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A Proposed Methodology for retrofit the Efficiency of Facades of High Educational Buildings in Egypt

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Abstract:

This study deals with raising the energy efficiency of university building facades that are currently spreading in Egypt. The methodology of the study extracts from previous studies the most important techniques of modern materials for façades. Facade simulation modeling includes internal void type, exterior environmental orientation, hole-to-wall ratio, physical properties of materials used. The results of the application indicate that the best outcomes are ranked in line with different study cases. In the case of the inputs of a commonly used classroom, the separation ratio is 1.5: 1, the use of windows with an opening of the wall area of 30%, the application of a wall of hollow concrete bricks with a thickness of 20 cm and clear glass of 6 mm, the best outputs of the retrofit of the walls came, but by using traditional insulation materials, it was found that the best Wall thermal resistance 1 for different directions, where saving in energy consumption ranges between 4-5%, or by using high-performance insulation materials as these materials depend on technology in the industry where a balance was worked out between the highest rates of energy savings and the economic cost. **Research Aim:** Most educational buildings use large amounts of energy. The research aims to find an integrated approach to evaluate and improve the energy efficiency of design alternatives for facades of higher educational buildings, based on measuring energy efficiency. It is possible to deal with improvements in this type of building based on the climatic conditions in Egypt to highlight the problem of primary energy consumption related to building facade elements in existing educational buildings to reduce energy consumption and improve performance. Throughout the year by applying the technical development of modern building materials in the facades using methods of wall insulation and glazing. To improve the thermal performance of the interface with energy efficiency. **Methodology:** This research aims to reduce energy consumption and improve thermal comfort as a scientific and practical solution to the energy problem in Egypt. Thus, there is a problem that needs to be solved, which classifies the research as an applied pilot case study research. The literature has helped identify the most efficient solutions to improve the building's thermal performance, reduce the building's energy consumption and incorporate energy-saving retrofit with material technology. The traditional and advanced high-performance materials suitable for us have collected in the facade of the building as examples used to verify; its performance and for each type of ratio of walls to openings that can be found in the facade of a higher educational building. An application was conducted on an experimental case study of an educational space with a medium role, and this space is exposed to all directions using a computer simulation program to assess the effect of a set of proposals for the thermal resistance of the wall, the solar gain factor of the windows, the use of materials and the strategies for energy retrofit on the facade of the building of the higher education building in Cairo. The conclusion and recommendation were extracted in a program that collects a database; Helps predict the solution to the energy problem and the amount of savings and cost. **Research problem:** The facades of the educational buildings, especially the university, are one of the essential elements of the building, which led many designers to take care of the aesthetic and philosophical form of the building as a priority at the expense of the environmental aspects to the development of their concepts with the technological development of life and the development of their practical impact on the performance of the environmental building and on the rates Energy consumption. This negligence by the designers of the environmental aspects led to the negative performance of the building, and the energy consumption in the educational buildings sector increased significantly. The poor façades of the educational buildings contribute to severe problems and hurt the performance of students and attended, the excellent design of the facades, which takes into account the achievement of thermal comfort has a significant role in improving the concentration and attendance of students. **This research aims at trying** to raise and improve the facades of educational buildings.There is a demand for a new and practical approach to the university education interfaces to the better educational experience and sustainable climate conditions as it approaches energy reduction in the study spaces. The building façade is responsible for about 20 per cent of the building's total energy consumption. Energy-efficient

strategies are needed in order to optimize the building façade's share of energy consumption. Since existing buildings make up the bulk of the built environment, it is crucial to initiate energy conservation solutions. Building facade energy retrofit can provide a solution to improve the building's energy consumption. This research focused on the use of technical materials with strategies for energy retrofitting of a building façade component. Retrofitting an existing building facade provides significant opportunities to reduce global energy consumption and greenhouse gas emissions by modifying the properties of walls and windows by adding heat insulation or other technologies to enhance the building's sustainability. **Conclusion:** This study was set out to suggest an effective solution for the energy problem in Egypt. The energy efficiency of buildings is very low, which increases energy demand. Therefore, the central aspect to consider while solving this problem is improving building facades for existing high educational buildings. High energy efficiency buildings have been widely used in different parts of the world, and they have proven their success and feasibility. It has been applied commonly in new buildings and cold climates; for this reason, the study had to amend the current methodologies to make it applicable for existing buildings and suit the hot arid climate in Egypt. This research provided a methodology for the appropriate retrofit of facades existing high educational buildings in Egypt to reduce energy consumption.

Keywords:

High Educational Building, SHGC Solar Heat Gain Coefficient, Thermal Comfort, Energy Saving

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