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PECULIARITIES OF ORGANIZATIONAL AND TECHNOLOGICAL APPROACHES TO THE POST-WAR RESTORATION OF INFRASTRUCTURAL OBJECTS IN UKRAINE

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Problem statement. As a result of russia's insidious war against Ukraine, thousands of infrastructure facilities and energetical objects were destroyed or damaged. We are sure, Ukraine will win this war. Already today, the territories of the country freed from the occupiers with the destruction of residential and civilian buildings, infrastructure facilities need restoration. In Ukraine, the Government Plan for the Recovery of Ukraine has been developed. Ukraine's recovery plan is aimed at accelerating sustainable economic growth. But this Program outlines general approaches and directions for the recovery and development of Ukraine. Therefore, it is necessary to develop detailed local programs that contain organizational and technological approaches to the implementation of restoration works. The programs must to help local authorities, territorial communities in which housing and social infrastructure objects were damaged or destroyed as a result of russian armed aggression, to make decisions regarding the planning and implementation of restoration works and the development of territories.

Purpose of the study. To develop detailed local program which specifies the National Programs of the Recovery Plan of Ukraine and contain organizational and technological approaches to the implementation of restoration works.

Main results. The war, insidiously unleashed by russia against Ukraine, continues. russian armed aggression against Ukraine includes: Russia's armed invasion of Crimea on February 20, 2014, the war in eastern Ukraine (Donbas) since April 2014, and the full-scale invasion of Ukraine by russia on February 24, 2022.

The war brought many human victims. From February 24, 2022 to January 10, 2024, 10,233 civilians were killed and 19,28 were injured. Human rights activists claim that up to 700,000 Ukrainian children were forcibly taken to russia. The kidnapping of young Ukrainians by russia is a crime of genocide. The number of refugees from Ukraine reaches 6.3 million worldwide [1].

The extent of the destruction of civil infrastructure as of February 20, 2023 is estimated at 81305 destroyed and damaged objects. More than 44 million square meters of housing stock worth 39.3 billion dollars were destroyed. As a result of the russian armed aggression against Ukraine on June 1, 2022, Ukraine lost 35 percent of its GDP, and direct losses from the war already exceed 600 billion dollars. The World Bank estimated Ukraine's losses from the war at 350 billion (as of June 1, 2022).

But the war will still end with our victory and it will be necessary to rebuild the country. In Ukraine, the Government Plan for the Recovery of Ukraine has been developed [2]. Within the framework of the plan, a list of 17 National programs for achieving key results has been determined. Among the National programs, 5 of them directly affect the construction sector of the economy: Strengthening defense and security; Reconstruction of a clean and protected environment; Energy independence and the Green Course; Restoration and modernization of

housing and infrastructure of the regions; Restoration and modernization of social infrastructure.

The construction industry will play a key role in the recovery of Ukraine. It is known that the level of development of construction speaks about the economic development of the country and the standard of living of its population. The share of construction in the GDP of Ukraine in 2010 was 8 %, today it is slightly more than 2 %. In EU countries, according to 2019 data, the industry provides 9 % of GDP. Construction during the three months of the war was reduced by 70 %, the cost of construction increased by 20 % [3].

We have developed the Program “Regenerative industrial construction (restoration of destroyed) objects of the social infrastructure of Ukraine using recycling and distributed energy technologies”, which specifies the National Programs of the Recovery Plan of Ukraine. The program is designed to help local authorities, territorial communities in which housing and social infrastructure objects were damaged or destroyed as a result of Russian armed aggression, to make decisions regarding the planning and implementation of restoration works and the development of territories. The program includes technologies and organization of restoration works of infrastructure objects of Ukraine.

Main features of the Program:

1. Focus on low-rise construction. Energy-efficient reconstruction. Three zero buildings – zero energy, zero emissions, zero waste.
2. Industrial (factory-made) architectural-constructive-technological systems of buildings to ensure high rates of construction.
3. Technologies of recycling (reusing) materials of destroyed buildings and structures.
4. Creation of a network of distributed small industrial productions, close to the places of destruction areas and construction sites for the rationalization of transport costs.
5. Use of distributed (decentralized) energy systems using renewable energy sources to ensure autonomous production.

Organization of the implementation of the stages of the Program:

1. Assessment of the amount of destruction of social infrastructure objects of a separate region or city of Ukraine as a result of the war.
2. Diagnosis and evaluation of the local scale of the destruction of social infrastructure objects by robotic and IT technologies for the selection of machines and mechanisms for the dismantling of destroyed objects.
3. Diagnostics and assessment of the technical condition of damaged buildings and structures for the development of capital repair technologies, strengthening, and reconstruction of structural elements of structures.
4. Development of detailed local programs for the restoration of destroyed social infrastructure facilities with the involvement of local authorities and territorial communities.
5. Development of detailed area plans (DPT) – urban planning documentation of the local level and land management documentation, which determines the planning organization and development of the territory.
6. Design of objects of housing and social infrastructure with the development of estimate documentation to determine the necessary amounts of financing.
7. Restoration of damaged buildings and structures in non-emergency technical condition (overhaul, strengthening, reconstruction).
8. Dismantling of buildings and structures that are in an emergency technical condition and completely destroyed.
9. Creation of distributed energy systems of production, transformation, storage and use of energy for the production process.

10. Construction of local technological lines for the production of industrial elements and building structures.

11. Determination of construction organizations for construction works.

12. Restorative construction (restoration of destroyed) objects of social infrastructure

Reconstruction of the country after the war will be a great challenge for our state in its history. The restoration of Ukraine is not the reconstruction of Ukraine to the pre-war state, it is a comprehensive transformation, a deep modernization of the country. That is why the construction industry of Ukraine should be the locomotive of innovative reconstruction of infrastructure facilities. The main criteria for evaluating this process will be the quality and speed of reconstruction. It is possible to achieve this through the introduction of modern construction methods using construction products of industrial (factory) manufacture in combination with the most modern design approaches based on BIM technologies [4].

Conclusion. 1. Developed the Program “Regenerative industrial construction (restoration of destroyed) objects of the social infrastructure of Ukraine using recycling and distributed energy technologies”, which specifies the National Programs of the Recovery Plan of Ukraine.

1. Modern organizational and technological solutions are proposed to speed up renovation works, reduce construction costs, ensure energy security, and provide modern energy-efficient architectural solutions for residential buildings: low-rise residential buildings; energy-efficient buildings; industrial (factory-made) architectural-constructive-technological systems; recycling (reusing) materials of destroyed buildings; distributed small industrial productions, close to the places of destruction areas and construction sites; distributed (decentralized) energy systems using renewable energy sources.

2. The main organizational and technical stages of work execution according to the program are defined.

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