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## ENERGY CONSUMPTION OPTIMIZATION SYSTEM IN THE SILK INDUSTRY

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### Abstract

This paper presents the scientific foundations for improving the energy efficiency management system in silk industry enterprises, ensuring the rational use of energy resources in production processes, and managing energy consumption based on regulatory standards. The hierarchical structure of the system, combined management principles, relational information model, and the interrelationships among management blocks are analyzed. The proposed approach contributes to enhancing energy efficiency, reducing energy consumption, and improving the overall performance of silk production enterprises.

**Keywords:** Energy efficiency, energy management, silk industry, relational model, automation, energy balance, database, energy conservation.

### Introduction

Based on the Green Economy Concept of the Republic of Uzbekistan and the strategic program aimed at increasing energy efficiency by 30% by 2030, the implementation of energy-saving systems in industrial enterprises has become one of the key priorities for sustainable economic development.

At present, the limited availability of energy resources and the continuous increase in production costs in the silk industry have made energy efficiency improvement a strategic challenge. Reducing energy consumption during production processes, conserving thermal and electrical energy, and implementing automated control systems are among the main factors ensuring the



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competitiveness of enterprises. Therefore, the development of scientifically grounded energy efficiency management systems is of great importance.

The effective management of energy resources not only reduces production costs but also contributes to environmental protection and sustainable industrial development. In this regard, the application of modern management approaches, information technologies, and automated monitoring systems can significantly improve energy performance indicators in silk production enterprises. Consequently, the development and implementation of integrated energy efficiency management systems represent an important scientific and practical task.

The essence of the energy efficiency management system is the process of interaction between the controlling object and the controlled object. The primary objective of the system being developed for silk industry enterprises is to reduce the energy intensity of products, standardize energy consumption, and improve overall production efficiency.

The energy efficiency management system is based on a three-level hierarchical structure:

Level 1 – Monitoring and controlling energy consumption at the level of individual equipment and technological units.

Level 2 – Conducting energy analysis and establishing consumption standards at the workshop or production department level.

Level 3 – Forming the enterprise-wide energy balance, as well as performing energy planning, monitoring, and management at the corporate level.

This hierarchical structure ensures effective coordination between operational and strategic energy management activities, enabling continuous monitoring and optimization of energy use throughout the production process.

The management mechanism based on the relational model represents a systematic process of collecting, processing, and analyzing energy-related data and transforming this information into effective management decisions.

Within this approach, energy consumption management is carried out through the integration of information flows, databases, and analytical tools. The collected data are evaluated against established standards and performance indicators, allowing managers to identify inefficiencies, determine energy-saving



opportunities, and implement corrective actions. As a result, the relational model provides a reliable foundation for data-driven decision-making and supports the development of an intelligent energy efficiency management system for silk industry enterprises.

In this study, a relational model was applied, and the energy efficiency management process was implemented through the following stages:

**Figure 1. Relational information model of energy efficiency management, illustrating the interconnections among management modules and data flows within the system.**

Stage	Description	Expected outcome
1	Collection of data and analysis of energy tariffs and consumption volumes	Development of strategic and prospective plans
2	Conducting an energy audit and preparing an energy balance	Identification of energy-saving opportunities
3	Performing a techno-economic assessment	Development of energy-efficient projects and measures
4	Standardization and normalization of energy consumption	Formation of the primary control signal
5	Comparison and evaluation of management parameters	Determination of the final management action

In designing the database, the database intended for the energy efficiency management system is developed through the following stages: analysis of information sources and industry requirements; development of a logical model, including production volume, energy intensity, and energy balance elements; creation of a physical model consisting of energy-type-specific tables and normative indicators; and development of a management interface incorporating reports, graphical representations, and analytical performance indicators.

The database serves as the core component of the management system, ensuring reliable storage, processing, and retrieval of energy-related information. It provides the necessary foundation for monitoring energy consumption, evaluating system performance, and supporting data-driven management decisions.



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The block structure of the energy efficiency management system consists of several functional units, including the energy management department, database module, energy balance module, and monitoring and control unit. These modules interact through an integrated information system, enabling continuous data exchange and automated management of energy resources.

The implementation of such an information system facilitates real-time monitoring of energy consumption, improves the accuracy of energy accounting, and enhances the effectiveness of managerial decision-making. As a result, the enterprise's energy balances are optimized, leading to improved operational and economic efficiency.

The results of the study indicate the necessity of developing an integrated hierarchical system for energy efficiency management in silk industry enterprises. The proposed system enables the standardization of energy consumption, identification of energy-saving opportunities throughout various stages of production, and implementation of automated analysis and control based on information technologies.

Furthermore, the integration of hierarchical management principles, relational database technologies, and automated monitoring tools provides a comprehensive framework for improving energy performance. The implementation of the proposed system can contribute to reducing energy intensity, optimizing energy resource utilization, and enhancing the overall competitiveness and sustainability of silk industry enterprises.

**References:**

1. Shukurillo, Y. U., Ruzimatjon, A. U. S., Musulmonkul, I. U. M., Saleem, A., & Kuchkarova, D. T. (2024). Increase the operational reliability of the electric drive of the weaving machine. *International Journal of Power Electronics and Drive Systems*, 15(2), 704–714. <https://doi.org/10.11591/ijpeds.v15.i2.pp704-714>
2. Usmonov, Sh. Y., Kuchkarova, D. T., Igamberdiyev, B., & Sulstonov, R. A. (2024). Introduction of resource efficient, cleaner production (RECP) methods in industry. *BIO Web of Conferences*, 141, 04005.



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4.0 International License.***

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3. Kuchkarova, D. T. (2023). Regulation of Energy Consumption in Multi-Stage Technological Processes of Silk Reeling Enterprises. Scientific and Technical Journal of Fergana Polytechnic Institute, Special Issue No. 17, pp. 239–241.