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Elaboration of energy saving renovation measures for urban existing residential buildings in north China based on simulation and site investigations

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Abstract

It is necessary to determine whether to implement a retrofit measure or not based on its energy saving and economic benefits, when conducting a retrofit project. The common way to do that is to set up a building simulation model and calculate its energy saving and economic benefits. Because of the great discrepancy between the actuality and the building simulation model, it is very important to use the factual energy use to calibrate the model, so as to accurately predict the benefits of retrofit measures. Although the energy efficiency retrofit of residential buildings in north China is implemented in a large scale, it seldom knows whether the commonly used retrofit packages are optimized. Therefore, a typical residential building is selected in Beijing, and the energy saving and economic benefits of different retrofit measures are analyzed using a simulation model calibrated with its actual space heating energy use, and the optimized retrofit packages are put forward. Results shows the retrofit of space heating system is a very attractive measure due to its relatively low investment but good energy saving benefit, and roof retrofit is also cost effective, while window retrofit and wall retrofit are not economic to conduct separately. Four optimized retrofit packages are figured out to realize the 50% and 65% reductions of space heating intensity required in the energy efficiency standards, which have less investment costs compared with currently widely used packages, and the retrofit packages for the 65% reduction is more cost-effective than the packages for the 50% reduction.

Keywords

residential buildings in north China,
energy efficiency retrofit,
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Article History

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1 Introduction

There are 40 billion m^2 of existing buildings in China, where the floor area of urban existing building with central space heating in north China amounts to 3.3 billion m^2 in the year of 2008 (National Bureau of Statistics of China 2009). Central space heating systems run full time and full space in the buildings with poor thermal performance in north China, and the space heating supply cannot be controlled individually based on the occupancy and actual indoor temperature. Another problem is that heat supply is charged by floor area, so there is no incentive for occupants to save energy (Liu et al. 2011). All these problems lead to a great energy saving potential for space heating energy use in north China. In this circumstance, energy efficiency retrofit of residential buildings in north China has been carried out in a large scale, under the management of Chinese central government. In 2008, Ministry of Housing and Urban and Rural Development issued an official document, namely *Opinions on the Implementation of Heat Metering and Energy Conservation Retrofit for Existing Residential Building in North China*, targeted at the retrofit of 150 million m^2 floor area by 2010. The goal is to realize 50% of heating intensity reduction after the retrofit compared with the heating

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