INVESTIGATION OF COMPUTER-ORIENTED TECHNOLOGIES FOR THE OPTIMIZATION OF ELECTRIC SUPPLY AND ENERGY SAVING OF RAILWAY TRANSPORT

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Abstract: The analysis of the current state of power electric equipment of traction substations of railways, power supply systems for traction and control systems based on what was shown that current trends to ensure a high level of efficiency of the power industry are directly related to its informatization and the development of distributed computer systems and networks intellectual technology for monitoring, identifying and intellectualizing the management of energy saving modes of electric supply systems. The temporary decomposition of the tasks of management of electric networks of railways and the methodology of the organization of intelligent electric power traction networks are proposed. The methods for registering primary information monitoring parameters of normal and emergency modes of electric networks based on the use of mathematical tools of differential transformations and the presentation of data in the form of T-spectra are developed. On the basis of the system-wide principle of a single information space and the results of experimental studies, the architecture of the computer environment is studied, which reflects the range of possibilities for intellectualizing the traction network based on the characteristics of electricity supply to railways, taking into account restrictions and specificity of consumption. And at its base, modern computer-intelligent technologies have been created for managing energy saving in the process of power supply to railways at the level of traction substations, power supply distances and the upper level of the railway as a whole. The possibilities of the proposed structure of the intellectual traction electric network of Ukrzaliznytsia developed as a result of the mutual integration of the topology of the traction network of power supply and architecture of the computer environment, which is the infrastructure for managing power supply for railway transport, as well as the possibility of integrating real-time monitoring, state, optimization of consumption and management of energy saving in the process during the maintenance of electricity for traction at all levels of management of the railway in market conditions.

Keywords: intellectualization of management procedures, computer-oriented technologies, energy saving, technological process, computer systems and networks.

1. Introduction

In the market conditions of the electric industry of Ukraine, a number of increased demands are being made in the process of production, transmission and consumption of electricity. An important problem in organizing the effective functioning of the power supply systems of railways is ensuring their reliability and quality of work, including the organization of energy savings, which is due to the growth of its share in the cost of production [1, 2]. The high level of physical and moral deterioration of electric equipment of railways contributes to a significant increase in power consumption and the creation of a number of environmental problems. In this situation, the development of systemic accidents due to the unreliability of equipment and personnel errors, as the experience of many countries shows, can lead to multi-million economic losses [3, 4]. The solution to the problem of energy saving, ensuring reliability, optimizing power consumption and improving the safety of railway traffic is the development of distributed computer systems and network technologies for monitoring, identifying and intellectualizing the management of energy saving modes of power supply systems. According to estimates of domestic and foreign scientists, a significant increase in the efficiency of using modern information technologies is possible only by conducting research on the general properties of mathematical models, methods, algorithms, management tasks, features of modern and future network technologies, as well as architectural features of power supply networks and information management systems of computer systems [5]. Analysis of the results shows that the creation of modern intelligent electric networks of railways is associated with the latest achievements in the field of computer, intellectual and communication technologies. This is possible thanks to the development of innovative models for converting electric traction networks based on modern computerized intelligent infrastructure with an adequate power supply system topology, which will ensure optimal control and the formation of energy-saving technologies [6]. The authors have identified new approaches to conducting research on the innovation and investment transformation of traction electric networks of railways for the formation of energy-saving technologies for optimal power consumption and trouble-free rail traffic. It is possible to achieve the objectives by creating a new model of the intellectualization of power supply networks, the dominant feature of which is the formation and accumulation of new knowledge. The scientifically based concept of the intellectualization of energy, which displays the intellectual interaction of pricing, technological processes of power supply and energy efficiency, based on the "smart railway energy" and "smart efficiency" of energy consumption of railways. The authors also develop and substantiate the method and methodology of research on the intellectualization of energy. Due to this, it is possible to display the mutual integration and intellectual interaction of the pricing of technological processes of power supply, the modern capabilities of distributed computer networks and the efficiency of using energy resources [7]. New methods for determining the full information content of the registered primary multidimensional information data have been developed. The updated methods and tools for the synthesis of mathematical models and methods of increased intellectual complexity and dimension in the field of management of complex energy objects, processes and phenomena are proposed. The set of basic principles for the formation of the methodology for the synthesis of intelligent computer systems of optimal power supply management based on mutual integration of the computer environment architecture and the topology of an energy facility is formulated.

2. Results

Studies allow to imagine the architecture of a distributed computer network, reflects the topology of the power supply system of the railway, as well as modern computer-intelligent technologies. The results will be used for operational

commercial management of power consumption for traction, optimization of power supply, energy saving, including self-regulation and self-repair procedures, which are almost an order of magnitude cheaper than existing foreign analogues [8]. It is also positive that in the proposed computer environment the functionality in the field of energy saving has been significantly expanded.

Thanks to the computerization of the operational management procedures for power supply, modern working conditions will be implemented in the form of a set of IT-workplaces, as well as modern operating conditions for traction electric networks will be created. All this will significantly improve the quality of services in the conditions of the electricity market, as well as create a modern level of automation related to the management of power supply [8, 9], **Fig. 1.**

3. Discussion of results

As a research result, mathematical models, methods and computer-oriented algorithms for computerization and intellectualization of fast technological processes are presented to optimize power supply for traction and power consumption during transportation. The results will also allow the creation of procedures for managing energy saving, traffic safety and reducing the cost of the transportation process [9]. Based on the results of previous studies, the architecture of a single distributed computer environment is proposed and developed. By analyzing the characteristics of the supply of electricity and taking into account the specifics of consumption for traction, the architecture allows displaying the range of possibilities for the intellectualization of the traction network of a separate railway.

On the basis of the proposed architecture of a distributed computer network, modern computer-intelligent technologies are created, which reflect the topology of the power supply system of the railway. Modern technologies allow optimizing power supply, energy saving, including self-regulation procedures and self-repair of power supply networks in real time at the level of traction substations, power supply distances and the upper level of the railway as a whole.

A set of programs for registering primary information monitoring the parameters of normal and emergency modes of electric networks, the formation of a single information space of primary information is provided. The space is formed from common system-wide positions in the process of monitoring the parameters of normal and emergency modes of electric networks [10]. The complex has opened up the possibility of computerization and intellectualization of power supply management procedures, information processing, spectral analysis of emergency power supply modes for traction. After processing and analysis, express files of complete and emergency information are generated and transmitted to all levels of operational management of power supply.

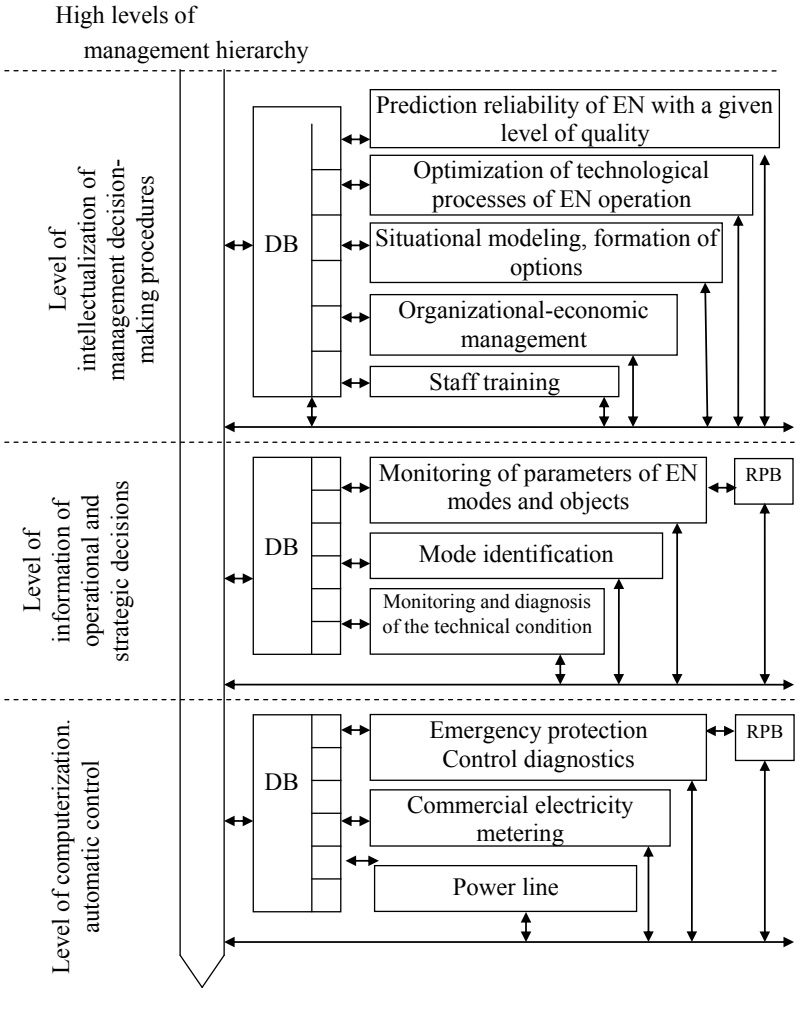

Fig. 1. Architecture of an intellectual traction electric network of transport RPB

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