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Cover Design: PhD Valerio Perna

Guest Editors: PhD Fabrizio Aimar
PhD Ermal Hoxha
PhD Keti Hoxha

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Contacts:

Rr. Autostrada Tiranë-Durrës, Km.5, Kashar
KP 2995, Tirana Albania
Tel:+ 355.(0)4.24074 - 20 / 21
Cel: +355.(0)69.20 - 34126 / 81881
Email: forumap@universitetipolis.edu.al
www.forumap.org

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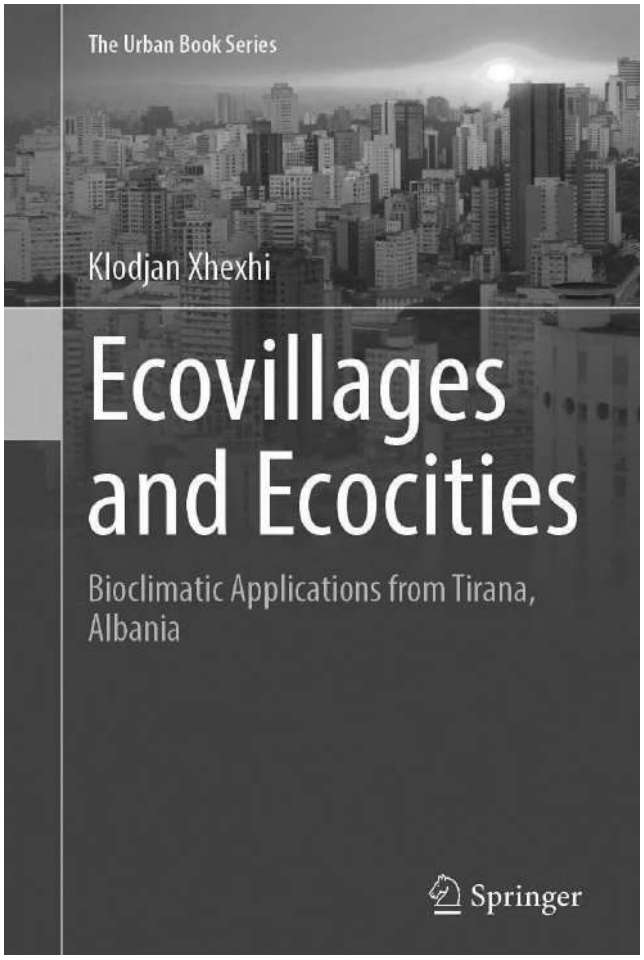
SANTINA DI SALVO
POLIS University



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Introduction

The book "Ecovillages and Ecocities. Bioclimatic application from Tirana, Albania" focuses on the latest technological advances in bioclimatic architecture at a global level, starting with the description of the characteristics of ecovillages and eco-cities, and ending with the case of Tirana, the capital of Albania. The author, Klodjan Xhexhi, Ph.D., Head of the Applied Research Department of the Polis University of Tirana, highlights the relevance of the holistic approach to the scientific investigation of the factors and mechanisms that determine the degree of performance of the building envelope, starting from types of ancient building systems and proceeding with the consequent development of technologies for the exploitation of energy resources at no cost, with particular attention to the application to the building system of the city of Tirana. In this regard, global evaluations were made on ten case studies, to determine the advantages of bioclimatic architecture thanks to the use of passive resources for lighting, heating, and passive cooling. The book is a comparative study that represents the result of several years of research by the author in this field and is divided into 9 chapters. Each chapter has an introductory abstract and conclusions that facilitate reading and results, with bibliographic references that help to understand the research and experimental path.

Contents

In the first chapter, the author provides the selection criteria of the 10 case studies, chosen based on comprehensive geographical coverage, to have a clear vision of different continents in cities with a high population rate. Therefore, 5 Ecovillages are selected: 1. Auroville, India 2. Sieben Linden, Europe 3. Eco villages at Ithaca, U.S. 4. Ecoovila, Brazil 5. Mbam and Faoune, Senegal. And 5 ecocities: 1. Dongfang, Shanghai, China; 2. Masdar, Abu Dhabi, United Arab Emirates; 3. Arcosanti, Arizona, USA); 4. Chang Chun, China; 5. Zira island, Baku Azerbaijan 6. Globe Town, Nizhny Novgorod, Russia. For both groups, ecovillages, and eco-cities, matrix tables are

constructed to better understand their potential and functionality as well as the particularities and characteristics related to biodiversity, health, energy, urban planning, costs and projects, project surfaces, transport, water, project time, population. The comparative study also includes a neighborhood chosen in Tirana, concerning the potential of the city to become an ecocity based on carbon-neural policies with the attempt to evaluate and improve the lives of the citizens of Tirana.

Therefore, in the second chapter, the author gives an overview of the city of Tirana and the relevant ecological potential, starting from the geographical and climatic description. Actually, flora and fauna contain different typologies of species and plants. Tirana benefits from a temperate Mediterranean climate and, despite knowing the benefits of solar radiation, the urban structure of the city does not take advantage of it, suffering from different types of pollution such as air and noise with values far above the limit imposed by EU and WHO (World Health Organization) standards. In order to understand the choice of certain types of construction, the author describes the legislative, at the level of the general regulatory plans, to collect useful information for a correct bioclimatic eco-restructuring. Particular attention is given to the construction type of underground tunnels built during the communist regime throughout the city between 1945 and 1983 in response to a hypothetical nuclear attack to repair the town from bombing. Here the author notes how, typologically, these underground tunnels represent a natural solution that exploits convective air motions and geothermal principles to lower the temperature and have sustainability characteristics of passive cooling systems, with zero energy expenses for the inhabitants.

To establish what the parameters must be to build a sustainable building, in the third chapter, the reference is made to the two environmental certification protocols of the most adopted buildings in the world: LEED and BREEAM. These protocols are relevant because they transparently measure and declare the building's sustainability performance. Similarities and differences between the two protocols reflect the cultural, legislative, and economic context in which they originated. Of British origin, the BREEAM scoring method reflects the peculiarities and different approaches to the green building sector. While credits for each area apply globally in LEED, BREEAM has developed flexibility through a national weight system adapted to local geographic specifications and regulations. The list of requirements is very articulated and is aimed at giving each building a global score. The author points out that, currently, Tirana does not follow either protocol but highlights the need to adapt both new and existing buildings to these standards to achieve good energy consumption levels for typical use. The building is considered a zero-energy building when very low or almost zero energy needs are covered in a very significant way by energy from renewable sources, including energy from renewable sources, produced on-site or nearby.

The central part of this work constitutes the fourth chapter concerning the experimental analysis carried out in a specific district of Tirana, located on the outskirts of the historical inner ring of the city, characterized by buildings built in the period 1965-1980. In particular, these are five buildings all the same, with retaining walls that follow the technical construction parameters of the time. Here the author assesses the social impact of the energy behavior of buildings on the inhabitants. Through a questionnaire to the inhabitants of the buildings in the neighborhood to have a better understanding of the social, economic, and housing behavior in the site, data were collected on lifestyle, level of satisfaction, actual conditions of buildings, electricity and water consumption, heating and cooling tools, ventilation systems, the degree of pollution of the area, etc. The results showed that the level of satisfaction with life in the neighborhood is surprisingly above average, despite the physical condition of the buildings being precarious and energy consumption very high.

In the fifth chapter, the author describes the benefits of the reduction of energy needs for heating, cooling, and lighting and how the exploitation of passive resources can improve the quality of life in the city by providing comfortable conditions throughout the year. The data collected during the analysis of the case studies give a better understanding of the general approach of the bioclimatic project and that the management of energy flows also depends on construction elements as walls, windows, roofs, and floors, to collect, store and distribute solar thermal energy and prevent overheating. Today, simulations through specific software help designers in designing a sustainable building, and the results show that, as much as we try to evaluate all the parameters, the use of the principles of bioclimatic design is still a challenge to achieve the goals of a functional bioclimatic house.

The sixth chapter confirms the importance of urban morphology and materials of the built environment on the trend of the heat island phenomenon in cities characterized by the Mediterranean climate. Specifically, the city of Tirana has a Mediterranean climate characterized by hot and dry summers and mild and cold humid winters with high daily temperature ranges and an average annual temperature of 15.4 ° C. In the city center, there are areas with a high percentage of commercial and industrial activities characterized by various settlements and traffic, the so-called sealed areas with high noise and air pollution. In these areas, heat islands are formed since the temperature is higher than in nearby rural areas. Heat islands can affect communities by increasing energy demand during the summer season, also increasing the costs of air conditioning systems, air pollution, greenhouse gas emissions, heat-related disease, mortality and water quality. The choice of materials with different energy absorption capacities and the densification and integration of green spaces in the urban context, following the principles of bioclimatic design, can help mitigate the effects of overheating on the microclimate.

The seventh chapter deals with the analysis of the site within which the underground tunnels are located and of the physical conditions of the structures and materials of the buildings under study. The arrangement of buildings concerning the city's urban structure is random since the socialist regime and profes-

sionals of the time did not consider the orientation of buildings to benefit from solar radiation. Regardless, the comparative analysis of the window-to-wall ratio (WWR) and window-to-floor ratio (WFR) showed relatively good results compared to international case studies. Data from thermographic analysis on buildings and the determination of the effectiveness of materials as insulators (u-value) showed poor results compared to the international and national standards. Based on this, it emerges the need to consider energy requalification strategies to include buildings within the comfort zone, increasing the degree of thermal potential and avoiding thermal bridges due to current construction materials as much as possible. For this reason, it is essential to use specific instruments Testo 882 for thermal photographs and Testo 435-2 for measuring the heat transfer coefficient (masonry).

In actual fact, through the eighth chapter, the author aims to create awareness in the community about the great benefits of such bioclimatic design strategies and the need to implement them, not only in Tirana but also throughout the region. As for traditional materials, the use of materials with high heat capacity, such as stone or water, is becoming known nowadays in the bioclimatic and passive design approach of buildings. These materials are efficient when they have large surfaces and cope with strong solar radiation. Hence, the author goes into the heart of innovative materials emphasizing their importance in terms of solar gain, materials such as PCMs, piezoelectrics, the implementation of the wall of trumpets, and EFTEs allow obtaining the maximum benefits from the exploitation of passive resources for lighting, heating and cooling. The techniques of exploitation of clean energy allow comfort and economic advantages, avoiding the use of traditional air conditioning systems.

For this purpose, the important example of the Empathic House, which was exhibited in Saint Etienne for the France Biennale, is cited, which aims to raise awareness about significant issues and facilitate the potential for change through the integration of new systems and concepts in our lives. Nano-Ordinaire by Matali Crasset is a key example that is important to mention because it focuses on the current way in which people generate, store, transmit and use energy, proposing different frameworks in which nano energy becomes the key actor in providing clean energy to a household, exploited and stored through simple daily actions. The concept aims to shift the user's condition from consumer to energy producer. Living actions every day can generate energy for local consumption through ultra-low energy consumption appliances that use smart materials. These materials are mini-energy producers that indicate the first inputs that the inhabitant must face to change the way the people perceive the objects around us, considering alternative physical relationships with them. Similarly, in the case of Tirana, exploiting underground tunnels would mean obtaining fresh air since the temperature of the subsoil remains constant, minimizing the use of mechanical systems in summer. Of course, it is also necessary to choose suitable thermal insulation materials, a complex and sometimes decisive issue, in order to reduce heat gain. The best insulation material most used in Tirana is expanded polystyrene (EPS). The energy required for its production is relatively low compared to other insulating materials, so the exploitation of this type of material would help reduce the ecological footprint of buildings. One aspect of bioclimatic design also concerns the use of specific materials to recycle rainwater through drainage. Another relevant aspect in the management of energy flows concerns the design of windows from the point of view of dimensions, material characteristics and thermal performance.

In the ninth and final chapter, the author describes in detail the passive systems and applies them to the case study of the buildings of Tirana, comparing them with data obtained using traditional tools and materials that exploit the principles of bioclimatic design. It evaluates the average annual temperature of the city and the orientation of the different areas of the building, also considering the glazed areas, the use of various shielding devices, the heat trap area, the thermal masses, and the ventilation systems. The current orientation of the sampled buildings does not meet the criteria of bioclimatic design but can be adapted so that they can use energy intelligently. In an experiment, greenhouses are applied to buildings designed according to international standards, also considering the climatic characteristics of the geographical context. It is estimated that the average temperature of Tirana is 15.4 degrees, like the temperature of the subsoil that remains constant up to 6 meters.

Greenhouses represent one of the base systems of passive strategies designed to conduct the desired air to other spaces through the direct opening having the character of a transitional space between the indoor and outdoor environment. During the winter, their internal temperature is higher due to the heat trap, while in the summer, such structures need ventilation. Thermal mass is usually applied to the floor. The use of shading devices and planting vegetation helps reduce the penetration of solar radiation into the building. In another experiment, it is shown that the application of the passive system of solar chimneys is used to accelerate the flow of fresh air from the underground tunnels, thanks to the differences in temperature and pressure, to the outside bringing it to the residents. The advantages of the solar fireplace/tunnel combination are fundamental to ensure cooling and comfort characteristics inside buildings without the use of mechanical systems. In addition, based on the electricity demand, specific calculations are made using the application of the Canadian expert Retscreen in order to meet the electricity requirements of one of the buildings sampled. The data showed that implementing photovoltaic panels to convert solar radiation into electricity can help reduce greenhouse gas emissions, hence air pollution.

Even the technology of solar collectors applied in buildings to illuminate areas that cannot be reached directly by sunlight has proved to have an excellent performance, with a considerable saving of electricity. As a passive strategy, recycling rainwater and wastewater is also considered using the reed bed strategy and fertilization of bathtubs. Based on the results obtained, the author makes a specific and unique proposal to graphically realize the proposed ideas in combination with a

software simulation application, MEEC (Montenegrin Energy Efficiency Certification), which is finally used as a tool to better understand the thermal performance of the building considered, to improve the degree of thermal performance of the building.

Conclusions

In conclusion to the arguments and indications given by the author, it is clear that Tirana has all the potential to be an ecocity, a case for implementing processes for bioclimatic eco-renovation in every cell of the city, both in existing and new buildings. Reducing energy demand can lead to the creation of zero-energy buildings. This analysis represents the starting point for a comprehensive program of gradual ecological restructuring of the city. There are many areas or neighborhoods in Tirana that lack such advantages offered by underground tunnels or proper orientation. For these areas, other strategies can be implemented to enable buildings to function better by exploiting natural systems. Therefore, this book is of interest to both academics and professionals because it represents a reference point to address the challenges that characterize the complexity of cities in expansion such as Tirana, and develop interdisciplinary strategies to implement the energy transition process in progress.

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