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# ENERGY EFFICIENCY OF THE COGENERATION SYSTEM BASED ON THE BOILER HOUSE OF THE CHERNIVTSI OIL AND FAT PLANT

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**Abstact**

*The issue of increasing the energy efficiency of the cogeneration system based on the boiler room of the Chernivtsi oil and fat plant is considered. A mathematical model was developed and numerical studies of the indicators of vocational training were carried out. The effect of changing the turbine efficiency and parameters of the sharp steam was investigated. An analysis of the energy efficiency of using a steam turbine plant to meet the needs of an oil and fat plant was carried out.*

**Keywords:** energy efficiency, cogeneration plant, sunflower husk pellets

## Introduction

In the sectors of the fuel and energy complex, the most energy-consuming are technological processes related to the production, transportation and use of thermal energy. Many scientists pay attention to the issue of increasing the efficiency of enterprises. However, despite the existing developments, a number of issues related to the use of primary energy and the reduction of emissions into the atmosphere remain open and require more in-depth study and research.

Today, domestic CHP plants are in a difficult situation. In this regard, it is necessary to modernize heat and power plants and switch to a new development of heat and electricity production. A promising direction for improving the efficiency of heat supply organizations is the use of cogeneration plants with piston and steam turbine engines. The creation of a wide and powerful range of autonomous energy sources with combined production of electric and thermal energy will help provide a certain energy reserve for the centralized system.

The goal of the work is to increase the efficiency of energy use in the thermal scheme and determine the energy-efficient modes of operation of the cogeneration plant in the thermal scheme of the boiler room of the oil and fat plant.

## Results

It was determined that the use of cogeneration plants is a promising way to energy efficiency and energy saving of the enterprise. Installation of a cogeneration plant at the enterprise is economically beneficial and attractive for investment. The introduction of cogeneration plants has an effect in the following areas: economic (significant reduction in the cost of electricity and heat; increasing the energy independence of the enterprise due to the increase in the efficiency of the use of fuel resources); environmental (reduction of harmful production emissions into the environment).

An analysis of the energy efficiency of using a steam turbine plant to meet the needs of an oil and fat plant was carried out. A mathematical model of vocational training indicators has been developed. Calculations were made for options for changing the turbine efficiency and changing the parameters of the sharp steam. As a result of the calculations, graphs of the dependence of the theoretical and operating heat transfer on the efficiency of the turbine were constructed. So, in the range of 0.7 - 0.9, the operating heat transfer increases from 117.6 kJ/kg to 151.2 kJ/kg, and the electric power of the turbine increases from 228.6 kW to 294 kW. Also, an analysis of the impact of changing the parameters of acute steam was carried out.

Also, an analysis of the impact of changing the parameters of acute steam was carried out. In the range of 2988 - 3174 kJ/kg, the steam enthalpy after theoretical expansion increases from 2840 kJ/kg to 3000 kJ/kg, and the actual heat transfer increases from 118 kJ/kg to 139 kJ/kg. In both variants of increasing the efficiency of the turbine and the parameters of the sharp steam, the cost of overspent fuel per turbine and savings on

electricity increase to UAH 390 000/year and UAH million 15.5 /year, respectively.

The main indicators of investment effectiveness in an innovative project are calculated: net cash receipts NV = UAH 9,039 million; net present value NPV = UAH 2,850 million, and the payback period, T = 2.43 years.

## Conclusions

1. The introduction of cogeneration plants has an effect in the following areas: economic (significant reduction in the cost of electricity and heat; increasing the energy independence of the enterprise due to the increase in the efficiency of the use of fuel resources); environmental (reduction of harmful production emissions into the environment).
2. The efficiency of the turbine in the range of 0.7 - 0.9, the operating heat transfer increases from 117.6 kJ/kg to 151.2 kJ/kg, and the electric power of the turbine increases from 228.6 kW to 294 kW..
3. The cost of overspent fuel per turbine and savings on electricity increase to UAH 390 000/year and UAH million 15.5 /year, respectively. The payback period near 2.43 years are calculated.

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