



THE ENERGY AND
RESOURCES INSTITUTE

Creating Innovative Solutions for a Sustainable Future



SUSTAINABLE BUILDINGS

ABOUT US

We are a group of researchers, who provide innovative, integrated and cost-effective solutions to mainstream the principles of sustainability in the buildings sector. We promote resource efficiency and optimization in design, construction, operation, maintenance and demolition of facilities. Our objective is to create Centres of Excellence, which aim at stimulating low-carbon development pathways leading to increased resilience and mitigation potential.

80,000

**mtCO₂-e
MITIGATED**

15,000

**PROFESSIONALS
TRAINED**

+300

**BUILDINGS
AUDITED**

MoHUA

CENTRE OF EXCELLENCE

Recognition endowed by the erstwhile Ministry of Urban Development

1998

Energy, Environment & Technology (EET) Division established within TERI

2010

Sustainable Habitat Division, including the CRSBS Group, carved out of EET Division

IAQ

Studies on Indoor Air Quality - Formaldehyde monitoring in indoor environments of tropical climates

UTC-TERI

CENTRE OF EXCELLENCE on Energy Efficient Buildings

MaS_SHIP

Mainstreaming Sustainable Social Housing in India in collaboration with Oxford Brookes University, Development Alternatives and UN-Habitat

AMARAVATI

SUSTAINABILITY PARTNER Support to the Andhra Pradesh Capital Region Development Authority for establishing the capital city

SE ASIA

Nationally Appropriate Mitigation Actions (NAMAs) for buildings sector in Indonesia, Thailand, the Philippines and Vietnam

UTTARAKHAND

Building regulation guidelines for disaster resilience in Uttarakhand

1974

Foundation of TERI

2004

Centre for Research on Sustainable Building Science (CRSBS) established within EET Division

GRIHA

Adopted by the Ministry of New and Renewable Energy as national rating system for green buildings

NEPAL

Market assessment for climate resilient low-cost housing in Nepal

NMSH

ADVISORY MEMBER National Mission on Sustainable Habitat

UHI EFFECT

Urban planning characteristics to mitigate climate change in context of Urban Heat Island Effect

SOUTH ASIA

Study on affordable & climate resilient building materials & technologies for cold climates of South-Asian Region

2017

The CRSBS Group rechristened as Sustainable Buildings

IFC-SHLC

Technology lever for green housing scale-up in India

MAHINDRA-TERI

CENTRE OF EXCELLENCE for Sustainable Habitat



SERVICES

We are working with a diverse range of organizations, including nodal ministries/ departments, PSUs, corporates, academia and international development agencies. We present a mosaic of services catering to both new as well as existing buildings. Impact of our work is significantly enhanced by leveraging our experience and expertise across other thematic areas within TERI. Our services span across geographies, especially among developing countries.

POLICY RESEARCH & ADVOCACY

RESEARCH & DEVELOPMENT

ENVIRONMENTAL DESIGN CONSULTANCY

RESOURCE & ENERGY EFFICIENCY AUDIT

TRAINING & CAPACITY BUILDING

PROJECT MANAGEMENT UNIT



FACILITIES

MODELLING & SIMULATION

Our in-house expertise in various tools of modelling & simulation enables us to co-relate and validate our field observations and recommendations.

- TRNSYS
- ECOTECH
- RADIANCE
- FLOVENT
- Energy Plus
- BLAST
- DesignBuilder
- DIALux
- DOE
- eQUEST
- AGi32
- HAP
- Phoenics
- RETScreen
- IES
- Daysim
- Rhinoceros
- DIVA

LAB FACILITIES

Our state-of-the-art lab facilities at TERIGram, GwalPahari, Gurugram specialize in material testing, thermal-visual comfort studies and building envelope optimization.



TOOLS & EQUIPMENT

On-site measurement of technical parameters through various tools & equipment provides us with the capability to look beyond calculations and estimations.

- Temperature Indicators
- Thermography Camera
- Radiant Asymmetry Sensor
- Single Phase Power Analyser
- Three Phase Power Analyser
- Radiant Temperature Sensors
- Floor & Ankle Temperature Sensor
- CO₂ and CO Measurement Sensors
- Lux Meter
- Anemometer
- Pyranometers
- Heat Flux Plate
- Flue Gas Analyser
- Heat Stress Meters
- Water Flow Meters
- Thermo Hygrometer

PUBLICATIONS

RESEARCH PAPERS

- Investigating resident experiences of a sustainable social housing development in the composite climate of Delhi
- Analysis of weather conditions of Indian cities with respect to rating conditions for HVAC equipment
- Road Map Towards Net Zero Energy Building

MANUALS & GUIDELINES

- GRIHA Manual—Volume 1, 2, 3, 4 & 5
- Sustainable Building Design Manual—Volume 1 & 2
- Environmental Building Guidelines for Hyderabad Metropolitan Development Authority
- Glare Management Guidelines for Artificial Lighting



POLICY RESEARCH & ADVOCACY

We support governments at national, state and local levels in formulation, review and amendment of enabling policies. We also offer technical services for implementing various building codes & standards and green rating systems.

KEY PROJECTS

- Nationally Appropriate Mitigation Actions (NAMAs) for buildings sector in Indonesia, the Philippines, Thailand and Vietnam
- Monitoring, Verification and Enforcement (MVE) of efficient lamps in South East Asia Technical assistance for GCF readiness proposal for Thailand
- SCP Framework for affordable and climate resilient building materials and construction technologies in cold climates of South Asian Region
- Sustainable Social Housing Initiative (SUSHI) in Bangladesh and India
- Market assessment for climate resilient low-cost housing in Nepal
- Policy inputs to building codes and regulations in Nigeria
- Dialogue on 'Construction Waste Management' in collaboration with Charles Darwin University and the University of Melbourne, Australia
- Building regulation for resilience in Uttarakhand
- Formulation of incentives policy for promoting green buildings in Tamil Nadu
- Development of policies, regulations and guidelines for Bengaluru municipality and development authority
- Study and preparation of Green Building Guidelines for Hyderabad Metropolitan Area
- Technical reviewer for Energy Conservation Building Code (ECBC) of India 2007
- "Approach to Sustainability" chapter in National Building Code 2005
- Review and revision of CPWD's PAR/ Schedules/ Specifications to facilitate ECBC and GRIHA compliance

ESTEEMED CLIENTS

- Asian Development Bank
- Chennai Metropolitan Development Authority
- ClimateWorks Foundation
- Clinton Climate Initiative
- CTCN
- Fraunhofer Society
- French Development Agency
- HSBC
- HUDCO
- Hyderabad Metropolitan Development Authority
- KfW
- REEEP
- UN Environment
- UN-Habitat
- Uttarakhand Disaster Recovery Initiative
- World Bank Group
- Wuppertal Institute for Climate, Environment and Energy

RESEARCH & DEVELOPMENT

We specialize in designing green buildings and energy efficient systems. Our areas of expertise include building materials, construction technologies, cool roof, façade and fenestration shading techniques, daylight integration measures, hybrid air conditioning system, earth air tunnel system and thermal mass storage system. We assess the energy performance of advanced technologies like district cooling system, tri-generation system, heat pump and radiant cooling system. TERI has established a Centre of Excellence (CoE) for Sustainable Habitat, in partnership with Mahindra Lifespaces. The CoE aims to perform in-depth studies on thermal comfort, building envelopes and visual comfort. The Centre is also engaged in the development of sky-models and a database of building materials, suitable for Indian climatic conditions.

KEY PROJECTS

- Mainstreaming sustainable social housing in India
- Technology lever for green housing scale up in India
- Mainstreaming high performance commercial buildings in India
- Urban planning characteristics to mitigate climate change in context of urban heat island effect Habitat Model for efficiency and comfort
- Studies on Air Purifier—Investigation on improvement of IAQ for paediatric asthma patients
- Studies on Indoor Air Quality—Formaldehyde monitoring in indoor environments of tropical climates
- Thermal performance evaluation of indigenous roofing materials
- Design of green warehouse for CWC
- Development and demonstration of solar energy based Model Rearing House for silkworm seed crop rearing
- Biogas driven cold storages for sub-zero applications
- Techno-economic feasibility study on tri-generation at Pune Airport in Maharashtra
- Feasibility study and demonstration of geothermal system, integrated with renewable energy system, in Arunachal Pradesh
- Performance prediction of earth air tunnel at Guru Gobind Singh Indraprastha University campus
- To analyse infiltration and exfiltration of façade using computational fluid dynamics
- Study on benefits of Somfy roller blinds in Indian context

ESTEEMED CLIENTS

- Arunachal Pradesh State Council for Science & Technology
- Asia Pacific Partnership on Clean Development
- BEE
- Central Warehousing Corporation
- EMPRI
- Energy Efficiency Services Limited
- Haryana Shehari Vikas Pradhikaran
- Indian Hotels Company Limited
- Ingersoll Rand
- Madhya Pradesh Tourism
- Ministry of Science & Technology
- MNRE
- Saint-Gobain Research India
- Sharp Business Systems (India) Pvt Ltd
- Somfy India Private Limited
- South Asia Network of Economic Research Institutes
- World Bank Group
- 10YFP Trust Fund

ENVIRONMENTAL DESIGN CONSULTANCY

We offer services for enhancing the design of buildings and the selection of climate responsive building materials. We assist our clients in fulfilling their vision of constructing net-zero buildings, with minimal environmental footprint. We provide dedicated assistance for planning, management, design and implementation of projects. We provide support in promoting compliance with relevant building codes like ECBC. We also help achieve suitable ratings for buildings under green rating systems like GRIHA & its variants and LEED.

KEY PROJECTS

- GRIHA consultancy services for:
 - Centre of Excellence for Energy Studies (CoEES), OIL, Guwahati
 - Dr B C Roy Institute of Medical Science & Research, IIT Kharagpur
 - IIM Raipur
 - ITC Projects in Kolkata, Guntur & Chennai
 - Product Development & Innovation Centre, BEL, Bengaluru
 - National Academy of Customs, Indirect Taxes & Narcotics, Bengaluru
 - Zuari Rain Forest, Goa
 - NTPC NRHQ, Lucknow
 - ONGC Housing Complex, Noida
 - NHPC Office Complex Phase-2, Faridabad
 - Huda City Centre Metro Station, Gurugram (formerly known as Sushant Lok Metro Station)
- LEED consultancy services for:
 - ITC Centre, Gurugram
 - Minestone Diamond Factory, Navsari
 - Navi Mumbai Metro Stations & Depots
 - Hotel Cidade-de-Goa, Goa
 - CII-Sohrabji Godrej Green Business Centre, Hyderabad
 - R&D Centre, Bengal Shrachi Housing Development Ltd, Kolkata

ESTEEMED CLIENTS

- Arcop Associates (P) Ltd
- CPCB
- Crown Group of Companies
- DMRC Ltd
- Forits Healthcare Ltd
- InterGlobe Education Services Ltd
- Karnataka Rural Infrastructure Development Ltd
- L&T Ltd
- NARL, Department of Space, GoI
- NBCC (India) Ltd
- NCAER
- PGCIL
- Pimpri Chinchwad New Township Development Authority
- PWD Assam
- Shapoorji Pallonji & Company Ltd
- SIDBI
- Sociedade De Fomento Industrial Private Ltd
- Tamil Nadu Housing Board
- Telecommunications Consultants India
- The British School
- The Doon School
- Zuari Infracore India Ltd

TRAINING & CAPACITY BUILDING

We organize workshops, seminars, refresher courses, and customized training programmes for building professionals, including developers, architects and engineers. In addition to a broad gamut of publications, we have the essential expertise to provide hands-on training in various modelling & simulation tools as well.

Our team members are routinely invited as panellists, guest speakers and lecturers at various forums and institutions to share their insights on themes related to sustainability. We also execute programmes in collaboration with TERI School of Advanced Studies, and Manipal Academy of Higher Education.

KEY PROJECTS

- Curriculum development on “Green Buildings” for post-graduate level under the aegis of the erstwhile Ministry of Urban Development
- Workshop on analytical methods and software tools to predict sustainable performance of built environment for post-graduate students at SPA, Vijayawada
- Workshop on “Policy and Regulatory Framework for Promoting Energy Efficiency and Renewable Energy in Buildings and Appliances”, organized for twelve Asian countries
- Thirty-four multi-city seminars on “Standards & Labelling Programme” under Phase II of Retailers Training Programme
- More than fifteen training programmes on “Sustainable Buildings & Construction—a GRIHA approach” for officials of NBCC (India) Ltd
- Workshop on “Mainstreaming ODS phase out and low GWP in building construction projects”
- Training programmes on “Green Buildings”, “ECBC” and “Sustainable Lighting Practices”
- Hands-on practical training on energy efficiency in pumps, lights, fans & compressed air systems, and training on ISO 50001 energy management plan

PANELS, DISCUSSIONS & STAKEHOLDER CONSULTATIONS

- India Pavilion, COP 23, Bonn, Germany
- International HVAC+R Technology Symposium, Turkey
- Indian Geothermal Energy Development Framework
- ROshanEE—Roadmap of Sustainable and Holistic Approach to National Energy Efficiency

GUEST SESSIONS & LECTURES

- Adhiyamaan College of Engineering, Hosur
- CSIR in-house training programme for engineers
- Dayananda Sagar College of Architecture, Bengaluru
- Delhi Productivity Council
- Manipal Academy of Higher Education
- MGIRED, Bengaluru
- NIT, Tiruchirappalli
- PES University, Bengaluru
- TERI School of Advanced Studies

ESTEEMED CLIENTS

- Anna University
- BEE
- EESL
- Government of Odisha
- HAREDA
- MoHUA
- NBCC (India) Ltd
- Philips India Ltd
- SPA, Vijayawada
- UN Environment

RESOURCE & ENERGY EFFICIENCY AUDIT

We conduct audits and recommend retrofit measures with the intent of optimizing energy consumption and improving resource efficiency in existing buildings. Performance of buildings and their sub-systems is measured using an extensive array of tools & equipment. Wherever required, identified measures are validated against simulations, and their techno-economic proposals are drafted considering different financing models in consultation with vendors.

TERI has established a Centre of Excellence (CoE) on building energy diagnostics and evaluation for improving energy efficiency in existing buildings, in partnership with United Technologies Corporation. The CoE aims to develop MRV framework and design & retrofit guidelines to enable market uptake of energy efficient technologies.

KEY PROJECTS

- Resource use benchmarking and performance enhancement in selected Asian railway stations with comparative analysis of resource use
- Assessment of energy efficient street lighting technologies and financing models for Thailand
- Energy efficiency study for Indian data centres
- Resource conservation study for incorporating sustainability aspects in
 - Existing Buildings of UNDP and Ford Foundation, New Delhi
 - KRIBHCO Bhawan, Noida
- Facilities Audited:



- CESC, Kolkata
- GAIL Training Institute, Noida
- ICICI, Hyderabad
- NIIT, Noida
- SBI, Jaipur
- WIPRO, Multi-city



- Max Hospital, New Delhi
- NH Hospital, Multi-city
- PGI, Chandigarh



- CY Marriott, Gurgaon
- Le Méridien, Gurgaon
- The Leela, Gurgaon
- Vivanta by Taj, New Delhi

ESTEEMED CLIENTS

- Climate Technology Centre and Network
- DLF Assets Pvt Ltd
- DLF Cyber City Developers Ltd
- Embassy of France
- International Union of Railways (UIC)
- ITC Ltd
- Kanematsu Corporation
- Krishak Bharati Cooperative Ltd
- Mayo College, Ajmer
- Medanta—The Medicity
- State Bank of India
- UNDP India

PROJECT MANAGEMENT UNIT

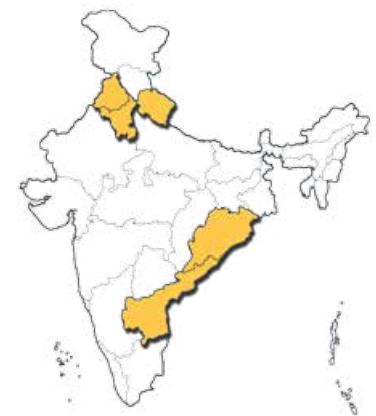
We counsel public entities, including state governments, by setting up Project Management Units (PMUs) within the established institutional framework. PMUs help in the implementation of building standards & codes to ensure safe and sustainable built environment. They also facilitate amendments in existing regulatory frameworks.

KEY PROJECTS

- Green Building and Sustainable Habitat Cell, APCRDA
 - The Cell supports the Andhra Pradesh Capital Region Development Authority in ensuring green design for all the buildings being constructed at Amaravati. The City aims to achieve GRIHA Green City Rating.
- PMU for strengthening DRR capacity of Uttarakhand
 - Building bye-laws are powerful tools for Disaster Risk Reduction (DRR) in the Himalayan belt. The PMU recommends regulation for resilience that can be incorporated in the present building bye-laws.
- Facilitation for ECBC implementation through the creation of ECBC Cell in the States of Haryana and Punjab
- Consulting services for energy conservation activities, by setting up PMU, in the State of Odisha

ESTEEMED CLIENTS

- Andhra Pradesh Capital Region Development Authority
- Bureau of Energy Efficiency
- Punjab Energy Development Agency
- Renewable Energy Department, Haryana & HAREDA
- SDA, Odisha
- Uttarakhand Disaster Recovery Initiative



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