World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:10, No:09, 2016

Refurbishment Methods to Enhance Energy Efficiency of Brick Veneer Residential Buildings in Victoria

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Abstract : The current energy and climate change impacts of the residential building sector in Australia are significant. Thus, the Australian Government has introduced more stringent regulations to improve building energy efficiency. In 2006, the Australian residential building sector consumed about 11% (around 440 Petajoule) of the total primary energy, resulting in total greenhouse gas emissions of 9.65 million tonnes CO2-eq. The gas and electricity consumption of residential dwellings contributed to 30% and 52% respectively, of the total primary energy utilised by this sector. Around 40 percent of total energy consumption of Australian buildings goes to heating and cooling due to the low thermal performance of the buildings. Thermal performance of buildings determines the amount of energy used for heating and cooling of the buildings which profoundly influences energy efficiency. Employing sustainable design principles and effective use of construction materials can play a crucial role in improving thermal performance of new and existing buildings. Even though awareness has been raised, the design phase of refurbishment projects is often problematic. One of the issues concerning the refurbishment of residential buildings is mostly the consumer market, where most work consists of moderate refurbishment jobs, often without assistance of an architect and partly without a building permit. There is an individual and often fragmental approach that results in lack of efficiency. Most importantly, the decisions taken in the early stages of the design determine the final result; however, the assessment of the environmental performance only happens at the end of the design process, as a reflection of the design outcome. Finally, studies have identified the lack of knowledge, experience and best-practice examples as barriers in refurbishment projects. In the context of sustainable development and the need to reduce energy demand, refurbishing the ageing residential building constitutes a necessary action. Not only it does provide huge potential for energy savings, but it is also economically and socially relevant. Although the advantages have been identified, the guidelines come in the form of general suggestions that fail to address the diversity of each project. As a result, it has been recognised that there is a strong need to develop guidelines for optimised retrofitting of existing residential buildings in order to improve their energy performance. The current study investigates the effectiveness of different energy retrofitting techniques and examines the impact of employing those methods on energy consumption of residential brick veneer buildings in Victoria (Australia). Proposing different remedial solutions for improving the energy performance of residential brick veneer buildings, in the simulation stage, annual energy usage analyses have been carried out to determine heating and cooling energy consumptions of the buildings for different proposed retrofitting techniques. Then, the results of employing different retrofitting methods have been examined and compared in order to identify the most efficient and cost-effective remedial solution for improving the energy performance of those buildings with respect to the climate condition in Victoria and construction materials of the studied benchmark building.

Keywords : brick veneer residential buildings, building energy efficiency, climate change impacts, cost effective remedial solution, energy performance, sustainable design principles
Conference Title : ICASBE 2016 : International Conference on Architectural, Structural and Building Engineering
Conference Location : Rome, Italy
Conference Dates : September 15-16, 2016