WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979 (Volume 2, Issue 5, May, 2021)

GENERAL CHARACTERISTICS OF SYSTEMS WITH REDUCED OBJECTS

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Abstract
The paper analyzes the features of management of dispersed objects with a continuous technological process, discusses the current state of development of problems of control and modeling of electrical network objects, gives recommendations for building models of the current and operational state of objects, for optimizing these models.

Keywords: Transport, information, energy, economy, importance, class, electricity, geography

In recent years, thanks to advances in the creation of reliable means of data transmission, the use of computers, the organization of a database, geographically distributed systems (for example, transport, information, energy) are gaining more and more recognition in the world.

Among the geographically distributed systems, electrical networks are of the greatest importance in the national economy of the country. They are the most common and typical class of such systems.

The main purpose of electrical networks is the transmission and distribution of electricity between consumers. This process involves a huge number of pieces of equipment and devices of electrical networks, geographically distant from each other for tens and hundreds of kilometers [1].

The planned increase in the length of electric grids in the country by 2030 is taking place in the context of increasingly stringent requirements for the reliability and

optimality of grids modes, while reducing the specific number of service personnel. In this regard, there is a need to revise the traditional methods of managing electrical networks.

Electric networks from the standpoint of control have special characteristics [2].

1. The technological process in electrical networks is organized by the simultaneous operation of many objects of geographically distributed systems. In modern electrical networks, electricity is transmitted from a power source to consumers over long distances.

2. The processes of generation, distribution and consumption of products (electricity) are inseparable in time.

3. Objects of electrical networks perform the functions of transmission, distribution and transformation of electricity. The transmission function is performed by power lines (PTL) with voltage from 0.4 to 500 kV. The function of lowering (increasing) voltage is performed by transformer substations, differing in power and voltage (500, 220, 110, 35 KV), and transformer stations (10 and 6 KV). The distribution function is performed by switchgears.

4. It is impossible to select the performance and parameters of individual objects and links in isolation outside of their intended use in the system. The set of elements of electrical networks should be considered as a single material whole, and the integrity is due to internal connections and the interchangeability of products (electricity).

5. Modes of operation of facilities depend on the mode of operation of consumers (agriculture, construction, metallurgical plant, etc.), climatic and local conditions for the location of facilities (landscape, mountainous terrain, salty and gas-polluted areas, areas with strong winds, ice, areas with a predominance of high and low temperatures, etc.), directive requirements for a given administrative region or region, requirements and operating mode of the energy system, which includes this power grid.

6. For the management of electrical networks, an enterprise of electrical networks (PES) with services and departments is organized, it is at the highest level of the hierarchy of management of electrical networks. The structure of the PES includes geographically distributed regions of electrical networks (RES), the coverage areas of which are usually limited to the area of administrative regions and which constitute the average hierarchical level of management. The lower level of management consists of sections of electrical networks (UES), the number of which in the distribution network depends on the density of dispersal of electrical network objects in a given area. The system - control of electrical networks contains two groups: "operational-

dispatching, related to the objects of electrical networks, and organizational and economic, related to the control part. The control process at the upper level is organized by the united dispatching center of the enterprise, at the middle - by the district dispatching point, and at the bottom - the support operational point of the sections. The united dispatch point is operatively subordinate to the central dispatch point of the power system. Organizational and economic management is carried out by the services and departments of the PES, groups and management of RES, brigades and performers. Both groups of processes are closely related between The sets that determine the structure of the first group of processes are divided by the nature of the elements into the following types: subjects of activity - duty operators, performers, officials, divisions; control objects - power lines, substations, converters, devices property, etc .; the results of the subjects' activities - indicators, parameters, documents. The sets that determine the structure of the second group of processes are divided by the nature of their elements into subjects (officials, divisions of an enterprise, district and section of electrical networks), fragments (work, activities, tasks, functions) and results (indicators, documents) of activities. The elements of both sets are distributed in the area of the TES and their control can be carried out according to the principles [3]:

Objectives. In this case, the control system for electric grids is built to fulfill this goal, after which the control system can change to fulfill new emerging goals;

Functions. To perform the same functions, specialized management bodies (services, subdivisions, groups) are created that have the appropriate powers in their field. With the functional management principle, the structure of the enterprise remains relatively constant. Dispersed objects are assigned to the appropriate governing bodies according to their technological and technical characteristics;

Territories. Objects of all types and capacities are assigned to governing bodies according to the location of objects (for an enterprise, district or site), depending on where they are located. Moreover, the objects do not differ, that is, at a given level there can be objects of all types and capacities;

Mixing (territorial and functional principle). In this case, for some objects, functional management is used, when certain types of objects are assigned to specialized services, and for the rest, it is territorial, when objects are assigned on a territorial basis to an enterprise, a district and an UES. This principle finds the greatest application in the management of electrical networks. The functioning of electrical networks is largely determined by the work of operators serving the facilities, and the timely

implementation of repair, maintenance work and measures to improve the reliability of the equipment of the electrical network. Repair of electrical network facilities is carried out by central repair teams (BCR) for large works and by the personnel of the distribution zone. The choice of types of measures to ensure the reliable operation of objects depends on the state of the latter. Distinguish between basic (operating, backup, repair and forced downtime state) and intermediate (failure and monitoring state) states. When all the parameters of the network objects are within the specified limits, the electrical network performs all its functions efficiently. After completion of operational work, objects from intermediate states go into working. After the completion of the repair work, the objects from the repair state also go into working. From the state of forced downtime to the working objects, they pass after the performance of emergency work. Maintenance work is divided into preventive and control and adjustment. The frequency of maintenance work is much higher than that of repair work. Thus, ensuring the reliability of the functioning of objects is achieved by the implementation of measures that determine the state of objects in the future, current and operational periods of time. Changes in the scope and timing of these works determine the state management of network objects.

7. In electrical networks, the processes of control and analysis have specific features, namely: delay or distortion of control commands; error of operators and personnel exercising control and analysis of the work of dispersed objects; complex organization of control of dispersed objects; a large composition of controlled information, including directives, prescriptions, fulfillment of planned tasks, instructions and measures; the presence of a man-machine control system.

8. Feedback in the system is carried out for dispatching control of objects using automatic devices and telemechanical systems, and for current and future control - a system of accounting, analysis and regulation using computers and data collection facilities. In this case, the effect of feedback occurs with a significant time delay.

The listed basic properties of electrical networks in the control process are manifested not in isolation, but in inseparable unity with each other, permeate one another and impose the following requirements on the control system [4]:

• Increasing the speed of processing, transmission and reception of information about the state of dispersed objects;

• The required reliability of information obtained from dispersed objects;

• Ensuring the optimal mode of electricity transmission in various technological and climatic conditions;

• Maintaining the reliability indicators of facilities at a given level by:
• Timely planning and implementation of measures for repair, maintenance and reliability improvement;
• Ensuring reliable operator control of the distributed system;
• Stability of the electrical network in normal, seasonal, repair and emergency modes;
• Coordination between hierarchical levels of government.

The quality of power grids management is due to the reliability of electricity supply to consumers, determined by the number of facility failures per thousand conventional units; unit cost, determined by the ratio of fixed costs to the number of serviced objects; the specific number of personnel, determined by the ratio of the average number of personnel to the number of serviced facilities.

The quality of work of a distributed system of electrical networks is determined by the entire complex of basic, and not by individual indicators.

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