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## **ON THE FEASIBILITY OF THE CONSTRUCTION OF NEW HYDROPOWER PLANTS IN UKRAINE**

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*There are presented results of feasibility analysis of the building of new hydropower plants in Ukraine according to the Hydropower development program for the period till 2026, which was approved by our Government in 2016.*

**Keywords:** *alternative, feasibility, hydropower plants, pairwise comparison, renewable energy, risk.*

## **ПРО ДОЦІЛЬНІСТЬ БУДІВНИЦТВА НОВИХ ГІДРОЕЛЕКТРОСТАНЦІЙ В УКРАЇНІ**

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*Представлено результати аналізу доцільності будівництва нових гідроелектростанцій в Україні згідно з*

*урядовою Програмою розвитку гідроенергетики на період до 2026 року, прийнятою в 2016 році.*

**Ключові слова:** *альтернатива, відновлювана енергетика, гідроелектростанції, доцільність, попарне порівняння, ризик.*

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As renewable energy, especially solar and wind, steadily has been increasing in our country [1, 2], so has been the need for additional high-maneuver hydropower capacities to provide the stable and reliable operation of the national combined energy system (CES) [3, 4].

Admittedly, the role of maneuver power sources in the CES is best fulfilled by hydropower plants (HPPs) and pumped-storage hydropower plants (PSHPPs) [1-4]. As well as, it is believed that for the stable and reliable operation of the CES, the share of maneuver capacities in its overall electricity balance should be about 15-20% [3, 4]. However, at present, the domestic hydropower is capable of reliably providing only about 8-9% of the overall electricity balance in the country. Therefore, the decision on a further increase of hydropower capacity in the country laid out in the famous Hydropower Development Program for the period till 2026 [4] seems to be rational. Although the achievement of a hydropower share goal of 15% in the total electricity balance of the CES due to the implementation of the Program [4] is quite questionable [5, 6], still an increase in high-maneuver hydropower in the national CES will have an essential positive effect undoubtedly.

This report presents the results of feasibility analysis of perspective plans for the second stage of modernization and reconstruction of the existing HPPs of the Dniprovsky and Dnistrovsky cascades, building the Kakhovka HPP #2 and six new HPPs on the river Dniester, as well as boosting small hydropower in the country. The analysis is based on a pairwise comparison of several alternatives by the criterion of minimum aggregate risk taking into account the risk of lost (unused) opportunities [6, 7]. Components of aggregate risks of compared alternatives are estimated in dimensionless units for main water-energy and operability characteristics, and costs of commissioning of new hydrogenerating capacities.

Totally, there were considered and pairwise compared next eight alternatives ordered and numbered according to increasing installed capacity:

1) the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades;

2) the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades, and also the further development of small hydropower in the country;

3) the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades, and also the construction of the Kakhovka HPP#2;

4) the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades, the construction of the Kakhovka HPP#2 and the further development of small hydropower in the country;

5) the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades and the building of the Upper Dnistrovskiy cascade of HPPs;

6) the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades, the construction of the Upper Dnistrovskiyi cascade of HPPs and the further development of small hydropower in the country;

7) the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades, the construction of the Kakhovka HPP#2 and the construction of the Upper Dnistrovskiyi cascade of HPPs;

8) the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades, the construction of the Kakhovka HPP#2 and the Upper Dnistrovskiyi cascade of HPPs, and the further development of small hydropower.

The problem was solved on the basis of a pairwise comparison of alternatives according to the method [7]. The obtained results showed that the best alternative is 3 - the second stage of reconstruction of the HPPs of the Dniprovsky and Dnistrovsky cascades, and the construction of the Kakhovka HPP#2. It may be the most feasible alternative. As well as, it was revealed that all considered alternatives providing for the further development of small hydropower in the country are worse than other alternatives neglecting its development. It may indicate that the decision to foster small hydropower in the country is questionable and ungrounded.

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