

Accepted Manuscript

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PII: S0378-7788(18)30076-8
DOI: [10.1016/j.enbuild.2018.05.026](https://doi.org/10.1016/j.enbuild.2018.05.026)
Reference: ENB 8567

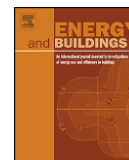


To appear in: *Energy & Buildings*

Received date: 8 January 2018
Revised date: 13 April 2018
Accepted date: 12 May 2018

Please cite this article as: Jimmy Chun-Kuen Tong , Jason Ming-Yeung Tse , Phillip John Jones , Development of Thermal Evaluation Tool for Detached Houses in Mongolia, *Energy & Buildings* (2018), doi: [10.1016/j.enbuild.2018.05.026](https://doi.org/10.1016/j.enbuild.2018.05.026)

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Development of Thermal Evaluation Tool for Detached Houses in Mongolia

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Abstract

During winter-time in Mongolia, the air pollution is so severe that it threatens the citizens' health. Ulaanbaatar is the capital city of Mongolia, and its population represents about half of the total population of Mongolia. The majority of people in the Ger area, approximately 50% of population of Ulaanbaatar, rely on direct coal burning to generate the required heat to maintain a comfortable environment in the cold season. The heavy reliance on coal leads to catastrophic air pollutant emissions including carbon dioxide, sulphur dioxide, nitrogen oxides and particulate matter, which leads to global warming, climate change and human health. As it is identified that building insulation retrofit is one of the best ways to reduce the reliance on coal consumption due to the improved heat retention and air tightness, a tool, named "FIXIT" has been developed to quickly quantify the impact from insulation retrofit. This paper presents how "FIXIT" was developed and is applied to help house owners to understand their building performance. Not only can "FIXIT" be applied for individual houses, it can also be used to estimate the reduction of air pollution from coal burning due to insulation retrofit. With "FIXIT", it is estimated that about 530 ktons of carbon emissions reduction can be targeted by applying building insulation retrofit, if around the 100,000 detached houses in Ulaanbaatar apply insulation retrofit. By highlighting the advantages on the building performance, "FIXIT" can encourage more house owners to improve their house insulation quality and thus contribute to the air quality, creating a cleaner and healthier environment and saving on fuel use.

Keywords: Detached Houses, Insulation, Thermal Tool, Building Energy Use, Fossil Fuel Reduction

1. Introduction

The aim of the paper is to provide insights for Mongolia on the implementation of an insulation retrofit scheme for the detached houses in the Ger area of Ulaanbaatar. By reducing the use of coal, this can lead to the improvement of the severe air pollution problem. The paper summarizes the findings from the investigations and describes the developed thermal tool, named "FIXIT". The paper presents the development of "FIXIT" and the correlation process and results in accordance with the findings of interview questionnaire surveys and on-site measurements carried out for the detached houses in Ger area of Ulaanbaatar. By using "FIXIT", the advantages of adopting building insulation retrofit on the existing detached houses, in terms of building energy performance and carbon dioxide emissions, are also estimated.

The geography of Mongolia covers various characteristics, with a desert in the southern part, while the western and northern part is mountainous. In general, according to the weather file extracted from the Energy Efficiency and Renewable Energy of the Department of Energy of the U.S. [1], the temperature in Mongolia fluctuates over a wide range throughout the year. It can be as cold as -32°C in winter-time and as hot as 32°C in summer-time. Figure 1 below illustrates the hourly temperature profile throughout a typical year in Mongolia.

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