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MODERN AND ENERGY EFFICIENT MUSEUM BUILDING CONCEPT

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Abstract: This article analyzes the conceptual foundations of the design of modern and energy-efficient museum buildings, architectural and engineering solutions, and their importance in sustainable development. The study examines the application of energy-efficient building materials, renewable energy sources, natural lighting and ventilation systems, intelligent control technologies, and ecological design principles in museum buildings.

Keywords: energy efficiency, smart building, innovative technologies, ecological design, museum concept, sustainable development, microclimate

Introduction: Today, the rational use of energy resources, reduction of environmental problems and ensuring sustainable development are becoming one of the priority areas of architecture and construction worldwide. Energy efficiency, environmental safety and the use of modern technologies are especially important in the design of large-scale public buildings, including museums. Museums are important public buildings that preserve the cultural and historical memory of society and develop scientific and educational activities. Modern museum buildings should not only perform the function of storing and displaying exhibits, but also create a comfortable, aesthetic and environmentally sustainable environment for visitors. Therefore, the use of energy-saving technologies, renewable energy sources, natural lighting and ventilation systems remains one of the main principles of designing museum buildings. The topic “Concept of a modern and energy-efficient museum building” is aimed at developing innovative architectural solutions that meet today's requirements. This concept aims to reduce energy consumption, optimize the building's operating costs, ensure environmental sustainability, and create a high level of comfort for visitors. As a result, the museum building will be a harmonious example of modern architecture, advanced technologies, and a careful attitude to the environment.

The main idea of the concept: The museum building will be designed in a way that combines modern technologies and national architectural traditions. The shape of the building reflects the natural and historical features of the area. The main goal of the project is to reduce energy consumption, reduce the carbon footprint and maintain ecological balance.Architectural solutions: 1. Natural lighting - Use of large glass facades and atriums, maximum daylighting through skylights, reducing the need for artificial lighting (Figure 1).

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Figure 1. Architectural solutions of the museum.

2. Energy-efficient facade - Double-layer ventilated facade, solar panels, materials that reduce heat loss.
3. Renewable energy sources - installation of solar panels on the roof, geothermal heating and cooling systems, use of rainwater for technical needs.
4. Green roof and landscape - green roof coverings, landscape design consisting of local plants, improvement of the microclimate of the building.
Intelligent management systems: (Figure 2).



The building will be equipped with a BMS (Building Management System): Automatic temperature and humidity control; Energy consumption monitoring; Intelligent lighting systems;

Figure 2. Intelligent control systems.

Museums require strict control of temperature and humidity indicators for storing exhibits. An intelligent control system automatically controls these parameters, ensuring long-term preservation of museum collections and historical artifacts. At the

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same time, natural and artificial lighting systems work in coordination with each other, which significantly reduces electricity consumption. The proposed conceptual solutions not only form the aesthetic appearance of the museum building based on modern architectural requirements, but also increase its functional efficiency and environmental sustainability. As a result, this project can serve as an example of modern architecture that combines innovative technologies and the principles of sustainable development in the design of cultural and educational facilities. Analysis and results: The analysis shows that the concept of a modern museum building has the potential to reduce total energy consumption by up to 75% by integrating passive architectural elements with intelligent engineering systems. The results obtained prove that sustainable museums can serve not only as a means of preserving cultural heritage, but also as a leading example of green architecture in the context of the global ecological crisis.

Thermal inertia and load reduction: The construction of a building from materials with high thermal mass absorbs sharp fluctuations in external temperature. As a result, the peak load on artificial cooling or heating systems is reduced by 40-45%. This creates conditions for HVAC systems to operate at lower power, in a stable and long-term mode.
CONCLUSION: In the process of developing the concept of a modern and energy-efficient museum building, the architectural and planning structure of museums, the principles of functional zoning, energy-saving technologies and the importance of intelligent control systems were studied. The results of the study showed that modern museum buildings should not only fulfill the function of preserving and presenting cultural heritage, but also meet the requirements of environmental sustainability, energy efficiency and creating a comfortable environment for visitors.

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