Monitoring thermal-flow parameters of the power unit to determine the degree of contamination of the turbine condenser and its impact on the efficiency of the power plant.

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SUMMARY:

The research carried out as part of the doctoral dissertation confirmed the negative impact of contamination of the internal surfaces of the condenser pipes on the operation of the unit, especially in the case of too long duration for condenser cleaning. As expected, there is an upward trend in the amount of heat absorbed by the cooling water in the condenser simultaneously with the increase in the degree of contamination of the pipes and the need to keep electrical and thermal power at a constant level. The simulations carried out also showed a significant impact of the deterioration of heat exchange in the condenser on the reduction of the efficiency of the entire cycle, and thus on the operating costs.

In the case of a condenser, in a situation where deposits are growing on the inner surface of the pipes in order to maintain the production of electricity at the same level, it is necessary to increase the fuel stream supply to the boiler in order to increase the amount of steam or the parameters of the steam that performs the work in the turbine and then condenses. in the condenser.

The heat flux taken up in the condenser by the cooling water is used in the proposed methodology for calculating losses related to the increasing degree of contamination of the condenser. Already at the stage of initial analyzes, the key issue turns out to be inaccurate measurement of the mass flow of flowing cooling water. Installing an appropriate cooling water flow measurement system will significantly improve the accuracy of calculating directly the amount of heat absorbed by the cooling water of the condenser. At this dissertation has been demonstrated demonstrates the opportunity of using the existing segmented bend supplying cooling water to the condenser as a reliable measuring instrument. The test results showed that it is possible to adapt the bend of the segmented cooling water pipeline to measure the mass flow of water cooling the condenser.

In the developed numerical model with the use of the EBSİLON program, the negative impact of the increase in condenser contamination on the efficiency of the energy cycle and unit indicators was

clearly demonstrated. Using the software and the appropriate model, it is possible to determine many parameters of the unit's operation during the simulations, including: circulation efficiency, the amount of fuel consumed and the resulting cost. By placing the system in two different states in one model, the differences in key parameters, resulting from the increased degree of pollution, were presented.

Based on the introduced dependencies, it is possible to calculate the increase in energy supplied in the fuel, necessary to maintain electricity production at the assumed level with the increase in contamination of the condenser pipes.

Using the methodology described in the work and the developed mathematical model of a power unit, it is possible to determine the degree of contamination of the condenser, based on the existing operational measurements of the unit, and to accurately measure the stream of flowing cooling water.

The simulations carried out in the work allowed to determine the optimal time interval for cleaning the condenser.

The combination of all the tools used in the work under a common methodology will result in the creation of a comprehensive tool for assessing the state of contamination of the surface of the condenser pipes, which, in consequence, will allow to consciously and with appropriate economic reasons to plan and conduct a policy of maintaining turbine condensers in an optimal condition. With the right tool, it will be possible to implement production plans, which will enable simulation for the conditions that are most likely to be realized. It should be noted that the simulations and analyzes carried out in the study concerned selected loads.

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