Energy-saving renovation of Bayu traditional residence: Taking Anju Town of Chongqing as the example

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Abstract

Traditional residence is an important part of our culture and heritage of ancient architecture, which contains rich experience in the construction of ecological. But limited at the construction technology and economic level, traditional residence also has shortcomings. Therefore, in addition to heritage of its ecological wisdom, syndrome differentiation treatment should be used. In this paper, on the basis of the energy-saving reconstruction project located in Anju town of Chongqing, its energy-saving advantages and disadvantages were analyzed. Then methods of traditional residence in energy-saving were proposed, which not only met the energy requirements and economics, but also improved the thermal comfort significantly. Analyzing the annual energy consumption of its before-after renovation by Design Builder. The building energy saving rate was 54.36\% after renovation.

1. Introduction

With the rapid development of the national economy, people's demand for living standard is higher and higher [1, 2], and the quality of human settlements environment and building energy consumption have attracted attention widely [3]. “13th Five Years Plan ”clearly pointed out that to speed up the construction of the beautiful livable

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countryside, comprehensively improve production and living conditions in rural areas, carry out ecological civilization demonstration action of villages and towns and the rural living environment comprehensive rectification action, increase the traditional villages and residents and the national characteristic town’s protection, heritage of rural civilization, construction idyllic and beautiful country scene, harmony and happiness of the beautiful livable countryside[4]. Chinese traditional dwelling is an important part of the rural construction in China, which it can best embody the local culture and carry nostalgia plot, how to protect the traditional dwelling and develop it is facing the grim task of current building in the livable villages and small towns’ construction period. But traditional dwellings are unable to meet the requirements of modern living from the space form, health conditions, lighting and indoor thermal comfort environment. The residents have the desire to improve the indoor environment strongly which lead to the heating and air conditioning energy consumption grow very prominent [5]. At the same time, with the blind pursuit of bright and spacious to pull down the old houses, the construction of a large numbers of low qualities and high energy consumption of simple brick houses has caused the loss of regional culture and will eventually lead to serious damage to the environment. Therefore, it is of great significance to seek suitable traditional dwellings update mode, to realize the sustainable development of traditional dwellings, and to protect the local culture and environment.

This paper takes one of the traditional residences which located in Anju Town of Chongqing as the research object. Combining with characteristics of local climate to analysis the climate adaptation passive energy saving strategy. Changed the typical functional layout of the traditional residences, and indoor physical environment of comprehensive transformation of the integration, and through energy simulation and actual measurement to evaluate the effects of the reconstruction.

2. Climate analysis and passive energy saving strategies analysis in Chongqing area

The building's passive adjustment to achieve low energy consumption and high comfort is advocated by the means of ecological [6], so it needs to take full account of the impacts of climate and take appropriate measures.

2.1. Analysis of the climate in Chongqing

Chongqing is located in the southwest of China, which is a typical hot-summer and cold-winter area. As can be seen from the Fig.1, the highest monthly average temperature of Chongqing in summer is 28.3 degrees Celsius, and the lowest monthly average temperature is 10 degrees Celsius. While Chongqing belongs to high humidity area in China, the average annual rainfall is abundant, and the annual average relative humidity is 70%~80%. In addition, as one of the least annual sunshine area in China, the annual sunshine time is 1000~1400 hours, and the percentage of sunshine is only 25%~35% [7].

![Fig.1. The monthly temperature in Chongqing.](image-url)
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