**Modeling Energy-Efficient Consumption at Industrial Enterprises**

**Georgi N. Todorov 1\*, Elena E. Volkova 2, Andrey I. Vlasov 3, Natalya I. Nikitina 4**

1 Varna Scientific Institute of the Eastern European Commonwealth – VSIEEC, Bulgaria

2 Tyumen Industrial University, Russian Federation

3 Bauman Moscow State Technical University, Russian Federation

4 Russian State Social University, Russian Federation; Pirogov Russian National Research Medical University (RNRMU), Russian Federation

\*Email: todorov.g@protonmail.com

**ABSTRACT**

A possibility to reduce costs incurred in both product manufacturing and energy consumption constitutes energy-efficient consumption at industrial enterprises. Manufacturers operating in various economic sectors adopt similar conceptual models of energy consumption, which allows developing a universal solution for modeling such processes. The central problem of modeling lies in finding an adequate objective function based on a sufficient set of parameters and characteristics of the efficiency of an enterprise’s power circuit. The article justifies the performance indicators of industrial enterprises’ power supply systems. The literature review proves that economic feasibility of energy efficiency is especially obvious if a massive modernization program is implemented. The estimates produced indicate that the largest portion of the potential energy savings is attributed to implementation of energy-saving projects in industrial buildings and other structures. We present a mathematical model designed to perform a comparative analysis of technical and economic features of two modernization scenarios of the heat and power supply system of an industrial enterprise circuit. Performing a simulation calculation based on performance aspects of Russian companies, the paper outlines the advantages of integrated modernization and analyzes the influence of various factors. The results reveal that there is an inverse correlation between specific heat consumption of buildings under thermal modernization and the length of the thermal network. As specific energy consumption in the thermal modernization scenario increases, the payback period for capital investments decreases. The effect of this dynamics is virtually proportional. Compared with total costs for various heat sources, the share of capital costs differs significantly; however, the share of running costs is dominant for all types of units. At the same time, the length of an enterprise’s heat circuit weakly affects the payback period of capital costs.

**Keywords:** Energy efficiency; Industrial enterprise; Thermal modernization; Energy modeling.

**JEL Classifications:** Q43, L95, L97