Architecture Design and Energy Performance of a Nearly Zero Energy Building with easily mounted and demounted modules in hot climate

Mohammed Ahachad

University of Abdelmalek Essaadi, Faculty of Sciences and Techniques, Tangier, Morocco

Short Communication

Abstract

Buildings use a tremendous amount of energy and are thus responsible for between 25 and 40% of greenhouse gas emissions globally, and more than 30% of total Morocco carbon dioxide emissions.

The Moroccan building sector accounts for 33% of the country's total energy consumption, of which 25% for the residential sector and 8% for the tertiary sector. This energy consumption will have to increase rapidly in the coming years for two main reasons: the first one is the important developments in the building sector, the 170,000 per year housing program. The second is the significant increase in the rate of household HVAC equipment, lighting and hot water due to the improvement in the quality of life and the drop in the prices of such equipment (heating, ventilation, cooling, water heating, refrigeration, etc.). Thus, Morocco is targeting a strategy that will allow it to achieve renewable electricity of about 52% of the total installed in Morocco and to achieve 20% of energy saving by 2030 thanks to the energy efficiency in different sectors.It is in this context that TDART team from Abdelmaleek Essadi University, challenges to design and build highly efficient Building with easily mounted and demounted modules based on the full integration of active-passive solar technologies and bioclimatic architecture to reach a positive energy balance. Our home is required to meet exact criteria and perform specific tasks which are as follows:1. The house had to be kept within a comfort zone of T°C between 21.7 and 24.4 °C and less than 60% rH.2. as regards Appliances: the refrigerator and freezer had to remain on in a “normal” fashion, while others like washer, dryer, dishwasher, cooktop had to be operated in a normal fashion at prescribed times in the competition period.3. Lighting and home electronics were required to be on during specified hours, and the team had to draw a fixed amount and temperature of hot water (simulating a shower) and host dinner parties and a movie night for a group during the experiment period.4. As regards the energy balance, the teams were required to producing more energy than they consumed.The impact of insulation, HVAC system on thermal performance have been analyzed through the comparison with other houses on-site and TDART house demonstrated excellent performance. The monitoring results of the TDART house during the Solar Decathlon Africa competition showed that the total real energy consumption (180.74 kWh) was nearly half of the generated energy (304.45 kWh) providing a net positive balance of 123.70kWh. The combination of low energy consumption and high energy production during competition merited the TDART home the first place in the four measured contests "Comfort Conditions", "Electrical Energy Balances", "Appliances" and “Home Life and Entertainment" and the 6th place overall. The TDART house brings, not only, an original form of residential building in Morocco, but also a novel and reliable reference for the near-zero energy modular building responding to the social and environmental demand of the African continent and the Mediterranean region.

Biography

Mohammed Ahachad, Prof. Dr. at the Faculty of Sciences and Techniques, University Abdelmalek Essaadi, Tangier – Morocco, since 1996. He is a Consultant Expert on Energy Efficiency and an Expert trainer certified ADEME/ADEREE and GIZ/AMEE for the Energy Efficiency training course. As an expert in energy efficiency and renewable energy, Mohammed Ahachad, has developed an extensive expertise in the field of Energy Efficiency and Renewable Energy and has over 40 publications in scientific journals and international conferences. On behalf of public institutions and organizations such as the Moroccan Agency of Energy Efficiency (AMEE), and United Nations Development Program (UNDP), he was National Coordinator of Energy Efficiency Building Program in which Moroccan Thermal Regulations for Construction was developed. Since 2010, He is Director of the Renewable Energy and Energy Efficiency Chair of the Euro-Arab Foundation for Higher Studies in Granada (Spain. He was Executive Director (2009-2010) of the Arab Science and Technology Foundation, UAE (International NGO S & T, www.astf.net). Moreover, he has supervised several Ph D and Masters Theses and has been the principal investigator and the project manager for several international research projects dealing with different research topics concerned with his research interests mentioned above.

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