

# PRINCIPLES OF ENERGY-EFFICIENT RECONSTRUCTION OF URBAN DEVELOPMENT

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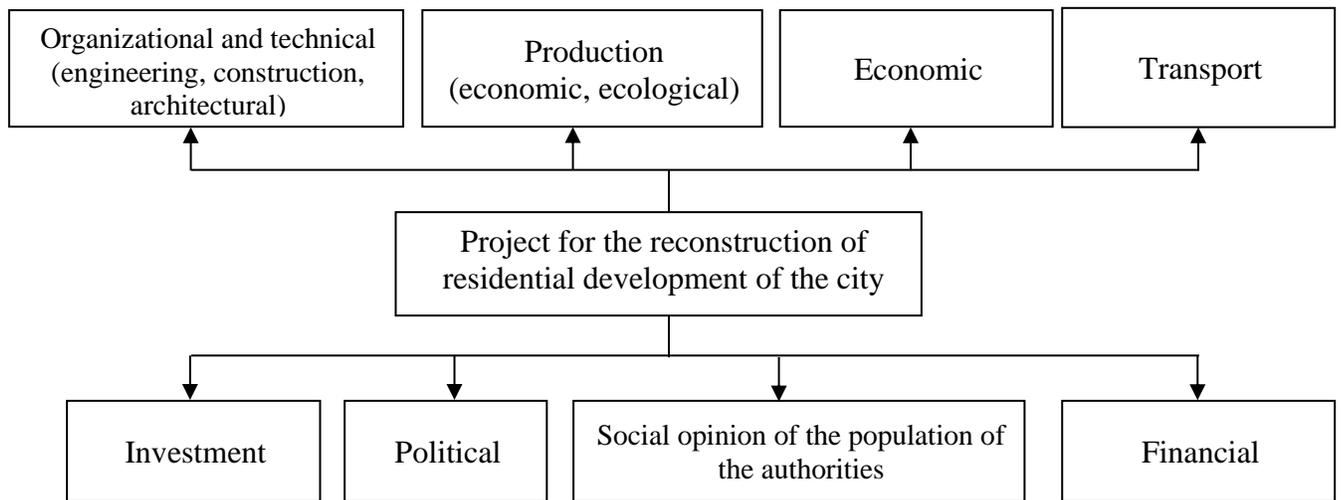
## **Abstract:**

This study addresses the growing necessity for energy-efficient reconstruction in urban environments, highlighting a critical knowledge gap in integrating energy-saving principles into the multi-level planning and transformation of existing residential areas. Utilizing a systematic analysis of regulatory documents, environmental and socio-economic factors, and urban design strategies, the authors developed a conceptual model that links technical and planning decisions with energy efficiency outcomes. The findings underscore the influence of legal frameworks, building conditions, and infrastructural factors on reconstruction efficacy. The results reveal that implementing staged, energy-oriented urban planning significantly enhances energy conservation and environmental sustainability. The implications of this research support national strategies for energy reform and contribute to aligning Uzbekistan's urban reconstruction efforts with global energy standards.

**Keywords:** Urban planning principles, urban reconstruction, urban environment, energy efficiency, energy saving

## **1. Introduction**

Urban reconstruction in a broad sense is aimed at the transition from territorial growth to the qualitative transformation of existing development, imparting modern economic, social and technical qualities to the city structure, objects and communications [1]. Urban planning principles for the reconstruction of cities are based on compliance with current regulations applicable to residential development. When designing the reconstruction of urban development, a number of problems are considered, for each of which solutions are developed (Figure 1).



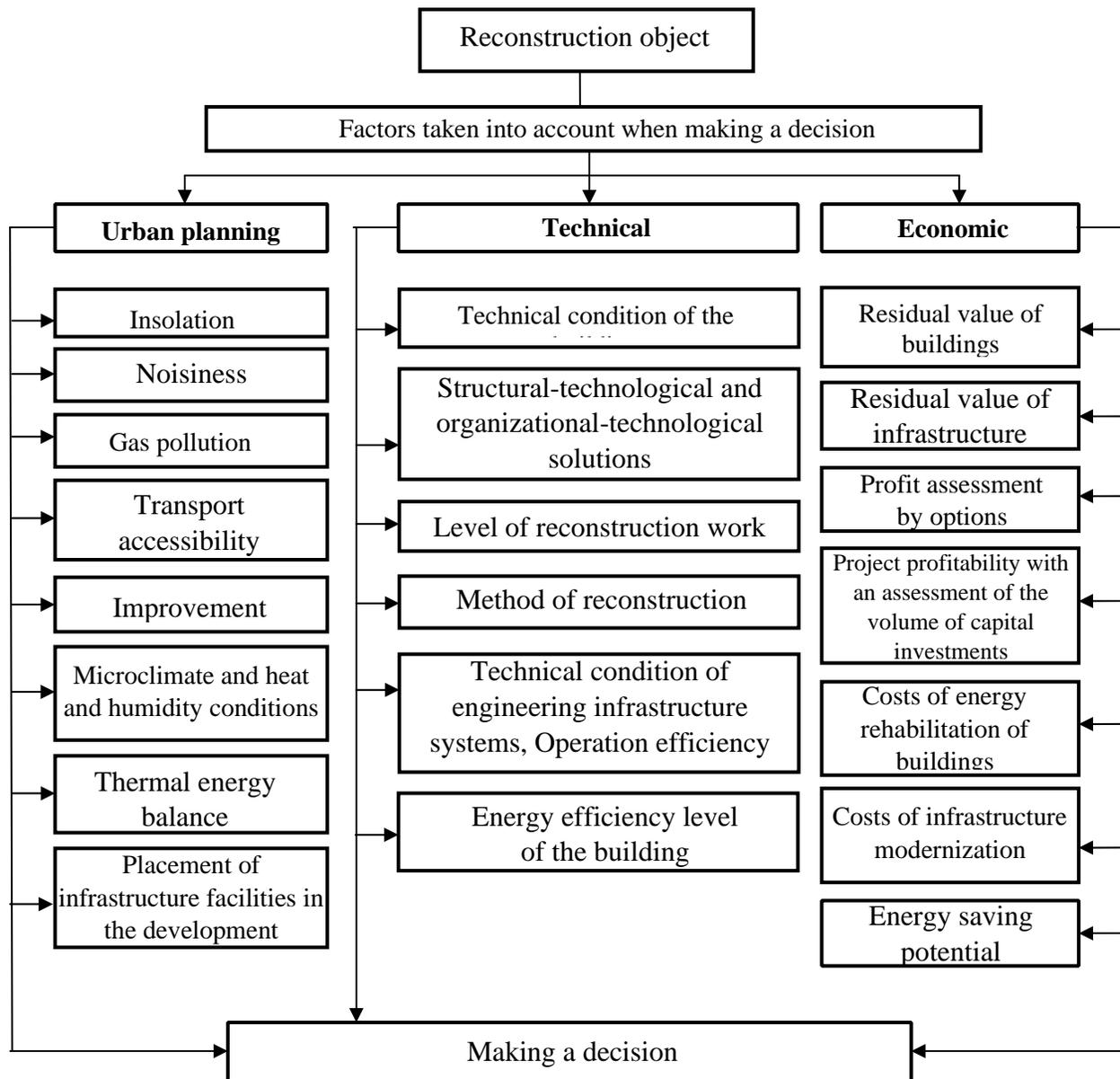
**Figure 1 – Structure of problems considered during reconstruction of buildings**

The implementation of reconstruction projects should be combined with the real trends of the process of transformation of the urban environment. It is obvious that in modern conditions, due to the urgent need to save energy resources, the reconstruction of buildings should also cover energy saving issues [2,3,4].

## 2. Materials and Methods

It is known that decisions on the reconstruction of residential buildings are influenced by urban planning, technical and economic factors [5,6]. When developing a rational solution for the reconstruction of buildings for the purpose of energy saving, it is also necessary to take into account the factors influencing the level of energy consumption in urban development and its elements. In this regard, the system of factors influencing decision-making on reconstruction was interpreted for the purposes of energy saving and increasing the energy efficiency of urban development (Figure 2).

An effective system of legal regulation is the basis for the rational use of energy resources [7,8]. Over the past five years, Uzbekistan has been actively reforming the construction industry, the most important element of which is the improvement of the legislative and regulatory framework [9,10]. As part of this reform, existing regulations were revised and new ones were developed that govern the design and construction of energy-efficient buildings.



**Figure 2 – Factors influencing the reconstruction of residential buildings**

The main goal of introducing this system of regulatory documents is to maximize the use of energy saving potential in the construction sector. This is achieved by increasing the energy efficiency of both new and reconstructed and already operating buildings, as well as improving their energy supply systems [8].

In addition, the task was formulated to reduce greenhouse gas emissions during energy supply to buildings, including both new buildings and modernized buildings. The implementation of these measures not only helps solve global environmental problems, but also increases the level of energy and environmental security of Uzbekistan.

### 3. Results and Discussion

#### Result

The concept of multi-level energy saving management during construction of a large city includes the following levels [11]:

- management of energy saving parameters of construction projects at the design and construction stage;
- construction of a multi-level energy saving management system – city, industry, internal – for the implementation and control of energy saving parameters during the operation of buildings;

- formation of a horizontal structure of functional management of the investment and construction complex;
- development of a monitoring system for the formation of energy saving program indicators – indicators of the specific energy intensity of buildings under construction and measures to achieve them;
- ensuring the transition of the investment and construction complex to projected indicators through the use of systemic regulators of urban significance (regulators of contractual relations, budget and tax, legal, etc.).

An important task is to harmonize the national concept of energy efficiency with European standards defined by Directive 2010/31/EU, taking into account the specifics of the construction industry of Uzbekistan, climatic conditions, economic situation and the level of development of the manufacturing and construction industry [12]. It is also necessary to improve the system of classifying the energy efficiency of buildings by developing a national methodology that will take into account not only energy costs for heating, ventilation, hot water supply, electricity and air conditioning, but also the use of renewable energy sources. This will allow for a more accurate assessment of the energy efficiency of facilities at all stages - from design to operation [13].

For the development of the industry, there are:

Decree of the President of the Republic of Uzbekistan dated January 28, 2022 No. PF – 60 “On the new Development Strategy of Uzbekistan for 2022-2026”;

“On additional measures to support housing construction and the building materials industry” dated February 21, 2022 No. PF-139;

“On operational measures to improve the energy efficiency of economic and social sectors, the introduction of energy-saving technologies and the development of renewable energy sources” No. PP-4422 dated August 22, 2020;

Resolution of the Cabinet of Ministers dated July 10 No. PP - 4779 “on additional measures to improve the energy efficiency of the economy and reduce the dependence of economic sectors on fuel and energy products by attracting available resources” and Resolution of the Cabinet of Ministers dated 10/19/2024 “On measures to reduce the dependence of consumers on fuel and energy resources, buildings and structures”;

“On approval of the Regulation on the procedure for providing compensation from the State Budget of the Republic of Uzbekistan for the purchase of energy-efficient and energy-saving devices and covering part of the interest costs on loans received for these purposes” Resolution of the Cabinet of Ministers (PKM–217 dated 04/14/2021);

“On approval of the Regulations on the Extrabudgetary Intersectoral Energy Conservation Fund under the Ministry of Energy of the Republic of Uzbekistan” Resolution of the Cabinet of Ministers (PKM–640 dated 09.10.2020) [13].

Special regulatory and technical documents have been developed that address energy conservation issues, such as:

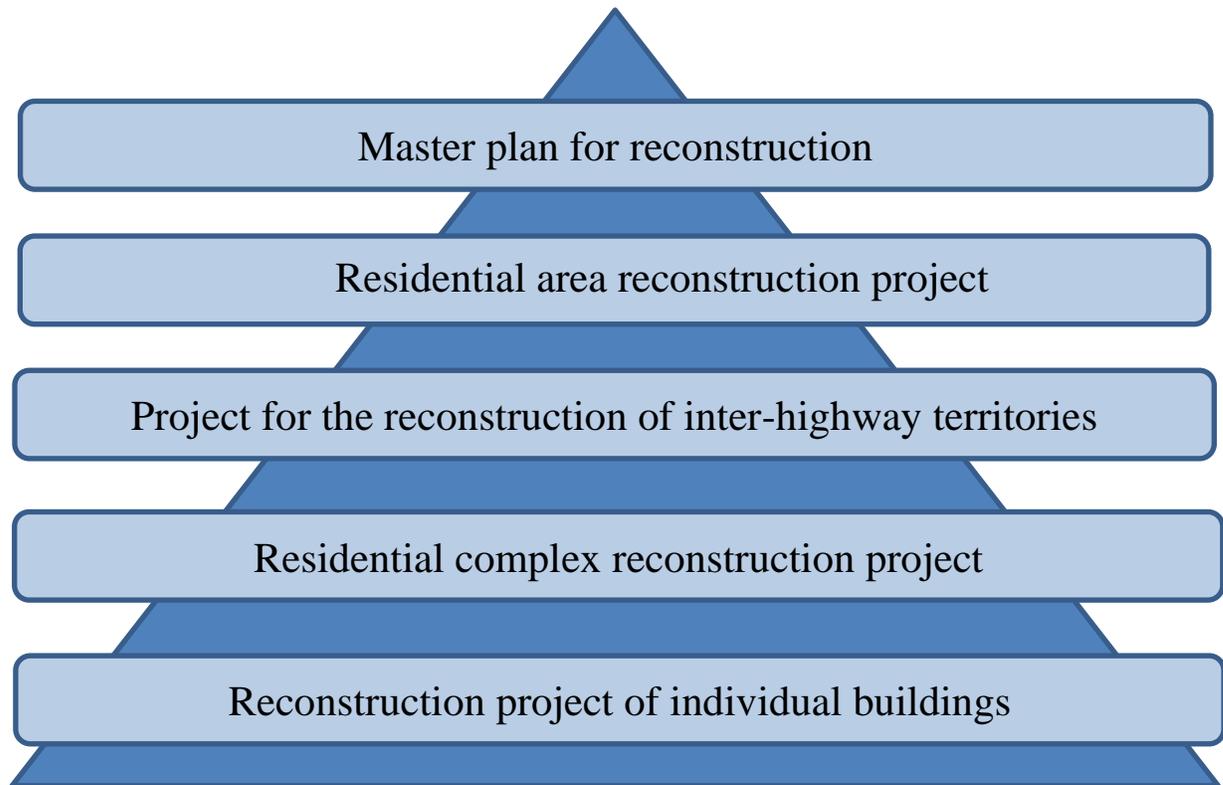
- KMK 2.01.04-18 Construction heat engineering
- Manual for KMK 2.01.04-97 On the design of new energy-saving solutions for construction heat engineering
- SHNK 2.01.05-24 Natural and artificial lighting
- KMK 2.01.18-2000\* "Standards of energy consumption for heating, ventilation and air conditioning of buildings" [2,3], etc.

## Discussion

The presented concept is aimed at orienting the construction complex towards the implementation of

energy-saving solutions and finding the most favorable ones for this purpose to adapt to the processes of reconstruction of urban development.

The design of urban development reconstruction is carried out in several stages, at each of which a number of problems corresponding to the level of urban planning are solved (Figure 3).



**Figure 3 – Stages of urban development reconstruction**

The problem of energy saving also has a multi-level nature and is clearly traced at different levels of urban planning. Therefore, the reasons for low energy efficiency and measures to improve it can be classified depending on the levels of the urban area and its objects [14]: city, residential microdistrict and individual buildings.

Adopting rational energy-saving decisions at every stage of design – from an individual building to a city’s master plan – can form a holistic system for managing the city’s energy efficiency.

Energy-efficient reconstruction of urban development is a process of transformation and renewal of existing urban development, caused by the constant increase in energy efficiency requirements.

The need to carry out energy-efficient reconstruction is due to a number of reasons and is based on the following principles [15].

#### 4. Conclusion.

1. Energy-efficient reconstruction of urban development is aimed at ensuring the efficient and rational use of energy resources in the process of city functioning and the life of the population, the formation of energy-efficient production and consumption of energy, as well as improving the energy standards of urban development elements.
2. It has been established that the development of urban areas should take place in accordance with modern trends in state and world policy and taking into account compliance with current regulations, in connection with which the main direction of urban development activities is the reconstruction of existing residential buildings taking into account the requirements of energy efficiency and energy saving for development elements.
3. In order to meet modern requirements for energy conservation and sustainable development of urban areas, principles for energy-efficient reconstruction of residential development have been developed, which make it possible to include in the process of transforming urban development urban planning energy-saving measures for the territory as a whole, along with engineering and technical energy-saving measures for housing stock facilities.

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