DEVELOPMENT OF SPECIFIC STANDARDS OF ENERGY CONSUMPTION BY TYPES OF PRODUCED PRODUCTS OF THE SPINNING PRODUCT

F A Hoshimov¹, I I Bakhadirov¹, M S Kurbanbayeva², Aytbayev N.A.³

¹Tashkent State Technical University named after Islam Karimov, 100095, Uzbekistan, Tashkent, University St. 2A
³Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Tashkent, Uzbekistan
²Karakalpak State University, 230100, Uzbekistan, Nukus, Ch. Abdirov St.1

Abstract. The article deals with the regulation of the energy consumption of a spinning enterprise. For a certain pattern of changes in power consumption and specific power consumption, we studied the hourly performance, which determines the performance of the machine. On the basis of the predicted values of the volume of production, the norms of electricity consumption were developed, which are reflected, taking into account its specificity, the energy intensity of products. When developing the norm, a calculated static method was adopted, based on the analysis of static data for a number of previous years, on the actual consumption of electricity, the volume of output of factors influencing their change.

Introduction

Planning for a long-term power supply should begin with the regulation of energy consumption. Progressive, scientifically grounded standards also make it possible to assess the level of operation of existing equipment, to open and sell unused reserves. The norms should be based on the energy characteristics of the technological equipment and take into account the optimal operating mode. Rationing the consumption of electrical energy is the establishment of a planned measure of their production consumption [1-4].

Main part

Rationing of electricity consumption includes the development of standards and their consumption for the production of products, the approval and delivery of design standards to production shops, as well as the implementation of systematic monitoring of implementation [5-8].

The rate of consumption of energy resources, taking into account the specifics of the facility, can contribute to an increase in production efficiency.

Let's consider the norms of consumption of energy resources in the production of yarn at LLC "VERIGOROW IPAGI".

In 2019, the spinning production of FE VERIGOROW IPAGI LLC produced 3,163,352.33 kg of single-strand and 565,641.68 kg of double-strand yarn, while the annual actual power consumption amounted to 1,6242862 kW*h.

Below. Table 1 shows the consumption of various types of energy.

| №  | Type of energy        | Unit   | 2019   | Equivalent fuel | 2020 (9 month) | Equivalent fuel |
|----|-----------------------|--------|--------|-----------------|----------------|----------------|
| 1  | Electrical energy     | kW/h   | 16242862 | 1997,8         | 90,7          | 15576015       | 1915,8         | 93 |
| 2  | Natural gas           | m³     | 176757  | 205            | 9,3           | 131993         | 151,1          | 7  |
| 3  | Household drinking water | m³  | 23985   | -              | -             | 20131          | -              | -  |
|    | Total                 |        | 2202,8  | 100            | 2066,9        | 100            |

© The Authors, published by EDP Sciences. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (http://creativecommons.org/licenses/by/4.0/).
The installed capacity of the entire fleet of technological and power equipment for production as a whole is 4935.6 kW, and the maximum consumed power is 3453.5 kW, i.e., the utilization factor is 0.7.

The balance of power consumption by production shops and the enterprise as a whole is shown in Table 2.

| №  | Name of workshops     | Power consumption, kW | % to total power requirements |
|----|-----------------------|-----------------------|------------------------------|
| 1  | Rotor spinning section| 951,5                 | 27,5                         |
| 2  | Ring spinning section | 1459,2                | 42,2                         |
| 3  | Twisting section      | 264,7                 | 7,7                          |
| 4  | ventilation. cameras  | 546                   | 15,8                         |
| 5  | Compressor room       | 65                    | 1,9                          |
| 6  | Boiler room           | 5,7                   | 0,2                          |
| 7  | XBO                   | 10,6                  | 0,3                          |
| 8  | Pumping station       | 5,3                   | 0,2                          |
| 9  | Workshop lighting     | 97,3                  | 1,9                          |
| 10 | АБК                   | 61,2                  | 1,8                          |
| 11 | Territory lighting    | 22,8                  | 0,7                          |
|    | **Total**             | **3459,3**            | **100**                      |

Fig. 1. The balance of power consumption in production shops and the enterprise in scrap.
The balance of power consumption shows that the main consumer of power is: pneumatic spinning section - 27.5%, ring spinning section - 42.2%, twisting section - 7.7%, ventilation. cameras -15.8. The rest of the sections consume from - 0.2% to - 1.9% of the total power consumption [9-12].

To determine the regularity of changes in power consumption and specific power consumption, the hourly productivity was studied, taking into account that for each type of yarn such a speed of spindles is required, which determines the productivity of the machine.

To calculate and analyze the predicted value of specific power consumption and the dependence on the type of yarn produced, as well as taking into account the specified technological requirements for the machine, we determine the values of these indicators, based on the formula below.

\[
d = \frac{P_n \cdot K \cdot 10^9}{n_y \cdot 60 \cdot T \cdot m \cdot k_n}
\]  

(1)

where \( P_n \) - power consumption of the machine, to the yarn twist value, \( T \) - yarn thickness, \( m \) - number of spindles per machine, \( n \) - spindle speed, \( k \) - useful time coefficient.

Accounting for the consumption of energy resources and energy carriers can be carried out by appropriate devices, and in the absence of them, by calculation, experimental, experimental calculation, average statistical methods.

Experimental and computational-experimental methods were adopted as the main calculation methods, covering the consumption of electric energy and fuel for basic and auxiliary production needs (ventilation, lighting, etc.), including losses in networks [13-16].

The norms should contribute to the assessment of internal reserves of fuel and electric energy saving, fulfillment of planned targets and achievement of economic production indicators.

On the basis of the predicted values of the volume of production, the norms of consumption of electric energy and fuel for the production of a unit of finished goods for each production are developed, taking into account its specifics, and it should reflect the energy intensity of the product.

Taking into account the specification of "VERIGOROW IPAGI" LLC, the specific energy consumption should be taken as a calculation unit: for yarn production kW * h / kg.

When determining the power consumption of the main technological sections of rotor spinning, ring spinning and yarn twisting, the power of auxiliary facilities (compressor, pumping, boiler room, lighting, etc.) was added in proportion to the power consumption of each section.

\[
P_{\text{ном}} = \sum P_{\text{тр}} + \sum P_{n,k} + \sum P_{\text{ном}} + \sum P_{\text{отс}} + \sum P_{\text{абк}}, \text{ kW}
\]  

(2)

Based on this expression, taking into account the proportional division of the power consumption of the auxiliary equipment, the following power consumption values are obtained:

For the rotor spinning section:

\[P_{\text{ном}}^{\text{n}} = \frac{1242.3}{kW}\]

For ring spinning:

\[P_{\text{ном}}^{K} = \frac{1760.8}{kW}\]

For yarn twisting section:

\[P_{\text{ном}}^{np} = \frac{465.2}{kW}\]

Specific energy consumption by assortment is calculated for each production redistribution according to the formula:

\[
d = \frac{\sum P_{\text{ном}}}{\sum A} \text{ kW} / \text{kg}
\]

(3)

| Table 3. The summary values of specific energy consumption by product range are given in |
| --- | --- | --- | --- | --- |
| **Rotor spinning section** | **Ring spinning section** | **Torsion section** |
| **Range** | **УРЭ** | **Range** | **УРЭ** | **Range** | **УРЭ** |
| 27/1 | 2,1 | 28/1 | 3 | 34/2 | 1,4 |
| 34/1 | 2,66 | 31/1 | 3,4 | 36/2 | 1,5 |
| 40/1 | 3,1 | 34/1 | 3,7 | 40/2 | 1,57 |
| 50/1 | 4,3 | 36/1 | 3,94 | 50/2 | 2 |
| 54/1 | 4,9 | 40/1 | 4,6 | 54/2 | 2,3 |
|  |  |  |  |  |  |
| 50/1 | 6,5 | 65/2 | 3,3 |
| 54/1 | 6,4 |  |  |
| 65/1 | 8,5 |  |  |

The rate of electricity consumption per unit of output allows you to comply with the most advantageous mode of equipment loading, control over energy use in shops and at the enterprise as a whole. Thus, the value of the specific power consumption by type of product varies: for a rotor spinning section from 2.1 to 4.9 kW / kg, for a ring spinning section from 3 to 8.5 kW / kg, for a yarn twisting section from 1.4 to 3.3 kW / kg.
It should be noted that the value of specific energy consumption for each assortment is calculated taking into account the technological regulations for a specific assortment is optimal [17-19].

When modernizing or reconstructing production, the value of the specific power consumption should be adjusted.

Analysis of production work for 2018-2020 shows that some of the equipment works depending on the demand of consumers. In particular, 8 out of 10 ring spinning machines can work, and 6 of 8 rotor spinning machines can work 6. In addition, reed and twisting machines work on demand. Thus, the variability of the operation of the entire fleet of technological equipment throughout the year leads to energy savings [20-24].

Rationing of electricity consumption in yarn production, taking into account the likelihood of the nature of the process of electricity consumption of spinning machines, makes it possible to determine the required electricity consumption per unit of output (yarn) for specific production conditions, establish a baseline value to determine the need for electricity for the planned period and ensure its rational consumption.

The main method for the development of norms for the consumption of electric energy for the enterprise as a whole and for technological processes is the calculation method - the statistical method, which is based on the analysis of statistical data for a number of previous years on the actual consumption of electric energy, the volume of products, factors affecting their change.

The developed norms are not data once and for all. It is very important to timely monitor compliance with the standards and make the necessary adjustments so that they correspond to the level of modern scientific achievements and best practices in the field of improving the technological process and equipment operation.

### Table 4.

| Years         | Calculated energy consumption kW*h | Actual energy consumption kW*h | Difference (+) cost overruns (-) economics |
|---------------|-----------------------------------|-------------------------------|-------------------------------------------|
| 2018          | 22789140,85                       | 15962583                      | -6826557,85                               |
| 2019          | 16462628,7                        | 16242862                      | -219766,7                                 |
| 2020 (9 month)| 18710403,96                       | 15576015                      | -3134388,96                               |

### References

1. Allaev, K.R., Fedorenko, G.M., Postnikov, V.I., Ostopchuk, L.B. Asynchronous generators as power system's natural dampers. 43rd International Conference on Large High Voltage Electric Systems 2010, CIGRE 20102010, 9p43rd International Conference on Large High Voltage Electric Systems 2010, CIGRE 2010; Paris; France; 22 August 2010.

2. Fazylov, Kh.F., Allaev, K.R. Analysis of the operation of an electrical system during simultaneous operation of synchronous and asynchronous generators. Power engineering New York Volume 18, Issue 3, 1980, Pages 81-88.

3. Fazylov, Kh.F., Allaev, K.R. Asynchronous turbogenerators with stator excitation and the prospects for their utilization. Power engineering New York Volume 23, Issue 2, 1985, Pages 7-13.

4. Fazylov, Kh.F., Allaev, K.R. Calculation and experimental analysis of conditions of electrical power systems containing induction generators Power Engineering New York Volume 27, Issue 6, 1989, Pages 27-34.

5. Allaev K., Makhmudov T. Research of small oscillations of electrical power systems using the technology of embedding systems. Electrical Engineering, 2020; Issue 1: 309-319.DOI 10.1007/s00202-019-00876-9

6. Allaev K., Makhmudov T. Prospects of diversification and ensuring energy safety of Uzbekistan. E3S Web Conf., Volume 139, 2019, Rudenko International Conference “Methodological problems in reliability study of large energy systems” (RSES 2019).https://doi.org/10.1051/e3sconf/201913901002

7. Khashimov A.A., Imomnazarov A.T., Pulatov A.O. Mathematical model of metal melting processes in crucible furnaces. International Symposium on Helting by Electrotermic Sourses, Padua (Italy), June 22–25, 2004.

8. Toshov, Zh.B. Ways towards optimization of washout components of rock cutting tools Information about author // Gorny Zhurnal. Volume 2016, Issue 2, 1 January 2016, Pages 21-24.

9. Burievich, T.J. The questions of the dynamics of drilling bit on the surface of well bottom// Arch. Min. Sci. –Poland. - Vol. 61 (2016). – №2. – P. 279-287. DOI 10.1515/amsc-2016-0020.

10. Toshniyozov, L.G., Toshov, J.B. Theoretical and experimental research into process of packing in drilling// Mining Informational and Analytical Bulletin Volume 2019, Issue 11, 2019, Pages 139-151. DOI: 10.25018/0236-1493-2019-11-0-139-151.
11. Avezova N.R., Toshov J.B., Dalmaradova N.N., Farmonova A.A., Mardonova M.Sh. Renewable Energy: Scenario and Model of Development // ISSN 0003-701X, Applied Solar Energy, 2019, Vol. 55, No. 6, pp. 438–445. DOI: 10.3103/S0003701X19060021
12. Rakmonov, I.U., Niyozov, N.N. (2019) Optimization setting of steel-smelting industry in the issue of alloy steels E3S Web Conf 139 doi:10.1051/e3sconf/201913901072
13. Mannanov U., Toshov J., Toshniyozov L. Perspective Solutions for the Design of Drilling Tools / E3S Web of Conferences 105, 03027 (2019) IVth International Innovative Mining Symposium, https://doi.org/10.1051/e3sconf/201910503027
14. Toshov J., Saitov E. Portable autonomous solar power plant for individual use / E3S Web Conf., Volume 139, 01087, 2019, Rudenko International Conference “Methodological problems in reliability study of large energy systems” (RSES 2019), https://doi.org/10.1051/e3sconf/201913901087
15. Azamatovich, A.N., Amrillo, M.B, Burievich, T.J., Umarxanovich, J.R., Shvakatovich, Z.A. A complex of methods for analyzing the working fluid of a hydrostatic power plant for hydraulic mining machines / International Journal of Advanced Science and Technology. Volume 29, Issue 5 Special Issue, 28 March 2020, Pages 852-855
16. Rakmonov, I. U., Tovbaev, A.N., Nematov, L.A., Alibekova, T.Sh. (2020) Development of forecasted values of specific norms for the issues of produced products in industrial enterprises Journal of Physics: Conference Series 1515 doi:10.1088/1742-6596/1515/2/022050
17. Rakmonov, I.U., Nematov, L.A., Niyozov, N.N, Reymov, K.M., Yuldoshev, T.M. (2020) Power consumption management from the positions of the general system theory Journal of Physics: Conference Series 1515 doi:10.1088/1742-6596/1515/2/022054
18. Rakmonov, I. U., Reymov, K.M., Dustova, S.H. (2020) Improvements in industrial energy rationing methods Journal of IOP: Conference Series. MIP: Engineering-2020. 862 (2020) 062070 doi:10.1088/1757-899X/862/2/062070
19. Rakmonov, I.U., Berdishev, A.A., Niyozov, N.N., Muratov, A., Khaliknazarov U. (2020) Development of a scheme for generating the predicted value of specific electricity consumption Journal of IOP: Conference Series. MIP: Engineering-2020. 883 (2020) 012103 doi:10.1088/1757-899X/883/1/012103
20. Rakmonov, I.U., Berdishev, A.A., Khusanov, B.M., Khaliknazarov, U., Utegenov, U. (2020) General characteristics of networks and features of electricity consumers in rural areas Journal of IOP: Conference Series. MIP: Engineering-2020. 883 (2020) 012104 doi:10.1088/1757-899X/883/1/012104
21. Hoshimov, F.A., Bakhadirov, I.I., Erejepov, M., Djumamuratov, B. (2019) Development of method for normalizing electricity consumption E3S Web Conf 139 doi:10.1051/e3sconf/201913901074