

## DETERMINATION OF THE TURBOGENERATORS CONDITION ANALYSIS DIRECTIONS WHICH ARE DETERMINANT IN LIMITING THEIR LIFETIME

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The purpose of the work is to establish the necessary actions and direct the use of experience in maintenance, history of operation, repair and modernization, evaluation of operational information from control verification of the specific diagnostic tests results to the study of archive data to extend the turbogenerators (TGs) operating life that are already working in a state of wear and tear [1]. It is necessary to understand and be able to evaluate the critical characteristics of the generator state in transient modes, which is practically their constant state at modern thermal power plants.

Extending the service life of machines in recent decades has been a real alternative to a complete renewal of the power plants machine park, the necessary replacement of TGs with new ones due to the global economic crisis. For our country, extending the service life of TGs is the only option for the operation of thermal energy during the war and will be the main one in the post-war period. However, before considering technical factors and proposals, it is necessary to formulate the main questions and determine the directions for conducting technical analysis of TGs that operate in a state of wear [2]:

1) What operating modes of TGs have the greatest impact on limiting their service life, on failure-free operation during and after the end of the rated operating time? What modes should be avoided?

2) What actions can be taken to maintain TGs and electrical equipment in order to extend their service life?

3) How do changes in the generator external parameters and changes in the equipment operating characteristics operating nearby affect its service life?

4) What indicators from the TG operational history determine the possibility of extending its service life?

5) Which elements of the TG require additional, constant monitoring? The failure of which units and parts is most dangerous for ensuring the possibility of extending the operation of the TG?

6) What additional actions, studies and control techniques must be performed to ensure reliable operation of the TG after the end of its rated service life?

7) What level of service personnel professional training is necessary for the operation of electrical equipment in a state of wear, in particular, TGs?

8) To what extent does the current level of scientific research in the field of electrical mechanical engineering and its funding affect the possibility of continuing the operation of thermal power plants TGs in a state of wear and tear?

Carrying out an assessment of the condition of TGs based on the questions posed will allow us to determine the possibility and real duration of their further reliable operation at power plant units. In this case, it is necessary:

1) Analysis of research results and obtaining answers on the given indicators should be based on statistical data, on the results of monitoring the turbogenerators of various power plants condition;

2) For machines in a state of wear, it is necessary to make adjustments to the test program, to the assessment of the boundaries of normal parameter values, which are determined during repairs and in online mode, taking into account the characteristics of the operating history of each specific TG;

3) When abandoning the program of scheduled preventive maintenance for TGs of thermal and nuclear power plants and switching to a system of repairs "based on technical condition", it is necessary to develop and use a system of additional monitoring of the condition of turbogenerators at thermal power plant power units in real time; conduct training for power plant personnel in monitoring additional parameters;

4) When upgrading TGs that have reached the end of their service life, it is necessary to use new capabilities, materials, and technologies from the manufacturer, which will increase the capacity of the turbogenerator. For example, if we consider TGs of the TGV-200, TGV-200M and TGV-300 type from the Electrotyazhmash plant (Kharkiv, Ukraine) with a capacity of 200 and 300 MW, it is advisable to carry out work to increase the capacity of such machines to 220-250 and 325-350 MW. An example of such a modernization with an extension of the service life at a nuclear power plant unit is the modernization of the turbogenerator TVV-1000-2U3, carried out in 2020-2021 by Westinghouse at Unit No.2 of the Khmelnytsky NPP. The capacity of the TG was increased to 1100 MW while maintaining the dimensions of the machine and foundation.

### Reference list

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- [2] Shevchenko V. V., Lazurenko K. O. Statistical analysis of obvious and hidden defects of thermal power plants turbogenerators and assessment of damage from their failures. XL International scientific and practical conference «Mechanisms of Development of the Scientific and Technical Potential of Modern Society» Salzburg, Austria. International Scientific Unity, 2024. p. 213-217. DOI 10.70286/ISU-25.09.2024