Design of a Modified Egyptian Solar House Using PV Energy

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Abstract

Energy demand is continuously increasing due to global population growth and improved living standards. However, fossil fuels, the current primary energy source, are being consumed in a random increasing manner, even though they are non-renewable and their global quantity is limited. Consequently, environmental pollution and global warming are fearfully increasing. Based on this fact, worldwide governments are working hard to raise the share of renewable energy sources, reduce energy consumption and accordingly reduce environmental pollution. A solar house takes advantage of solar energy to minimize the use of traditional energy sources. This can include design elements that take advantage of the sun's rays to light and heat the house, to heat water, and to set up a favorable flow of air. Many solar houses contain a solar mass that will absorb the heat during the day and release it slowly at night. This paper proposes and develops the design of a small two-story residential solar house of 110 square meters for a medium-size family located in Cairo, Egypt The house consists of a ground floor which includes 2 bedrooms, living room, kitchen, bathroom, entrance and upper floor. It includes a large bedroom that is accessed by a wooden staircase from the ground floor. The house is illuminated using natural light during daylight and cloudy hours as well as artificial light sources at night hours .the proposed solar house, which meets almost all its energy demands, including space heating in winter and a summer humidification and ventilation system .Hot water is obtained throughout the day by using sheltered black tank A stand-alone photovoltaic (PV) system is used to feed the electrical load of the solar house. The proposed electrical and thermal systems of the solar house are designed, modeled and simulated using MATLAB.

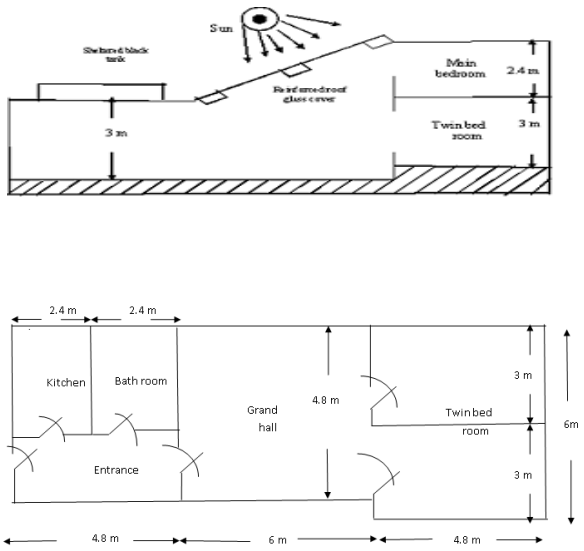


Figure 1: The proposed solar house

Recent Publications

1. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE), (2005) ASHREA Handbooks, Fundamentals.
2. Charron, R., and Athienitis, A. K. (2006) Optimization of the Performance of Double-façades with Integrated Photovoltaic Panels and Motorized Blinds. Solar Energy 482-491
3. C. Garnier, J. Currie and T. Muneer (2009) Integrated Collector Storage Solar Water Heater: Temperature Stratification. Applied Energy 1465-1469.
4. American Concrete Institute (ACI), 2005. ACI 122R-02 Guide to Thermal Properties of Concrete and Masonry Systems, Manual of Concrete Practice, Part 1.
5. Charron, R., and Athienitis, A. K. (2006) Optimization of the Performance of Double-façades with Integrated Photovoltaic Panels and Motorized Blinds. Solar Energy 482-491.



Biography

Dr. Hanaa Mohamed Farghally received her BSc in electrical power and machines from the faculty of engineering, Helwan University in 2000. She awarded her MSc in 2005 s in the field of medical herbs drying using renewable energy in remote area , from the faculty of engineering, Cairo University , while the PhD degree was awarded in 2009 in the field of optimization of renewable energy systems, from the faculty of engineering, Cairo University. She is currently an assistant professor in Photovoltaic cells department, Electronics Research Institute since 2015. Her experience is mainly in the field of design, control and optimization of renewable energy systems.

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Prof. Faten Hosney Fahmy received her BSc in electrical power and machines from the faculty of engineering in 1972. Her MSc was in automatic control while the PhD degree was in the field of operation research and optimization. All the above degrees were received from the faculty of engineering, Cairo University. She is a professor in Electronic Research Institute. She was the women of the year 1998, listed in Five Hundred Leaders of the 20 th Century, Who's Who 99 Encyclopaedia. Her experience is mainly in the field of operation research and optimization. Also, in the field of renewable energy systems and applications

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Notes/Comments: