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Energy Savings and Cost-benefit Analysis of the New Commercial Building Standard in China

Shanguo Zhao[a, b], Wei Feng[a*], Shicong Zhang[c], Jing Hou[d], Nan Zhou[a], Mark Levine[a]

[a]*Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA*
[b]*SouthEast University, Nanjing, Jiangsu Province, China*
[c]*China Academy of Building Research, Beijing, China*
[d]*Beijing Jiaotong University, Beijing, China*

Abstract

In this paper, a comprehensive comparison of the commercial building energy efficiency standard between the previous 2005 version and the new proposed version is conducted, including the energy efficiency analysis and cost-benefit analysis. To better understand the tech-economic performance of the new Chinese standard, energy models were set up based on a typical commercial office building in Chinese climate zones. The building energy standard in 2005 is used as the baseline for this analysis. Key building technologies measures are analyzed individually, including roof, wall, window, lighting and chiller and so on and finally whole building cost-benefit analysis was conducted. Results show that the new commercial building energy standard demonstrates good cost-effective performance, with whole building payback period around 4 years

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Keywords: Commercial building; Energy efficiency standard; Reference building; Cost-benefit, Simulation

1. Introduction

The issue of energy and environment is increasingly prominent. Industry, transportation and building energy consists of the main consumption factor, among which building-related energy consumption contributes to 48% of the total social energy consumption[1]. Commercial building accounts for a great part of the total building floor area.

* Corresponding author. Tel.: +1-5104865156.
E-mail address: weifeng@lbl.gov

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In China, the total floor space of commercial buildings increased from 2.8 billion m2 to 7.1 billion m2 from 1996 to 2008, with approximately 0.5 billion m2 of new commercial building floor space built annually[2,3]. From 2001 to 2011, the area of commercial buildings increases by 0.8 times and the average energy consumption per unit floor area increases from 17.9 kgce/m^2 to 21.4 kgce/m^2 [4].

To improve the indoor environment & energy efficiency and promote the utilization of renewable energy in commercial buildings, China has issued its own standard on commercial building energy conservation in 1993 and an upgrade in 2005 [5]. The 2005 version mandated that commercial buildings be 50% more efficient than a 1980's baseline defined by the 1980s building characteristics[8]. It was estimated that the commercial building energy standard in China can produce 249 mtce savings from 2010 to 2030[7]. In this paper, a comprehensive cost-benefit analysis comparison between the previous 2005 version and the new proposed version is conducted for cost-benefit purposes.

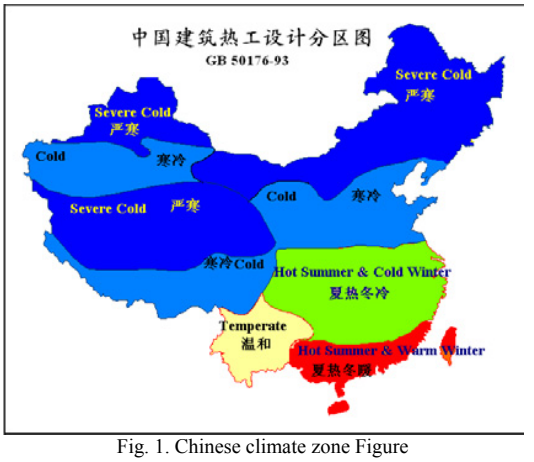

Fig. 1. Chinese climate zone Figure

2. Methodologies

There are five climate zones in China: Severe cold, cold, hot-summer & cold-winter, hot-summer & warm-winter and temperate (seen in Figure 1), among which cold, hot-summer & cold-winter and hot-summer & warm-winter climates consist of the majority of building floor space and energy consumption. Beijing, Shanghai and Guangzhou are chosen as the typical cities for the energy and cost-benefit analysis in these three climate zones respectively.

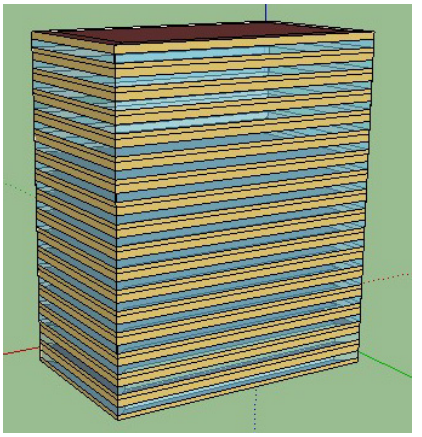

Fig. 2. Chinese reference office building geometry