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Article

The main features of an eco-city in Kazakhstan: development prospects

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Abstract. This article is devoted to the prospects of construction and development of an eco-city in Kazakhstan. The mixed research method was chosen as the most effective for a diverse review. The objective is to identify the main features of an eco-city on the territory of Kazakhstan. The task is to theoretically identify the main features of an eco-city in Kazakhstan with its future development prospects. The construction system, city infrastructure, and landscape design are analyzed. Based on the conducted research, the authors have identified and justified the need to improve the design and research activities of construction. The importance of choosing a territory is described. The principles and qualities of the territory when choosing a place for construction are presented. The conclusion is made about the importance of preserving the ecological environment of the territory during construction. Environmental conservation methods and their importance are described. It also describes the impact of construction on the state of the air, its impact on human health and the environment. An experimental study was conducted and the results of a survey were presented, the purpose of which was to identify the ecological situation of Kazakhstan and the project of the future eco-city. The research shows that urban development is a priority area for the implementation of “green” principles in the economy, along with industry, energy, transport and infrastructure, and agriculture.

Keywords: project activity, project, green construction, sustainable development, construction, eco-city.

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Introduction

The Decree of the President of the Republic of Kazakhstan No. 577 dated May 30, 2013 on the concept of transition of the Republic of Kazakhstan to a "green economy", has led to a greater focus on environmental issues. According to the decree, one of the primary tasks of construction is 100% recycling of construction waste, as well as the impact of construction on the environment in order to minimize environmental damage on the construction site.

In the contemporary era, the growth of construction and expansion of cities have had a significant impact on air quality. The increase in harmful emissions has resulted in an urgent need for the construction of eco-cities. According to the AQI system [1], the territory of the capital of Kazakhstan, Astana, is ranked 7th in the air quality pollution index, second only to megacities in China and India.

Thus, for the construction of an eco-city, it is necessary to take into account the air quality on the territory of the planned construction, where six main air pollutants are taken into account for calculating the AQI: solid particles (PM 10 and PM 2.5), carbon monoxide (CO), ozone (O₃), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂). An AQI in the range of 0 to 500 has different concentrations of pollutants and associated health effects. The concentration of PM_{2.5} in Astana is now 11.9 times higher than the WHO recommended average annual air quality value.

Inhaling air with PM_{2.5} particles causes 3% of deaths from diseases of the respiratory and cardiovascular systems, and 5% of deaths from lung cancer. P_{2.5} arises from the smallest pieces of soot, asphalt and car tires, particles of mineral salts [2].

Based on research, it is necessary to design and manage new and innovative ways in the construction and design of buildings and structures.

Eco-city planning is formed based on the lessons of the past and the expectation of a new future, which entails the formulation of a multi-scale vision that, by further interacting with the main trends and trends and evolutionary shifts in science and technology, creates new opportunities for achieving the sustainable development goals of the eco-city.

The processes of conversion to sustainable construction are motivated by the need to solve environmental problems. This means that when design in eco-city, it is necessary to analyze, plan, research and manage new and innovative construction methods in order to improve and increase their contribution to the development perspective.

The purpose of this study is to examine the territory for the development of an eco-city in Kazakhstan, to study the terrain and landscape for creating a future eco-city.

When studying the literature, it was revealed that the concepts of "landscape ecology" and "conservation of environmental ecology" are used synonymously, but there is a fundamental difference between them. Landscape ecology, unlike simple environmental ecology, includes not only abiotic and biotic components, but also humans.

Thus, it will allow determination of the optimal ratio of its natural and cultural elements during construction for the purposes of environmentally safe and economically efficient land use, conservation of biological diversity, etc. The application of landscape and environmental

studies are used in the field of design of protected natural areas and ecological networks, the restoration of disturbed landscapes, in landscape planning, the management of multifunctional land use, etc.

The work positively assesses the design experience in which the architectural and planning characteristics of the building are aimed at the qualitative use of passive solar energy, the creation of natural ventilation and the most efficient use of daylight. It is proposed to introduce vertical gardening and the creation of landscape spaces inside the objects to improve indoor air quality and control the microclimate [3].

The central theory of landscape ecology is derived from the "Theory of Island Biogeography" by MacArthur and Wilson. This work considered the totality of flora and fauna on the islands as a result of colonization from the continental support and stochastic extinction.

Geomorphology, the science of relief, its appearance, origin, history of development, modern dynamics and patterns of distribution were also considered to determine the territory. Geomorphology studies the history and dynamics of terrain changes, predicts future changes, which will allow you to choose an area for an eco-city with greater stability.

Also taking into account the data studied during the survey the main qualities were selected as shown in Figure 1



Figure1. Main qualities when choosing a territory [photo authors]

Thus, the main aspects were:

1. Geographical location (near the capital, near major cities, in the central part of the country, in the border region, the climate is better where it is warmer);
2. Good environmental conditions (no environmentally hazardous, harmful production, etc.);
3. Relief. The most favorable is the relief with a surface slope from 0.5 to 10%

Summing up the results of the selection, the territory near the capital, the lake, was chosen Zhaltyrkol, which met the most criteria.

The methodology

In this article, to identify the principles of the application of green construction in Kazakhstan, mixed research methods were used: interviews, observations, analysis of documents, as well as an ecological and geographical approach combining the analysis of physical, geographical and environmental characteristics of territories.

The considered area for the eco-city landscape is located 3-5 km from Astana – Lake Zhaltyrkol in Figure 2. The absolute height is 377 meters above sea level. The climate is cold-temperate, with good humidity. The average annual air temperature is positive and is about +3.9°C. The average monthly air temperature in July reaches +19.8°C. The average monthly temperature in January is about -14.2°C. The average annual precipitation is about 440 mm. Most of the precipitation falls in the period from May to August [4].

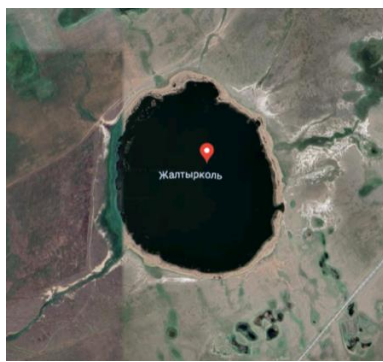


Figure2. Zhaltyrkol Lake [googlemap photo]

Findings/Discussion

In the course of the study, a survey was conducted to determine people's attitudes towards environmental management.

To select and analyze the territory for the construction of an eco-city, interviews were conducted with designers, designers and topographers. There are very many free territories in Kazakhstan that are completely environmentally sustainable and stable. 13 people from project organizations participated in the interview. To assess the structure of research work, the methods used in building construction and project work, designers were asked the following questions:

1. Which reservoir is suitable for building an eco-city?
2. What criteria should be considered when choosing a territory?
3. Impact of remoteness on construction.
4. Is it important to have communications?
5. It would be beneficial to consider the environmental assessment.
6. What is the purpose of an eco-city?
7. The construction of an eco-city requires a significant financial investment.
8. To what extent is landscape design a significant consideration?

9. How to preserve the ecological environment?

Table 2. Analysis of Responses by Key questions

Questions	Answers
Study the ecological situation of Kazakhstan	10
Make projects with an impact on health	13
Take into account the importance of preserving the ecological environment of the area	13
Study modern and harmless materials	10
Take into account the prospects for the development of the city	
Design landscape design to preserve the ecological environment	

As can be seen from the data presented in the table, all interviewers are familiar with environmental problems and prospects for urban development in the future. The majority of respondents say that now the environmental section must be taken into account during the design examination. They also take into account the landscape, because according to the law, when cutting down a tree during construction, you need to plant five.

When designing new ecosystems, landscape architecture is a related area in attempts to create and define translational strategies for restoring and preserving ecological functions. As cities become more crowded and polluted, eco-landscape design is attracting more attention. Open spaces play a vital role in improving the natural environment, as well as the physical and mental health of citizens [5] Thus, the preservation of the ecological environment of the area during construction is the main task.

When building an eco-city, the necessary infrastructure was taken into account: shopping centers, chain stores and shops within walking distance, an outpatient clinic, a kindergarten, a secondary school, a precinct, a center for early development and creativity, a sports center, and regular transport links to the city. Now, according to modern state standards, the requirements for construction, improvement and design have increased, which has led to new methods of implementation.

Taking into account the "Environmental Code of the Republic of Kazakhstan" and "Environmental Protection", the optimal implementation method was chosen:

Impact on water. In construction, it is used for mixing mortars, slaking lime, preparing concrete, watering rubble stone and bricks in hot or windy weather. There is underground water (ground, key, drainage, well) and surface water (river, swamp, lake, sea). All these waters are suitable for construction work.

The quality of water depends on the conditions of its formation, the composition of the soil and the degree of pollution by industrial wastewater [6]. A closed water supply cycle with purification stages was chosen as the solution.

Influence on flora and fauna. During construction, the priority is always to preserve the local ecosystem, and in particular the preservation of trees. According to Environmental Protection, when one tree is cut down during construction, five trees are planted, or the tree is transplanted when it is suitable.

The impact on the soil is also taken into account, since the foundation is first built during the construction of buildings. The thickness of the fertile soil layer varies from 5 to 15 mm. According to the norms, the fertile layer is transported and stored in special temporary dumps (piles).

Conclusion

Summing up the results of the study, it should be noted that the methods of eco-friendly implementation of objects in the new territory were revealed. The trend of "green" construction in Kazakhstan is starting to gain momentum: new draft laws, information and scientific bases are being released. The President's order on expanding legislative incentives for saving energy and water resources, using "green" technologies and developing eco-tourism attached particular importance to the topic. In October 2013, the Kazakhstan Green Building Council KazGBC was officially launched KazGBC, one of the main bodies leading the process of implementing and distributing this concept [7].

Kazakhstan is only at the initial stage of "green" development, which aims to achieve a new sustainable and efficient economic model by 2050. The plans that our State is building are based on the rational use of natural resources [8].

The construction sector in Kazakhstan is developing in accordance with global trends. The national economy is increasingly focused on the optimization and efficiency of the use of resources, including natural resources, which is one of the priorities of the "green economy". Studies show that urban development is a priority area for implementing "green" principles in the economy, along with industry, energy, transport and infrastructure, and agriculture. The concept of "green" construction is based on the idea of rational use of energy and material resources during construction.

The contribution of the authors

Samuratova Tatigul – significant contribution to the concept or design of the work; collection, analysis or interpretation of the results of the work, approval of the final version of the article for publication

Akhmetova-Abdik Gulzhanat – writing a text and/or critically reviewing its content.

Omarbekova Nasgul – writing a text and/or critically reviewing its content.

Yeziyeva Mariya – writing a text and/or critically reviewing its content.

Yerbolkyzy Gulim – writing a text.

Suyundykova Дамиля – writing a text.

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Қазақстандағы экоқаланың негізгі белгілері: даму перспективалары

Андатпа. Бұл мақала Қазақстандағы экоқаланың құрылысы мен даму перспективаларына арналған. Әртүрлі шолу үшін ең тиімдісі ретінде аралас зерттеу әдісі таңдалды. Мақсаты: Қазақстан аумағындағы эко қаланың негізгі белгілерін анықтау. даму перспективалары. Тапсырма – Қазақстандағы экоқаланың негізгі белгілерін: даму перспективаларын теориялық тұрғыдан анықтау. Құрылыс жүйесі, қаланың инфрақұрылымы, ландшафты дизайны талданады. Жүргізілген зерттеулер негізінде авторлар құрылыстың жобалық және ғылыми-зерттеу қызметін жетілдіру қажеттілігін анықтап, негіздеді. Аумақты таңдаудың маңыздылығы сипатталған. Құрылыс үшін орынды таңдау кезінде аумақтың принциптері мен қасиеттері сипатталған. Құрылыс кезінде аумақтың экологиялық ортасын сақтаудың маңыздылығы туралы қорытынды жасалады. Қоршаған ортаны қорғау әдістері және олардың маңызы сипатталады. Сондай-ақ құрылыстың ауаның күйіне әсері, оның адам денсаулығына және қоршаған ортаға тигізетін әсері сипатталады. Эксперименттік зерттеу жүргізіліп, сауалнама нәтижелері ұсынылды, оның мақсаты Қазақстанның экологиялық жағдайын және болашақ экоқала жобасын анықтау болды. Зерттеулер көрсеткендей, қаланы дамыту «жасыл» өнеркәсіп, энергетика, көлік және инфрақұрылым және ауыл шаруашылығымен қатар экономикадағы қағидаттар қамтылған.

Түйін сөздер: жобалық қызмет, жоба, жасыл құрылыс, тұрақты даму, құрылыс, экоқала

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Основные особенности экогорода на территории Казахстана: перспективы развития

Аннотация. Данная статья посвящена перспективам строительства и развития экогорода в Казахстане. Для разностороннего обзора был выбран смешанный метод исследования как наиболее эффективный. Цель: выявить основные черты экогорода на территории Казахстана. перспективы развития. Задача: теоретически выявить основные черты экогорода в Казахстане: перспективы развития. Проанализированы система строительства, инфраструктура города, ландшафтный дизайн. На основе проведенного исследования авторами выявлена и обоснована необходимость совершенствования проектно-изыскательской деятельности строительства. Описана важность выбора территории. Описаны принципы и качества территории при выборе места под строительство. Сделан вывод о важности сохранения экологической среды территории при строительстве. Описаны методы сохранения окружающей среды и их значение. Также описано влияние строительства на состояние воздуха, его воздействие на здоровье человека и окружающую среду. Проведено экспериментальное исследование и представлены результаты опроса, целью которого было выявление экологической ситуации Казахстана и проекта будущего экогорода. Исследования показывают, что развитие городов является приоритетным направлением внедрения «зеленых» принципов в экономику, наряду с промышленностью, энергетикой, транспортом и инфраструктурой, сельским хозяйством.

Ключевые слова: проектная деятельность, проект, зеленое строительство, устойчивое развитие, строительство, экогород

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