A PASSIVE HOUSE STRATEGY FOR EFFICIENT ENERGY SAVING IN EGYPTIAN BUILDINGS

By
Eng. Hebat Allah Abdel-Halim Mahmoud

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Architectural Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Title of Thesis:

A PASSIVE HOUSE STRATEGY FOR EFFICIENT ENERGY SAVING IN EGYPTIAN BUILDINGS

Key Words:
Passive House Criteria; Energy efficiency; Egyptian energy situation; Electricity prices increasing; Energy consumption

Summary:
Egyptians desperately need to save energy, especially in residential buildings. Where the government raised the electricity tariff and announced a policy to reduce electricity subsidies and then reduced to zero in 2021. This sudden economic situation created a real problem for the Egyptian consumers of electric power. This was the main motive for conducting this study to find a solution to save energy in the Egyptian buildings. The aim of this research is to develop a proposed framework for energy efficiency in Egyptian buildings by adopting the Passive House Criteria PHC as a leading global energy efficiency standard that provides up to 70-90% of energy consumption.

الحمد لله الذي بنعمته تتم الصالحات
الحمد لله الذي اعانني على اعداد هذه الرسالة

Disclaimer

I hereby declare that this is my own original work and that no part of it has been submitted for a degree of qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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Abstract

The Egyptians are in great need for saving energy consumption, especially in residential buildings, which has become inevitable. In July 2016, the government had raised the electric energy tariffs and declared a policy to reduce the electric power subsidy gradually and then to cut it to ZERO in 2021. This sudden economic situation created a real-life problem for Egyptian citizens reflected in their inability to pay the ever-increased electric monthly bill. In addition, with the warnings of climate change caused by the global warming phenomena, buildings are expected to consume more energy in the future to sustain the comfortable living environment. This complicated problem, has multi-faces of economic and environmental roots. This research found that the "German Passive House Criteria" has achieved tremendous energy saving up to 70-90% in buildings and has been successfully adopted and applied throughout the world.

This research studies the following topics: analyzing of the current energy situation in Egypt, reviewing of current and future programs for energy efficiency and identifying key barriers to apply energy efficiency strategies. Then, clarifying the importance of the energy efficiency worldwide, studying and comparing the most used energy efficiency systems in buildings globally (LEED, GPRS, BREEAM & PHC) to introduce the reason for selecting the PHC for this study. After that, analyzing the Passive House Criteria concept, principles & criteria requirements. Following that, the applied part of the study comes to investigate relevant best practices and lessons learned from international real case studies. Finally, the research suggests a framework to have ultra-low energy Egyptian buildings successfully.

The aim of this research is to develop a framework as a solution to save energy consumption dramatically in the Egyptian buildings by adopting the Passive House Criteria PHC. It is considered the power of now energy efficiency standard worldwide, so, the Resolution of the European Parliament called for its implementation by all member states by 2020. This suggested framework embeds the PHC with a design management processes to develop an Energy Efficiency Building Criteria in Egypt. This framework is divided into three approaches; Architectural approach, Governmental approach, and Academic approach.

This research expects to demonstrate that such framework could be feasible, and that would offer a range of benefits: on the individual level; it ensures that residents would significantly pay less for the energy used, on the state level; it is supposed to save several Mega-Watt from the national electric power load, gain a greener environment, and add value to the overall Egyptian economy. The result will include an integrated framework to adopt the PHC in the Egyptian buildings. Finally, the research concludes with several features which highlight the potential for a promising move towards ultra-low energy buildings ready to meet the challenges of the region in the future. The research recommendations should be followed up with further studies to validate the PHC across different building types.