



**DEPARTMENT OF
SCIENCE & TECHNOLOGY**

Ministry of Science and Technology
Government of India

EPSRC

Engineering and Physical Sciences
Research Council

**Joint India-UK Projects on
Energy Demand Reduction
in the built Environment**



India and UK are priority countries for energy research collaboration with the objective of sharing knowledge and capacity building among researchers



The funding call aligns closely with DST's BUILDING ENERGY RESEARCH INITIATIVE



Department of Science and Technology

Ministry of Science and Technology
Government of India

Department of Science & Technology,
Technology Bhavan, New Mehrauli Road,
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www.dst.gov.in

About

Department of Science & Technology (DST) was established in May 1971, with the objective of promoting new areas of Science & Technology and to play the role of a nodal department for organising, coordinating and promoting S&T activities in the country. DST plays a pivotal role in promotion of science & technology in the country.



EPSRC

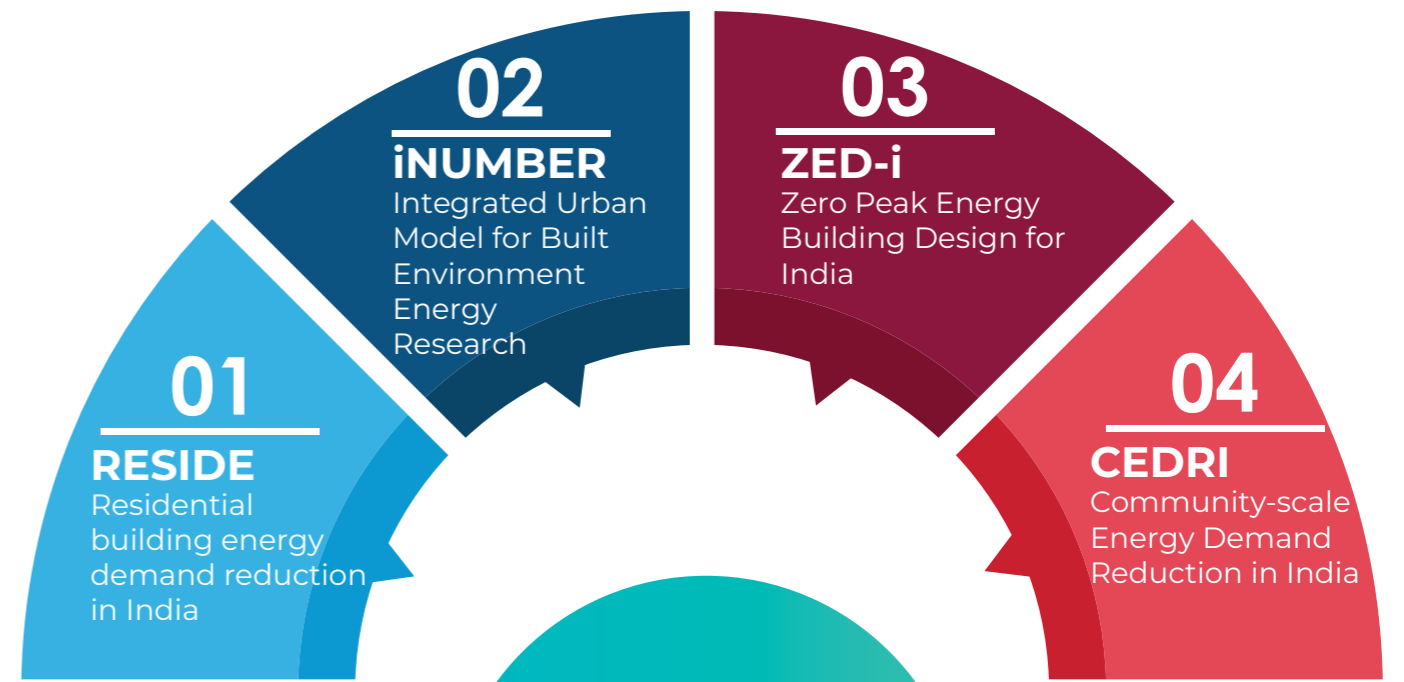
Engineering and Physical Sciences
Research Council

EPSRC, Polaris House, North Star
Avenue,
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www.epsrc.ac.uk

About

EPSRC is the main UK government agency for funding research and training in engineering and the physical sciences, in a broad range of subjects from mathematics to materials science, and from information technology to structural engineering.

**Reducing
Energy Demand
and Making
Clean Energy
More affordable**



CLEAN ENERGY
Innovative, Collaborative,
Interdisciplinary...

Program Background

The Government of India's Department of Science and Technology (DST) and EPSRC and ESRC are jointly supporting collaborative research projects focussing on reducing energy demand in the built environment. Research Councils UK and DST are looking to strengthen collaboration between Indian and UK research institutes. The topic aligns closely to DST's Building Energy Research Initiative and EPSRC's End-use energy demand reduction research area.



The funding aims to bring together the Indian and UK scientific research and innovation sectors to find joint solutions to the challenges in the field of building energy efficiency.

DST AND EPSRC APPROVED PROJECTS ON
**ENERGY DEMAND REDUCTION IN
THE BUILT ENVIRONMENT**

RESIDE

RESIDENTIAL BUILDING ENERGY DEMAND REDUCTION IN INDIA



VISION

To enable the development of a data-driven residential energy code and implementation framework by assessing all aspects of residential energy use in India.

PARTNERS



IIIT Hyderabad
Dr. Vishal Garg
Dr. Sachin Chaudhari



MNIT Jaipur
Prof. Jyotirmay Mathur
Dr. Tarush Chandra



Oxford Brookes University
Dr. Rajat Gupta
Prof Fergus Nicol



University of West of England
Dr Tim Chatterton
Dr Sonja Dragojlovic-Oliveira



PROJECT STRUCTURE

- 1** RESIDE will undertake surveys and monitoring of energy consumption in homes spread across the five different climatic zones in India in order to build up a new, open access database for policy and practitioner communities in India.
- 2** RESIDE will explore and establish protocols for assessing the potential for, and likely benefits of widespread take-up of energy efficiency and rooftop solar technologies on a community scale by using DECoRuM carbon mapping.
- 3** The project will establish factors essential for consideration in the development of a new residential building code for India by engaging with a wide range of stakeholders involved in planning and construction.



CARBON MAP

OUTCOME

- Online repository of metadata of residential energy and thermal comfort
- Datasets on electricity use, indoor environment, and thermal comfort
- Residential energy benchmarks and load profiles
- Smart home energy management system for development of demand response policies
- Energy Models of Residential archetypes
- Customized solutions for demand reduction in five climate zones
- Community energy planning toolkit
- Energy code
- POE-lite tool for residential buildings

iNUMBER

INTEGRATED URBAN MODEL FOR BUILT ENVIRONMENT ENERGY RESEARCH



VISION

iNUMBER's vision is to undertake research to develop a new model of buildings & municipal energy services which is grounded in appropriate empirical data.

PARTNERS



CEPT
UNIVERSITY

CEPT

Prof. Vidyadhar Phatak
Dr. Mona Iyer
Prof. Rajan Rawal



IIT Bombay

Prof. Krithi Ramamritham



UCL Energy Institute
UCL

UCL

Prof. Paul Ruyssevelt



University of Oxford

Dr. Kathryn Janda



Foster + Partners



PROJECT STRUCTURE

This research project will have three distinct but inter-related Research Work Packages (RWP)

- 1** RWP1 will incorporate and benchmark data sets on cities, buildings and municipal services to build a viable 3D urban model
- 2** RWP2 focuses on the activities of stakeholder organizations and institutions with a primary focus on Urban Local Bodies (ULBs)
- 3** RWP3 enriches the "data poor" through three different modes of high resolution data capture, non-intrusive, intensive, and extensive, to provide a 'real world' context for the urban model's data analytics.

OUTCOME



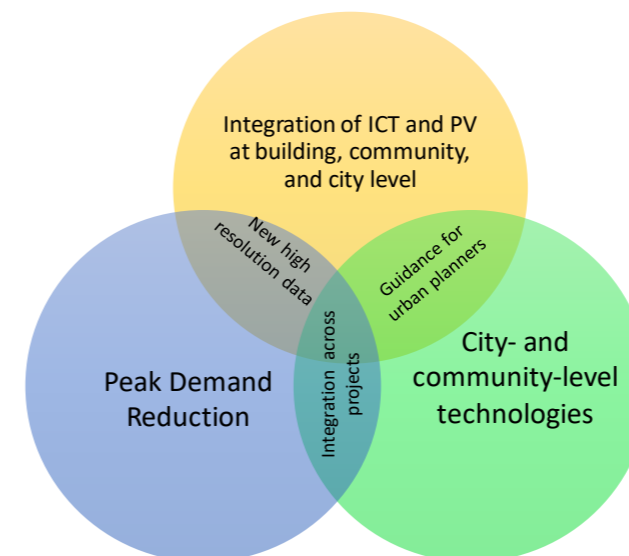
A building stock and municipal service energy model to help plan a secure energy supply for urban populations to be thermally comfortable and healthy.



Developing state of the art data collection and analytic methods to overcome the challenge of acquiring input data and test the validity of models in a range of scenarios with different data availability.



iNUMBER supports Indian municipalities and local partners to develop a data-driven intelligent urban model for built environment energy research and municipal planning.



BUILDING AND MUNICIPAL ENERGY SERVICES MODEL

ZED-i

ZERO PEAK ENERGY BUILDING DESIGN FOR INDIA



VISION

ZED-i's vision is to decouple building energy use from economic growth in India through a new science of zero peak energy building design for warm climates.

PARTNERS



IIT Roorkee
Dr. E. Rajasekar
Prof. DS Arya

Dr. K Murugesan
Prof. NP Padhy



IIT Delhi
Prof. Sukumar Mishra



CBRI
Dr. Ashok Kumar

Dr. L.P. Singh



University of Bath
Dr. Sukumar Natarajan
Prof. David Coley
Dr. Nick McCullen

Dr. Ian Walker
Prof. J. Davenport



PROJECT STRUCTURE

- 1** Weather files: This WP will generate synthetic average and extreme current and future weather files covering India.
- 2** Buildings and occupants: The detailed post-occupancy evaluation (POE) of 60 buildings all over India.
- 3** Peak suppression at building level: Testing Selected strategies under real weather at a purpose-built facility.
- 4** Peak suppression at network level: Demand profiles at building level are susceptible to the complex interaction of climate, buildings and people such that small building level "bumps" can synchronize to form sharp network level peaks.
- 5** A proto standard for zero peak design: Devising a step-by-step process for designing climate-resilient zero-peak compliant buildings.



WORK PACKAGES

OUTCOME



India's first weather generator (WGI) purpose-built to produce building simulation weather files.



A robust new Occupant Response Model that predict behavior under peak and non-peak conditions.



Well calibrated and documented thermal models. Best in class strategies graded by peak suppression and spread of geographical applicability.



New field validated and demonstrated dynamic models of peak suppression at network level.



A new open access standard for zero peak design in India

CEDRI

COMMUNITY-SCALE ENERGY DEMAND REDUCTION IN INDIA



VISION

The project will provide exemplary strategies towards energy demand reduction in Indian communities. This approach will be conscious of building activities and operations, but also the performance of the energy networks that are serving those buildings.

PARTNERS



IIT Delhi

Dr. Abhijit R. Abhyankar
Dr. Vigneswara Ilavarasan
Dr. Anandarup Das



IIT Bombay

Dr. Himanshu Bahirat



NIT Tiruchirapalli

Prof T Srinivas, Professor



Heriot-Watt University

Dr. David Jenkins
Dr. Andrew Peacock
Dr. Sarah Payne

Dr. Sandhya Patidar
Dr. David Flynn
Dr. Valentin Robu



PROJECT STRUCTURE

- 1** Modelling of community electricity demand through applied aggregation algorithms, converting small samples of individual building demand profiles into community-level profiles.
- 2** Identifying the demand-reducing measures likely to succeed in such regions and apply these to the community demand models to quantify potential impact.
- 3** The prototypic setup will be established to co-simulate the energy reduction measures' technical effectiveness and the community occupants' response to the same.
- 4** The project will therefore provide guidance that will ensure that approaches to demand reduction "co-evolve" with changes in the methods used to supply electricity to residential communities, over future timescales that already have considerable levels of uncertainty.

OUTCOME



Define grid characteristics of local networks at regional level in chosen case-studies and contextual data.



Collate individual and local network electricity demand data for chosen regions



Aggregate demand profiles of regions of buildings with future scenario-morphing techniques



Provide tailored, qualified demand-side options for Indian households informed by survey responses



Detailed guidance for required response to future demand pathways for Indian communities

BUILDING ENERGY RESEARCH INITIATIVE

CLEAN ENERGY

INNOVATION
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