset and built algorithms to classify them into cool/non-cool using the Planet-Scope dataset. Our methodology has proven effective, achieving an accuracy of 84% on the data evaluated thus far.

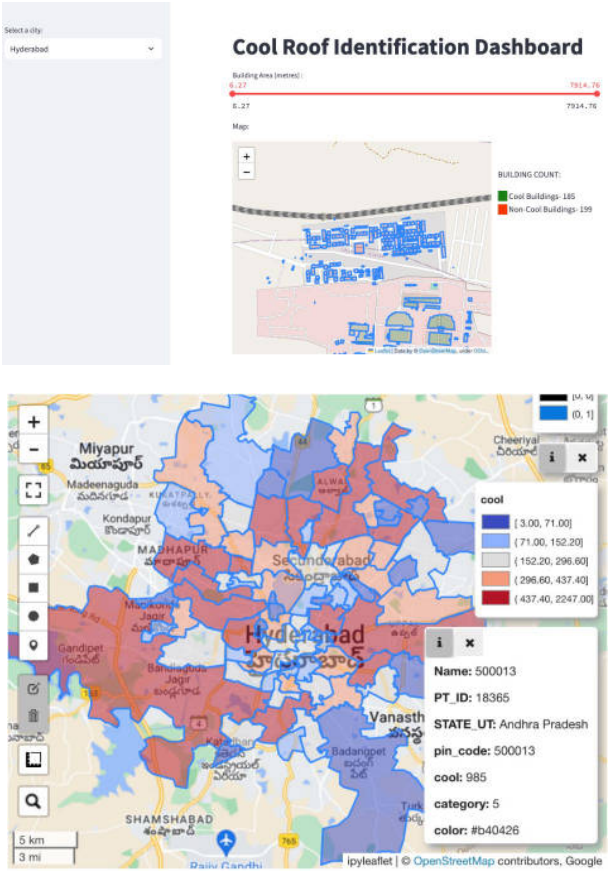


Figure 3 Cool roof identification dashboard

c) Building Energy Simulation

Building energy simulation is a critical process in achieving energy-efficient building design. It involves using specialized software tools to predict the energy usage of buildings, considering various factors such as climate, building design, construction materials, equipment efficiencies and usage. This predictive capability is essential for architects and engineers, allowing them to make informed decisions that improve energy efficiency from the earliest stages of design.

This past year, we concentrated on enhancing the early Design Optimization Tool (eDOT). We initiated the integration of virtual reality (VR) and energy simulation to provide an interactive design experience, enabling the visualization of energy flows and the impact of design alterations on a building's energy profile.

These advancements signify our commitment to reducing energy consumption in buildings, aligning with global sustainability goals, and paving the way for smarter building practices.

i. Enhancement of Early Design Optimization Tool (eDOT)

eDOT is a tool with an AI decision support system that provides useful strategies to make informed decisions for building energy efficiency in the early design stage. In the last year, our efforts were focused on investigating efficient clustering algorithms to generate design strategies for selecting low-energy solutions within the design space. Simultaneously, we've updated the backend input data files (idf) of eDOT to align with the most recent version of EnergyPlus. Figure 4 showcases the user interface of eDOT, and Figure 5 displays a sample output of the solution space using a parallel coordinate graph. This visual representation assists users in identifying the parameter ranges associated with energy consumption.

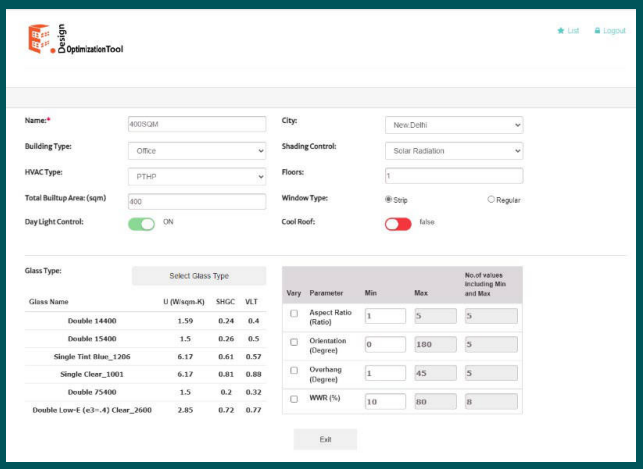


Figure 4 User interface of eDOT tool

ii. Building design with virtual reality

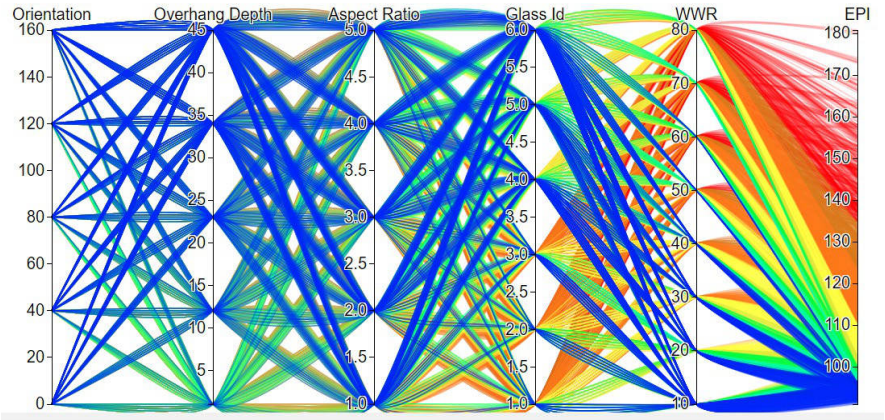


Figure 5 Parallel coordinate graph for all solutions

The exploration of virtual reality's potential in the realm of energy and daylight optimization for buildings is underway through the utilization of VR headsets. VR allows architects and engineers to experience the building from the perspective of its future occupants. To test and refine the concept, we are developing a digital twin of the IVCCE. This digital twin enables real-time exploration of diverse design options, considering factors like building orientation, window placement, and shading devices. We are evaluating the effects of these choices on energy consumption and daylighting within the virtual environment. Valuable insights from virtual walkthroughs can guide design adjustments for an optimal user experience.

Infrastructure Updates

Research laboratories are currently under development. The labs comprise studio areas for interactive and collaborative design and simulation, dedicated test chambers to evaluate thermal and visual comfort, as well as designated space for R&D in mechanical and electrical services of smart buildings and IoT devices.

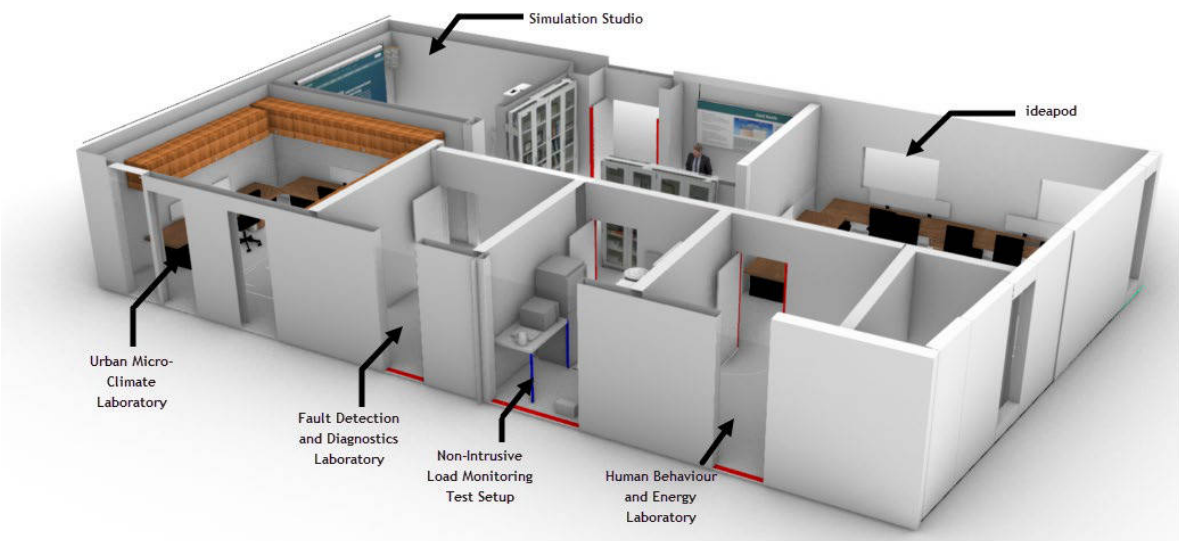
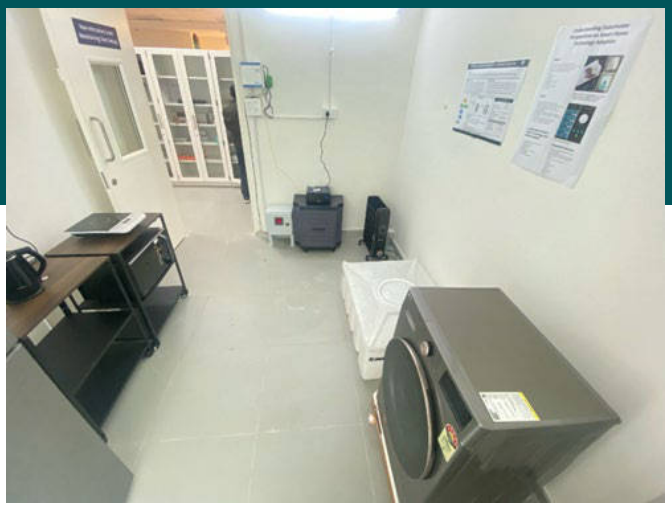


Figure 6 Different labs at IVCCE



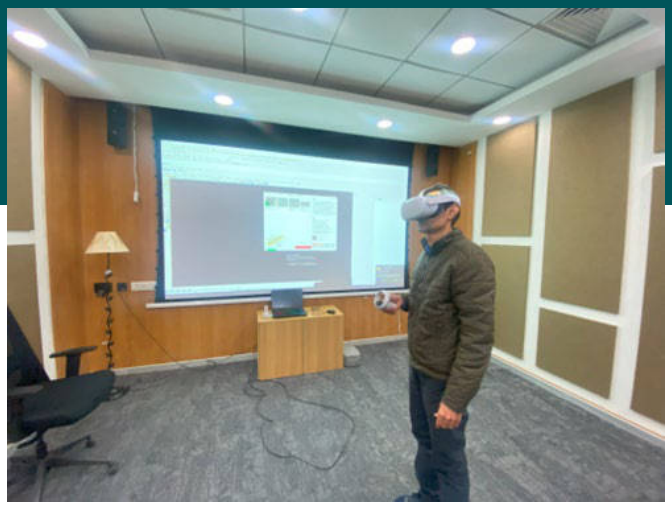


Figure 7 Infrastructure at IVCCE

Publication Highlights

While the infrastructure and laboratory were being established, faculty and researchers persisted in their endeavours and collaborative initiatives, resulting in a substantial number of publications. These publications cover diverse subjects, including the development of residential building archetypes, energy feedback studies, residential energy consumption analyses, and climate classification methodologies within the building energy efficiency sector. A significant portion of these publications stemmed from the sustained efforts of faculty and researchers building upon their prior research activities.

In addition to contributing to scientific journals and conferences, efforts are in progress to author the third edition of a workbook on energy simulation. The current workbook is used in several architectural schools as a teaching resource on energy simulation.

Further, our Center is actively engaged in academic conferences and workshops, sharing our findings and contributing to critical discussions on the future of clean energy and urban sustainability.

Some of the publication highlights are as follows:

- A baseline study for residential energy consumption using socioeconomic and physical building attributes was published. In this publication, an analysis of the energy consumption pattern of residential buildings in Jaipur, by utilizing a primary dataset (n=2327), was presented.
- In a study on summer electricity consumption and seasonal variations in households using load profiles, it was found that the air-conditioner was predominantly operated during nighttime around 11:00 PM and the highest usage was observed at 11:30 PM. A small peak in usage was observed during the day, while most of the consumption was concentrated during solar off-peak hours.
- A case study on air conditioning usage in a residential district cooling system, using operational data performed on 387 residences in Hyderabad with a DCS connection for chilled water supply. Operational data spanning three months across different seasons were assessed and published.
- A novel approach to climate classification utilizing agglomerative hierarchical clustering, aiming to enhance our understanding of environmental dynamics, was published.

- International Journals: 04
- National Journals: 02
- International Conference: 08
- Magazine Article: 02

Policy Support

The Center's team members have collaborated with a range of government and non-governmental organizations to assist in the development and support of various policies.

a) Energy Conservation and Sustainability Building Code (revised ECBC)

Energy Conservation Building Code, developed by the Ministry of Power, Government of India, and Bureau of Energy Efficiency (BEE) defines norms of energy performance for various building components to lower the building's energy requirement without affecting the function, comfort, health, or productivity of the occupants. The code underwent its last revision in 2017, and the Bureau of Energy Efficiency (BEE), intends to release an updated version in 2024, placing enhanced emphasis on sustainability aspects. One of the most significant aspects of this version is the incorporation of indoor environment quality measures for the first time. IVCCE researchers actively participated as members and chair of the sub-committee responsible for the revision of the chapter on lighting and controls.

We also contributed to the update of standard design case envelope reflectivity requirements and conducted thorough simulations to validate the newly proposed coefficient for modelling variable refrigerant flow systems in the standard design case.

Recognizing the impact of lighting on indoor environment quality and light pollution under sustainable sites, contributions have also been made to the chapters on Indoor Environment Quality (IEQ) and Sustainable Sites.

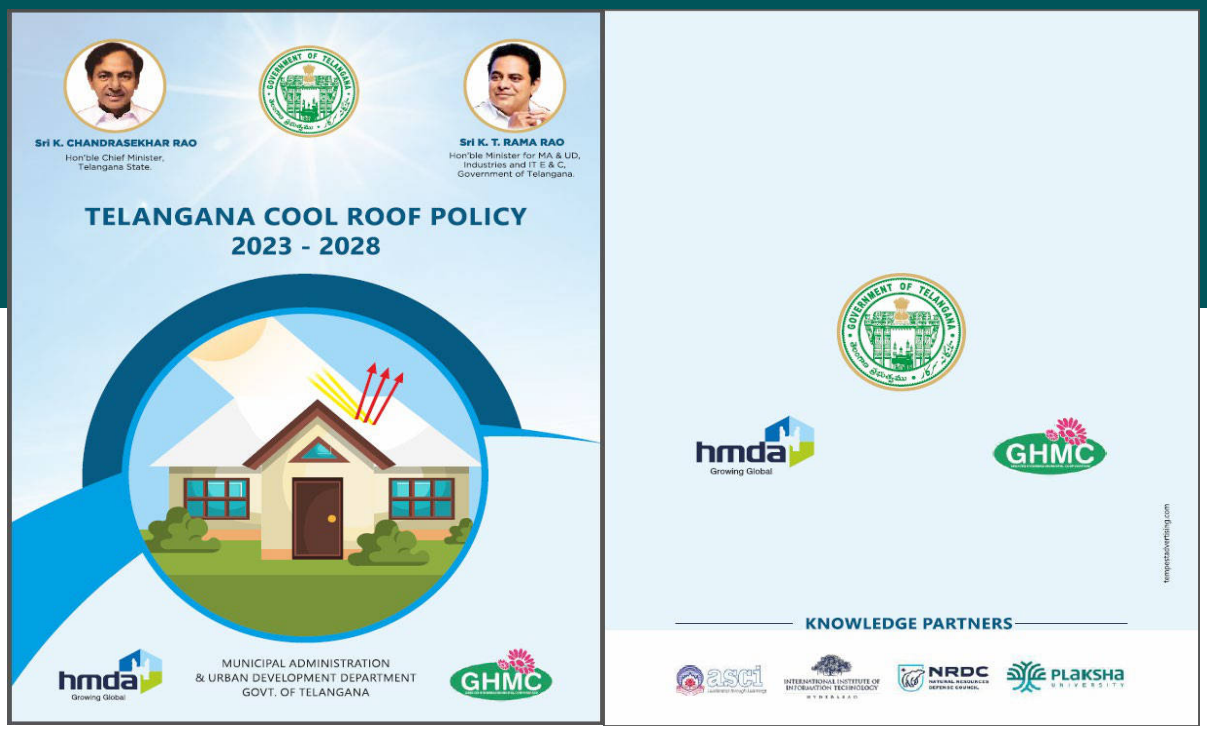
b) ISHRAE Indian Building Energy Performance Standard (IIBEPS)

Members from IVCCE introduced a new metric for measuring and assessing lighting energy performance. The new metric for lighting, increased adoption of occupancy and daylight sensor technologies are expected to reduce energy consumption and improve the energy efficiency of buildings in India.

c) Telangana Cool Roof Policy 2023-28

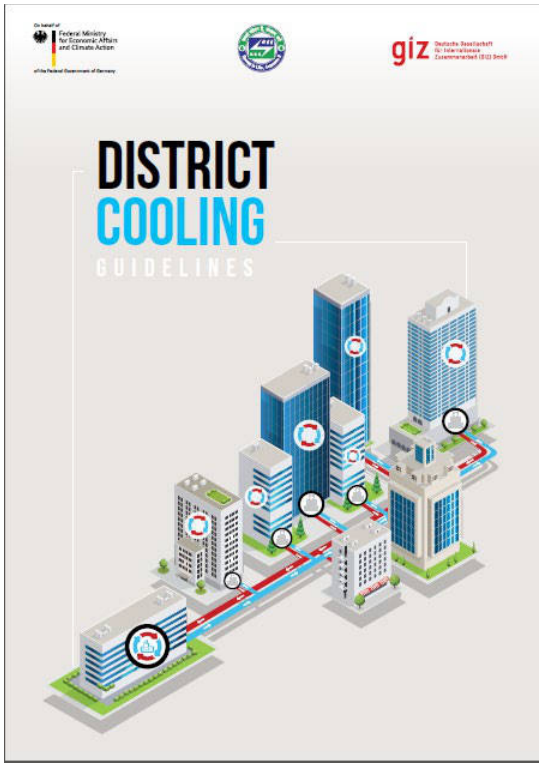
Telangana launched India's first Cool Roof Policy 2023-2028 on April 3, 2023, to promote the installation of cool roofing materials across the state. The Indorama Ventures Centre for Clean Energy helped formulate the policy and further assisting in developing a roadmap for implementation. The highlights of the policy are as follows:

- Target - 300 km^2 of roof area with cool roofs in the state (2023 – 28)
- This could save approximately 600 million Units (GWh) of electricity per year after five years of covering.
- This would lead to a one-time carbon offset of 30 million tCO_2.



d) District cooling

IVCCE Team at Plaksha developed a case study on district cooling system in India. The case study was covered in the district cooling guidelines.



9.2 DCS CASE STUDY 2: MY HOME ABHRA, HYDERABAD

My Home Abhra is a residential apartment complex in Madhapur, Hyderabad. The complex consists of 5 residential blocks, 18 floors each, with 5 apartments on each floor. The cooling requirements of the entire complex are met by a centralised air conditioning plant. The building is equipped with two water-cooled screw chillers of 450 TR each and one water-cooled screw brine chiller of 420 TR. Most of the time, one chiller is enough to meet the cooling requirements of the entire complex. Both chillers are used on a rotational basis based on a 15 day usage cycle. The brine chiller is used to charge a TES system of 3000 TR-h capacity that runs during low-demand days and power cuts. Each apartment has 7-10 indoor units (cassette/fan coil units) as per the size. Apart from homes, there are some common areas like the gym, shuttle court, multipurpose hall, etc. There are 9 CHW shafts to circulate chilled water from the plant to the indoor units of every apartment. For all apartments, chilled water tapping is taken from the respective shaft header through separate thermal energy (BTU) meters.

The building residents association owns, operates and maintains the DC System including the DCP and the distribution network. The indoor units belong to the respective apartment owners. There have been no tariff changes for cooling thermal energy consumption from the beginning i.e., 2015; however, the electricity tariffs have since then changed twice.

Figure 26: View of My Home Abhra, Hyderabad from Main Road

Events

1. Conference on AI in Clean Energy (CONFai):

The Center hosted a session on "The Software and AI-Driven Future of Renewables," followed by a panel discussion on "Intelligent Energy - The Impact of AI on Clean Energy. the three day academic event discussed the potential of AI and Data Science in finding effective solutions to societal change (via theory and AI applications such as, algorithms, data modelling, inference methods, privacy, computer vison, robotics, AI for water security).

The esteemed panel included luminaries such as Dr. Rajeev Rastogi from Amazon, Dr. Vivek Raghavan representing IndiaStack, Dr. Rohini Srivathsa from Microsoft, Dr. ShivKumar Kalyanaraman also from Microsoft, along with Parag Singla from IIT Delhi, Prasad Vaidya from Solar Decathlon India, Dr. Rohini Srihari from the State University of New York at Buffalo, Dr. Abinav Dhall from IIT Ropar, Dr. Siddharth Barman from IISc Bangalore, and Dr. Pratha Taludkar from Google Research, Dr. Shalini Sarin (Co-founder, Elektromobilit at Indiaamong other prominent experts.

2. Foundation Day: A Panel discussion on Just Energy Transition for All

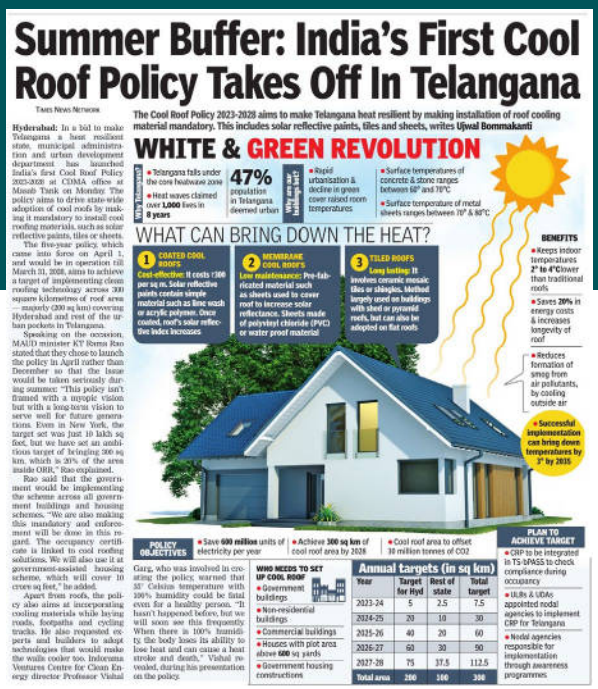
The panel discussion was conducted on 17.02.2024 where the thought leaders from industry and think tanks discussed the opportunities, challenges, and pathways towards a people-centred just energy transition.

The diverse panel comprised of Mr. Yashovardhan Lohia (Executive Director |Chairman of ESG Council, Indorama Ventures PC), Mr. Deepesh Nanda (CEO TATA-Power Renewables Energy Ltd.), Mr. Rahul Sahai (CEO- Kirloskar Oil Engines Limited), Dr. Satish Kumar (President-Alliance for an Energy Efficient Economy AEEE), Dr. Shalini Sarin (Co-founder, Elektromobilit at India |Board Member - Linde India, Automotive Axle, Kirloskar Oil Engines, Nagarro SE & ISM), Mr. Anirban Mukherjee (Managing Director and Partner BCG).

3. Roundtable: Innovative Approaches to Decarbonize India

The discussion brought together people from academia, industry, government, and think tanks including Tata Power Renewable Energy Limited, Ador Powertron, Linde India, Bharat Forge, Punjab Energy Development Agency, Blaze Automation Pvt Ltd, Nagarro, BCG, GIZ, and WRI. This discussion underscored the pressing need for focused research in critical areas such as assessing the urgency of action towards managing decarbonization for Indian entities, capability gaps to achieve net zero, global opportunities, and organizing ourselves across regulations and financing followed by the role and contributions of innovation and startups.

Media coverage



Summer Buffer: India's First Cool Roof Policy Takes Off In Telangana

Times News Network

Hyderabad: In a bid to make Telangana a heat resilient state, municipal administration and urban development department has launched India's first Cool Roof Policy 2023-2028 at CDMA office at Masab Tank on Monday. The policy aims to drive state-wide adoption of cool roofs by making it mandatory to install cool roofing materials, such as solar reflective paints, tiles or sheets.

The five-year policy, which came into force on April 1, and would be in operation till March 31, 2028, aims to achieve a target of implementing cleen roofing technology across 300 square kilometres of roof area — majority (200 sq km) covering Hyderabad and rest of the urban pockets in Telangana.

Speaking on the occasion, MAUD minister KT Rama Rao stated that they chose to launch the policy in April rather than December so that the issue would be taken seriously during summer. "This policy isn't framed with a myopic vision but with a long-term vision to serve well for future generations. Even in New York, the target set was just 10 lakh sq feet, but we have set an ambitious target of bringing 300 sq km, which is 20% of the area inside ORR," Rao explained.

Rao said that the government would be implementing the scheme across all government buildings and housing schemes. "We are also making this mandatory and enforcement will be done in this regard. The occupancy certificate is linked to cool roofing solutions. We will also use it at government-assisted housing scheme, which will cover 10 crore sq feet," he added.

Apart from roofs, the policy also aims at incorporating cooling materials while laying roads, footpaths and cycling tracks. He also requested experts and builders to adopt technologies that would make the walls cooler too. Indorama Ventures Centre for Clean Energy director Professor Vishal Garg, who was involved in creating the policy, warned that 35° Celsius temperature with 100% humidity could be fatal even for a healthy person. "It hasn't happened before, but we will soon see this frequently. When there is 100% humidity the body loses its ability to lose heat and can cause a heat stroke and death," Vishal revealed, during his presentation on the policy.

The Cool Roof Policy 2023-2028 aims to make Telangana heat resilient by making installation of roof cooling material mandatory. This includes solar reflective paints, tiles and sheets, writes Ujwal Bommakanti

WHITE & GREEN REVOLUTION

- Telangana falls under the core heatwave zone
- Heat waves claimed over 1,000 lives in 8 years

47% population in Telangana deemed urban

- Rapid urbanisation & decline in green cover raised room temperatures
- Surface temperatures of concrete & stone ranges between 68° and 70°C
- Surface temperature of metal sheets ranges between 70° & 80°C

WHAT CAN BRING DOWN THE HEAT?

1. COATED COOL ROOFS: Cost-effective: It costs ₹100 per sq m. Solar reflective paints contain simple material such as lime wash or acrylic polymer. Once coated, roof's solar reflective index increases
2. MEMBRANE COOL ROOFS: Low maintenance: Pre-fabricated material such as sheets used to cover roof to increase solar reflectance. Sheets made of polyvinyl chloride (PVC) or water proof material
3. TILED ROOFS: Long lasting: It involves ceramic mosaic tiles or shingles. Method largely used on buildings with shed or pyramid roofs, but can also be adopted on flat roofs

BENEFITS
- Keeps indoor temperatures 2° to 4°C lower than traditional roofs
- Saves 20% in energy costs & increases longevity of roof
- Reduces formation of smog from air pollutants, by cooling outside air
- Successful implementation can bring down temperatures by 3° by 2035

POLICY OBJECTIVES
- Save 600 million units of electricity per year
- Achieve 300 sq km of cool roof area by 2028
- Cool roof area to offset 30 million tonnes of CO2

WHO NEEDS TO SET UP COOL ROOF
- Government buildings
- Non-residential buildings
- Commercial buildings
- Houses with plot area above 600 sq yards
- Government housing constructions

Annual targets (in sq km)

Year	Target for Hyd	Rest of state	Total target
2023-24	5	2.5	7.5
2024-25	20	10	30
2025-26	40	20	60
2026-27	60	30	90
2027-28	75	37.5	112.5
Total area	200	100	300

PLAN TO ACHIEVE TARGET
- CRP to be integrated in TS-bPASS to check compliance during occupancy
- ULBs & UDAs appointed nodal agencies to implement CRP for Telangana
- Nodal agencies responsible for implementation through awareness programmes

DNA

Explained: What's Telangana's 'cool roof policy'? How will it help masses in extreme heatwave?

By requiring the installation of cool roofing materials like solar reflective paints, tiles, or sheets, the policy seeks to promote the adoption of cooler ceilings throughout the state.

Reported By: DNA | Edited By: DNA Web Team | Source: DNA Web Desk | Updated: Apr 05, 2023, 10:29 AM IST

Explained: What's Telangana's 'cool roof policy'? How will it help masses in extreme heatwave? Photo: File (Image for representation)

As experts raised alarms for upcoming months of extreme heat waves in India, Municipal administration and the urban development department on Monday unveiled India's first Cool Roof Policy 2023–2028 at the CDMA headquarters in Masab Tank.

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News / Education / education news / Plaksha University launches Indorama Vent...

Plaksha University launches Indorama Ventures Center for Clean Energy, aims to reduce carbon emissions & more

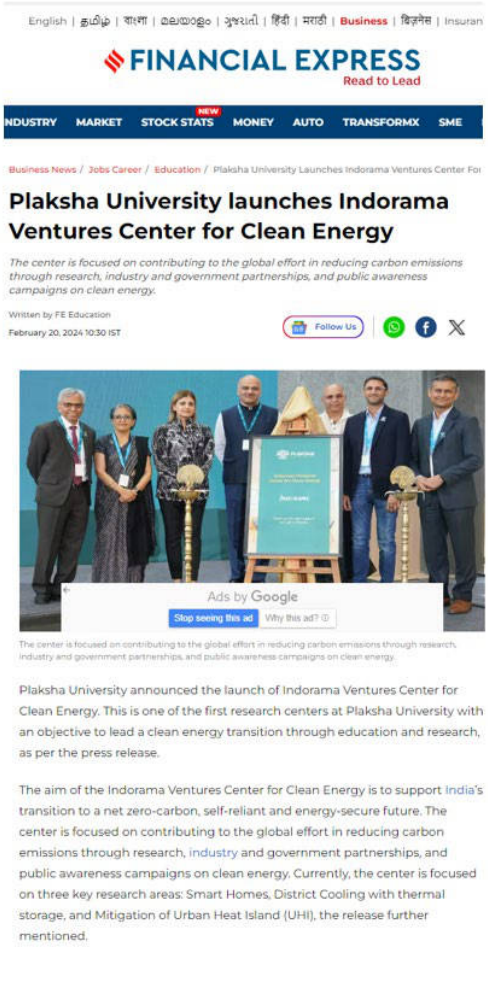
By HT Education Desk

Feb 19, 2024 07:14 PM IST

The research center envisages to support India's transition to a net zero-carbon, self-reliant and energy-secure future.

Plaksha University has announced the launch of the Indorama Ventures Center for Clean Energy – a research center that aims to lead a clean energy transition through education and research.

Plaksha University has launched the Indorama Ventures Center for Clean Energy - a research center aimed at supporting India's transition to a net zero-carbon, self-reliant, and an energy-secure future. It also seeks to contribute in global efforts to reduce carbon emissions through research and more.



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Business News / Jobs Career / Education / Plaksha University Launches Indorama Ventures Center For

Plaksha University launches Indorama Ventures Center for Clean Energy

The center is focused on contributing to the global effort in reducing carbon emissions through research, industry and government partnerships, and public awareness campaigns on clean energy.

Written by FE Education
February 20, 2024 10:30 IST

Plaksha University announced the launch of Indorama Ventures Center for Clean Energy. This is one of the first research centers at Plaksha University with an objective to lead a clean energy transition through education and research, as per the press release.

The aim of the Indorama Ventures Center for Clean Energy is to support India's transition to a net zero-carbon, self-reliant and energy-secure future. The center is focused on contributing to the global effort in reducing carbon emissions through research, industry and government partnerships, and public awareness campaigns on clean energy. Currently, the center is focused on three key research areas: Smart Homes, District Cooling with thermal storage, and Mitigation of Urban Heat Island (UHI), the release further mentioned.

Plans for 2024-25

The Center aims to continue the following activities in the next year:

- Design of campus microgrid to be used as research testbed.
- Design of district cooling system with thermal storage for the hostel-1 of Plaksha
- Build a model to describe the relationship between air temperature and land surface temperature.
- Execute field trials for smart homes.
- Enhance a cool roof dashboard to track the progress of Telangana's cool roof policy in Hyderabad city.

Proposed Infrastructure

a) Living laboratory to study district cooling and thermal storage

To comprehensively evaluate the potential of centralized cooling and heating systems in Indian residential settings, there is a need to establish a living laboratory where research can be conducted in the following areas:

a) Analysing the load patterns of air-conditioning usage, considering both hourly and seasonal variations.

b) Assessing the impact of behavioural changes on air-conditioning energy consumption.

c) Exploring design considerations for full and partial load shifting.

d) Evaluating the overall system efficiency, considering losses in storage and distribution.

e) Examining the performance of various Phase Change Materials (PCMs).

f) Developing forecast models for cooling storage requirements.

We propose to use the hostel building at Plaksha University as a living lab for decarbonization of air-conditioning energy use in a residential setting. The hostel building has a total of 10 floors with 221 rooms. Each hostel room has a fan-coil unit (FCU) with fresh air supplied through a Treated Fresh Air (TFA) unit installed on the roof.

The following are the requirements to convert the hostel into a living lab:

1. A phase-change-material (PCM) based TES system to store the thermal energy during the daytime which will be released during the night for cooling in summer.

2. A TES system to store the thermal energy during the daytime which will be released during the night for heating in winter.

3. A water-cooled chiller to charge TES system during solar hours as well as to meet the daytime load.

4. A heat pump (preferably the same chiller in heat pump mode) for space heating and meeting hot water needs.

5. A 700 kWp onsite Photovoltaic system.

6. The electric energy storage system (400 kWh) to run indoor units and pumps at night.

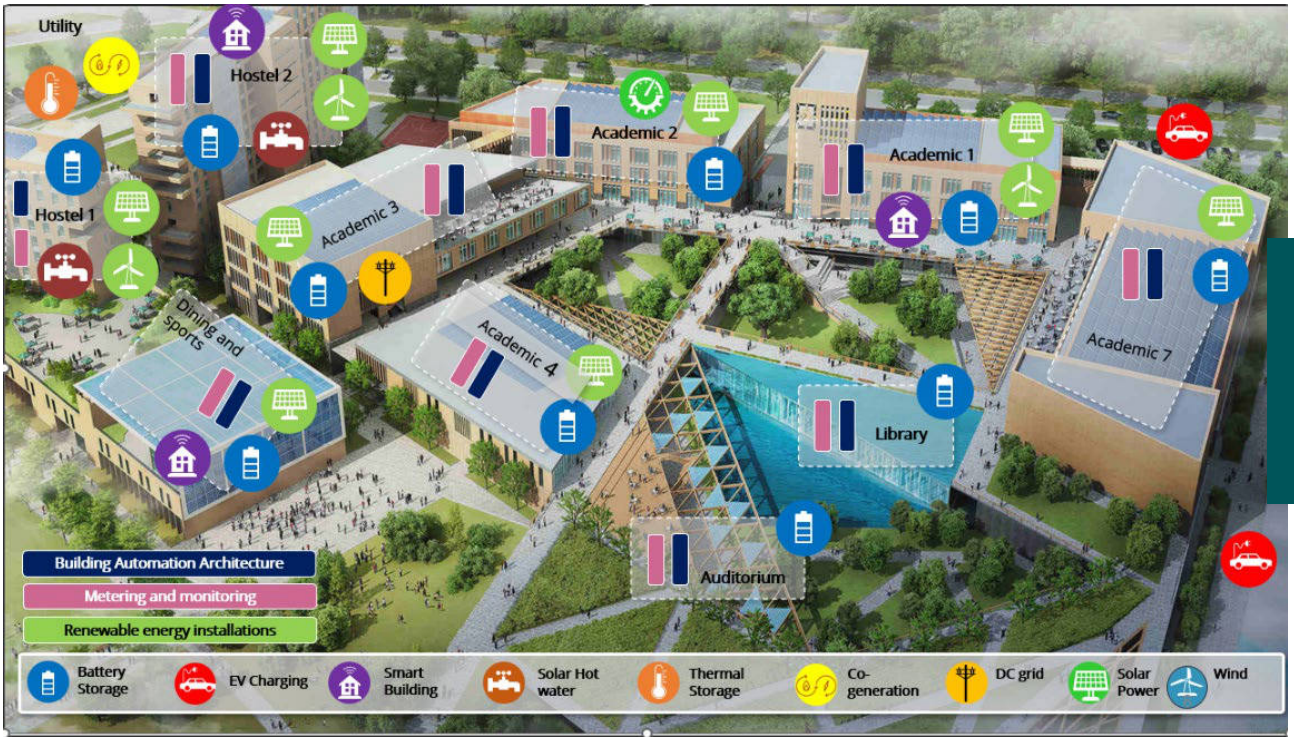
Plaksha University's faculty and researchers along with students will undertake interdisciplinary research in collaboration with industry experts to optimize the design and operation of thermal storage-based cooling and heating systems. This would include experiments, modelling and simulations to identify opportunities for improving energy efficiency, load management, and overall system performance. The testbed will support research involving behavioural studies, development of technologies (IoT, thermal storage, etc.), and the application of AI-ML for improving the design and operations of the system. The research team at IVCCE will also work on understanding economic, social, and environmental implications and propose supportive frameworks.

We intend to offer the testbed to startups, manufacturers, and solution providers to evaluate and demonstrate their technologies in a field environment.

Besides evaluating and developing new technologies in the testbed this research will also help in developing policies. Policies at the regional and national levels can have a big impact on residential air-conditioning energy consumption reduction and GHG emission reduction through the adoption of centralized cooling and heating systems.

b) Campus as Smart Micro Grid test bed

We plan to implement a campus-wide microgrid, integrating advanced technologies to enhance energy efficiency and sustainability. This will encompass diverse elements, including battery storage to optimize energy usage, smart building solutions to intelligently manage energy consumption, solar hot water systems for renewable thermal energy, thermal storage for load balancing, co-generation to maximize energy output, a DC grid for improved efficiency, and the incorporation of solar power and wind energy sources, a Vehicle-to-Grid (V2G) system for seamless integration of electric vehicles into the grid.



By deploying these interconnected components, our campus-wide microgrid aims to create a resilient, environmentally friendly energy infrastructure that not only reduces our carbon footprint but also serves as a living laboratory for research and education in sustainable energy practices.

c) Smart home living lab

We propose the establishment of a state-of-the-art Smart Home Living Lab for research and innovation that will be dedicated to advancing the capabilities and integration of smart technologies in the living environment. This living lab will serve as a collaborative space for industry experts, researchers, and technology enthusiasts to explore and develop creative solutions for improving the efficiency, security, and overall well-being of individuals in their homes. Through real-world simulations and practical experiments, our goal is to test and refine the latest smart home devices, sensors, and automation systems. The Smart Home Living Lab will not only provide valuable insights into user experience but also encourage partnerships across different disciplines that will speed up the development of smart home technologies. By creating a dynamic environment for experimentation and collaboration, we envision this lab becoming a center for driving forward the next generation of intelligent and interconnected living spaces.