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URBAN PLANNING ASPECTS ORGANIZATION AND FEASIBILITY STUDY OF ENERGY-EFFICIENT ECOLOGICAL SETTLEMENT IN KHARKIV REGION

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ABSTRACT

At present, there are no economic types of residential development on the market, which are socially just and environmentally friendly. At present, there is a growing scientific interest in creating comfortable living conditions, namely the creation of energy-efficient environmental settlements. Functional and planning structure of energy-efficient ecological settlements, which should provide a holistic urban planning and landscape-planning ecological framework of the structure of the Kharkiv region. The work presents a master plan for the projected energy-efficient ecological settlement with a detailed description of all project proposals and considers the functional zoning of the territory.

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Introduction. The rapid increase in urbanization in cities with a transitional economy requires immediate changes in urban planning. focuses on project proposals, including the general plan of energy-efficient environmental settlement and feasibility study on the feasibility of investment.

Energy-efficient environmental settlements can contribute to the improvement of the situation due to: the use of environmentally friendly transport and communications; application of methods of landscape design with a high proportion of landscaping; consideration of environmentally friendly building materials and structures in the construction of buildings and structures. So the main measures in the design of energy-efficient environmental settlements are: rational functional zoning of the territory; application of the concept of passive houses and reduction of energy consumption per unit area; rethinking transport infrastructure and public transport development; use of alternative energy sources (solar panels, windmills, geothermal heat pumps).

Materials and methods. During the article, methods such as:

- method of cartographic analysis (master plan for energy-efficient ecological settlement and functional scheme);
- method of statistical analysis (use of published materials of the State Statistics Service of Kharkiv region to determine the dynamics of demographic changes and household growth);
- method of system analysis (systematization of the obtained research results).

Results. The main purpose of the research is to develop a project proposal, an energy-efficient ecological settlement that will be economically feasible in the Kharkiv region.

Based on the goal, it is proposed to consider the following tasks:

1. Implementation of the master plan for energy-efficient environmental settlement;
2. Determination of functional zones of the territory and description of project proposals;
3. The design of these urban planning entities is subject to the feasibility of designing technical and economic indicators.

For an integrated approach to the tasks and justification of the best option for the design of energy-efficient urban planning and structures, some literary sources of leading urbanists were analyzed.

Dmitry o Devoist, Luke Hans and Walter de Lannois, in their book How Green Is The City?: An Assessment of The Sustainability and Management of the Urban Environment, focuses on a new concept that brings together ideas in many areas. Such as urban planning, transport, healthcare, housing, energy, economic development, natural habitat, public participation and social justice. The author and study the principles of ecological urban planning entities that can be carried out at the local level.

The newly released book by architect and author Chuck Darrett's "Home Guide for the Older Generation" came at a time of high interest in ecology, sustainable housing, and the challenges of affordable living. The book contains useful information about the concept of co-living.

Also one of the great books during the literary review should be highlighted: Urban Utopias Construction and Social Architecture and Alternative Settlements, authored by Malcolm Miles. The author connects modern utopian experiments with historical and literary projects, as well as theoretical problems in utopian thought.

Thus, the interest of scientists in the development of theoretical and practical techniques for the further implementation of energy-efficient environmental settlements, which will be designed considering all planning measures, building codes and standards, including the following areas: ecology, green construction, landscape planning, urbanism, environmental design is increasingly strengthened every year, and this means that this direction needs to be improved, developed.

Discussion. The master plan of energy-efficient ecological settlement on the example of Kharkiv region (Fig. 1). The projected site is 28.9 hectares.

Access to the territory is carried out on both sides, from the west and east. In the western part there is a parking lot for electric cars for 100 parking spaces and protected bicycles. On the territory of the parking lot there are also two shops: a shop with environmentally friendly products grown on the territory of the settlement by residents, and a shop of household and household goods for residents. Near the parking lot is located a guest area with five energy-efficient houses (for rent), gazebos for quiet relaxation with a children's area in the center.

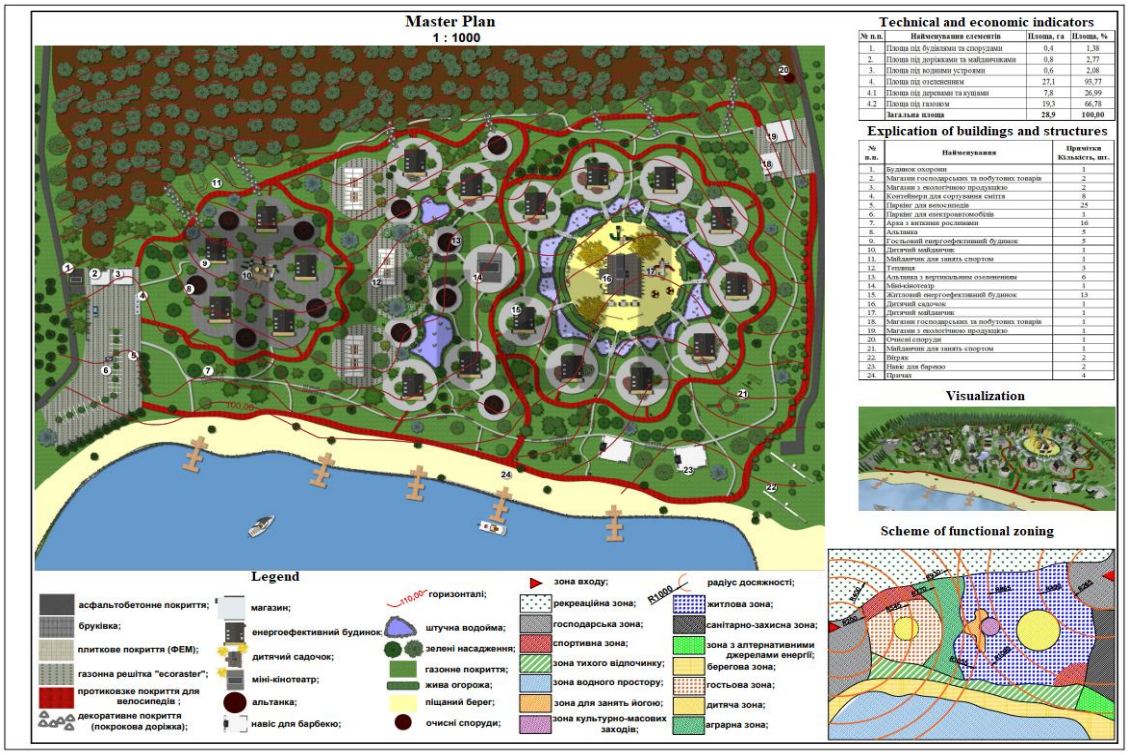

Fig. 1. Master plan of energy-efficient ecological settlement (on the example of Kharkiv region)

The guest area is limited to a fruit garden and three greenhouses for growing ecological products. Greenhouses are smart and fully automated, equipped with vertical racks. Vertical farming involves intensive use of existing territories and resources. The multi-tiered arrangement of plants

allows you to increase productivity hundreds of times and save 70-95% of water, compared to the traditional cultivation of different crops. Moving east of the greenhouses, the living area begins, which is 13 residential energy efficient buildings located at a convenient distance from each other.

On the residential territory there is a mini cinema for various events, presentations, and film viewings. In the very center of the residential area there is an alternative kindergarten (a workshop for implementing their own ideas, circles for creativity and learning foreign languages) for 50 children, equipped with an inclusive playground, and a playground for active games. In the western and eastern part there are two sports grounds for vorkaut (street training). At the bottom, near the reservoir, in the eastern part it is proposed to create two canopies for barbecues, which will provide residents with additional space for meetings and communications. Near the reservoir, along the coastline, it is proposed to create berths for boats. But on the outskirts of an energy-efficient ecological settlement, two windmills will be installed that will provide the territory with additional energy. One of the most important principles of effective use of the spatial potential of this settlement is the rationality of location in the space of objects of various sizes, functions and profiles that predeem to the formation of a settlement as a single mechanism. Therefore, consider the scheme of functional zoning of the territory (Fig. 2).

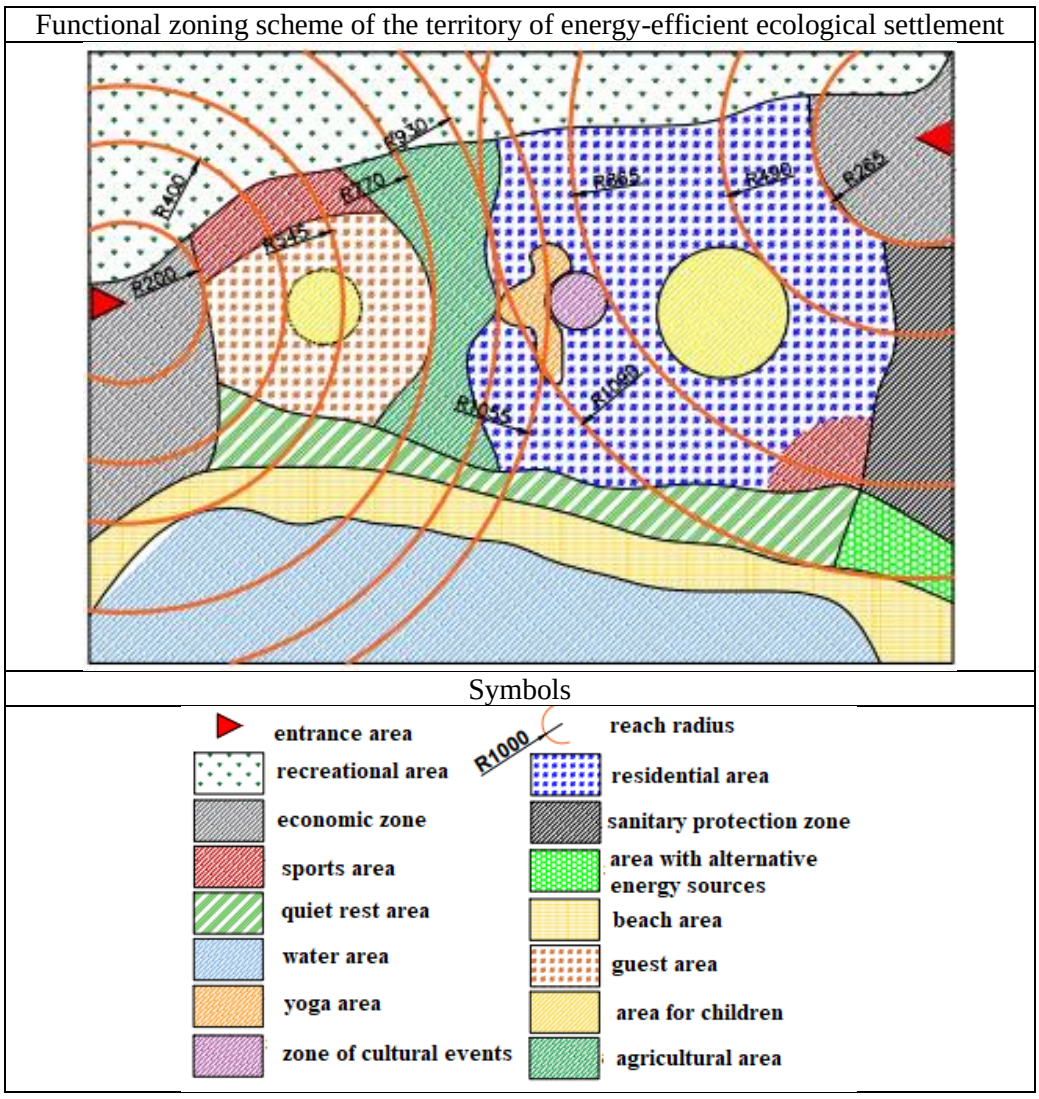

Fig. 2. Functional zoning schemes

Functional zoning as an effective mechanism for regulating spatial processes provides favorable conditions: for business development in this territory, for improving living and recreation, including from an environmental point of view.

Table 1 shows indicators that will be further used for calculating the feasibility of investments.

Table 1. Balance of the territory of energy-efficient ecological settlement

№	Indicator	Area, hectares	Area, %
1.	Area under buildings and structures	0,4	1,38
2.	Area under paths and platforms	0,8	2,77
3.	Area under waterways	0,6	2,08
4.	Area under landscaping	27,1	93,77
4.1	Area under trees and bushes	7,8	26,99
4.2	Area under the lawn	19,3	66,78
	Total area	**28,9**	**100,00**

Based on the above-mentioned design proposals, the building area allocied for buildings and structures is 4000 m^2.

The equipment includes modern infrastructure and communications: thoughtful roads and paths, drinking water from the well, collection and use of rainwater, ecological system of wastewater treatment, pleasant evening lighting, sorting and processing of organics and recyclables, transition to full autonomy. Buildings and objects: cottages for temporary residence of guests and employees; parking, care and washing of cars; a shared kitchen and a place for collective dinners; hall for discussions, events and film screenings; alternative kindergarten, play and sports spaces.

The maximum capacity of the development of an energy-efficient ecological settlement is 4000 m^2 per year. The required number of workers for the construction of the maximum construction volume is 10 people when working in one shift.

Capital investments in construction are summarized in the estimates on the consolidated indicators for energy-efficient environmental settlement. Thus, capital investments in the construction of the settlement amount to UAH 10,261,801 for 2021.

According to the results of 2021, the demand for cottages with an area of 100 to 350 square meters increased by 3-4%. The main reason for this interest of buyers is the price. For example, a house with an area of 100 squares in settlements near Kharkov can be purchased at the price of a 2-room apartment of 60 square meters in the sleeping area. Cottages are built mainly 1- or 2-storey. Such housing is designed for one family. According to experts, cottage construction can "lure" some potential buyers from developers in the suburbs of large cities that specialize exclusively in apartment construction. We will carry out small marketing research of the market of cottage settlements in the Kharkiv region to determine the possibility of implementing this project. Market analysis shows that about 6-8 elite cottage towns have been sold in Kharkiv region.

The price of 1 m^2 of ecological cottage town exceeds the price of 1 m^2 of premium cottage town, but for ease of analysis we will assume that an energy-efficient ecological settlement and a premium cottage town in the Kharkiv region will be implemented in equal proportions, so you can use the average price for such construction for analysis.

The average price of 1 m^2 of energy-efficient ecological settlement and premium cottage town offered by the domestic market is 55000 UAH. and above. The average price of 1 m^2 of local cottage towns is 6000 UAH.

We will analyze the probable capacity of the market for energy-efficient environmental settlements and premium cottage towns in the Kharkiv region.

Based on the population of Kharkiv region, namely Pecheneg district (9690) [4] and the assumption that the average family of the city consists of 3 people, we have an approximate number of families in the city – 3230[5]. Let's say, based on the caution of estimates, that only 2.43% of [6] families have their own housing (apartment or house).

We exclude the share of homeowners who are able to build their own cottage in the recreational area, or become buyers of an existing premium house in a cottage town.

Of the remaining owners, i.e. from 1245 – 42 = 1203, only 10%have enough home and d to buy or build a house in a cottage town.

We will assume that the purchase of housing is carried out every 50 years (when the children have matured, and the family solves the issue with their separate residence). Then the annual number of cottages and energy-efficient houses in cottage towns, where potentially new families will live, is 1203:50=24.

We accept that the average salary in the Kharkiv region is - 9521 UAH. The territory houses 1245houses. We accept an area per resident of 24.5 square meters, we have a total area of

1245/24.5=50.8square meters. We see that with the annual capacity of our energy-efficient ecological settlement, with an area of 28,900 square meters, cottages should cover the second part of the region's market.

This is possible with stable construction, which provides:

- the ability to carry out the construction of cottages at anytime, say the same type of houses, requiring a certain supply of raw materials.
- the ability to fulfill the order in a short time;
- the ability to provide high-quality construction.

In addition, the construction of an energy-efficient environmental settlement is possible with an appropriate pricing policy. The price of construction should be within the average for the market. per sq.m.

The price for the construction of an ecological house can be in the range from 5500 to 6000 UAH.

With an optimistic forecast, this corresponds to the gross income of 5500x 4000 = 22 000000 UAH per year, with a pessimistic forecast – 6000x4000 = 24000000 UAH per year.

A realistic forecast can be defined as the arithmetic average of optimistic and pessimistic forecasts, that is: (22000000 + 24000000):2 = 23000000 UAH per year.

Conclusions. Energy-efficient environmental settlements can become a means against chaotic suburbanization and offer an alternative approach based on comprehensive spatial planning, observance of sustainable mobility. Living environment for communication, labor, and recreation of the life of the population, so this movement must be developed.

As for the economic component of this project proposal, investing in the construction of environmentally friendly houses today is a profitable investment. However, currently, all investments in the construction of any type of housing, except social programs, bear the profit of the investor. It should also be taken into account that investments in the construction of energy-efficient housing led to a large percentage of return on investment in this area. Also, it is impossible to throw off other segments of the construction of the zone of environmentally friendly and suburban houses, which are quite favorable for lobbying the capital of potential investors.

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