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**Investigation of Winter Indoor Thermal Environment and Heating Demand of****Urban Residential Buildings in China's Hot Summer – Cold Winter Climate Region**

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**Abstract**

In this paper, the winter indoor thermal environment of dwellings in China's Hot Summer – Cold Winter (HSCW) climate region has been investigated by on-site measurement. And the driving forces of the heating requirements of residents in HSCW area has been scrutinized by heteroskedasticity-robust Ordinary Least Square analysis. It is found that in HSCW area, the average internal temperature is 13.5 °C for the living room and 12.7 °C for the bedroom, leading to an uncomfortable indoor thermal environment, markedly colder than that in the UK, which has similar winter climate. Through the investigation of the occupant heating behavior, it was found that domestic heating is operated part-time-part-space and triggered by both time and temperature in the HSCW area. 10 °C is found to be the lowest acceptable internal temperature without heating. The poor indoor thermal environment observed in HSCW area is mainly due to the short heating operation duration (averagely 1.9 hours per day for the living room and 1.4 hours for the bedroom). Income, presence of child, heating system and thermal experience markedly influence occupants' heating requirements. However, the education is not a statistically significant factor. The rebound effect is observed in HSCW area when analyzing the effects of building energy efficiency on indoor thermal environment.

**Keywords**

Indoor thermal environment; Occupant behavior; Residential buildings; China's Hot Summer – Cold Winter area; Field measurement and questionnaire survey

**1. Introduction**

Domestic heating in China's Hot Summer – Cold Winter (HSCW) <sup>1</sup> climate region has attracted increasing attention not only in China but also worldwide <sup>[1]</sup>. Chinese government is responsible for the supplying of central heating to dwellings only north of the Qin-Huai line. However HSCW area lies south of the line,

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<sup>1</sup> According to the Standard of Climatic Regionalization for Architecture <sup>[3]</sup>, the winter climate of HSCW climate region has the following two characteristics. Firstly, the average temperature in the coldest month is between 0 and 10 °C. Secondly, the annual days with daily average temperature less than 5 °C are no more than 90 days. According to ASHRAE Standard 90.1 -2010 <sup>[4]</sup>, the HSCW area can be classified into the Climate Zone 3.

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