

Comparative Analysis of energy performance in buildings in the Mediterranean area (Tunisia-Italy)

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Abstract

The objective of this paper is to illustrate the peculiar bioclimatic characteristics of given building types and of the importance of specific building parameters in different climatic environments, with the specific objective of identifying solutions capable of improving comfort within these specific building types.

The study consists in a comparative analysis between a typical building type in the city of *Gadhames* (Libia) and one in the central-southern area of Italy (*Loreto Aprutino* in the Abruzzo Region) from the point of view of bioclimatic behaviour. In fact, from the building typology point of view (geometry, distribution of spaces, dimension of walls) some analogies exist in the settlements: multilevel buildings with an internal courtyard can be found in both locations. In order to show to the fullest possible extent the differences in performance levels, given the above mentioned considerations, we took a real Libyan building and hypothesized its geometric and spatial reproduction in Italy. The "bioclimatic" performance of both buildings were evaluated by simulating their reaction to heat variables and by using climate data taken at various intervals during the day in both locations.

Particular attention was dedicated to the role of the internal courtyard so as to determine comfort levels inside the buildings in both summer (during overheating) and winter (during underheating).

After the different energy performance levels had been defined, various systems for improving both conditions were hypothesized and an attempt was made to establish the extent to which different climatic conditions require different materials, heat mass, insulation and other types of protection.

Software programmes for energy calculation in regime termico transitorio for different types of analysis were used; they were:

(Ecotect) Evaluation of the physical-environment system:

An evaluation of the physical-environment system is conducted with analysis of sun-air impact, evaluating via a qualitative approach, how a building reacts to the climatic conditions of the site.

(EnergyPlus) Analysis of the climatic conditions:

Parameters to analyze (air temperature, partial pressure of humidity in the air, wind velocity and direction, direct and indirect radiation from the sun,...) are characteristic of a given geographic area and it is necessary to know what they are in order to correctly evaluate the energy performance of a building so that in a design phase appropriate technological choices can be made to improve the overall well-being conditions within confined spaces.

Evaluation of energy performance of architectural technology

The results of the previous analysis established the basis for the subsequent evaluation of energy performance of the building in question. Analysis starts with an evaluation of heat transmission coefficients of the single elements that constitute the building, following analysis concentrates on the evaluation of heat inertia, a parameter which, in addition to heat insulation, contributes in a decisive manner to conditions of well-being in internal confined spaces.

Evaluation of internal heat-humidity

The evaluation consists in determining heat present in confined environment and therefore considers physical-environmental variables during the whole period of simulation with the possibility of evaluating the real energy performance of the building system and taking into consideration not only the efficiency of heat transmission of the structure but also the inertia that characterized these particular building configurations.

In conclusion, the results obtained allow us to make some generalizations on the entity of given building parameters in similar climatic areas, as well as providing indications on the best energy strategies to adopt in the climatic areas taken into consideration.