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THEORETICAL STUDIES OF ECO-PRINCIPLES IN ARCHITECTURE

Zelenska V.S.
student
Turikova O.M.
c.p.s., as.prof.
The Odessa State Academy of Civil Engineering and Architecture,
Didrichson Street, 4, Odesa, Odesa region, 65029

Abstract. *This article discusses ways to popularise ecological architecture. Today, the environmental situation in the world can be described as close to critical, so studying the environmental problems of the modern world and ways to solve them is an urgent task.*

Eco-architecture or sustainable architecture is an architecture that aims to minimise the negative environmental impact of buildings on the efficiency and moderation of the use of materials, energy and space for development and the ecosystem as a whole. Sustainable architecture uses a conscious approach to energy and environmental conservation in the design of the built environment. The idea of sustainability or ecological design is to ensure that our actions and decisions today do not hinder the opportunities of future generations.

Keywords: *Ecological architecture, sustainable architecture, green roof, passive house, eco-sustainable architecture, SIP panels, green roof, living roof, Luis De Garrido.*

Introduction. *Characteristics of sustainable architecture*

Sustainable buildings are characterized by environmentally sustainable optimization in the areas of resources, energy, water and waste water. This essentially means reducing the use of natural resources. For this reason, in sustainable construction, attention is paid to the use of building structures, components and building products at the planning stage, and their energy consumption is low - material and energy flows in the production, transportation and processing of building materials are assessed by calculating the building material. The primary energy content of building materials for non-renewable energy sources, their share in global warming and acidification, is required and made from renewable raw materials as far as possible. In turn, raw materials should be based on sustainable management. Sustainable building materials include, for example, building materials made of wood and clay. Many building materials made from renewable raw materials are suitable for thermal insulation. B. fiber from hemp, flax fiber or sheep's wool. Environmentally sustainable construction is further characterized by the fact that the transport routes of building materials to the place of use are as short as possible to save the necessary energy and material cycles are tightly tightened. If the building is

dismantled, sustainable building products and structures can be largely reused or reused. In this way, they can be safely recycled into natural material cycles. The use of building materials and structures with these substances, which have harmful effects on the environment and people, is therefore avoided or significantly reduced in sustainable construction. These include, for example, halogens used, for example, in refrigerants, heavy metals such as zinc, chromium, copper, lead and cadmium, z. B. in plastics or wood preservatives or volatile organic compounds (VOCs) or hydrocarbons used for carpets, flooring and coatings. These substances have a negative impact on the construction site or during the use of the building, for example, when materials are subjected to longer-term weathering. On the contrary, building materials and structures used in sustainable construction have low emissions, have little impact on the global as well as the local environment, and do not cause health hazards.

1. Insulation and thermal protection

An important criterion that influences the heating and thus the energy demand of a building is thermal insulation. Optimizing the structural insulation helps to reduce the energy consumption of a building, which goes hand in hand with the conservation of fossil fuels. This, in turn, means conserving natural resources and reducing CO2 emissions. Thermal insulation can be achieved in sustainable construction, especially through the building envelope. Thermal insulation systems are the most commonly used. They are thermal insulation material attached to the outer wall of a building with an adhesive. Optimal thermal insulation can be achieved by using insulation materials with low thermal conductivity and high overall thickness. Expanded polystyrene, with and without graphite, rock wool and cork, have the best LCA values in the field of thermal insulation composite systems. Another measure to prevent heat dissipation and thus energy loss through optimized thermal insulation is insulating glazing, which has been standard since the introduction of the third thermal protection ordinance in Germany in 1995. Insulating glass consists of two or three panes of glass. They have a heat-protective metal coating (metals). The interfacial spaces are filled with a noble gas (usually argon). When constructing a sustainable

building, attention is also paid to avoiding thermal bridges. They occur mainly at the transitions of different components, as well as in places where less insulation material can be used through the structure than in the rest of the building.

2. The use of sunlight in ecological architecture

Solar thermal systems are used in the form of solar collectors, especially for water heating. However, since the solar energy required for domestic water heating is not available all year round, the demand can usually only be met by combining solar collectors and existing heating systems. In addition to domestic hot water, solar systems can also be used for heating. In addition, solar energy for air conditioning construction can be combined well with an absorption chiller. Photovoltaic systems are increasingly being used for solar energy supply. They convert the radiant energy of sunlight directly into electricity. Thanks to photovoltaic technology, a building can generate electricity for its own production as well as for supplying it to the public grid.

The physical parameters that ensure a comfortable indoor environment are part of environmental architectural physics: architectural lighting, climatology, and sound (acoustics). These parameters of the indoor environment of buildings must be environmentally sound and acceptable to humans.

Sensory ecology (the ecology of environmental perception by the senses) plays a crucial role in the interaction of a city resident with the environment, in creating a favorable image of the city, in the perception of all environmental factors. The sensory environment is often aggressive to humans. Perhaps, the mechanism of "aggressiveness" of the modern urban environment is as follows: under the influence of the previous natural environment and living conditions, the human brain has developed a personal experience (personal environment) that determines its behavioral structure and biopsychological state. The brain has created a nature-like image of the environment and its components (places of settlement, houses, streets). New unusual sensory influences do not correspond to previous experience and create tension in the psychophysiological state: the modern aggressive environment requires the creation of a new image of the city, new experience, and a new structure of

behavior.

Acoustic ecology is one of the most relevant areas of ecological architecture. Humans are exposed to strong acoustic impacts that were not known before or were active in previous centuries for a short time (earthquake, avalanche, thunder, hurricane, landslide, storm, etc.). Although there are regulations to limit noise levels, noise pollution in the urban environment is growing, both outside the home - on the streets and inside buildings.

Based on the above provisions, we can propose architectural parameters of ecological housing, ranging from its size, materials, and sensory environment. The existing parameters of housing, which are regulated by various standards, are sometimes not sufficiently justified from an environmental point of view. These include, for example, the area of an apartment per resident (a well-known convention of its definition), the number of rooms, the height of the premises, the unobstructed view from the windows, the insolation time, the number of storeys, etc. Environmental parameters often cannot be met in a modern city (e.g., the absence of visual obstacles when looking out of a window), and cannot yet be precisely justified - for example, the ecologically necessary area per person, insolation time, room height, number of levels in an apartment, permissible number of storeys, ecologically justified building sizes, etc. But if the buildings are close to each other, and the window shows the wall of the neighboring building, this is not an environmentally friendly solution, as it limits the living space of the resident, which negatively affects eyesight (a person should look into the distance and see nature, not walls). Ecological housing is housing with a flexible layout, without the rigid restrictions on the area, number and size of rooms of traditional apartments, which is arranged over time in accordance with the wishes of residents and new technologies. The housing should have two floor levels - a high floor for rooms intended for rest and sleep, and a low floor for other rooms.

Also known as “roofs with vegetation” or “eco-roofs,” green roofs have become more popular in recent years, which is not surprising because of their incredible environmental benefits. They are known to extend the life of a building's roof by

protecting it from UV radiation and other elements such as snow and ice. Compared to a traditional roof, a green roof can last three times longer. Green roofs also reduce energy costs because they provide natural insulation to buildings by absorbing heat rather than attracting it.

Passive house as a type of sustainable architecture

A passive house (Annex 1.3) is a system that has very low energy consumption. The passive house should be heated by heat generated by the occupants, household appliances, and alternative energy sources. Hot water can be provided by heat pumps or solar collectors.

Thousands of passive construction projects have been built all over the world. The reason for this success is simple: passive house standards are clearly defined, work in all climatic zones, and ensure minimal energy consumption. Studies have shown that the energy consumption for heating and cooling in a passive house will be 80 percent lower than in conventional buildings. Given the rapid rise in energy prices, this makes a passive house an economically attractive construction option. For homeowners, it is also a chance to gain independence from fossil energy sources. The energy needs of passive buildings are so low that they can be easily met by equipment that uses renewable energy sources: solar collectors, pellet or wood fireplaces, and heat pumps of various types.

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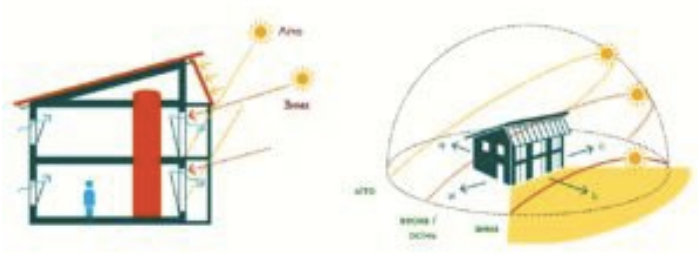

Picture 1 - ‘Scheme of solar energy supply for a passive house’

When designing a passive house, special attention is paid to solar architecture (Picture 1) - the orientation of the building in relation to the sun and the maximum use of passive solar heat. Special attention should also be paid to the careful planning

of windows, their location and size. For most climatic zones, ideally, the maximum glazing area should be orientated towards the equator. The windows themselves should have triple glazing, with two chambers filled with inert gas.

Conclusions.

The idea of sustainability or ecological design is to ensure that our actions and decisions today do not hinder the opportunities of future generations.

Every year, the term ‘ecology’ is becoming more and more ingrained in everyday life. This is not just another fashion trend, but an urgent need, as the state of the environment is deteriorating significantly. People have a direct, not indirect, impact on this factor. Therefore, it is also in their hands to prevent irreversible changes. In particular, eco-friendly architecture is a great opportunity to build housing that not only provides cosiness and comfort, but also does not have a detrimental impact on the environment.

In order for sustainable buildings to prevail in cities, it is necessary to overcome economic problems on a massive scale, which are rather insignificant compared to the catastrophe that is increasingly engulfing our home and our planet.

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Supervisor: Doctor of Pedagogical Sciences, Associate Professor O.M. Turikova.

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