

IT-Projects in Power Engineering

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The theses of the report are devoted to the necessity of application, as to the current requirements, acute for power engineering of information technologies. Development and implementation of IT projects at the enterprises of energy industry create opportunities to optimize the information movement at all stages of technological process, which in turn leads to improved efficiency of all levels of management.

Keywords: power engineering, IT projects, efficiency, automation.

Introductory part. Today the process of introduction of the electricity market is underway in Ukraine, the transition to which is provided by the Law of Ukraine “On the Electricity Market of Ukraine” [1]. This Law is the fulfillment of Ukraine's obligations to the Energy Community Secretariat (ECS) under the Energy Community Treaty [2].

The Law proposes a model providing for bilateral agreements (OTC trade) for the purchase and sale of electricity, which are concluded in advance, while at the stage of delivery for the next day a centralized market will be organized.

The exchange of information between the participants in the electricity market will have to be done through the exchange of the necessary files via the Internet or by filling in the appropriate forms through the website or web forms of the established sample [2].

According to the established rules, a market information system is required, which will be managed through the Market Operator control room, which is equipped with the appropriate equipment and software, which will allow to collect and process transactions and work plans, which will be registered on the Day Ahead Market and Intra Day Market platforms and platform for the registration of bilateral agreements. The Market Operator must also be equipped with software and equipment that enables the communication of data with the Transmission System Operator information system.

Maintaining the quality and reliability of electricity supply to consumers within the new structure of the single energy system requires the organization of clear operational-information interaction between market entities and the fulfillment of each of them specific functions and responsibilities. In addition, the prospect of joining the European and, as a consequence, the world energy system depends on improving the quality and efficiency of functioning of virtually all systems of automatic and automated control in the electric power industry. Thus, at the initial stage of the formation of this market, it is necessary to ensure the advance development of technical and software tools that can satisfy the growth of information requests of its participants. Obviously, it is impossible at this time without the use of the latest computer and information technologies, the implementation of modern equipment at almost all levels of dispatching and technological control systems [3].

The country's entire power system is integrated into power systems that have a unified and centralized management, using a variety of dispatch and technology controls. The introduction of information technology in the electricity sector is primarily related to the automation of the process of collecting, processing and displaying information. The availability of foreign computer and information technologies allows us to take a fresh look at the whole process of designing and implementing software of operational-information complexes, in particular: automated control system, for power utilities, which by their qualitative parameters should approach the level of operating systems in the power industry of developed countries of the world.

According to the accepted classification of modern control tasks in the power industry, the following information systems are successfully functioning, providing a local level of control (real time), in particular automated systems:

- emergency management;
- relay protection and linear automation;
- bandwidth management;

- frequency control and power flow;
- voltage regulation;
- power flow restriction;
- registration of data on accidents.

Main part. The energy market management information system should provide a single time in all parts of the system, the possibility of automatic or manual adjustment of system time, both at all controlled points at the same time (eg daylight saving time) and individually, for meters that have the opportunity. In addition, in the event of an emergency situation, the dispatcher must display messages indicating the time, place, type and cause of system malfunction. At the self-diagnosis checkpoint level, all controller and communication subbands must be passed. An error code is written to the log.

One of the important tasks of the generating companies, as well as the Market Operator in the market, is to ensure frequency control and power flow. At the same time, the participation of power plants in such regulation is considered as a system service and at the same time a rather important condition for its connection to the power grids.

At present, none of the energy companies in the country has a single corporate system that would completely cover and integrate most of the key processes in the energy sector and would provide integrity, transparency of the information space of the energy company.

The most urgent problem of the stable operation of electric networks is excessive increase of working voltage to absolutely invalid values, while the power engineering most needs continuous and non-break work.

In addition, the level of automation remains heterogeneous among the companies of the industry: if IT-systems, for example, such as dispatching systems, play major role in the network companies, the level of automation actually can be lower, and in generating companies the emphasis is made on certain highly specialized industrial solutions. In marketing companies the level of automation depends on the coverage of the region, scale of activity, and in the spotlight here is accounting, management of calculations and treaties [4].

Modern era requires global introduction of the latest information technologies in the energy sector and complete automation of the electrical network complex.

Modernization of the electro generating companies causes the need to develop high-tech information solutions.

At the international market the world's leading energy companies already use integrated IT solutions (SAP, Oracle, Axapta, Microsoft and other suppliers) and every year more enterprises of energy sector begin to use information technologies to increase the efficiency of their activities. Application of IT projects in power engineering is very promising and high-potential for improvement of information infrastructure.

IT projects in modern condition constitute a separate powerful specific class of «industrial» projects [5, 6].

With the help of IT projects the following tasks can be solved: the general increase of efficiency of all levels of management, support of current activity and long-term development of the enterprise, minimization of risks and reduction of specific expenses, increase of capitalization and modernization of the system of relations with suppliers and services of consumers.

Acute technological directions of IT projects are:

1. Systems and equipment for autonomous data collection and information transfer to track the dynamics of the energy system in real time.
2. Development of projects for modernization of existing information control support systems and operation of intellectual networks.
3. Low-budget communication systems for information transmission.
4. Equipment, methods and control systems of electrical network objects, taking into account optimization of life cycle cost.
5. Management systems for collection, integration, processing, transfer, decision making at the level of interaction between the assets of electricity in real time.
6. Systems of analysis and decision preparation at the level of power system.
7. Support system of operating processes of the intellectual network.
8. Software algorithms development for forecasting, analysis, monitoring and decision-making to optimize the management of power system.
9. Information security systems and equipment for control systems of electrical network objects, etc.
10. The new generation system for calculation and accounting of the consumers' payments for energy resources.
11. Service-oriented architecture.
12. Web services and Web 2.0.
13. Convergence of IT and operating technologies [4, 5, 7, 8].

Also, in connection with the introduction of the energy market in Ukraine [2], technological innovations such as: industrial Internet of things, real-time IT systems and solutions in the field of optimization of production and distribution of electricity are becoming relevant. This is caused, first and foremost, by global changes in the energy industry around the world, which opened up new opportunities for growth. Therefore, the problem of developing common standards for the use of IT in territorial distribution companies comes to the fore. One of the significant risks for such organizations is in the field of data protection, so the special role in these standards should be given to the organization of the information security system, the means of its secure storage and processing.

Most IT products implemented by energy companies are in the business-critical category, leading to increased security requirements such as cryptographic encryption and anti-virus applications.

Industry specificity is that in power engineering high speeds of calculations are not so much needed, but really important is reliability and non-failure operation of server and network equipment, i.e. the main tasks of IT projects are:

- automation of the systems of technological processes and control over the established equipment;
- ensuring stability of processes and work of equipment;
- increase of generating capacities;
- «intellectual» power supply networks (Smart Grid);
- risk management systems.

The need to develop a new concept for the development of electricity was dictated by economic growth, which is inextricably linked with an increase in energy consumption and an increase in requirements for the quality and level of reliability of energy supply. As a result of an analysis by the International Energy Agency and relevant US and EU analytical agencies of the state and prospects of the development of the world energy sphere, it is concluded that the successful solution of new problems within the former concept of extensive power development is mainly by increasing capacity and expanding the quantity of electricity equipment, even with improved performance, is inadequate [9]. Therefore, in most developed foreign countries, more and more attention is paid to the introduction of smart technologies (Smart Grid) in the electric power industry as a basis for future energy development based on the following starting points:

1. Systematic modernization of the industry covers all its components: electricity generation, transmission and distribution, metering and marketing systems, dispatching and energy management.

2. The electric grid (all its segments) is considered as the main object of formation of a new technological basis, development of functional properties of the power grid.

3. The energy system is developing as an "Internet-like" infrastructure with the formation in the energy, information, economic and financial spheres of relations between all subjects of the energy market and other interested parties.

4. The process of concept formation covers the whole complex of works - from preliminary researches to wide introduction of innovations at all levels of innovative development of the electric power industry - normative-legal, technological, technical, organizational, managerial and information.

5. The development and implementation of concepts and related programs for the introduction of "intelligent" technologies is innovative and gives impetus to the transition to a new technological role in the electric power industry and the economy as a whole.

Among the most significant changes in the development of society and economy that affect the energy industry, foreign studies include:

1. Shortage of electricity sources.

2. Consumers' ever-increasing demands for reliability and quality of power supply.

3. The constant increase in the cost of electricity worldwide.

4. An aging and growing shortage of skilled personnel in the energy sector.

5. Increasing requirements of consumer stakeholders for the performance of energy companies. Changing organizational forms of ownership and shaping market conditions have led to the emergence of a new system of requirements of stakeholders (shareholders, legislators, regulators, consumers, public and environmental organizations) for energy companies, the essence of which is to increase the reliability of electricity supply, reduce operating costs, reduce operating costs, reduce operating costs number of staff, etc.

6. Environmental and industrial safety requirements for the operation of energy facilities.

7. Reduction of system costs.

Smart Grid is an automated system that independently monitors and distributes electricity flows to maximize energy efficiency. In a world where the saving of natural resources has become a top priority, it is very important to find cheap and effective ways to reduce their use.

The main ideologues for developing this concept were the US and EU countries, which adopted it as the basis for their national energy and innovation development policies. The Smart Grid concept has been recognized and developed in almost all major industrialized and developing countries.

The analysis makes it possible to formulate the following baselines, adopted during the development and development of the Smart Grid concept:

- the concept of Smart Grid envisages systematic transformation of electricity (power system) and all its main elements - generation, transmission and distribution (including the utility sector), electricity sales with the introduction of modern metering systems, as well as dispatching and mode control of energy flows;

- the energy system is in the future regarded as an infrastructure designed to support energy, information, economic and financial relationships between all actors in the energy market and other stakeholders, and which operates similarly to the Internet;

- the development and operation of the energy system must be aimed at meeting the key requirements agreed by all stakeholders - key values produced as a result of a common vision of the goals and ways of development of electricity (reliability, energy efficiency, development of quality services, reasonable tariffing, etc.);

- long-term transformation of the electric power industry should be aimed at the development of existing and creation of new functional properties of the grid and its elements, which most ensure the achievement of these key values;

- the electric grid (all its elements) is considered as the main object of formation of a new technological basis, which makes it possible to substantially improve the achieved and to create new functional properties of the power grid;

- concept development comprehensively covers all major areas of development: from research to practical application, stimulates the development of scientific, regulatory, technological, technical, organizational, management and information spheres;

- the implementation of the concept is innovative and reflects the transition to a new technological way in the electric power industry and in the economy as a whole.

Conclusions. Development and implementation of IT projects at the enterprises allows:

1. to reduce the technical losses during the transmission of electricity;
2. to use the received electricity effectively;
3. to choose alternative energy sources;
4. to diagnose and eliminate the problem of automatic operating mode;
5. to improve the quality of electricity supplies to potential consumers;
6. to increase the funds of the exploited equipment.

Thus, implementation of IT projects is an element of building of a single information field, standardization of approaches to the automation of energy industry companies that support collection providing and integration of technological process information with the help of databases of the current time, formation of IT-model of the to be managed object, solving the tasks of control, management and analysis of power equipment based on the appropriate model.

The enterprise development strategy should define IT project management system as a tool for effective management of the energy industry enterprise.

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