New Ecological Paradigm of Architectural Development of the Energy Efficient Affordable Low Dwelling

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Abstract. The problems of the planet's ecology and the degradation of the environment are taking a dangerous turn. Uncontrolled growth of global greenhouse gas emissions has continued, the planet's temperature rises. The construction industry is harmful to the environment. Therefore, it is necessary to apply "green construction", especially developing the direction of energy-efficient low-rise housing. Designing low dwelling housing, focused on low energy consumption, it is necessary to take care not only about the heat, but also about the architecture of the building, ecology and internal comfort. It is necessary to suggest the construction of a building in which sunlight, the heat of the earth worked for the tenants. The considered ecological problems of the development of low dwelling architecture, adapting to the changing people’s needs, applying the principles of architectural and planning organization and developing construction technologies, move from the conceptual aspect to the actual one. In connection with this, it is necessary to use prefabricated buildings. It will require the erection of plants for the production of serial houses and the production of inexpensive building materials. There was a need to create buildings that would have maximum factory readiness, transportability, minimum volume, rapid erection and high comfort. There was a need to develop a project base and development of construction production for the low-rise housing industry. A wide application of prefabricated volumetric modular technologies for house building. Implementation of sustainable construction using only environmental materials. Analysis of the current situation for the development of low dwelling housing architecture showed that the main prerequisites for the formation of low dwelling housing are certain conditions. This is the impact of special natural and climatic factors, the choice of new land for construction, requiring minimum costs. A functional-spatial model of a low dwelling has been developed and proposed, an assessment of the comfort of a dwelling, the possibility of resource saving and expansion with an increase in the family. Energy saving and energy efficiency, they will be achieved in the form of increasing the heat-shielding properties of enclosing structures. Living in multistoried buildings leads to a progressive deterioration in the health of people, both physical and mental - this is the path to nowhere. Therefore, in the long term, an ecological low dwelling housing has no alternative. The sooner we start building them, the less our losses will be.

1. Introduction

For the first time, the need to change approaches to the construction of buildings and structures was reflected in Europe in the mid-1980s, when, in connection with the major energy crisis of the previous decade, a number of countries adopted a course for a global reduction in energy consumption,
primarily in the construction sector. The attention to this sphere is dictated by the fact that cities and, in particular, separate buildings consume about half of the world's energy resources [1].

In addition, by the end of the 20th century, the state of the environment was causing serious concern, and not least because of uncontrolled urbanization, accompanied by harmful emissions and imbalance in the biosphere. Simultaneously with the development of new technologies standards of quality of life have changed rapidly and continue to change. Today, the demands of the population for the level of organization of the urban environment have become much higher.

Environmental problems in the 21st century acquired special public attention. The destruction of the planet's ecological system and the degradation of the natural environment are becoming increasingly dangerous. Continuing uncontrolled growth of global greenhouse gas (GG) emissions, the average temperature of the planet rises.

The construction industry, according to the UN, is causing significant harm to the uncontrolled growth of global GHG emissions, so this industry requires major modernization. Such an important industry is connected with all production complexes and is subject to transformation in order to apply "green construction". To do this, it is necessary to constantly inform specialists of the construction industry on emerging problems of ecology, climate change, achievements in the field of energy efficiency and energy saving [2, page 2].

The direction of development of American and European construction of housing for the last decades has been constantly shifting towards ecology. People seem to have changed their mind and become more attentive to their own health. They are seriously concerned about the ecology of the home, understanding the inextricable link between health and ecological housing. Therefore, ahead of this movement are the most prosperous and respectable people in the world.

In Europe, ecological houses are built in accordance with the programs adopted at the level of the European Union, for example, the CEPHEUS program - "Passive House Effective at Cost as a European Standard" [3, 4].

2. Architecture, as an organized space for human life
The theoretician of architecture A.V. Ikonnikov gave the following definition: "The main feature of the work of architecture is a space appropriately organized for a certain socially significant purpose, containing a person and perceived visually. At the same time, we are talking not only about the space, on all sides, limited, as in the interior of the building, but also in outer space, organized by the volumes of buildings and structures, landscaping and green plantations. Thus, the concept of "architecture", together with buildings, includes development complexes and populated areas in general" [5, page 5]. Architecture, therefore, serves, since life is organized not only by its material structure, which provides the necessary conditions for the implementation of processes, but also the information that it carries. Architectural works have a dual value – material and practical and information-aesthetic [5, page 6].

The space organized for human life includes a dwelling house and an adjacent plot of land. This at all times was attractive and served as a symbol of well-being.

Today, in many cities of Russia, individual development occupies large areas of residential areas. Despite the dominance of multistoried industrial construction, the areas of individual development (private sector) in major cities occupy 40% to 50% of residential areas [6].

Each owner of the land plot wants to build a house of high-quality, environmentally friendly materials, and this is not surprising. A house is a place where a person rests from a work day, spends time with the family, receives guests. Most of the free time we spend in the walls of the house, and they must create a good indoor microclimate.

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[1] Andrei Vladimirovich Ikonnikov (1926 - 2001) - Soviet and Russian figure in architectural science, doctor of architecture, professor, historian and theorist of architecture.
3. Eco-friendly housing

Authors of low dwelling housing projects, which are focused on low energy consumption, have to take care not only of heat, utility payments and other mundane data, but also the aesthetics of the building, ecology and internal comfort (ergonomics). Developers of projects of modern houses for low dwelling construction, which are focused on low energy consumption, they must offer a design of the building in which both sunlight and heat of the earth also worked for the tenants. Low dwelling housing can be build from any materials - traditional local or some new. Therefore, in any case, the house needs high-quality additional insulation of the enclosing structures, energy-saving windows, and a well-thought-out modern ventilation system that does not conflict with the heating system [7].

The considered ecological problems of the development of low dwelling architecture, adapting to the changing needs of people by applying the principles of architectural and planning organization and developing construction technologies, move from the conceptual aspect to the actual one. Architects and builders face a huge challenge, as they need to find ways to stimulate dialogue with developers at a high professional level when addressing these issues [8, page 119]. Development of projects of affordable low dwelling housing, aimed at the application of green buildings with reduced material costs. This is a tendency of humanization, as it is associated with a decrease in the negative impact on the human environment, with the development of a strategy for the use of non-replaceable energy sources, which in turn leads to the exploitation of environmentally balanced systems and the development of alternative schemes for improving human living conditions [9, 10].

Such principles of architectural and planning organization of a low dwelling in the conditions of modern construction find the widest application among developers. In connection with which it is necessary to build prefabricated buildings on a frame and frameless basis. This requires the construction of large plants for the production of serial houses and the organization of production of modern and inexpensive building materials. There was a need to create such structures that would have maximum factory readiness, transportability, minimum volume and weight in the folded state, rapid erection and, at the same time, high comfort [11, 12].

A person who lives in his house, even if he does not have money, feels more protected in the world around him. Therefore, to solve the housing problem, not to manage without updating the development strategy of this sphere and moving from the town-planning concept of multi-storey housing construction to the "human" program of low dwelling housing - a house for the family [13, page 18].

Prospects for further development of this direction for low dwelling housing in the conditions of modern construction is of great importance. The need to develop a project base and development of construction production for the low dwelling housing industry. A wide application of prefabricated volumetric modular technologies for house building. Implementation of environmental construction using only environmental materials. Development of energy-saving technologies in the construction of low dwelling housing [14, 15].

Prefabricated volume-modular housing construction is the most promising type of housing for today. Application and introduction of this type of housing will significantly change the approach of developers to architectural design and construction of low dwelling housing [16, 17].

4. Conclusions

A functional-spatial model of a low dwelling has been designed and proposed (Figure 1), a greenhouse faces the south, a garage to the north. The estimation of comfort of a dwelling, an opportunity of resource-saving and expansion of habitation at increase in structure of a family is given. The system of
Figure 1. Transformation of the functional-spatial model of a low dwelling
"green certification" was applied in the context of the ecological construction of a traditional low dwelling [11; 18, page 111].

For northern climatic areas of construction, the form of an autonomous building should be compact, taking into account the features of the landscape and the terrain, if possible, buried in the ground, on the leeward side. On this side should be located buffer zones and technical rooms for the placement and maintenance of autonomous engineering equipment of the building. In the southern and far eastern regions, where the level of total solar radiation on the horizontal surface is higher than in the northern regions, it is recommended to arrange greenhouses on the south side of the facade, and all main premises should also be directed to the south. The shape of the building should be approximated to the cube, for greater energy savings. In the integrated system, active elements of autonomous energy supply systems are used, which are divided into attachable - attached to the roof, the walls of the building, enclosing the supporting structures and integrated, built-in, which are the enclosing structures of the building itself. Integrated systems are the most effective and require the maximum use of the area of technological enclosing structures (walls, roofing) [19, page 19].

The economic efficiency of the developed proposals for the thermal protection properties of structures is considered. Real reduction of energy consumption in an individual housing energy-saving and energy efficiency will be achieved in the form of an increased level of heat-shielding properties of enclosing structures by 15-20%. Energy-efficient houses are the closest in their composition to ecological houses [20].

A comprehensive scientific analysis of the current situation for the development of low dwelling architecture showed that certain conditions are the basic prerequisites for the formation of low dwelling housing. This is the impact of special natural and climatic factors and conditions, the choice of new land plots for building, which require minimal costs for their planning and engineering, using the existing regional potential of full-modular modular housing for the construction of residential buildings, mainly for the city and the suburbs. The choice of types and design schemes of prefabricated houses, most satisfying local conditions.

It is known that living in multi-storey buildings leads to a deterioration in the health of people, both physical and mental, that progresses in generations. So the continuation of the construction of multi-storey buildings is a road to nowhere, and the erection of low dwelling buildings no longer solves modern problems. Therefore, in the long term, there are no alternatives to environmental houses, including in cities. The sooner we start building them, the less our losses will be.

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