

Economic efficiency of the state program of renovation in Moscow

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Abstract. This article discusses the effectiveness of the state program of renovation of residential buildings of the first period of industrial housing construction in Moscow, calculated until 2032. The main task of the state program is to prevent an emergency situation in the residential sector of the city. The current state of the buildings indicates a decrease in the economic efficiency of their operation. The sub-programs of the state program of renovation are revealed and the technique of calculation of economic efficiency of renovation is offered. The implementation of the state program of renovation will show all the advantages and disadvantages of the decisions that will be taken into account in the future when the renovation of 9-12-14-16 storey apartment buildings in Moscow. The experience of renovation should be extended in the future to the regions.

1 Introduction

In connection with the development of the production of precast concrete constructions and parts in Moscow, in the first period of industrial housing construction for the years 1956-1970 were built 25504 thousand sq. m. of 5-storey panel and block houses. In the second period from 1965 to 1995 was built 57647 thousand square meters of panel and block 8-9-10-12 storey residential buildings. The rapid development of industrial housing has led to the rapid moral aging of typical residential buildings, both the first and second stages of housing construction. The decrease in consumer qualities of residential buildings was also facilitated by the physical wear and tear of structures, which is a consequence of a number of reasons: shortcomings in design, limited material resources, imperfection of production technology and installation of prefabricated structures, the impact of the environment and other factors. Monitoring of physical and moral depreciation of houses of the first period of panel housing construction showed that the technical condition of houses is characterized by a significant deterioration in thermal insulation and performance characteristics of building structures, and in the next 10-15 years not only will lead to a decrease in consumer characteristics of housing, but can also lead to an emergency situation generally. Currently, the volume of such houses is 45-60 percent, and in the next 15-20 years their number will increase to 70 percent or more. The main goal of the program is to prevent the emergency situation of the housing stock, which was built in the 1950s-1960s. The implementation of the state program of Moscow is designed for 15 years.

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The reconstruction program is the second phase of the program of complex reconstruction of Moscow, which began in 1999. At the first stage in a program of comprehensive reconstruction of residential areas the first period of industrial housing was included 1722 five-storey buildings of series K-7 and II-32 and II-35, 1605-AM, 1 mg-300, which was built in the late 1950's-early 1960-ies.

In accordance with the resolution of the Government of Moscow dated July 6, 1999, No. 608 "On the tasks of complex reconstruction of the five-storey buildings in the first period of industrial construction until 2010," demolition of 1,671 houses was carried out, with a total area of 6.1 million square meters. m, which is about 97% of the total volume of the program of complex reconstruction of the five-storey buildings of the first period of industrial housing construction.

The financing of the first stage of complex reconstruction of 5-storey residential buildings occurred at the expense of budget resources, extrabudgetary funds, financial resources of administrative districts and the investors' funds.

In the process of renovation, the city will receive qualitatively new areas. The parameters of construction, which today count increases the density is about 2.5 times. The city will have modern neighborhoods, parks, squares and new social facilities.

The renovation program is adopted for the period up to 2032 and will eliminate the imbalance in the development of the urban environment accumulated over the past decades and prevent the mass appearance in the next 10-15 years of the emergency housing in Moscow.

According to the resolution financing of the program of renovation is performed with attraction of means of the budget of the city of Moscow, and also from other sources according to the legislation of the Russian Federation. Importance is attached to public-private partnerships. The analysis of the previous first phase of the renovation showed that about 70% of the investment housing contracts annually yield of 1.78 million square meters of housing.

2 Literature review

Scientists from different countries studied the economic efficiency of state programs for the construction and reconstruction of social housing. Especially if the residential development has been produced in an industrial way.

“Public housing policy programs for the poor in Brazil began in the 1930s. The MCMV program Federal government's most recent well-publicized Program, aims to improve the quality of life of poor people, reduce housing shortages, and develop the economy. «The results show that the effect in the economy is different depending on the chosen housing typology investment; in other words, the estimated model provide tools to decide about the best housing type for promoting economic growth. The MCMV program and the CDHU's program affect the state economy system by expanding the demand for inputs for the construction of new buildings (direct effect); by expanding the demand in other sectors due to the feedback effect (indirect effect), and by expanding the income of families - it also increases the demand for goods and services in the economy (induced effect)” [1]. The benefit of renovation of apartment buildings substantiate scientists from Spain.

“Paying attention to the constructed city and renovating buildings are two objectives of current European policies. This article develops a system of physical performance indicators to detect multi-family housing estates that perform worse in energy efficiency, airborne sound insulation against outside noise and accessibility terms. Indicators were developed in close cooperation with the local Administration for residential estates and on a district scale, and allowed the buildings in worse conditions to be detected. The results are graphically

represented on urban plans. Indicators are presented by a case study of social housing states in the city of Zaragoza for the 1939–1979 period” [2].

Chinese scientists in their scientific article show the direct relationship between the improvement of housing conditions and the economic growth of cities in China and Asia «Over the past few decades, urbanization in Asia has been driven by rapid economic growth, and economic growth is possible. These events have allowed millions of people to escape poverty and have led to a growing middle class. His commitment to home ownership and capacity to pay, the dynamic financial sector of housing and communal services, and the provision of housing policies have led private developers to provide affordable housing for the urban population. This has resulted in improved housing conditions in cities» [3] .

The Chinese government attaches great importance to the housing investment policy. «Factors of urbanization significantly influence the housing need of residents in small cities. Improvement of urbanization rate would contribute to the consumption demand booming while prosperity of tertiary industry would boost improvement and investment housing demand. Not only could the analytic methodology of housing demand structure demonstrated in this paper be referenced, but the empirical answers carry vital implications for governments implementing diverse policy design in large and small cities in China». [4]

European experience shows a significant decrease in the economic efficiency of the use of obsolete residential buildings. Scientists who studied the European experience, found that: “The building sector accounts for 40% of energy use and 25% of CO2 emissions, mainly due to inefficient building practices and energy consumption during the operational phase of buildings. Social housing accounts for a significant proportion of the European building stock and about 50% of the existing buildings are likely to require large-scale renovations in the coming years, meeting the current EPBD directive. ... Significant European experiences have already shown the importance of an integrated approach finalized to the construction or renovation of social housing, leveraging on environmental sustainability, creating urban identity, adopting measures to face social disadvantage, offering at the same time quality housing standard. In this regard, it seems necessary to match technological advancements and knowledge in energy retrofitting with social needs and habits” [5] .

The Central issue is improving the energy efficiency of residential buildings. So, in many countries of the world on different continents this question is studied by scientists [6, 7, 8, 9, 10, 11,12] .

Energy saving potentials of Moscow apartment buildings in residential districts was also studied “Considerable energy savings could be achieved, up to 34% of the electricity demand and up to 72% of the heating demand, using different district modernization scenarios”. Energy and emission analyses of renovation scenarios of a Moscow residential district [13]. Calculations of international scientists have shown the economic efficiency of renovation of residential buildings compared to major repairs of individual buildings “The net present values for different building and district level renovation packages for a 20-year period were also calculated using different interest rates and annual energy price growth rates. The results suggest that renovation of a district may be more feasible than renovation of individual buildings”[14].

Proposals to improve the energy efficiency of multi-apartment residential buildings in Finland and in Russia are available in the article [15].

Scientists in India argue in their scientific paper that designing new neighborhoods may not provide for thriving urbanization unless they are built with adequate infrastructure and economic base. «It argues that alternative schemes for housing the growing middle income population should be promoted and—if planned inclusively—new towns can contribute to solving the housing crisis» [16]

It is important to preserve the historical heritage of the city during the renovation of residential buildings. “These constructions are usually excluded from the cultural heritage

conservation processes, and therefore a large quantity of them is currently unlivable, and because of this there is an urgent need to propose solutions. However, the extent of the existing building stock and the additional difficulty of protecting its patrimonial value requires an accurate analysis" [17].

The renovation will cover about 5,000 homes and about 350 of the thousands of apartments that will be about 10% of the housing stock of the capital. The program will build more than 15 million square meters of housing. About a million Muscovites will move to the new apartments. The main objective of the renovation Program is to prevent the mass appearance of dilapidated housing in Moscow and at the same time to adjust accumulated over the previous decades, imbalances in the development of the city and shape the urban environment fundamentally new quality.

According to the chief architect of Moscow Sergey Kuznetsov renovation is the largest project in Russia associated with the relocation of residents in the environment of a new quality. Renovation is the economic efficiency of development of the city a successful cultural life, comfort and safety of the urban environment [18].

3 Materials and methods renovation in Moscow

3.1. The legal basis for the renovation

The program of renovation of the housing stock in the city of Moscow has been prepared and implemented in accordance with the Law of the Russian Federation of 15 April 1993 N 4802-I "About the status of the capital of the Russian Federation", the Law of city of Moscow from 17 may 2017 N 14 "About additional guarantees of the housing and property rights of physical and legal persons in the implementation of the renovation of the housing stock in the city of Moscow" that is adopted in order to implement the said law of the Russian Federation and the Moscow city law, normative legal acts of city of Moscow on the basis of the results of voting and results of the General meetings of owners of premises in apartment houses, announced in the manner prescribed by resolution of the Government of Moscow from May 2, 2017 N 245-PP "About accounting of opinion of the population on the project of renovation of the housing stock in the city of Moscow".

The resolution defines the measures for renovation in Moscow: a set of measures aimed at the upgrading of living environment, creation of favorable living conditions of citizens and public space, in order to prevent the growth of emergency housing in the city of Moscow, development of residential areas and their improvement, the energy efficiency of buildings.

3.2. The basic principles of the state program of renovation

The principles of renovation are as follows:

- voluntariness of participation in renovation. The decision to participate in the renovation program was taken by voting of the owners and tenants of the apartments.
- The closed list of houses-participants of the program. The renovation program included only houses whose residents voted for before the adoption of the federal law. Expansion of the renovation program due to the inclusion of new houses is prohibited.
- The right to refuse to participate in the program. The owners of apartments in the five-story building, included in the renovation program, can at any time (before the conclusion of the first contract for a new apartment) decide to exit the program. The decision is taken by more than one-third of the votes of the owners at the general meeting.
- Resettlement - only in your area. In fact, new apartments will be built mainly in the same neighborhoods, within walking distance from old houses.

- Improved finishing of new apartments. Apartments will be suitable for living without additional repair or finishing works.
- Exemption from contributions for capital repairs. From the moment the home is included in the renovation program. Previously collected funds will be used to build new homes.
- Moving to equal ranking apartment. Number of rooms - no less than in the old apartment. The living area is no less than the living area in the old apartment. The total area is more than in the old apartment due to more spacious common areas (kitchen, hallway, corridor, bathroom, toilet).
- If you do not like an equal ranking apartment - you can get an equal value apartment or cash compensation. The amount of compensation will be equal to the market value of the old apartment.
- The new apartment is transferred free of charge and into the property.
- Comfortable urban environment and quality homes: monolithic houses or a modern panel; possibility of replanning apartments; glazing of balconies and loggias, basket for air conditioning; of stairs and of ramps - convenient access to the entrance for the disabled, pensioners and moms with strollers; freight and passenger elevators; convenient streets and parking; wide sidewalks, green courtyards and parks; social facilities in walking distance.
- Social assistance in moving. Free transportation of furniture and things to veterans, single and lonely pensioners, disabled people, large families and other privileged categories of citizens.
- The right to increase living space. Possibility for an additional payment to purchase an apartment of a larger area and with a large number of rooms.
- Public discussion. The plans for the planning of the renovation areas will be discussed with residents in the framework of public hearings.
- Right to retain the lease. Small and medium-sized businesses that leased from the state non-residential premises in five-story buildings have the right to lease on the same terms an equivalent non-residential premises. The right to buy out the leased premises is also preserved.

3.3. Organization and holding of architectural and urban planning competition

At the end of 2017 and early 2018, the city held an open exhibition of the 20 finalists' projects of architectural and urban planning competition for the concept development of pilot sites renovation of the housing stock. The pilot sites located in areas: Kuzminki, Golovinskiy, Tsaritsyno, Prospekt Vernadskogo, Khoroshevo-Mnevniki.

New homes will be built with modern materials: concrete or panel of the new generation and on contemporary projects with elevators and wide halls; the ceilings in the apartments will be higher, and the soundproofing is much better than in prefabricated houses; in all the Windows in the apartments are fitted with double glazing; a convenient entrance for people with disabilities, entrances and elevators are located on the same level; bright and unconventional facades will improve the appearance of the capital; durability of new homes for 100 years at least.

The authors of renovation projects has developed a unique economic model of the project, allowing not only to calculate the amount of investment structure and funding sources of the project, but also to fundamentally new quantitative assessment of all micro- and macroeconomic effects of the project – from the calculation of standard indicators of investment effectiveness to assess the effectiveness of the project for the budget of the city, its housing sector and the economy of the city as a whole within 15 years of implementation of the program. It allows to choose not only the best architectural design solutions and provide economically viable project, and therefore to reduce the risks for the market and for budget investments in the renovation. Already built 12 houses. Then begins the second

"wave" of renovation: 151 launch pad will provide housing 83 to thousands of Muscovites, whose resettlement will begin in 2020.

4 Economic efficiency of the state program of renovation

Financing of the renovation is carried out with attraction of means of city budget of Moscow, as well as from other sources in accordance with the legislation of the Russian Federation. The renovation in Moscow will be allocated 400 billion rubles from the city budget. About 100 billion rubles have already been allocated from the city budget.

Evaluation of the effectiveness and efficiency of the state program The calculation is based on the methodology specified in the order of the Government of Moscow dated 08.04.2015 N 189-PP, are calculated by the following formula:

$$E = (k_{SP} \cdot R_{SP} + k_p \cdot R_p + k_A \cdot R_A) \cdot 100\%, \quad (1)$$

when E - effectiveness and efficiency of the state program

R_{SP} , R_p , R_A - result of achievement of final results of the state program, result of achievement of sub-programs of the state program and the result of the activities of the state program sub-programs according to the planned terms and the level of expenses;

k_{SP} , k_p , k_A - weighting factors for the achievement of the final results of the state program, sub-programs and activities in assessing the effectiveness and efficiency of the program, respectively.

Weight values are determined by experts according to the structure of the program.

$$R_{SP} = \frac{\sum_{i=1}^n (B_s \frac{R_{fi}}{Rp_i} + B_p \frac{Tp_i}{Tf_i})}{n} + B_f \cdot \frac{C_p}{C_f}, \quad (2)$$

when R_{fi} Rp_i - the achieved i-th final result of the state program and planned i-th the end result of the State program

C_p , C_f - actual and planned costs for the state program;

Tp_i , Tf_i - planned term of achievement of the I-th final result of the state program and the actual date of achievement of the I-th final result of the State program;

B_s , B_p , B_f - specific weights of indicators of degree of achievement of final results of the state program, the planned terms and level of expenses respectively.

The weight values are determined by the experts in accordance with the state program of renovation.

$$R_p = \frac{\sum_{j=1}^m R_{pj}}{m}, \quad (3)$$

when R_{pj} - result of achievement of final results of the j-th sub-programs of the state program

m-number of sub-programs of the state program;

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$$R_{pj} = \frac{\sum_{i=1}^n (B_s \frac{P f_i}{P p_i} + B_p \frac{T p_i}{T f_i})}{n} + B_f \cdot \frac{C_{pj}}{C_{fj}}, \tag{4}$$

when R_{f_i} , R_{p_i} - achieved I-th end result of the j-th sub-program and end result of the j-th sub-program ;

C_{p_j}, C_{f_j} - the actual level of spending on the j-th sub-program and the planned level of spending on the j-th sub-program

$T p_i, T f_i$ - the planned date for achieving the immediate result of the i-th activity of the sub-program and i-the actual date of achievement of the immediate result of the i-th activity of the j-th sub-program;

n - the number of indicators of the j-th sub-program

B_s, B_p, B_f - specific weights of indicators of degree of achievement of final results of the State program, the planned terms and level of expenses respectively

$$R_A = \frac{\sum_{j=1}^m R_{A_j}}{m}, \tag{5}$$

when R_{A_j} - results of the activities of the j-th sub-programme of the State program;

m - number of sub-programs of the State program.

$$R_{A_j} = \frac{\sum_{i=1}^n (B_s \frac{R f_i}{R p_i} + B_f \frac{C p_i}{C f_i} + B_p \frac{T p_i}{T f_i})}{n}, \tag{6}$$

when R_{f_i}, R_{p_i} - obtained result of the i-th activity of the j-th sub-program and planned a direct result of the i-th event, j-th sub-program;

C_{p_i}, C_{f_i} - actual level of expenditures for the i-th activity of the j-th subprogram and is the planned level of cost of i-th event and j-th subprogram;

$T p_i, T f_i$ - the planned term of achievement of direct result of the i-th action of the joy of the sub-program and

the actual term of achieving the immediate result of the i-th event, j-th sub-program ;

n - number of parameters the j-th sub-program;

B_s, B_p, B_f - specific weights of indicators of degree of achievement of final results of the State program, the planned terms and level of expenses respectively.

The values of economic efficiency will vary depending on the established list of renovation subprograms. This methodology was adapted taking into account the developed subprograms of the state renovation program. These subroutines should be evaluated by substituting the corresponding results in the formulas. The final indicators will show the economic efficiency of each subprogram and the overall economic impact of the state program. The analysis of calculations at the stages of subprogram implementation will make it possible to draw conclusions which of the subprograms are most effective and which subprograms are ineffective.

5 Conclusions

In accordance with the analysis, the following priority renovation sub-programs can be established.

1. Establishing of priority of demolition of the apartment houses included in the program of renovation taking into account their technical condition.

2. Survey and collection of opinions of citizens in the formation and implementation of the renovation program..

3. The procedure for determining the points of connection of objects of capital construction to networks engineering-technical maintenance, electricity networks, including their location on the border of the land plot and (or) territories in respect of which is preparation of documentation on territory planning.

4. Construction of monolithic apartment buildings, apartment buildings of modern panel structures with high energy efficiency.

5. Compliance with modern standards for such adaptation of houses for disabled people.

6. Providing with objects of municipal, transport, social infrastructure according to documents of territorial planning, standards of town-planning design and other requirements defined by the legislation on town-planning activity.

7. Creation of production of construction materials, products, structures for housing construction for the implementation of the renovation program

8. Formation of the road network, Parking space.

9. Organizations of yards and intra quarter green areas, which should be formed in the form of a single system, including areas of green spaces along pedestrian and transport links (lawns, ordinary planting of trees and shrubs), landscaped areas outside the yard areas (playgrounds, children's playgrounds, sports grounds), recreation facilities (intra quarter squares, boulevards, gardens).

When carrying out calculations of economic efficiency of the state program as a whole it is necessary to make calculations of efficiency of each of the specified sub-Programs of renovation. As a result of the calculations, the economic efficiency of the state renovation program will be determined

The implementation of the State program is considered to be. Excellent result if the efficiency reaches 95-100%. A good result if the efficiency is from 85% to 95%. Satisfactory performance if the efficiency is from 75% to 85%. Unsatisfactory rating if the efficiency is less than 75%. Preliminary calculations will help to adjust efforts towards future solutions.

The implementation of The state program of renovation will show all the advantages and disadvantages of the decisions that will be taken into account in the future when the renovation of 9-12-14-16 storey apartment buildings in Moscow. The experience of renovation should be extended in the future to the regions.

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