5th World Conference on
Climate Change and Global Warming
07 - 09 March 2025 Vienna, Austria

Impact of Urban Heat on Thermal Comfort: A case study of Kharagpur town, India

Ipshita Jhirwal[1*], Anurag Aman Kaushal[2], Bharath Haridas Aithal[3]

[1,2,3]Energy and Urban Research Group, India
[2]Ranbir and Chitra Gupta School of Infrastructure Design and Management,
Centre of Excellence for Indian Knowledge Systems, Indian Institute of Technology
Kharagpur, West Bengal, India
*Corresponding Author

Abstract

Irreversible and increasing urbanization has aggravated several demands and consequences. This encompasses energy demand, with consequences such as climate change and increased temperatures. Such factors exacerbate indoor heat increases, negatively impacting thermal comfort within structures. Residents of low-income, naturally ventilated tropical areas are especially susceptible to insufficient thermal comfort from increasing urban heat. However, the majority of contemporary studies focus on air-conditioned buildings. It is essential to evaluate thermal comfort in naturally ventilated homes, especially in low-income settings. This research assesses the impact of urban heat on indoor thermal comfort and proposes strategies to improve thermal conditions in Kharagpur, India, characterized by a hot and humid climate. It assesses the thermal comfort of residents in five naturally ventilated residences within a two-kilometer vicinity. Indoor thermal comfort evaluations include field devices to quantify air temperature (Ta), relative humidity (RH), and air velocity (Va). The metrics and consistent personal characteristics are documented at ten-minute intervals throughout one month. The data are analyzed via the CBE Thermal Comfort Tool, adhering to ASHRAE-55 standards, to produce essential metrics like Predicted Mean Vote (PMV), Predicted Percentage Dissatisfied (PPD), and Standard Effective Temperature (SET). Furthermore, spatial heat distribution is evaluated by outside surveys and meteorological station data to examine the impact of vegetation, building orientation, and window apertures. Preliminary results indicate that building orientation affects thermal comfort, highlighting reduced comfort levels in west-facing rooms. This study presents design techniques emphasizing building orientation, phase change materials, shading, and thermal mass to address thermal comfort challenges in warm and humid regions.

Keywords: Air quality; Building assessment; Naturally ventilated buildings; Standard Effective Temperature; Warm-humid climate