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ENERGY PERFORMANCE OF DOUBLE SKIN FAÇADE FOR HIGH-RISE RESIDENTIAL BUILDING IN ABU DHABI

By

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Abstract

The hot climate of the UAE generates unique challenges for architects and building engineers looking for energy efficiency in high-rise residential buildings. The use of glass building facades has been increased; this type of façade usually comes with a high air-conditioning cost due to the higher heat gain. To design energy-efficient buildings, it is essential to adapt the principles of sustainability and innovative transparent glass façade design into practice as the building facade is a major element in determining the amount of energy used in buildings. Construction details, methods, and materials of the residential building facade play an important role in controlling the energy performance level in buildings. This research aims to study, analyze and assess the type of glass and the suitable cavity between the transparent glass façade that can reduce the energy use of the high-rise residential buildings in the hot climate of Abu Dhabi. This can be achieved by recommending different types of double skin façade glass types and the optimum cavity value which can be adjusted innovatively to the changing climatic conditions. The Double Skin Façade (DSF) is a multi-objective, high-performance envelope that can respond to the external climate to meet the internal load requirements (cooling, heating, lighting, or ventilation) and occupants' need. The complexity of the DSF evaluation is related to the performance coupled with occupant behavior and occupant satisfaction. The main benefit of using DSF is to investigate the thermal performance of DSF in High-rise residential buildings in a hot climate. In this context, the study focuses on design principles of a double skin façade implementation details, including building material and construction technology to help architects and engineers reduce energy in high-rise residential buildings. In this research, the data was collected through a survey to define the research problem. The online survey was distributed to the residents of the selected residential tower. In addition, based on the literature, the data were analyzed using qualitative and quantitative approaches to reach the final results. The collected data was studied and analyzed about the following variables: a) the cavity, and b) glass types and their u-value properties. Each variable was explored according to the theoretical framework of the prior studies. However, based on the analysis and feedback received from residents, the design of the selected case study was modified and analyzed accordingly. In addition to the information from other official resources such as the AD municipality archive, the base case was tested by Energy Plus simulation software. The study concluded that the optimum DSF design greatly impacts energy efficiency in high-rise residential buildings. The existing data was modeled and the results were compared with the new model results for each variable. As a result, The optimum double skin façade with a 35 cm cavity with double glazed single skin layer in the interior and a Low-E double-glazed single skin layer as an outer layer, this selected DSF reduces the energy consumption by more than 30% and reduced the AC energy consumption more than 25%.

Keywords: Abu Dhabi, double skin façade, high energy performance building, hot climate, high-rise residential buildings.