

BIOCLIMATIC ARCHITECTURE: BRIEF HISTORY AND FUTURE OF THE PHENOMENON

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Abstract

In the article the characteristic of «bioclimatic architecture» is presented and the theoretical concept of this phenomena is given. The author designated the signs of this phenomenon which were periodically arising in the history of construction practice. Factors which influence defining on process of architectural and engineering design are revealed and probable prospects of development of this direction are considered.

Keywords: bioclimatic architecture, history of architecture of the XX century, actual architecture, contemporary architecture, energy efficient buildings, sustainable buildings, low energy buildings, ultralow energy buildings, passive buildings, healthy buildings, intelligent buildings, actual design, eco-design, bio-tech, organi-tech.

Introduction

The old aspiration of the person to subdue a force of nature led today to the change of ideas of value of the natural world around. Now in the world of architectural and construction practice the huge attention is given to a problem of economy of fuel and energy resources which are spent for a heat supply and a climatisation of buildings. It led to the emergence of the special architectural building type called “energy efficient building”. The main task of such architecture is in a balanced creation between a pole of a technogenic civilization and the nature. This balance will allow to avoid danger of an ecological disaster, regulating formation of the artificial environment of abiding of a man. The solution of this task is in the following factors: usage of the latest developments from the area of fundamental sciences, possibility of the attraction of nonconventional power, and also optimization of the streams of heat in buildings (including those operated on the bases of computer equipment).

In the 1951 brothers Aladar and Victor Olgiay have introduced into a practice the concept of «a thermal building» and «a bioclimatic approach» in design. They mean operation of renewables – such as the sun, water, streams of air masses, and also oblige architects to include the natural or artificially created green girdle into the project.

At the beginning of the XXI century post-modern «hi-tech» style has changed a vector of development of architecture of “tekhmitsizm” towards connection with what design and biotechnologies are. The bioclimatic architecture is one of the perspective directions of hi-tech style (BioclimaticX, 2009). Now definitions and characteristics of separate

concepts of design of “energy efficient buildings” and «sustainable buildings» which are carried out diversely of hi-tech style are yet accurately created. They are distinguished according to concepts of the technologies involved at design. Closest to biopower architecture are such phenomena as «low energy building» or «ultralow energy building», «passive building», «healthy building», «intelligent building». In the literature of the general character such terms as «high-tech building» or «energy efficient building» are used more often.

Design and construction of bioclimatic buildings is based on aspiration to establish harmonious connection of architectural space with the natural surroundings. In the course of construction of power effective and non-polluting buildings the most actual construction technologies are applied. Building materials, in its turn, are non-polluting and positively influence a microclimate of premises. Active usage of the energy resources is reached at the expense of application of the latest inventions in the field of equipment. The quantity and the quality of the consumed energy intended for bioclimatic buildings shouldn't cause notable violations in a state of environment (Nohmis Design. Dr. Ken Yeang, 2011).

Architectural researches and design of such objects include studying of a possibility of ecological renewables usage, preservation of water resources, and application of construction materials of a reuse that should lead to improvement of quality of habitat of a man. Such principle of work will allow to regulate formation of the architecture planning environment and to reveal maximum-permissible conditions of the development of town planning as

a whole. The approximate assessment of ecological and power efficiency of projects should be provided by the following indicators: the minimum power consumption, regulation of an intake and pollution of water resources, restriction of amount of allocated gases (which lead to a “greenhouse effect”), disposal and processing of construction and domestic garbage, etc.

The history of development of a phenomenon of bioclimatic architecture

The phenomenon of bioclimatic architecture originates at sources of a human civilization. Direct contact of the ancient man with the nature has influenced preferences of certain climatic conditions. Therefore the most ancient centers of settlements were ranged in the zones favorable for human life. Possibility to be engaged in agriculture defined the development of so-called «early agricultural cultures» on the territory of East Coast of the Mediterranean Sea, in lands Anatoly, in valleys of the deep rivers – Nile, the Tiger and Ephrata, Indus and Huang He. The climatic girdle of subtropics with high mid-annual temperatures and the minimum seasonal changes appeared the most acceptable for accommodation. The need to protect oneself from the severe natural phenomena led to the fact that the natural topographical land form relief became shelter: a cave or a grotto warmed by means of fire. Development of instruments of labor generated a big variety of types of the dwelling: temporary tents, dugouts, and also constructions on piles. Adaptations to conditions of the district and protection against aggressive climatic factors have affected the formation of the most ancient types of the dwelling which the person built upon a level of intuitive searches (because of low technology development). The megalithic architecture of an era of metals illustrates the development of spatial thinking in the ancient man.

On the way of improvement of comfort and a microclimate of the dwelling it is possible to consider as the following step the emergence of several independent premises and their group round a uniform courtyard. Quite often in the center of such architectural space the well, a reservoir settled down or trees landed, was formed with its own microclimate. The architecture of ancient Egypt, Mesopotamia, Assiro-Babylon and the Aegean world shows how a rectangular shape of a yard is reflected in a configuration of the plan of the house as a whole. This way the type of an inhabited multiroom cell is formed. There are also first town-planning features which are directly connected with the climate. In particular – with a land relief and desire to protect

the house from scorching beams of the sun. For this purpose buildings were built under a dense construction, continuous facades created a dense shadow, and living rooms settled down from cool North side. The lowered temperature kept in buildings by means of ventilating apertures and special roofing designs. It was detained by also clay walls and whitewashing which slowly dried out during a day. Vineyards and gardens in houses of prosperous people, as a rule, have formed the closed space and promoted maintenance of a comfortable microclimate of all complex. In architecture of Mesopotamia and Forward Asia, for example, such function was carried out by also special balconies galleries in courtyards of houses and the planted trees and shrubs terraces. In palace architecture of ancient Egypt, Babylon and Assyria there were also smart and ceremonial yards. At the general severity of rectangular plans of the buildings, yards weren't symmetrized in them, but only taking into account their practical meaning. In shumer-babilonian architecture of step temple-zikkurat and well-known Babylon Hanging Gardens of Queen Semiarid was simulated for the first time an artificial landscape by a habitat principle.

In architecture of the Greek world there was a comfortable inhabited cell – «megaron», and up the time of ancient Roman construction practice the system of a country house – «solar house» belongs. Ideas of energy saving architecture can also be observed in the principle devices of the Roman baths which were called the «terms».

The architecture of China became the highest achievement of ancient civilizations in the field of connection between architecture and a landscape. The great doctrine “feng-shui” («the wind and the water») about the world harmony of coexistence, still inspires the imagination of modern designers and architects. In universal practice the Chinese and Japanese architects learned to solve for the first time questions of seism stability of buildings and entered into use mobile walls partitions. It is possible to consider as a special achievement also the design of gardens and parks. Imitation of natural conditions of environment in China and Japan reached the highest peak of perfection. On the basis of deep studying of natural factors the Chinese and Japanese architects improved construction and design methods and learned to create comfort conditions, being guided by psychological aspect of the impact on the person.

Thus, in the Ancient world in construction practice there were certain features, which were typical for bioclimatic architecture. Among them it is possible to list the following: decrease in impact on the person of negative natural factors (the building

protection function), search for special architectural planning decisions and creation of comfortable temperature and humidity mode in a building interior, harmonious interaction with features of the landscape, the first attempts of imitation of visual natural effects. The modern bioclimatic architecture seems to come back to development sources in search of the most comfortable conditions of accommodation of the person. But now tasks became complicated because they need not only to correspond to the nature, but also to keep and support ecological environment.

During the periods of the Middle Ages and the Renaissance styles and art concepts have changed. But up to the era of Education in the history of construction there was no such wave of innovations in the field of communication of architecture with energy saving effect which was shown in the Ancient world. The French lodges of “c’est tout”, exotic pavilions of east orientalism, tiny palaces of rococo and English landscaping became the next important stage of discovery. And further – the principles of Victorian “garden city” which have anticipated at a turn of centuries, a train of innovations in architecture of a modernist style (Фремптон, 1990, 98).

Priority place in this regard have such directions of architecture as «plastic modern».

At the beginning of the XX century functionalism and constructivism became the base for the origin of new type of «mass architecture», having mentioned practical aspect of conducting construction. Process of «architectural globalization» and the international style Le Corbusier form began (as well as its well-known plans of the ideal cities) became the following significant step (Фремптон, 1990, 363). The attention to environmental problems became more active during the period of «futuristic boom» in the 1960s. The world energy crisis of 1974 resulted in need to concentrate attention of architects on a problem of economy of fuel and energy resources (with reference to construction practice). Signs of approaching ecological crisis and the need to protect environment became obvious in the late eighties. Reference points on global interests of the mankind appeared to be directly connected not only with prospects of development of world economy and the industry, but also with questions of engineering, architecture, construction as separate objects, and formations of structure of the cities as a whole (Иконников, 2002, т. 2, 541–552).

World famous architects – Ken Yeang (Jodidio, 1999, 524–531) and Norman Foster (Jodidio, 1999, 166–169) became classics of the new direction of bioclimatic architecture. A significant contribution to the development of practice has also brought

Santiago Calatrava Valls (Jodidio, 1999, 126–131), Renzo Piano (Jodidio, 1999, 406–413), Jacques Herzog and Pierre de Meuron (Jodidio, 1999, 212–221). Authoritative architectural groups such as “SOM” and “Herzog & de Meuron Architekten” pursue nowadays a consistent policy of binding with eco design.

Among factors which influence greatly the architectural and engineering solutions of bioclimatic buildings it is possible to list the following: climatic, factors of social and public character, factors of the renewables usage, factors of ecology control, factors of the common planning decisions (at town planning level). Design of objects of bioclimatic architecture should develop towards a principle of conservation of energy and decrease in heat losses (with the minimum expense on heating, conditioning and cooling). Thus, there is a new welfare aspect of architecture which becomes an important link in the course of safety of a world ecosystem and the ecological environment of the concrete district.

Conclusion

In a modern world architectural practice of bioclimatic objects there is little to say, despite obvious advantages and prospects of development of this direction (Bayandin, 2007). It is possible to allocate some reasons of current situation. The first of them is a high cost of design. Need of involvement of highly professional experts and authoritative civil engineering firms are connected with it (Hamzah T.R. & Yeang Sdn.Bhd. International, 2012). The second reason – in lack of interest of consumers (cost of energy remains rather low, and we yet can quite estimate a damage which we put with quite prodigal usage of it).

However construction of power effective and non-polluting buildings, certainly, will gain more active rates already in the nearest future. Humanistic thoughts on improvement of living conditions of future generations should not affect it, though the factor of commercial interest rather should be shown. It can proceed from the investors aspiring to increase in the market sales of housing, and also – from the house owners or from management companies on operation of rent rooms. These social groups of the population are interested in fall of payment for the utilities.

In the modern world there is an objective belief that quality of the surrounding us environment makes direct impact on the quality of our life. Material requirements and spiritual needs of people throughout all history of our civilization influenced prospects of development of architecture. At a

turn of the XXI century it became obvious that the nature can't be a passive background of our activity. Therefore a powerful impulse of development of modern design is the energy saving problem. Problems of architecture of the future – in creation of «the new environment», consisting of special buildings which possess high indicators of comfort in exploitation. The bioclimatic architecture can't only be the separate actual direction. Synthesis with other directions is possible: such as eco-tech, bio-tech, organi-tech. It is architecture in which the ecology and artificially created environment should be organically interconnected at all levels: from the design concept before calculations of economic forecasting. It reflects a new level of synthesis: the union of arts with modern scientific technologies and natural sciences.

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