



India-UK Joint

Integrated Urban Model for Built Environment Energy Research

(iNUMBER)

**Executive Summary:
Residential Energy and Environment Monitoring:
Improving Data Granularity**

January 2019

Vidyadhar Phatak (Principal Investigator)

Paul Ruysevelt (Principal Investigator)

This page is intentionally left blank.

Document No: Work Package 3/17-21

India-UK Joint Integrated Urban Model for Built Environment Energy Research (iNUMBER)

Work Package 3 (WP3): Improving Data Granularity

Executive Summary: Residential Energy and Environment Monitoring: Improving Data Granularity

January 2019

Authors:

Rajan Rawal, Himani Pandya, Tithi Soladhara

Centre for Advanced Research in Building Science and Energy

CEPT University, Ahmedabad

Paul Ruyssevelt, Kathryn Janda, Pamela Fennell

University College London, London

Research Team:

Asha Joshi, Kartikay Sharma, Sachin S, Veeren Poola

This page is intentionally left blank.

Acknowledgments

The Department of Science and Technology (DST), Government of India, the UK Engineering and Physical Sciences Research Council (EPSRC) and Economic and Social Research Council (ESRC), as part of the Newton Bhabha Fund, provided joint funding to “Integrated Urban Model for Built Environment Energy Research (iNUMBER)”. The EPSRC and ESRC support the UK iNUMBER activity to University College London. The DST, Government of India supports the Indian iNUMBER activity to CEPT University under sanction order number DST/TMD/UK-BEE2017/18(C) and DST/TMD/UK-BEE2017/18(G) dated 29 December 2017.

iNUMBER (iNtegrated Urban Model for Built Environment Energy Research) is a four-year (2017-2021) research project to help cities reduce their energy demand and improve their municipal services. This goal is led by CEPT University, Ahmedabad and supported in India by Indian Institute of Technology Bombay, Mumbai. It is led by University College London, London, and supported by the University of Oxford, Oxford.

Authors acknowledge guidance from Dr. Yash Shukla, Technical Director and Mr. Agam Shah, Senior Research Associate at Centre for Advanced Research in Building Science and Energy (CARBSE), CEPT University. Authors also acknowledge Ms. Shelly Vaish, iNUMBER - Direct Research Project student, CEPT University for designing the graphic of the cover image of this report.

Please cite this document as:

Rawal, R., Pandya, H., Soladhara, T., Ruyssevelt, P., Janda, K., Fennell, P. (2019). *Executive Summary: Residential Energy and Environment Monitoring: Improving Data Granularity*, Ahmedabad, India: Centre for Advanced Research in Building Science and Energy (CARBSE), CEPT University. Submitted to the India-UK Joint Integrated Urban Model for Built Environment Energy Research (iNUMBER)

This page is intentionally left blank.

Executive Summary:

iNUMBER is an Indo-UK collaborative research project that was co-created to address the Newton research topic: “Integration of information, communication and renewable energy technologies at building, community and city level interventions”. The project aims to address this research topic by developing a data-driven Intelligent Urban Model for Built Environment and Energy Research (iNUMBER). The primary focus of this tool is to support the Indian Municipalities to understand the variations in energy demand and thereby assist in providing clean and sustainable energy services to its citizens. iNUMBER being a four-year collaborative research project (2017-2021), Ahmedabad has been selected as the primary case city for the research. Further, the project could be extended by considering other cities as well.

The key objective of the project is to develop a City Energy Model that includes the 3D building stock and the municipal services energy model. The project aims to achieve the same by linking the existing and new data sets and testing the validity of the developed model for a range of scenarios in accordance with different data availabilities. To achieve this overarching objective, the project has been sorted into 3 work packages (WP) as mentioned below,

1. WP1: Create 3D Building Stock Model
2. WP2: Incorporate Municipal Energy Services
3. WP3: Improving Data Granularity

This executive summary provides a brief account of the activities carried out under the WP3: Improving Data Granularity. This WP focusses on gathering intense datasets at dwelling unit level and common amenities at community level pertaining to the energy consumption, indoor environment parameters and thermal comfort conditions. There are two major outcomes under the WP3. First outcome is, ‘Intensive Data Collection in Dwelling Units’. This includes capturing thermal comfort conditions, indoor environment parameters and energy consumption associated with the use of electrical appliances in 267 sample dwelling units in Ahmedabad city. The second outcome is, ‘Extensive Data Collection at Community Level’. This includes gathering energy consumption data for common utilities using lower-tech participatory tools and methods in multi-storey buildings at community level in Ahmedabad city.

Under outcome-1, the report provides a detailed overview of energy and environment monitoring in dwelling units. Further, the report also demonstrates a detailed sampling methodology for the selection the dwelling units. The sample size has been divided into number of clusters with reference to building typology, population density and property count. Intensive data from WP3 becomes the source to build the city energy model which has been envisaged in WP1.

Under outcome-2, the report provides a brief overview of energy monitoring in multi-storey buildings. Further, the report mentions a pilot case study to measure energy consumed in common utilities at community level. The extensive data would feed building level energy consumption pertaining to municipal water services in WP2.

The integration of the outcomes from all 3 work packages will assist in understanding the energy demand of the entire city. Through a fourth work package, the activities under iNUMBER will further be integrated with other projects, related research in India, and across the world. Further, this integrated approach will develop new areas of inquiry related to future building stock and municipal services in India.

This page is intentionally left blank.

CEPT
UNIVERSITY

Kasturbhai Lalbhai Campus,
University Road,
Ahmedabad - 380009, Gujarat, India
www.cept.ac.in/carbse

www.inumber.org