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Study on increase of operation efficiency of electrical energy and electrical equipment

A J Isakov^{1*}, and Z S Abdullaev¹

¹Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, 100000, 39 Kari Niyazov, Tashkent, Uzbekistan

*Email: abduaidus72@mail.ru

Abstract. This article discusses and reveals the problems of the need for proper use of electricity and electrical installations to improve efficiency. Information on the structure of installed capacity at power plants, the structure of fuel consumption and the consumption of electricity by consumers are reviewed and given; as well as information about the increase in efficiency and causes of failure in operation. Agro-industrial complex consumes about 30 percent of all electricity produced in the country (including the rural population), including pumping stations. This figure is expected to reach 45-50% over the next few years. Thus, the choice, design, installation, maintenance and repair of electrical equipment, which have different forms of ownership and management, but are interconnected by consumers in strict accordance with the rules of electricity consumption, Joint modernization, that is an operating efficiency, remains relevant.

1. Introduction

The necessary measures are being taken to ensure the stable operation of energy companies and energy equipment in order to fulfill the tasks specified in the Decree of the President of the Republic of Uzbekistan dated December 22, 2017. In particular, JSC "Uzbekenergo" developed a set of measures aimed at reducing the cost of production to achieve high rates of economic growth and stable operation of the energy sector. In the first half of 2018, the volume of production of goods in the industry amounted to 100.1%. Also, consumers received 30.9 billion. kWh of electricity and 3.95 million Gcal of supplied heat. The forecast indices for the export of products and services which have been produced in Uzbekistan are fulfilled by 132.1% with total cost of 331.6 million soum [1-6].

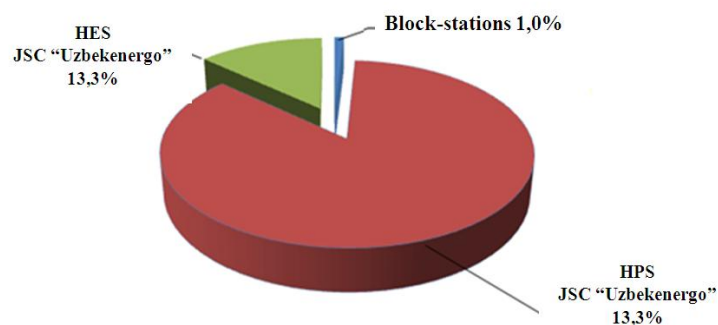
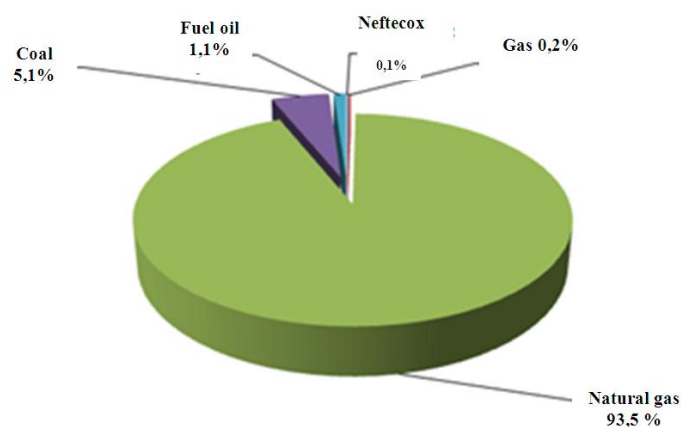
In accordance with the Decree of the President of the Republic of Uzbekistan No. PP-3507 "On Approval of the List of Investments and Infrastructure Projects for 2018" of February 3, 2018, Uzbekenergo has implemented 5 investment projects for the construction, modernization and reconstruction of new energy facilities. Since the introduction of a procedure to improve electricity metering by the enterprises of JSC Uzbekenergo, it spent 251.5 thousand soums to implement this law. The company installed 203.4 thousand of three-phase electric power meters and 50.6 thousand of single-phase electric power meters. The main production indices of Uzbekenergo for the first half of 2018 are presented in Table 1 [1, 6-8].



Table 1. Performance Indices

Main factors	Unit of measurement	Indices for the 1st half of 2018
Power generation:		
All over Republic of Uzbekistan	billion kWh	30.9
"Uzbekenergo" JSC (HES and ATPP)	billion kWh	27.87
Specific fuel consumption:	Billion Gcal	
Supplied power	gr/ kWh	353.53
Energy supply	kg/Gcal	179.84
Heat supply	Billion Gcal	3.95
Export of electro-energy	Billion kWh	1.4
Total mastered investment projects	Billion UZB soums	1394.3
Funds of JSC "Uzbekenergo" (industry funds)	Billion UZB soums	206.3
Foreign loans guaranteed by the Government of the Republic of Uzbekistan	Billion UZB soums	1030.3
Commercial Bank Loans	Billion UZB soums	24.4

2. Research Methods and Results

**Figure 1.** Structure of installed capacity of power plants in Uzbekistan**Figure 2.** Composition of fuel consumption by 2017 at Uzbekenergo power plants

The results of theoretical studies and practical experiments on the use of electrical equipment in the agro-industrial complex show that the question of further improving the efficiency of electrical equipment operation should be based on a systems approach.

Most of the electricity in the country is produced by thermal power plants (Figure 1). The use of gas and coal as a fuel for thermal power plants is well known (Figure 2).

Agro-industrial complex consumes about 30 percent of all electricity produced in the country (including the rural population), including pumping stations. This figure is expected to reach 45-50% over the next few years (Figure 3) [1, 6, 9, 10].

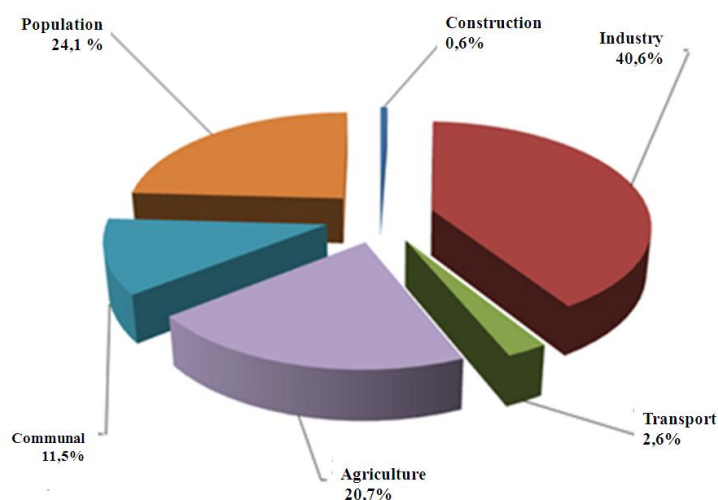


Figure 3. Structure of electricity consumption by 2017 in the spheres of economy and by population

The construction of a nuclear power plant in Uzbekistan-Russia cooperation has begun alongside the most convenient and safe place for the delivery of resources required for the construction of nuclear power plants.

As part of this project, the station of the current generation "3+" VVER-1200 is being installed in Uzbekistan. The complex consists of two power units, each of a capacity of 1200 megawatts. The safest and most modern stand in the world for nuclear power plants has been selected. It is planned to be commissioned by 2028. The cost of construction of a similar station in Bangladesh was about \$ 13 billion. The estimated cost of the project in Uzbekistan is about 10 billion USD [11-13].

A nuclear power plant (NPP) is a power plant that transfers energy generated by controlled nuclear reactions. Simply stated, the heat generated by nuclear reactions in a reactor is used to produce water vapor and to direct water vapor to turbines to generate electricity. That is, water, like in traditional methods, plays an important role. Atomic energy is much more efficient than conventional energy resources. The volume is quite high. For example, 1 kg of uranium produces as much energy as 3,000 tons of coal. Given the human factor and natural factors, more and more attention is paid to security issues. That is, we need highly qualified personnel and a high level of operation.

Consumers who have different forms of ownership and management, such as agriculture, livestock, poultry, water management and land reclamation, pumping stations, forestry, processing and production facilities, should strictly follow the rules for the use of electricity, selection, design, installation and maintenance of electrical equipment, upgrading and unification of modern equipment. All of the above problems are the result of rational use of electrical equipment.

To rationally use electrical equipment, it is important to pay attention to the causes of its failure. Switching off electrical equipment depends on objective and subjective reasons. These are internal, external, constructive, production and operational situations.

A broader analysis of the causes of emergencies, the prevention of the causes of emergencies is associated with specific features, which means that it is difficult to avoid material destruction, but

accidental breaking can be avoided. That is, the problem is solved by an individual approach, but it also requires an increase in operating efficiency.

Mechanical impacts associated with production conditions, regardless of climatic and biological effects, are an integral part of the prevention of external influence.

The reason for the constructive damage may be the problem of the production of electrical equipment, which does not depend on the efficiency of operation, that is, the choice of structures, materials, circuits and profiles. However, the choice of high-quality equipment may lead to an increase in operating efficiency.

The reasons for the break of production are connected with technological selection and complex control and require operational efficiency.

Causes of disruption of operation are the most important factors in improving the efficiency of work with the use of modes, high-quality electricity supply and high qualification of service personnel.

Consumers connected to the power network strictly follow the rules for the use of electricity. The meaning of this is that all consumers should pay attention to the use of cost-effective technologies and save energy.

Unfortunately, at present the procedure for using energy efficient technologies in private enterprises is not fully controlled. Thus, operation, improving the efficiency of property consumption and management of enterprises, regardless of the type of operating system and choice of electrical equipment, design, installation should ensure the necessary maintenance work; and close attention to the issues of modernization and the elimination of short-term malfunctions is a good solution for organizational and technical measures. It also ensures the reliability of electrical equipment.

Analysis of the reliability of electrical equipment allows us to solve several issues:

- correction of reliability standards;
 - optimization (normalization) of materials and spare parts for maintenance and repair;
 - determination of operating conditions and the influence of regimes on the reliability of electrical equipment;
 - determination of economic efficiency of improving the operational reliability of electrical equipment.
- Solving the above problems, one can develop measures to improve the operational reliability of electrical equipment, to improve the quality of electrical equipment and the quality of maintenance and repair.

Experimental testing of electrical equipment should be maximally brought to operational conditions. A number of mathematical methods available in probability theory [14, 15, 16] should be determined

Reliability indices can be obtained from accident information, certificates, repair and maintenance documents. The duration or residual life of each electrical device is monitored, and its future service life is determined.

Reliable functioning of electrical equipment at the facilities of the agro-industrial complex is connected with the uninterrupted power supply system.

When analyzing the shortage of electricity in the regions of Uzbekistan, the following situation is observed. The main failures (from 65% to 70%) are due to faults in the electrical network, 25% are due to faults and breakdowns in switchgear and 5-10% are due to failures of power transformers [6,17,18].

Most of the power lines in the country are air networks [19, 18, 19]:

- networks with a voltage of 0.4 kV - 97.5%;
- networks with a voltage of 6 and 10 kV - 93%;
- mains with a voltage of 35 kV - 97.4%;
- networks with a voltage of 110 kV - 99.8%;
- networks with a voltage of 220 and 500 kV - 100%.

The quality of electricity in agriculture and water is not enough. This is a result of a shortage of electricity and maintenance consumers. Depreciation of electrical equipment and power lines also requires special attention in regard to the reliability of electrical equipment. Regular checks are needed. Stationary testing of electrical equipment is carried out by specialized teams at factories and

testing centers. The actual operating conditions and operating conditions for exploring devices are simulated, analyzed in standby tests.

Agriculture and water management is ensured by proper selection, high-quality installation, commissioning of electrical equipment with the conditions for the production of electrical equipment, ensuring reliable operation under optimal mode and load, regulated for all operating modes; timely maintenance and repair works should be conducted. At the same time, electrical equipment functions with reliable and high energy efficiency, with high efficiency.

3. Conclusions

Agro-industrial complex consumes about 30 percent of all electricity produced in the country (including the rural population), including pumping stations. This figure is expected to reach 45-50% over the next few years. Thus, the choice, design, installation, maintenance and repair of electrical equipment, which have different forms of ownership and management, but are interconnected by consumers in strict accordance with the rules of electricity consumption, Joint modernization, that is an operating efficiency, remains relevant.

References

- [1] Isakov A 2008 *Journal TashSTU Habarlari* **4** 73-77.
- [2] Mirziyoev Sh 2019 Decree of the President of the Republic of Uzbekistan from February 1, 2019 PK-4348, Tashkent.
- [3] Mirziyoev Sh 2019 Decree of the President of the Republic of Uzbekistan from May 30, 2019 PK-4348, Tashkent.
- [4] Radjabov AR, Muratov XM 2009 *Mechanization and Electrification of Agriculture* **7** 29-31.
- [5] Kamalov TS, Toirov OZ 2016 *European Science Review* **2**(3-4) 299-304.
- [6] Khushiev S, Ishnazarov O, Tursunov O, Khaliknazarov U, Safarov B 2020 *E3S Web of Conferences* **166** 04001.
- [7] Kamalov TS, Toirov OZ 2016 *International Journal of Advanced Research in Science, Engineering and Technology* **3** 2635-2642.
- [8] Kan EK 2018 *Journal of Irrigation and Melioration* **3**(13) 34-37.
- [9] Kodirov D, Tursunov O, Parpieva S, Toshpulatov N, Kubyashev K, Davirov A, Klichov O 2019 *E3S Web of Conferences* **135** 01036.
- [10] Toirov OZ 2018 *International Journal of Advanced Research in Science, Engineering and Technology* **5** 5456-5463.
- [11] Kodirov D, Tursunov O 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **883** 012085.
- [12] Rakhmatov AD, Namazov SR 2018 *Journal Irrigation and Melioration* **2**(12) 52-54.
- [13] Isakov AJ, Erkinov BN 2010 *Journal TashSTU Habarlari* **3** 65-68.
- [14] Galperin AS, Sushlevich VO 1970 Determining of the optimal durability of machines, Kolos, Moscow.
- [15] Isakov A 2010 *Applied Solar Energy* **46** 77-79.
- [16] Toirov OZ 2018 *International Journal of Advanced Research in Science, Engineering and Technology* **5** 5464-5471.
- [17] Avezova NR, Avezov RR, Rustamov NT, Vaxidov A, Suleymanov Sh 2013 Technical and economic indicators of flat solar water-heating collectors in hot water supply systems, Proceedings of the international conference dedicated to the 70th anniversary of the Physico-Technical Institute of the Physics-Sun Scientific-Practical Association "Fundamental and Applied Problems of Physics", Tashkent, pp 293-295.
- [18] Isakov AJ, Rakhmatov AD 2009 *Journal of Energy and Resource Saving* **3-4** 170-173.
- [19] Isakov AJ, Ishnazarov OKh 2015 *International Journal of Emerging Technology and Advanced Engineering* **5**(3) 510-513.