

The Impact of Passive Design Factors on House Energy Efficiency for New Cities in Egypt

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Abstract : The energy consumption of a house can be affected simultaneously by many building design factors related to its main architectural features, building elements and materials. This study focuses on the impact of passive design factors on the annual energy consumption of a suggested prototype house for single-family detached houses of 240 m² in two floors, each floor of 120 m² in new Egyptian cities located in (Alexandria - Cairo - Siwa - Assuit - Aswan) which resemble five different climatic zones (Northern coast - Northern upper Egypt - dessert region- Southern upper Egypt - South Egypt) respectively. This study present the effect of the passive design factors affecting the building energy consumption as building orientation, building material (walls, roof and slabs), building type (residential, educational, commercial), building occupancy (type of occupant, no. of occupant, age), building landscape and site selection, building envelope and fenestration (glazing material, shading), and building plan form. This information can be used to estimate the approximate saving in energy consumption, which would result on a change in the design datum for the future houses development, and to identify the major design problems for energy efficiency. To achieve the above objective, this paper presents a study for the factors affecting on the building energy consumption in the hot arid area in new Egyptian cities in five different climatic zones , followed by defining the energy needs for different utilization in this suggested prototype house. Consequently, a detailed analysis of the available Renewable Energy utilizations technologies used in the suggested home, and a calculation of the energy as a function of yearly distribution that required for this home will presented. The results obtained from building annual energy analyses show that architecture passive design factors saves about 35% of the annual energy consumption. It shows also passive cooling techniques saves about 45%, and renewable energy systems saves about 40% of the annual energy needs for this proposed home depending on the cities location on the climatic zones.

Keywords : architecture passive design factors, energy efficient homes, Egypt new cites, renewable energy technologies

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