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TECHNICAL AND ECONOMIC JUSTIFICATION FOR SELECTING METHODS FOR RESTORING WATER SUPPLY AND WASTEWATER NETWORKS, TAKING INTO ACCOUNT ENVIRONMENTAL AND ECONOMIC DAMAGE

Given the increasing anthropogenic impact on climate and the environment, the actualization of environmental safety is becoming an integral component of sustainable development. Climate change, water resource pollution, ecosystem degradation, and other environmental challenges require immediate and comprehensive measures. International agreements such as the UN Framework Convention [1], the Paris Agreement [2], and the Kyoto Protocol [3] define the strategic directions of global environmental policy, stimulating the development of national regulatory acts and the implementation of environmentally safe technologies, particularly in the design and operation of wastewater systems.

In view of the growing environmental threat caused by anthropogenic impact on the environment, the destruction of infrastructure during ongoing hostilities (fig.1) and Ukraine's international obligations, the selection of the optimal option for reconstructing the water (wastewater) network should be based on the calculation of comparative economic efficiency, taking into account ecological and economic damage.

The selection of the optimal reconstruction option should be based on the calculation of comparative economic efficiency, taking into account ecological and economic damage.

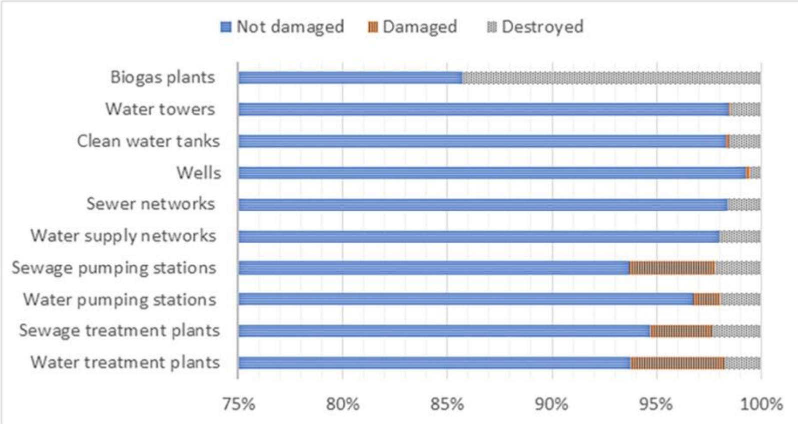

Fig. 1. Damage to water supply and sewerage infrastructure as of the beginning of 2024 (compiled from data [4])

In this case, the net present value [5] for selecting the method of pipeline reconstruction takes the following form (1):

$$NPV_P = -IC_P + \sum_{t=1}^{n} \frac{CF_{Pt} - OC_t - ERC_t}{(1+i)^t}, UAH/year. \qquad (1)$$

де CF_{Pt} – Cash flow in the period, UAH/year, which is defined as the prevented environmental damage from pipeline failures;

OC_t – operating costs in period t, UAH/year;

ERC_t – financial costs associated with potential negative environmental impacts in period t, UAH/year, are calculated using formula (2):

$$ERC_t = (1 - P_t) \cdot S_t,\ UAH/year; \qquad (2)$$

P_t – probability of failure-free operation of the pipeline in period t [6, p. 83] (3):

$$P_t = e^{-\lambda_n L_i t_i} \qquad (3)$$

λ_n – standard number of failures of the section, $\frac{1}{km \cdot year}$, is taken from the reference data of manufacturers;

t_i – operating time is taken from the moment of commissioning to the present moment plus 1 year, i.e. t = (t_{exp}+1) year (for new pipelines, the first year is taken as 0);

S_t – assessment of potential losses from negative environmental impact in the event of pipeline failure.

Discounted Payback Period (DPP) in this context takes on a form that considers additional factors (4):

$$\sum_{1}^{DPP}\frac{CF_t - OC_t - (1-P_t)\cdot S_t}{(1+i)^t} \geq \sum_{t=1}^{n}\frac{IC_t}{(1+i)^t}, \text{грн.} \qquad (4)$$

where n – is the depreciation period of the longest investment activity, calculated in years.

The optimal option among a set of alternative projects is the one that is characterized by the maximum positive value of net present value (NPV) and the smallest discounted payback period (DPP).

Conclusions: the proposed methodology provides a scientifically sound basis for making rational decisions regarding ensuring the environmental safety of municipal water and wastewater systems, promoting sustainable development and efficient use of resources.

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THE CREATION OF EFFECTIVE POWER SUPPLIES FOR UNMANNED VEHICLES

Unmanned aerial, ground and marine vehicles are widely used around the world. The movement of these vehicles is provided by engines: internal combustion, electric and their combination. The use of electric engines for unmanned vehicles allows to reduce their cost, eliminate heat signature, reduce sound trace, eliminate exhaust gases, etc. For unmanned aerial vehicles (UAV) like multicopters there is practically no alternative to electric propulsion because of the ease of their control. Ease of operation, high reliability and low cost have become a decisive factor for manufacturers of electrically powered UAVs [1, p. 13]. Today, the bottleneck for all types of unmanned vehicles is their poor power capability [2, p. 677]. This problem is most acute for unmanned aerial vehicles, where the mass of the structure is one of the main indicators [3, p. 67]. This trend directs specialists to search for efficient UAV power supplies. In UAV design, batteries and secondary power supplies (SPUs) are the most massive. However, the power source, as well as the type of propulsion system that