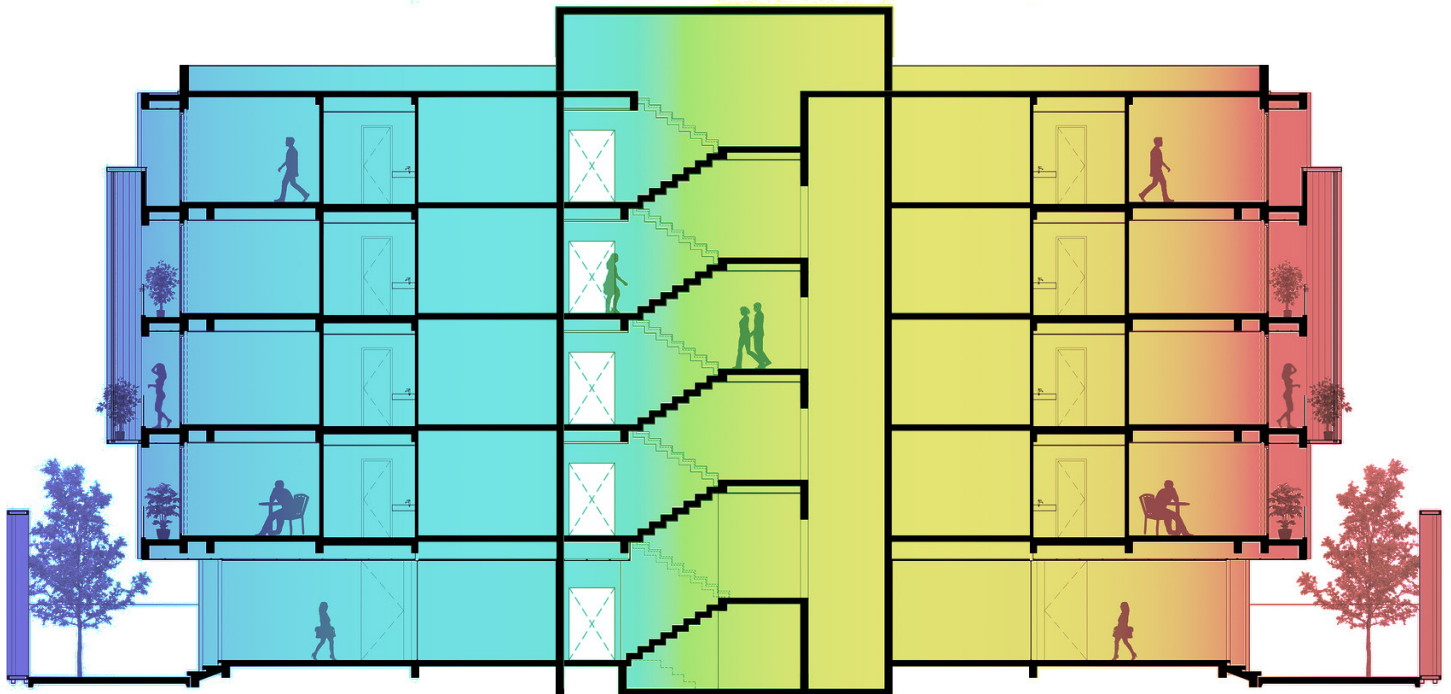


# BEE – GiZ: Preparation of Database and Adaptive Model for Thermal Comfort of Occupants in Residential Buildings of India

In 2015, 'Housing for all by 2022', a large-scale housing initiative to provide quality affordable housing to the lower economic section by 2022, was launched by the Indian government. As of now, the energy consumption in the affordable housing units is low, but with the increase in income and comfort expectations, that scenario is likely to change. Along with the initiative to provide housing, the government has also taken steps towards reducing energy consumption, one of which was Eco-Niwas Samhita. It was launched with an aim to enhance thermal comfort inside residences as well as reduce external heat gains into the residential buildings.

## Overview

Thermal comfort has a direct impact on energy consumption. ANSI/ASHRAE Standard 55 mentions about predictive and adaptive model for thermal comfort. The predictive model does not take into account the ability of the occupant to make himself comfortable by adapting to the surrounding environment by either controlling the fan/AC or adding/removing clothes. An adaptive model of thermal comfort recognizes that the thermal comfort requirements of people depend on their past and present context and that these vary with the outdoor environmental conditions of their location.



This concept can play a major role in reducing energy use whilst maintaining the comfort, productivity, and well-being of occupants.

### **Aim:**

This study aimed to develop a single nation-wide adaptive thermal comfort model.

### **Objectives:**

- Develop a comprehensive plan for carrying out thermal comfort survey and monitoring.
- Carryout field surveys and monitoring as per developed plan spread over one complete year.
- Develop a methodology to curate the collected data and carry out the analysis for the same.
- Analyze thermal adaptation in residential building to propose a single nationwide adaptive thermal comfort model.

### **Task Schedule**

#### **Task 1: Setting up logistics**

- Eight cities, representative of five climate zones, were chosen.
- Data for this study was gathered between March 2020 and April 2021.
- The sites identified for data collection were categorized into the following typologies: apartments, bungalows, rowhouses, tenements, affordable housing units, chawl units, etc.

#### **Task 2: Gathering data**

- This study followed an online data collection and storage methodology. All data was filled up on Google survey forms using cell phones.
- A one-time background survey of the house mapped the building characteristics, respondent details, and appliances.

- A Right Now Right Here (RNRH) thermal comfort survey, recording the respondent's thermal sensation, acceptance, and preference, clothing insulation, metabolic activity, as well as indoor environmental parameters, was conducted monthly.
- 2691 RNRH surveys, from 849 respondents of 314 sites, were collected in this study.
- Outdoor weather data was sourced from International Surface Database.

#### **Task 3: Assuring data quality**

- The collected data underwent a rigorous quality assurance and control protocol.
- Multiple statistical analysis were conducted, and summary of the derived results was tabulated.
- An open-source database was developed on lines of ASHRAE Database 2, International Glass Database and GBPN database.

#### **Task 4: Conducting data analysis**

- Multiple statistical analysis were conducted, and an adaptive thermal comfort model was derived.
- The salient trends in occupant's behavior and thermal comfort preferences were underlined

